# Fort Rock Redband Trout

### *Existing Populations*

Historically, at the highest lake levels, Fort Rock basin drained into the Deschutes River basin through Crooked River. Today Fort Rock is a closed interior basin. Silver Lake and Paulina Marsh are just remnants of the basin's large Pleistocene lake. Three redband trout populations, Buck, Silver and Bridge, comprise the Fort Rock SMU (Table 1). All three populations occupy streams that terminate at Paulina Marsh.

**Table 1. Description, existence status, and life history of redband trout populations in the Fort Rock SMU.**

| Exist | Population | Description | Life history |
|---|---|---|---|
| Yes | Buck | Buck Creek. | Resident |
| Yes | Silver | Silver Creek and tributaries. | Resident |
| Yes | Bridge | Bridge Creek. | Resident |

All redband trout populations in the Fort Rock SMU are described as expressing a resident life history, however a few large individuals (>21 inches) have been observed in Buck Creek and anecdotal reports exist of large fish in both Silver and Buck creeks (R. Smith, ODFW Klamath Fish District, pers. comm.). Historically, the Fort Rock populations regularly expressed an adfluvial life history, rearing in Paulina Marsh and spawning in the headwater streams. Since then the Paulina Marsh has been drained and it now provides little or no habitat to support an adfluvial life history (Bowers et al. 1999).

### *Distribution*

Analysis of the distribution criterion is based on 1:100,000 GIS hydrography of redband trout distribution (Flitcroft and Dambacher 2001). A population passes the distribution criterion if it satisfies two of three metrics – the current distribution must 1) occupy >10% of the total stream distance in the populations basin, 2) total more than ten km (six miles), or 3) be connected to other populations. Buck and Bridge populations pass the distribution criterion (Table 2).

**Table 2. Distance of current distribution, total stream distance in each basin, percent of each basin occupied, and presence of migratory corridors for redband trout populations in the Fort Rock SMU (Flitcroft and Dambacher 2001).**

| Population | Current (km) | Total Basin Distance (km) | % Occupied | Connected to Other Pops. | Pass/ Fail |
|---|---|---|---|---|---|
| Buck | 30.0 | 78.5 | 38.5 | No | Pass |
| Silver | 34.1 | 474.1 | 7.8 | No | Fail |
| Bridge | 29.9 | 68.4 | 43.6 | No | Pass |

The distribution of redband trout in Silver Creek appears limited relative to the size of the basin. Redband trout only occupy 8% of the total stream distance in the Silver Creek watershed (Table 2). In 1968 Behnke (1992) found redband trout in upper Buck and Bridge creeks, but only brook trout in tributaries of Silver Creek. Thompson Valley Reservoir is a barrier to upstream migration, preventing redband trout from moving into the upper basin. Although the historic distribution likely did not include all streams in the basin, this statistic serves as a red flag to identify populations in which distribution may be drastically constricted and warrants further investigation.

Paulina Marsh has been drained and channelized for agricultural purposes (Bowers et al. 1999). During normal precipitation cycles populations are isolated by a lack of connection at Paulina Marsh and impassable irrigation structures and diversions. Buck and Bridge creeks are able to connect only during extended periods of above average precipitation. These periods are infrequent; Paulina Marsh last filled in 1982 (B. Bowersox, ODFW Lakeview Fish District, pers. comm.). In addition, a large irrigation diversion dam on Silver Creek prevents fish from moving into Silver Creek. Data describing movement and life history do not exist. Therefore we assume the populations in the Fort Rock SMU are functionally disconnected until movement data suggests otherwise (Table 2).

### *Abundance*

Data describing the abundance of constituent populations of the Fort Rock SMU over the last 30 years do not exist, therefore minimum abundance thresholds cannot be calculated. Instead, mean density of a given population serves as a surrogate criterion. Mean density estimates were compared to density benchmarks for redband trout populations in eastern Oregon streams (Dambacher and Jones In press). A population passes the abundance criterion if the average density is classified as 'moderate' or 'high' in three of the previous five years. Populations with a 'low' rating for three of the last five years fail the criterion and are warranted for further investigation. When density estimates for the last five years are not available, the criterion is applied to those years for which data are present.

Using a probability sample design, ODFW conducted an SMU level population estimate of redband trout in 1999 in the Fort Rock Basin (Dambacher et al. 2001). Population and density estimates were conducted at 30 randomly selected, spatially balanced sample sites throughout the SMU. Redband trout in the entire SMU were estimated at 56,964 +/- 23 % (95% CI) age 1+ individuals. Average redband trout densities for the SMU were moderate relative to other eastern Oregon streams (Dambacher and Jones In Press). Sites with the highest densities were located in narrow canyon reaches, protected from the effects of grazing and other land uses (Dambacher et al. 2001). Average density was calculated for all sites within a population (Table 3). Based on these data, all populations in the Fort Rock redband trout SMU pass the abundance criterion.

**Table 3. Mean density, age 1+ fish/m$^2$ (number of samples), of redband trout populations collected during 1999 basin wide population estimate (Dambacher et al. 2001).**

| Population | 1999 | Assessment | Pass / Fail |
|---|---|---|---|
| Buck | 0.09 (9) | Moderate | Pass |
| Silver | 0.18 (11) | Moderate | Pass |
| Bridge | 0.23 (10) | High | Pass |

### *Productivity*

Data are not available to quantitatively assess productivity and the intrinsic potential of population increase for redband trout in the Fort Rock SMU. In the absence of these data a qualitative assessment of the productivity criterion is based on distribution and abundance, connectivity, life history, habitat quality, and presence of non-native species. A population that is widely distributed and exhibits high densities is assumed to have minimally rebounded from past drought or disturbance events. Connectivity to a diversity of high quality habitats capable of supporting multiple life history types during extreme environmental conditions enables populations to rebound quickly. Thus, a population passes the criterion if it: 1) is connected to habitat capable of supporting multiple life histories and/or serving as refuge during periods of environment constraint, 2) expresses multiple life history strategies, 3) is widely distributed, and

4) relatively abundant. A population may also pass the criterion if data indicate an increasing or stable trend in abundance. These qualities suggest populations are resilient and minimally able to rebound rapidly after periods of low abundance. This assessment, however, does not attempt to describe the degree to which populations may rebound. A population may pass the productivity criterion and not attain total abundance equivalent or greater than that prior to the previous low period. The presence of non-native species, hatchery fish, or significant habitat degradation may negatively affect productivity and cause a population to fail the criterion. In many populations the intrinsic potential productivity is uncertain; these populations fail the criterion until productivity can be adequately assessed.

Given the lack of connection to habitat capable of supporting a migratory life history all populations fail the productivity criterion except Buck. Estimates of density collected in 1976 in Buck Creek were similar to those of 1999. In 1976 densities were moderate (0.17 age 1+ fish /$m^2$) in the upper reaches and high (0.21 age 1+ fish /$m^2$) in the lower reaches (Kunkel 1976). These data suggest the population trend was stable through various climatic cycles or the population was able to rebound after period of depressed abundance. Only the Buck population passes the productivity criterion (Table 4), though productivity for the entire SMU warrants investigation.

**Table 4. Factors influencing productivity of Fort Rock SMU redband trout populations.**

| Population | Factors | Pass/Fail |
|---|---|---|
| Buck | Low to moderate densities; distribution minimally adequate; expression of a migratory life history limited by lack of consistent connection to habitats capable of producing large fish; headwater habitats in good condition; densities in 1976 sampling similar to 1999, generally indicating a stable trend in abundance through various climactic cycles (Kunkel 1976; Dambacher et al. 2001); brook trout abundant in upper reaches. | Pass |
| Silver | Moderate densities; distribution minimally adequate; expression of migratory life history limited by lack of consistent connection to habitat capable of producing large fish; brook trout abundant in upper reaches; potential interbreeding with hatchery rainbow trout stocked in reservoirs. | Fail |
| Bridge | High densities; distribution minimally adequate; expression of migratory life history limited by lack of consistent connection to habitat capable of producing large fish; high quality habitat in canyon reaches. | Fail |

### *Reproductive Independence*

Data specific to reproductive independence do not exist for the Fort Rock redband trout SMU. Instead this review uses current and historical stocking records to evaluate the risk of hatchery origin rainbow trout to native redband trout. A population passes the criterion if hatchery origin rainbow trout are not currently stocked within the population, and if any available genetic analyses reveal minimal evidence of genetic mixing between hatchery and wild stocks.

Planting of hatchery rainbow trout has occurred in all three populations, though most extensively in Silver Creek. Bridge Creek was stocked three times between 1943 and 1958. Buck Creek was stocked with rainbow trout ten times between 1925 and 1960. Silver Creek was stocked up to three times annually between 1925 and 1984 (ODFW stocking records). Stocking of hatchery rainbow trout in rivers and streams ceased in 1984. Native redband trout sampled in 1964 from Buck Creek showed a slight evidence of breeding with hatchery rainbow trout based on morphological characters (Behnke 1992).

Currently, hatchery rainbow trout are only stocked in Thompson Reservoir (Silver Creek). In high water years it is suspected that hatchery rainbow trout can leave the reservoir and potentially spawn with native redband trout downstream. However, the threat may be minimal since the reach downstream of Thompson Reservoir is dewatered annually for irrigation purposes, minimizing the likelihood that redband trout are present in this reach (Bowers et al. 1999). Given the current stocking program, the Silver Creek population fails the reproductive independence criterion until the effect of hatchery rainbow can be genetically assessed.

### *Hybridization*

Non-native cutthroat trout are not present in the Fort Rock Basin and not a threat to redband trout. All populations pass the hybridization criterion.

### *Assessment Conclusions*

The Fort Rock Redband Trout SMU is comprised of three populations in the Silver Lake basin. Populations occupy tributaries of Paulina Marsh which has been diked, channelized, and drained for agricultural purposes. Populations are only connected during consecutive high water years, severely limiting the opportunities for the expression of a migratory life history and inter-population mixing. Lack of a migratory life history and degraded habitat impacts the potential productivity This SMU is classified as 'at risk' because 80% of the populations meet only three of the six interim criteria. Limited data sets and inferences from other information for populations in this SMU provide a qualified level of confidence in the assessment of the interim criteria.

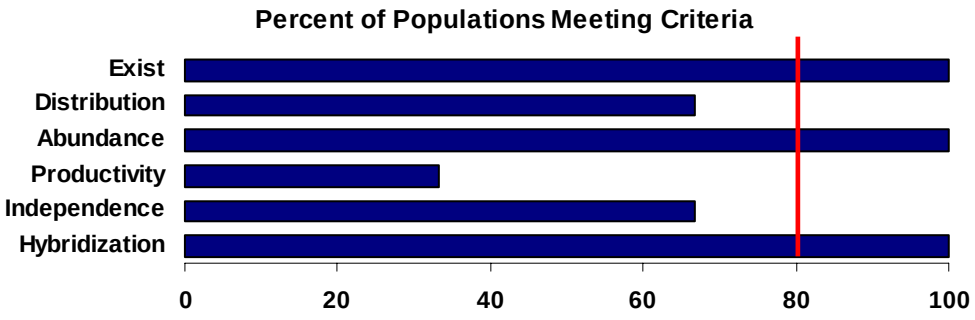


**Figure 1. Assessment outcome for each of the six interim criteria with respect to the 80% threshold identified by the NFCP.**