Warner Lakes Redband Trout

Existing Populations

Warner Valley is an endorheic basin that contains a complex series of interconnected lakes, marshes, sloughs, and potholes, all of which are remnants of pluvial Lake Warner. The headwaters of Warner Valley drains the Warner Mountains through three major subbasins. Each subbasin is occupied by a redband trout population. Deep Creek flows into Pelican Lake and Crump Lake. A barrier falls splits Deep Creek into Upper and Lower Deep populations. Honey Creek flows into Hart Lake and Twentymile Creek flows into Greaser Reservoir. Populations were identified based on Bowers et al. (1999) and reviews by ODFW staff (Table 1).

Table 1. Description, existence status, and life history of redband trout populations in the Warner Lakes SMU.

Exist	Population	Description	Life History
Yes	Honey	Honey Creek and tributaries, including Camas Creek.	Resident/Migratory
Yes	Lower Deep	Deep Creek downstream of Deep Cr. Falls.	Resident/Migratory
Yes	Upper Deep	Deep Creek and tributaries upstream of Deep Cr. Falls.	Resident
Yes	Twentymile	Twentymile and Twelvemile Creeks & tributaries.	Resident/Migratory

For the purpose of this review Lower Deep is identified as a distinct population, although it is uncertain if it functions as an independent population. Fingerlings and adfluvial adults have been captured below the falls and in Pelican and Crump lakes and are assumed to have originated below Deep Creek Falls (C. Edwards, ODFW Lakeview field office, pers. comm.). There is a possibility that some or all of these individuals originated from the Upper Deep population.

Distribution

Redband trout appear to be distributed throughout the perennial streams and lakes of Warner Valley as conditions permit. Distribution of redband trout varies according to water years and annual fluctuation of instream flows. During drought years distribution constricts as streams and lakes dry and become uninhabitable. Trout re-colonize these streams during wet cycles, re-expanding the distribution. Many of the large lakes in Warner Valley dried in 1992 and redband trout were found in the lakes before and after the dry period (USFWS 1998).

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. Only the Lower Deep population fails the distribution criterion (Table 2).

Table 2. Distance of current distribution, total stream distance in each basin, presence of each basin occupied,and presence of migratory corridors for redband trout populations in the Warner Lakes Rdband Tout SMU.

Population	Current (km)	Total Basin Distance (km)	% Occupied	Connected to Oher Pps.	Pass/ Fail
Honey	82.9	410.6	20.0	Yes	Pass
Lower Deep	--	15.5	--	Yes	Fail
Upper Deep	141.7	561.1	25.2	No	Pass
Twentymile	41.2	171.9	24.0	No	Pass

Current year around distribution of the Lower Deep population is not quantified (Table 2), but is thought to be limited. The lower reaches of Deep Creek are channelized with little or no riparian buffer to provide habitat and minimize impacts from high flow events. A high gradient canyon reach, approximately five provides limited spawning habitat but contain deep, well oxygenated pools. These pools serve as refuge to redband trout from high summer water temperatures in the lower reaches (R. Smith, ODFW Klamath Falls district office, pers. comm..).

Redband trout in Honey, Lower Deep, and Twentymile populations have access to the Warner Lakes and express multiple life histories; however, passage to the lakes is hindered by numerous irrigation diversions. Water year and climactic conditions determine stream flow and irrigation needs, which in turn, influence the migratory success of redband trout between the lakes and upper stream reaches. Honey Creek contains eight diversions, Deep Creek contains two diversions, and Twentymile Creek contains three diversions (R. Smith, ODFW Klamath Falls district office, pers. comm..).

Inter-population connection, although very limited, is possible between two of the four populations. Hydrologic connection is maintained between Crump and Hart lakes during adequate water years, giving Honey and Lower Deep populations the opportunity to mix. The Twentymile population is likely isolated from other populations in the SMU; only in very high water years could large migratory redband trout possibly ascend the concrete diversion dam in the lower river (W. Tinniswood, ODFW Klamath district office, pers. comm.). Deep Creek Falls is a fish barrier that isolates the Upper Deep population. Both populations lack the opportunity for genetic mixing which puts them a greater risk of extinction due to the effects of inbreeding if the populations become very small.

Abundance

Data describing the abundance of constituent populations of the Warner Lakes Redband Trout SMU are lacking. Instead, mean density of a given population serves as a surrogate criterion. Mean density estimates are compared to density benchmarks for redband trout populations in eastern Oregon streams (Dambacher and Jones In press). A population passes the abundance criterion if average density is classified as 'moderate' or 'high' in three of the previous five years. Populations with a 'low' rating 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 only those years for which data are present.

Using a probability sample design, ODFW conducted an SMU level population estimate of resident redband trout in 1999 in the Warner Valley basin (Dambacher et al. 2001). Population and density estimates were conducted at 24 randomly selected sample sites throughout the SMU, although the lower reaches were not adequately represented (Dambacher et al. 2001). Redband trout in the SMU were estimated at 172,240 +/- 31% (95% CI) age 1+ individuals. Average density among all sites was 0.216 age 1+ /m^2. The large confidence interval suggests density varies widely among sample sites. Average density was calculated for all sites within a population (Table 3). Densities of each population ranged from moderate to high. Based on these data, Honey, Upper Deep, and Twentymile populations pass the abundance criterion.

Table 3. Mean density, age 1+ fish/m^2 (number of samples) of redband trout populations sampled each year.

Population	1999[a]	2000[b]	Assessment	Pass/ Fail
Honey	0.24 (5)	--	High	Pass
Lower Deep	--	--	--	Fail
Upper Deep	0.14 (13)	--	Moderate	Pass
Twentymile	0.36 (6)	0.04 (6)	High/Low	Pass

[a] *Dambacher et al. 2001*
[b] *Data for 2000 from Edwards, ODFW, unpublished data.*

A 2000 survey estimated overall densities in Twentymile Creek as relatively low (Table 3). Both 1999 and 2000 surveys in Twentymile Creek found high and moderate densities in mid and headwater reaches, however, due to a summer die off where stream temperatures exceeded 28° C, the 2000 survey documented low densities in the lower reaches (C. Edwards, ODFW Lakeview field office, unpublished data). The difference in densities between years suggests conditions in the lower reaches are highly variable and populations may fluctuate dramatically according to environmental conditions. This is likely true for all of the Warner Lakes redband trout populations. We classify Twentymile as passing the abundance criterion because densities were consistently high in the upper reaches, though we acknowledge that abundance in the lower reaches is unstable and subject to extreme environmental conditions.

Quantitative data describing density of redband trout in Lower Deep do not exist. In the absence of these data this population is assessed based on findings of the 2000 population estimate in Twentymile Creek, field observations, and professional judgment. Conditions similar to lower reaches of Twentymile Creek are assumed to exist in the lowest reaches of Deep Creek. Given these factors the Lower Deep population fails the abundance criterion until status can be better assessed.

Current abundance of adfluvial adults in the Warner Lakes is considered relatively low and thought to be dramatically reduced from historical levels (Bowers et al. 1999). Adfluvial redband trout are regularly captured in the lakes but rarely in high numbers. Recent trapnet sampling shows adult redband trout are seldom captured in the lakes, even in high water years (R. Smith, Klamath Fish District, pers. comm.). Seasonal passage barriers associated with irrigation diversions and presence of non-native warm water fish in Warner Lakes prohibit adfluvial populations from attaining historical levels.

Productivity

Data are not available to quantitatively assess productivity and the intrinsic potential of population increase for redband trout in the Warner Lakes 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 a population 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. Both Honey and Upper Deep populations pass the productivity criterion (Table 4).

Table 4. Factors influencing productivity of Warner Lakes SMU redband trout populations.

Population	Factors	Pass/Fail
Honey	Adequate distribution and abundance; good quality habitat in upper reaches; potential migratory life history during high water years, however barriers to movement and the presence of non-native species in Warner Lakes may limit the expression of adfluvial life history.	Pass
Lower Deep	Low density; limited distribution with limited spawning habitat; large individuals rear in deep pools; habitat in lower reaches degraded; barriers to movement and the presence of non-native species in Warner Lakes limits the expression of adfluvial life history.	Fail
Upper Deep	High densities; large watershed with a diversity of high quality habitat with good water quality; connected to habitats potentially capable of supporting large migratory adults.	Pass
Twentymile	Densities variable; adequate distribution; total or partial year class failures observed in lower reaches (Edwards, ODFW, 2000 unpublished data) suggest recruitment is episodic; lacks adfluvial life history; habitat in lower reaches severely degraded.	Fail

Reproductive Independence

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

Stocking of rainbow trout has occurred regularly in Honey, Deep, and Twentymile populations from 1925-1989 (ODFW stocking records). Introduced stocks were primarily of coastal origin. Stocking activities ceased in 1989 and current practices stock rainbow trout only in waterbodies without native fish. Effects of stocking rainbow trout into native redband trout populations are not certain. Behnke (1992) found differences in morphological characters for samples collected in Honey, Deep, and Willow creeks. These differences can be attributed to small sample sizes (n = 8-14), environmentally induced morphological changes, or introgression (D. Markel in USFWS 1998). Detailed genetic analysis is necessary to ascertain the source of these differences. Preliminary genetic examination suggests Warner Lakes redband trout are still genetically distinct and any introgression has reached equilibrium within the larger metapopulation (USFWS 1998). Because hatchery rainbow trout are not currently stocked in waterbodies with native redband trout, all populations pass the reproductive independence criterion.

Hybridization

Non-native cutthroat trout are not present in the Warner Lakes basin and not a threat to redband trout. All populations pass the hybridization criterion.

Assessment Conclusions

The Warner Lakes Redband Trout SMU includes four populations in the interior basin of pluvial Lake Warner. Distribution is widespread in perennial streams and lakes, although multiple irrigation diversions and the presence of non-native warm water fish in Warner Lakes limits the expression of an adfluvial life history. Although densities and abundance are relatively high in the headwater and mid-reaches, densities in the lower reaches may be low and vulnerable to extreme environmental fluctuations and degraded habitat. Only three of the six interim criteria were met, thereby classifying this SMU as 'at risk'(Figure 1). 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.

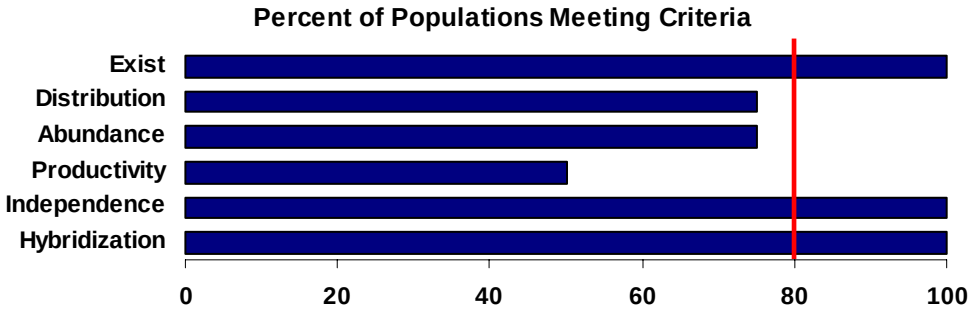

Figure 1. Assessment outcome for each of the six interim criteria with respect to the 80% threshold identified by the NFCP.