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Blitzen River Redband Trout Evaluation
Blitzen River
Redband Trout Evaluation

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INTRODUCTION

Redband trout (Salmo sp.) thrive in the harsh, arid environment of Southeast Oregon. This race of trout once inhabited many of the large inland lakes that contained an abundance of aquatic invertebrates and chubs for food. Taxonomists cannot agree whether the redband trout is a separate species or a subspecies of the rainbow trout. Describing the external appearance of redbands is difficult because of similarities with wild or hatchery rainbow and because of hybridization in some streams. Adult redbands generally have pronounced parr marks, although these may be lacking in large, lake-reared redbands. Spots are primarily restricted to the area above the lateral line and to the caudal peduncle. The lateral line band is normally darker (brick red or purple red) than the band on rainbow. The posterior tip of the dorsal fin has a yellow to orange tint, and the leading edges of the pelvic, ventral, and anal fins are milky white, much like brook trout (Fig. 1). Additional characteristics are described by Behnke (1979).

The historic life cycle of the redband was similar to that of anadromous fish. In the spring mature fish migrated into tributary streams to spawn. Many young trout reared in the stream for 1 to 2 years, then migrated downstream to rear in the rich lake environment. Others lived their entire life in the stream.

Historical information indicates that the Blitzen River System (Fig. 2) and Malheur Lake were inhabited by large numbers of large-sized redband trout. The first recorded observation of trout in Malheur Lake comes from the diary of Captain Charles Bendire, U.S. Calvary. In 1875 Bendire, an amateur naturalist, was stationed at Fort Harney, located about 15 miles east of present-day Burns. He states he was the first person to fish in Malheur Lake and observed trout that averaged 5 pounds. He also observed "redside suckers" (probably bridgelip suckers) and pelicans feeding on perch-like fish, undoubtedly roach (Bendire, 1875).

The first irrigation ditches in the Blitzen Valley were built in the late 1800's. The irrigation system was further developed by the Civilian Conservation Corps (CCC) between 1935 and 1941 when irrigation ditches were enlarged and extended to obtain better water control throughout the valley. The CCC also replaced many of the old rock dams with permanent concrete structures. The present Page Dam was rebuilt in 1935-36.

Marcus Haines, a member of the Harney County Historical Society, grew up in the Blitzen Valley and provided considerable information on redbands. In 1914 and 1915 he worked on a cattle ranch near Frenchglen. During the spring months the cowboys would go to the Grain Camp Dam on the Blitzen River near Frenchglen and place a box with a chicken-wire bottom in the spill of the dam. The following day the box would be full of 20- to 30-inch trout. Haines also remembers seeing trout up to 24 inches long below Dunn Dam, a rock structure on the Blitzen located
Fig. 1. Blitzen River redband trout.
Fig. 2. Blitzen River System.
about 4 miles south of the Malheur Refuge headquarters. This dam
blocked fish migration at certain flows, and ranchers would dynamite
the trout and pick up the fish they wanted. In 1945 Haines and a
friend saw large numbers of big trout below the dam on the McCoy
diversion ditch. This dam is located 200 yards up the ditch from where
the ditch enters the Blitzen River at RM 26. They shut the water off
and caught a gunnysack full of large trout with their hands (Marcus
Haines, personal communication).

John Scharff, manager of the Malheur National Wildlife Refuge from
1935 to 1971, also provided information about redbands in Malheur
Lake. He stated that in 1931 and again in 1934 Malheur Lake went dry
and many fish died. However, during 1940 and 1942 trout populations in
the lake were extremely high; and each spring he saw many fish trying
to negotiate various irrigation dams in the Blitzen Valley. During
these years he recalled seeing numerous large trout (20-28 inches)
trying to ascend the crude fish ladder in Sodhouse Dam located near the
Refuge headquarters (John Scharff, personal communication).

Mr. Scharff stated that fair numbers of trout also reared in Boca
Lake, a lake adjacent to the Refuge. Many times he would change irri-
gation flows in the spring months to help these fish move into the East
Canal so they could spawn in Bridge and Mud creeks.

An Oregon Game Commission lake survey report (Pillow, 1941) stated
that Boca Lake was uninhabitable for trout during the warm summer
months but was used for rearing during the other parts of the year when
water conditions were favorable. This is still true today as young
tROUT from the Blitzen migrate upstream into Boca Lake and utilize the
abundant food supply found in the lake. Each spring and early summer a
few mature trout are observed around the lake outlet as they migrate
from the lake to spawn.

Pillow (1941) also reported that although a detailed survey of
Malheur Lake was not conducted, reports of large trout were prevalent.
He found conditions in portions of Malheur Lake suitable for trout even
during the critical summer period. He did not capture any trout during
his sampling, but pumpkinseed sunfish and lake chub were abundant.

Both Haines and Scharff stated that trout numbers were at their
highest in the Blitzen Valley during the early 1940’s. By the late
1940’s and early 1950’s, however, the carp population in Malheur Lake
had increased substantially, and both men mentioned that this was the
demise of large trout in the Blitzen System. During the 1950’s few
tROUT were seen below the irrigation dams.

Carp were first introduced into some waters of the Harney Basin as
a food fish in the late 1800’s. They appeared in the Silvies River in
the early 1920’s and in Malheur Lake in the late 1930’s and early
1940’s. Reproduction of carp in Malheur Lake apparently did not occur
until the late 1940’s and early 1950’s (McLaury, 1968). Extremely high
runoff from the Silvies River in April of 1952 apparently flushed large
numbers of adult carp into the marsh as a definite increase in carp was
observed by Refuge personnel after this time (Marshall, 1957). Refuge personnel also noted that increased activity of carp was followed by reduced numbers of waterfowl at the Refuge.

The first carp control program began in the fall of 1955 when the Blitzen River downstream from the mouth of Fish Creek, Malheur Lake, Bocá Lake, and the Silvies River were chemically treated to remove carp. By this time trout habitat in the Refuge had already been reduced by competition from carp and by the turbidity they caused. John Scharff observed only two or three trout in the tons of carp killed in the first treatment project, and these trout were in poor condition. He did not observe any large migration of trout out of Refuge waters to the Blitzen River since the buildup of carp. Subsequent treatment projects on the Refuge have failed to control the carp population.

The Blitzen River has historically provided excellent angling for native redband trout, and is recognized by anglers as one of Oregon's finest "wild trout" streams. Each spring the Oregon Department of Fish and Wildlife (ODFW) releases yearling hatchery rainbow into the mainstem Blitzen between RM 40 and 45. We believe the gene pool for the population of wild redbands in the upper Blitzen River is still relatively unaltered because the upstream migration of hatchery fish is blocked by a dam at RM 46, and because hatchery trout have not been released above this point since the 1940's. In recent years fishermen seeking quality angling for wild trout have been concerned about the decline in the number of large trout (16 to 20 inches) in the population. Surveys conducted in 1972 on the Blitzen River indicated an overharvest of trout was occurring in parts of the river accessible to anglers. In the inaccessible areas trout were small. Surveyors also found a major problem in the basin was the degradation of habitat due to overuse by livestock.

In 1973 the Fish and Wildlife Commission reduced the daily bag limit on trout from 10 fish to 5 fish in the Blitzen River and several other streams in Southeast Oregon to protect native fish. In 1975, after hearing public testimony concerning the decline of large trout, the Commission imposed a daily bag limit of one trout and a restrictive terminal tackle regulation on the Blitzen between Page Springs Campground (RM 45) and Blitzen Crossing (RM 55). Local anglers felt these regulations were too restrictive and the following year the terminal tackle regulation was removed and the five-fish-daily bag limit reinstated. These regulations have been in effect since.

In 1975 we attempted a tagging study to obtain information on in-stream movement, size, and growth of the redband trout in the Blitzen River. Fish were caught by hook and line because the Blitzen was difficult to sample using conventional sample methods. The Portland Anglers Club assisted in this program. The inventory yielded little biological data; however, the educational value and the working relationship that developed between the Department and the Anglers Club was significant.
In 1980 we planned an expanded inventory of the Blitzen River System to begin in 1981. The goal of the study was to collect information needed to manage wild redband trout in the Blitzen River. Specific objectives were to:

1) Determine species composition of the total fish population.
2) Determine size and age composition of the redband trout population.
3) Calculate population estimates of redband trout at selected sites.
4) Define movement of redband trout from the tributaries into the main stem Blitzen.

This report presents the findings and conclusions from the work conducted during the summers of 1981 and 1982.

**STUDY AREA**

The Blitzen River heads on the west side of Steens Mountain in southern Harney County and flows north into Malheur Lake (Fig. 2). The drainage basin contains approximately 760 square miles of surface area and 279 linear miles of trout-producing stream. Discharge from the lower Blitzen averages 120 cfs and ranges from 25 to 43,000 cfs. High, murky water occurs in May and June because of snow melt and runoff. Periodic severe summer thunderstorms increase discharge dramatically. Water temperatures in the lower Blitzen range from 32 F in the winter to 75 F in the summer.

The upper portion of the Blitzen System is primarily summer range-land where alpine meadows and aspen thickets predominate. Gradient ranges from steep to fairly flat with a good pool-riffle ratio. The South Fork Blitzen and its tributaries flow through wide, juniper-sage valleys that are, for the most part, extensively grazed by livestock. The upper drainages have large areas of poor trout habitat as heavy grazing has disturbed the vegetation on a thin, poor soil mantle. In some areas beaver have contributed to removal of woody vegetation from the stream corridor. Silt and sediment cover much of the food producing and spawning area.

The river flows through a narrow, rocky canyon from Blitzen Crossing downstream to the mouth of Fish Creek. Livestock access to this area is limited. Below Fish Creek the canyon widens and this area has had extensive use by livestock which has resulted in degraded riparian habitat. In 1980 the Bureau of Land Management (BLM) constructed a fence along the river from 2 miles above Fish Creek down to Page Springs to exclude livestock from this area. Fencing of the area has resulted in improved stream bank vegetation. Below Page Springs the Blitzen enters the wide Blitzen Valley where the river has been channelized and diverted into numerous canals and ditches to distribute water on the Malheur National Refuge. Little trout habitat
remains in this area because of slack water pools, diversions, siltation, and high concentrations of rough fish.

Despite the areas with poor trout habitat, the Blitzen River System as a whole contains an excellent population of wild redband trout. Angling pressure is generally light due to its remote location, few access sites, rough terrain, and private land ownership.

MATERIALS AND METHODS

Sampling Sections

Sample sections were chosen to provide a representative sample of habitat type, stream size, and angler access. Sampling locations were selected in three general areas. These were 1) main stem Blitzen River within the Malheur Refuge, 2) main stem Blitzen upstream from the Refuge, and 3) tributaries of the main stem. For purposes of this study these areas were identified as Malheur Refuge, main stem Blitzen River, and Blitzen River tributaries, respectively. Fifteen sites, ranging in length from 200 yards to 2.5 miles, were sampled. Sample site locations are shown in Figs. 3 and 4, and a description of each site is included in Appendix Table 1. Appendix Figures 1 and 2 show two of the habitat types that were sampled.

Transportation of Gear and Personnel

We used a Hughes 500D helicopter (Fig. 5), under fire contract to the Burns BLM office, to transport gear and personnel to and from sample sites 1, 2, 3, 8, and 10. A four-wheel drive pickup was used to reach the other sample sites.

Electrofishing Gear

We used backpack, raft mounted, and drift boat mounted electrofishing gear to obtain fish samples. Smith-Root type VII and Coffelt BP-2 backpack units were used to sample the tributaries (sites 4, 5, 6, 7, 8, 9, 10, 11 and 12). An Avon Redseal raft was used to sample sites MR-3, 1, 2, and 3 since a drift boat could not be effectively used due to low streamflows. We designed a breakdown metal frame for the raft that held a generator, a variable voltage box, and additional sampling gear. This system combined the best features of backpack and drift boat mounted gear (Figs. 6 and 7). Two backpack-type probes were used as positive electrodes and two negative electrodes were hung astern and two amidship. Seven people were required to effectively operate the raft mounted system—two to work the positive electrodes, two to diphnet, two to carry fish buckets, and one to guide the raft around obstructions. This gear was most effective with an output of 300 volts and 1.5 amperes. We electrofished from a 16-foot McKenzie-style Aluminum drift boat in sampling sections MR-1 and MR-2 where the Blitzen was too deep for the raft mounted gear to be effective. The drift boat used the same generator and pulsator box as the raft mounted
**FIG. 3.** Sample sections on the Malheur Refuge.
Fig. 4. Blitzen River showing main stem, lower tributary, & upper tributary sample sites.
Fig. 5. Hughes 500D helicopter, inventory crew, and disassembled raft shucker.
Fig. 6. Raft mounted boat shocker.
Fig. 7. Raft mounted shocker gear in use.
gear but had a fixed positive electrode in the bow and a fixed negative electrode in the stern. Current flow was controlled by a foot switch operated by the dipnetter.

Handling of Fish

Captured fish were placed in 5-gallon plastic buckets, anesthetized with Benzocaine, measured to the nearest 1/2-inch (fork length), and released. Water was changed frequently to keep temperature low and dissolved oxygen high, and fish were examined and released often enough to minimize holding stress. We tried to complete all fish handling work by early afternoon because increased handling mortality occurred in the afternoon when water temperatures started to climb. Generally, observed handling mortality at all sampling sections was low.

Scale Collection and Analysis

Scales collected from a sample of the redbands captured at each sampling section were placed in envelopes for storage. Scales were taken from both sides of the larger fish because we had found many unreadable scales in earlier collections. Scales were later mounted on a glass slide in 95% glycerine and 5% waterglass solution. Age was determined from a projected image of the scales.

Population Estimates

Two mark and recapture population estimates were made at sample sites 3 (Main Stem Blitzen) and 4 (South Fork Blitzen) using the procedure developed by Robson and Hegler (1968). Members of the Portland Anglers’ Club, using barbless flies, captured trout for marking. Electrofishing gear was used several days later to make the first recapture. All fish captured on this pass were given an identifying mark and released. Electrofishing gear was again used for the final recapture. Standard assumptions about mortality and movement were made.

In-stream Movement of Redband Trout

We removed all fish from sample sites 5 (South Fork Blitzen) and 9 (Big Indian Creek) in 1981 to document movement of redbands back into a barren stream section. To remove fish, blocking seines were placed at the upper and lower boundaries of the sections and repeated passes were made through the sections with backpack electrofishing gear. The same areas were resampled in 1982, using the same gear and methods, to determine fish movement back into these areas.
RESULTS AND DISCUSSION

Species Composition

Fish species collected in the Blitzen River system above Page Springs Dam were redband trout, Salmo sp.; mountain whitefish, Prosopium williamsoni; longnose dace, Rhinichthys cataractae dulcis; and mottled sculpin, Cottus baikdi semiscaber. In addition to the species listed above, hatchery rainbow, Salmo gairdneri; redside shiner, Richardsonius balteatus sp.; bridgelip sucker, Catostomus columbianus; and carp, Cyprinus carpio were collected during sampling in the Refuge. Roach, Gilia bicolor, are known to be present in the Refuge, but none were collected.

The redband was the most common species found in the Blitzen System. Percent composition ranged from 13.2% in waters of the Refuge to 86.7% in the upper tributaries (Table 1).

Whitefish appear to be very dependent on such factors as good stream habitat, large stream size, and good water quality as they made up a low percentage of the total population in areas where water quality was degraded (Table 1). Most whitefish were found in the main stem and lower 2 miles of Big Indian Creek.

Table 1. Percentage species composition of fish found in the Blitzen River System.

<table>
<thead>
<tr>
<th>Species</th>
<th>Malheur Refuge</th>
<th>Main stem Blitzen</th>
<th>Lower tributaries</th>
<th>Upper tributaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redband trout</td>
<td>13.2</td>
<td>42.2</td>
<td>77.2</td>
<td>86.7</td>
</tr>
<tr>
<td>Hatchery rainbow</td>
<td>3.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Whitefish</td>
<td>4.0</td>
<td>8.1</td>
<td>1.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Longnose dace</td>
<td>33.1</td>
<td>12.3</td>
<td>10.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Mottled sculpin</td>
<td>39.3</td>
<td>37.4</td>
<td>15.4</td>
<td>13.3</td>
</tr>
<tr>
<td>Bridgelip sucker</td>
<td>3.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Carp</td>
<td>2.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Redside shiner</td>
<td>1.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Low numbers of Longnose dace and mottled sculpin were recovered in the upper tributaries compared to the number captured in other areas. Previous work in Southeast Oregon indicates these fish are found only where water quality is good. Bridgelip suckers, carp, and redside shiners were only captured in the Malheur Refuge, an area of poor water quality and degraded habitat. Many of these fish could be seen avoiding the electrofishing gear and were not captured. Carp were only captured at sample site MR-1, and a single sucker was captured at sample site MR-2.

Size Composition of Redband Trout

Malheur Refuge

We were interested in the size structure and relative population of redband trout in the portion of the main stem within the Refuge for a number of reasons. First, the area just below Page Springs Campground (site MR-3), receives heavy angling pressure since about 5,000 legal-sized trout are stocked annually in this reach. We wanted to determine how native redbands responded to this heavy angling pressure and the presence of hatchery fish; also, determine the number of hatchery fish present. Second, the three sample sites in the Refuge have been impacted heavily by man's activities (channelization, irrigation withdrawal and return, bank protection work, etc.), more so than other areas sampled; and we wanted to see how these activities influenced the trout population.

Because of the low numbers of fish recovered at all three sample sites in the Refuge, catches were combined and a length-frequency distribution for all redbands captured was plotted (Fig. 8). The redbands averaged 8.6 inches in length. This large size is probably the result of increased productivity in this area because of concentration of nutrients, large stream size, and decreased whitefish numbers (i.e., decreased competition).

Main Stem Blitzen River

The bulk of the angling pressure in the System occurs in the main stem above the Malheur Refuge and we were most interested in the population structure of the redbands in this area. Figures 9, 10, and 11 show the length-frequency distribution of redband trout collected from sample sites 1, 2, and 3. Redbands were largest in section 1, which is, with the exception of the MP Ranch site (site MR-2), the most heavily fished section we sampled. This large size (average 7.1 inches) is probably the result of better productivity and habitat.

We expected to find larger-sized redbands in section 2 since angling access is poor and angling pressure is only a fraction of that occurring in section 1. However, this section does not have the amount of riffle area found in the other two main stem sections and apparently is a less productive area. We believe this would explain, to some extent, the smaller average size of 6.4 inches that we found.
Fig. 8. Combined length-frequency distribution of all redbands captured at sample sites MR-1, MR-2, and MR-3.
Fig. 9. Length frequency of redband trout captured at sample site 1—main stem Blitzen River.

Sample Site 1
N=227

FORK LENGTH IN INCHES

NUMBER OF FISH
Fig. 10. Length frequency of redband trout captured at sample site 2—main stem Blitzen River.
Fig. 11. Length frequency of redband trout captured at sample site 3--main stem Blitzen River.
Average length of redbands in section 3 was 6.9 inches; however, size may be artificially inflated because one-half of this 1-mile section is on private land with almost no angling pressure. Fish in the private section are lightly cropped. The Little Blitzen enters this section at the uppermost boundary and the lower part is also on private land with little or no angling pressure.

Figure 12 shows the combined length-frequency distribution of all redbands sampled in the three main stem sites. The low number of fish over 12 inches in length has also been noted in inventories conducted in the past. This low percentage of large fish and the combined main stem average length of less than 7 inches is a true reflection of the actual size distribution of the redband population. The main stem Blitzen above the Refuge is fairly productive, but it is not conducive to rapid growth and large-sized trout because of various environmental conditions including siltation, low summer flows, lack of riffle area, etc.

Blitzen River Tributaries

Figure 13 shows the length-frequency distribution of redbands captured in lower tributaries, and upper tributaries of the Blitzen River. Average size decreased as the streams became smaller. Few redbands over 12 inches in length were recovered in the tributaries. A greater proportion of fish under 4 inches in length was present in the upper tributaries where the streams are small, habitat degraded, and living conditions are impaired. These conditions result in a crowded, stunted population with the fish maturing at an average length of only 4.5 inches.

Age Composition of Redband Trout

Malheur Refuge

Only a few scale samples were collected at sample sites in the Refuge. Analysis showed no fish older than age 3, considerable overlap between age groups, and no positive spawning checks. One fish from this group appeared to have a spawning check after its third growth ring; however, if this was in fact a spawning check, it is the only check we have ever observed on a redband scale.

Main Stem Blitzen River

Most angling occurs in this section of the main stem Blitzen River, thus we were interested in age structure of the redband population in this area. Since the age of large fish was our primary concern, more scales were taken from larger fish even though all age classes except 0+ were sampled. If additional age work is conducted in the future, a stratified sample representing all age groups should be taken.
Fig. 12. Combined length-frequency distribution of all redbands captured in the three main stem Blitzen River sites.
Fig. 13. Length-frequency distribution of redbands captured in lower tributaries and upper tributaries.
Figure 14 shows the length frequency of the five age classes sampled in the main stem. Considerable overlap occurred between age classes, especially age 2 and 3. This could be expected in the Blitzen where growth is variable because of differing habitat and growing conditions within the system. Redbands age 3 and younger made up 97% of the sample even though all larger fish were sampled. This is consistent with aging work done from otoliths by Knopack and Wallace (1980) for redbands in eight southwest Idaho streams.

Blitzen River Tributaries

Scale samples were taken from fish captured at all tributary sample sites. Figure 15 shows the length frequency of the three age classes sampled in the tributaries. Data are combined from the large and small tributary groupings since the number of fish collected from each site was not large enough to present each group separately. There was considerable overlap between age groups and few fish exceeded 12 inches in length. No fish older than age 3 were sampled even though scales were taken from all large fish. The upper length limit of each age class was from 1 inch to 2 inches less in the tributaries compared to the main stem. We feel this difference in size is a reflection of the slower growth rate experienced in the less than optimum habitat of the tributaries.

Population Estimates of Redband Trout

Redband population estimates were made at sample site 3 on the main stem Blitzen and sample site 4 on the South Fork Blitzen. Two estimates were made at each location. The first estimate involved the recapture of fish caught and marked by anglers. The second estimate was the recapture of fish originally captured by electrofishing equipment. We were disappointed with the accuracy of the population estimate obtained by recapturing angler-marked fish. Because of the low number of these fish at large in the population, the 95% confidence interval was high. The most accurate population estimate was obtained by capturing fish for marking using the raft mounted electrofishing gear and making the recapture with the same gear.

We believe the population estimate made on the main stem Blitzen of 326 redbands (95% CI ± 46) over 4.75 inches in length is very accurate (Table 2). We also believe this section has the lowest population of any of the main stem sites sampled.

The population estimate made on the South Fork Blitzen of 273 redbands was of little value because of the wide confidence interval (Table 2). This 0.5-mile section was heavily fished by anglers and we believe many of the marked fish were removed between the time the fish were marked and the recapture effort. Although we must assume the marked and unmarked fish were removed from the population at the same rate, the apparent removal of large numbers of marked fish lowered the number of marks at large in the population to such a low level that an accurate population estimate could not be made.
Fig. 14. Length-frequency distribution of age classes of redband trout in the main stem Blitzen River, from scale analysis.
Fig. 15. Length-frequency distribution of age classes of redband trout in tributary samples, from scale analysis.
Table 2. Mark and recapture population estimates for redband trout over 4.75 inches in length from sample sites 3 and 4.

<table>
<thead>
<tr>
<th>Sample site 3</th>
<th>M + 1</th>
<th>C + 1</th>
<th>R + 1</th>
<th>N</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>Angler mark</td>
<td>29</td>
<td>111</td>
<td>10</td>
<td>322</td>
<td>± 182</td>
</tr>
<tr>
<td>Electro mark</td>
<td>100</td>
<td>111</td>
<td>34</td>
<td>326</td>
<td>± 46</td>
</tr>
<tr>
<td>Sample site 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angler mark</td>
<td>37</td>
<td>53</td>
<td>10</td>
<td>196</td>
<td>± 104</td>
</tr>
<tr>
<td>Electro mark</td>
<td>44</td>
<td>56</td>
<td>9</td>
<td>273</td>
<td>± 155</td>
</tr>
</tbody>
</table>

In-stream Movement of Redband Trout

All redband trout were removed from sample site 5 (South Fork) and sample site 9 (Big Indian Creek) by electrofishing in 1981. Total number of redbands removed was 168 and 164, respectively. This work was repeated in 1982 to determine the movement of redbands into the barren area and to examine the size of the fish present. The South Fork site yielded 50 redbands, about one-third of the 1981 total. This section showed signs of having been heavily fished just prior to our sampling, and we assume that this influenced the samples. There was no significant difference between the 1981 and 1982 average size. One hundred and sixty-one redbands were captured in the Big Indian site in 1982, nearly the same number as the previous year; however, the average size of these fish was significantly smaller than in 1981. We believe the barren sections were repopulated primarily by fish migrating downstream from upriver areas.

SUMMARY

Information that we gathered on redband trout in the Blitzen River showed that most spawn at age 3; that most, if not all, apparently die after spawning; and that habitat and environmental conditions dictate growth rate and size at maturity. Work conducted at Parsnip Lake (ODFW, unpublished data), a small reservoir south of Jordan Valley, produced information similar to that from the Blitzen.

We believe that carp are the greatest single factor in the loss of large redband trout in the Blitzen System because they cause turbidity and compete for food, and because treatment projects to control carp also kill redbands and roach.

Several things could be done within the Blitzen drainage to improve redband trout populations. Fish ladders could be placed on irrigation dams within the Refuge to insure better passage for the
few large redband trout that now try to ascend the Blitzen during their spawning migration. Great care must be taken to ensure that carp, suckers, and roach could not negotiate these ladders and gain access to the Blitzen above the "P" Ranch. If rough fish were allowed to invade the upper Blitzen System, it would destroy the current valuable trout fishery. Better watershed protection on the upper South Fork Blitzen and tributaries would promote better soil stabilization and improve habitat in that area and water quality downstream.

In summary we found:

1. Redband trout average size decreased as we moved upstream. Few trout larger than 12 inches are present in the System.

2. Scale analysis showed that 97% of all redbands in the main stem Blitzen and tributary samples were age 3 or younger. Most, if not all, redbands die following spawning at age 3.

3. A substantial number of small redbands migrated from the tributaries into the main stem.

4. Redband trout comprised 13.2% of the total population of fishes in the lower main stem, and 86.7% in the upper tributaries.

5. Whitefish comprised from 0 to 8.1% of the total population but made up a higher percentage of biomass, especially in the main stem Blitzen.

6. Populations of sculpin and dace appeared to be dependent on good water quality, and their number decreased as stream size decreased.

7. The estimated number of redbands over 4.75 inches in a 1-mile section of the main stem Blitzen was 322 (95% CI ± 46).

8. The estimated number of redbands over 4.75 inches in a 0.5-mile section of the South Fork Blitzen was 273 (95% CI ± 155).

9. Using anglers to capture fish for a mark-recapture population estimate did not produce good statistical results.

10. Good populations of small redbands were present in the tributaries.

11. The elimination sites showed there was a rapid repopulation of barren habitat by redbands. These areas were repopulated primarily by downstream migrating age-1 and age-2 fish.

12. Carp appear to be the greatest single factor in the loss of large redband trout in the Blitzen System. Other factors such as irrigation diversion dams on water withdrawal, and degradation of streamside habitat have also contributed to the loss.
ACKNOWLEDGMENTS

We wish to thank the Burns District of the Bureau of Land Management for their helicopter and manpower; Malheur National Wildlife Refuge staff; the Portland Anglers Club for their years of help and concern about the Blitzen trout fishery; the Ecological Survey Crew of the Donner and Blitzen River (Linda Marchant, Paul Smithers, William Sydeman, and Shelly Wickham) for their hard work and assistance; ODFW staff that have worked diligently for years gathering biological information within the Blitzen Drainage; Jim Griggs for his help and guidance; Sam Hess for scale analysis; Larry Korn, Wayne Burck, and Rich Berry for their editing; and John Scharff and Marcus Haines for historical information.

REFERENCES


Bendire, C. E. 1875. Personal Diary, Smithsonian Institute.


Appendix Table 1. Sections in the Blitzen River System sampled to collect information on fish populations.

<table>
<thead>
<tr>
<th>Sample Section</th>
<th>From - to (RM)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Stem Blitzen</strong> - inside Refuge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MR-1 Below Bridge Creek</td>
<td>36.0 - 38.5</td>
<td>Channelized; little trout habitat; angling prohibited.</td>
</tr>
<tr>
<td>MR-2 &quot;P&quot; Ranch</td>
<td>40.8 - 42.0</td>
<td>Channelized; poor trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>MR-3 Below Page Springs Bridge</td>
<td>43.0 - 43.5</td>
<td>Deep slow pools; some banks riprapped; limited trout habitat; angling pressure heavy.</td>
</tr>
<tr>
<td><strong>Main Stem Blitzen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Fish Creek</td>
<td>48.0 - 49.0</td>
<td>Good pool-riffle ratio; good trout habitat; angling pressure moderate.</td>
</tr>
<tr>
<td>2 Burnt Car</td>
<td>52.0 - 53.0</td>
<td>Stream in deep canyon; good trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>3 Mouth Little Blitzen</td>
<td>57.5 - 58.5</td>
<td>Stream in canyon; excellent trout habitat; angling pressure light.</td>
</tr>
<tr>
<td><strong>South Fork Blitzen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Tabor Cabin</td>
<td>6.5 - 7.3</td>
<td>Stream in canyon; fair trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>5 Roughroad</td>
<td>10.3 - 10.5</td>
<td>Riffles and shallow water; poor trout habitat; angling pressure light.</td>
</tr>
</tbody>
</table>

Continued, next page.
<table>
<thead>
<tr>
<th>Sample Section</th>
<th>From - to (RM)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Fork Blitzen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Huffman Cow Camp</td>
<td>16.0 - 16.3</td>
<td>Small headwater stream; marginal trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>Little Blitzen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Clemens' property</td>
<td>1.8 - 2.0</td>
<td>Stream meandering through valley; good trout habitat; angling pressure light.</td>
</tr>
<tr>
<td></td>
<td>8 Canyon site</td>
<td>5.5 - 5.8</td>
</tr>
<tr>
<td>Big Indian Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Below Little America</td>
<td>0.8 - 1.2</td>
<td>Shaded but silted streams; fair trout habitat; angling pressure moderate.</td>
</tr>
<tr>
<td>10 Canyon Site</td>
<td>10.0 - 10.3</td>
<td>Stream in steep but wide canyon; marginal trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>Ankle Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Dry Gulch</td>
<td>5.0 - 5.3</td>
<td>Stream small and unshaded; marginal trout habitat; angling pressure light.</td>
</tr>
<tr>
<td>Deep Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Riley Huff</td>
<td>4.0 - 4.3</td>
<td>Small headwater stream; fair trout habitat; angling pressure light.</td>
</tr>
</tbody>
</table>
Appendix Fig. 1. Channelized section of the Blitzen River in the Malheur National Wildlife Refuge (RM 36).
Appendix Fig. 2. Blitzen River Canyon (Burnt Car, RM 52).