CHAPTER 5.0 ENVIRONMENTAL BASELINE

5.1 INTRODUCTION

The environmental baseline describes the impacts of past and ongoing human and natural factors leading to the present status of the species and its habitat within the action area. The environmental baseline provides a "snapshot" of the relevant species' health at a specified point in time (i.e., the present). The environmental baseline includes past and present impacts of all Federal, state, or private actions and other human activities in the action area (50 CFR § 402.2). Therefore, all existing facilities and all previous and current effects of the construction, operation, and maintenance of the Deschutes, Crooked River, and Wapinitia Projects are part of the environmental baseline. The environmental baseline also includes state, tribal, local, and private actions already affecting the species or habitat in the action area or actions that will occur contemporaneously with the consultation in progress. The environmental baseline assists both the action agency and the USFWS and NMFS in determining the effects of the proposed action on the listed species. The following section describes the effects of past and current activities as they relate to the current status of bald eagle, bull trout, MCR steelhead, Canada lynx, and northern spotted owl.

5.2 BALD EAGLE

5.2.1 Factors Contributing to Species Decline

Habitat loss and increasing human population will continue to be the greatest long-term threats to recovery of the bald eagle. Breeding, wintering, and foraging areas continue to be degraded by urban and recreational development and resource extraction activities. Shootings continue to be a problem for bald eagles. Electrocution is also an ongoing problem where powerlines do not conform to raptor protection standards. Nesting habitat quality downstream of dams may decline over the long term if flow releases do not permit perpetuation of forest riparian stands or if fisheries are negatively affected.

Contamination of waterways from point and nonpoint sources of pollution is also a potential problem. Contaminants may affect the survival as well as the reproductive success and health of bald eagles. The abundance and quality of prey may be seriously affected by environmental contamination. Although many compounds implicated in reduced reproductive rates and direct mortality are no longer used, contaminants continue to be a major problem in some areas. Pesticides in recent times have not affected the bald eagle on a population level; however, individual poisonings still occur.

Reservoir drawdowns, low winter flows, or high ramping rates that reduce fish populations impact bald eagle food supplies. Low winter flows reduce habitat availability by reducing spatial rearing area and restrict fish populations to a few residual pools, increasing their vulnerability to predation. Low winter flows that result in increased ice cover can affect the availability of fish and may be a factor in heavily used areas. Reservoir open water areas may not be available to bald eagles during the late winter because of ice conditions.

5.2.2 Environmental Baseline Conditions in Project Area

The Deschutes River basin supports a significant population of nesting and wintering bald eagles. The bald eagle population in the Deschutes basin (including Deschutes, Crook, Jefferson, and Wasco Counties as well as the very northwest tip of Klamath County) is in the High Cascades Recovery Zone (Isaacs and Anthony 2002). The Pacific Bald Eagle Recovery Plan identified recreation disturbance, logging, shooting, and trapping as the main threats for this zone. Since the plan's approval, new habitat issues have evolved including: insect, disease, blowdown, wildfire, and timber harvest effects on large potential nesting or roosting trees (BLM and USFS 2001). BLM and the USFS (2001) have consulted on programmatic activities on their respective administered lands in the upper Deschutes River subbasin.

Nesting activity in the High Cascades Recovery Zone has increased from 52 occupied breeding territories to 60 in the 5-year period from 1998 through 2002 (Isaacs and Anthony 2002). The number of young produced each year increased from 57 to 62 during the same time period. The habitat management goal for this recovery zone has been 47 occupied nesting territories and the recovery population goal has been 33 (Isaacs and Anthony 1999).

The 5-year (1998 through 2002) nesting success average was about 65 percent in the High Cascades Recovery Zone, and the 5-year average of young produced per occupied breeding territory was 1.00. These results are equal to those identified in the Pacific Bald Eagle Recovery Plan and similar to state of Oregon results of 64 percent success and 1.01 young per occupied territory.

5.2.2.1 Upper Deschutes River Subbasin

Nesting Bald Eagles

The upper Deschutes River subbasin above Bend contains the greater part of the bald eagle nesting population in the Deschutes basin (Figure 5-1). According to Isaacs and Anthony (2002) there are approximately 35 identified breeding (nesting) territories in this geographic area (Deschutes County and northern Klamath County), and they are mostly associated with the headwater lakes and reservoirs. For example: there is one breeding territory associated with Crescent Lake; about seven associated with Odell and Davis Lakes; two in the Lava Lake/Elk Lake area; about 17 associated with Crane Prairie and Wickiup Reservoirs and their tributaries; three along the Deschutes River below Wickiup Dam; one at East Lake on the Paulina Creek drainage; and two in the area north and west of Bend. Most nests are in the tops of large conifers, primarily ponderosa pine. A large blow-down of timber at Wickiup Reservoir has limited the availability of suitably sized nesting trees at the location (Morehead 1999).

There are approximately 20 bald eagle breeding territories that are influenced by the operation of Crane Prairie and Wickiup Reservoirs (Figure 5-1 and Table 5-1). For the 1972 through 2002 period of record, the number of occupied breeding territories in the vicinity of these two reservoirs has increased from 6 to 20 (Table 5-1). This increase is largely due to an expanding bald eagle population region-wide. The last 5-year average (1998 to 2002) has been between 18 and 20 occupied territories. The number of young produced over the period of record has varied from three in 1982 to 20 in 1999 and has generally been in an upward trend, similar to the number of occupied territories (Figure 5-2). The last 5-year (1998 through 2002) average was between 17 and 18 young fledged. The last 5-year average success rate per occupied territory was about 60 percent and the 5-year average of young produced per occupied breeding territory was 0.91 – both being near, but slightly below, the recovery goals of 65 percent and 1.0 young per occupied territory. The average success rate and average young fledged has varied considerably over the period of record, but appears to have been on a slight decline overall (Figure 5-3). This may be due to the increased competition for space and prey as breeding pairs have begun to saturate the available habitat and/or to other annual environmental variables such as climate or prey availability.

Eagles nesting in close association with project reservoirs and natural lakes in the upper Deschutes River subbasin are subject to a variety of disturbances, mostly associated with recreational uses of these resources. Some nesting pairs at project reservoirs appear to have grown somewhat tolerant of continued recreational activities such as fishing, boating, camping, vehicle traffic, etc., while other pairs have remained disturbed by such activities. Recreational issues of primary concern (i.e., have the most potential for disturbing nesting activities) are water surface activities. USFWS has suggested that restricting access to some bays during the eagle nesting period would help reduce disturbance impacts on nesting eagles (Dillon 2002).

The Deschutes National Forest administers the lands where the bald eagle nests are located. For most of the nesting territories, the USFS (2002) has established Bald Eagle Management Plans as indicated in Table 5-1. The Bald Eagle Management Plans include restrictions on recreational activities that may adversely affect breeding, nesting, and rearing activities; although these restrictions may be occasionally abused by undisciplined individuals.

Wintering Bald Eagles

Winter use by bald eagles of suitable habitats in the upper Deschutes River subbasin is dependent on winter conditions. When reservoirs, lakes, and streams remain ice-free, some eagles may remain at the higher elevation lakes and streams to prey on the resident fish populations (i.e., bald eagles both nest and winter at Wickiup Reservoir). The greatest winter use is in the Davis Lake arm of Wickiup Reservoir and in the Deschutes River arm below Crane Prairie Reservoir. These areas are most likely to remain ice-free. In extreme winter conditions when ice cover precludes prey availability in high elevation lakes and streams, most bald eagles move to lower elevations or migrate to lower basins to forage for food. A few bald eagles (possibly 10-12) forage along the upper Deschutes River during the winter season preying on fish and waterfowl which are in adequate supply (Morehead 1999). However, lower winter flows make this reach of river more susceptible to ice-cover and may, in some years, limit the availability of fish prey.

Crane Prairie and Wickiup Reservoirs

Bald Eagle

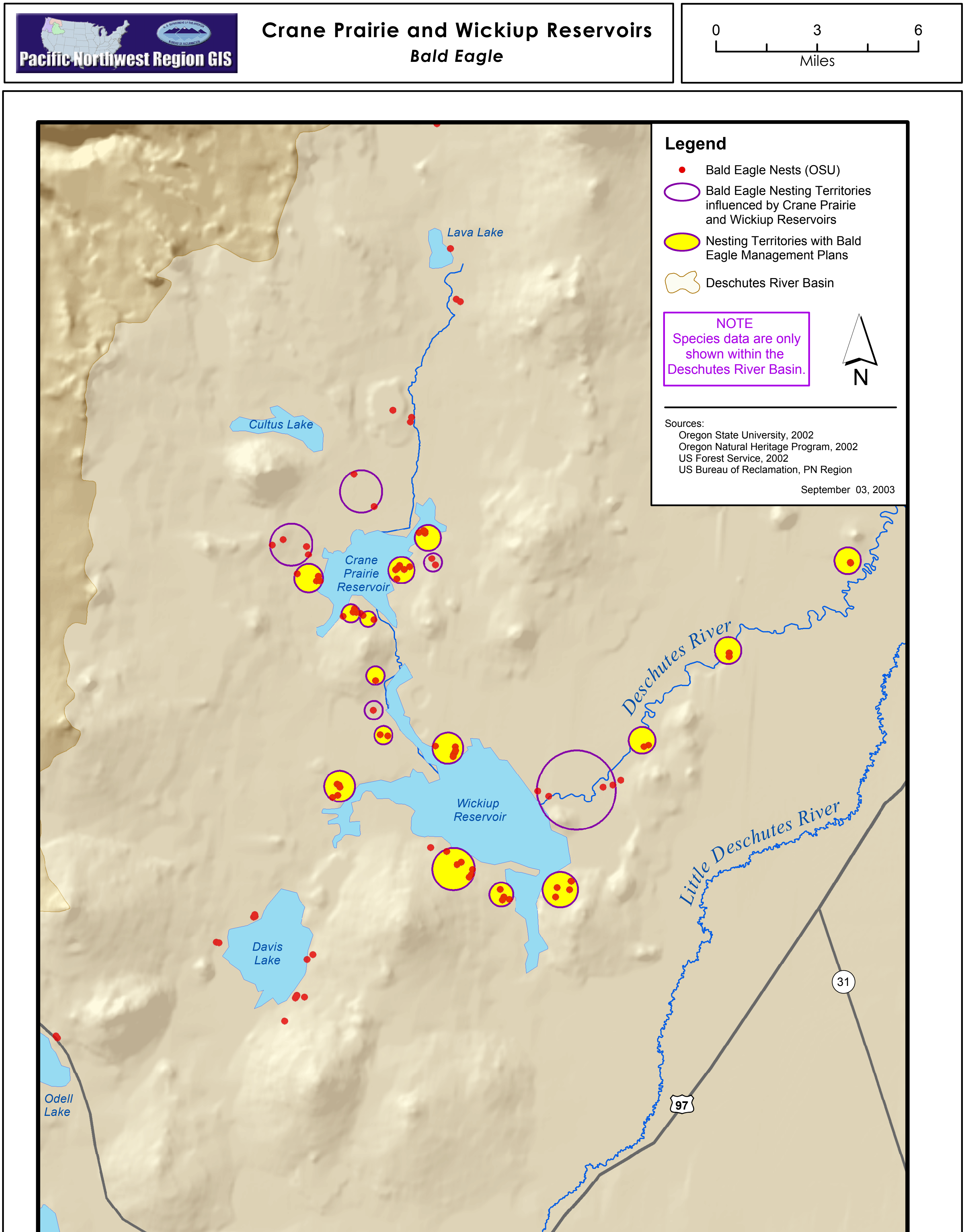

Figure 5-1

Table 5.1 [1]Bald Eagle Nest Production - Vicinity of Crane Prairie and Wickiup Reservoirs

Bald Eagle Nesting Territories	Number of Young Observed per Occupied Breeding Area 1972 - 2002																													
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
Associated with Crane Prairie Reservor:																															
1. ✰Crane Prairie North East		2		1	2	0	1	2	0	0	0	0		0	1	0	0	0	1	2	2	0	1	0	0	0	0	0	0	0	0
2. ✰Crane Prairie East					0	0				0	0	0	0	0	0	0	0	0	1	2	2	1	2	0	0	0	2	2	0	2	1
3. ✰Crane Prairie West			0	0	0	0	2	0	1	2	0	0	1	2	2	2	0	2	2	2	2	2	2	2	2	2	1	0	0	0	1
4. ✰Crane Prairie South West																						2	0	0	1	1	2	1	0	2	0
5. ✰Crane Prairie South East	1	1		2	2		2	0	0	2	0	0	2	0	0	0	2	1	1	2	2		0	0	2	1	0	2	0	0	1
6. Cultus River																													0	1	2
7. Quinn/Lemish Butte	0	0	1							0		0		0		0	0	0	0	1	0	2	0	1	1	1	2	0	0	2	0
8. ☐ Wuksi Butte																							1	1	1	1	1	1	2	2	2
Associated with Wickiup Reservoir:																															
9. ✰Brown's Mountain				1		2	0		2	1	0		0	2	1	2	1	2	2	0	1	2	2	2	1	2	1	2	0	0	0
10. ✰Brown's Creek	2	2	2		3	1	2	2		0	0	1	2	0	2	1	2	0	2	1	0	0	0	2	1	2	0	2	2	2	2
11. ✰Brown's Crossing																														0	0
12. ✰Wickiup Reservoir North	2	1	1	0			0	1	1	0	1	1	0	0	1	0	0	0	0	0	0	2	0	1	0	1	0	1	2	0	2
13. ✰Wickiup Dam/Wickiup Res. East									2	2	0	0	2	0	0	1	0	0	2	0	1	1	0	2	2	2	2	1	2	1	0
14. ✰Eaton Butte										0	0			0			0	0	0		0	0	0	0	0	0	1	1	2	2	2
15. ✰Davis Creek	1	1			1	0	2	2	1	2	2	1	1	0	0	0	0	2	1	2	1	1	2	2	0	0	1	2	1	0	1
16. ✰Round Swamp		1							0	0	0	1	1	0	1	0	1	1	0	0	2	0	0	0	0	0	1	2	0	0	2
17. ✰Wickiup Reservoir South								0	1	2	0	0	2	1	0	1	0	2	1	1	0	0	0	0	0	1	2	0	0	0	0
Associated with Deschutes River (Downstream of Wickiup Dam)																															
18. ✰Tetherow Meadow																	0	0	1	1	1	1	1	2	0	0	1	1	1	1	0
19. ✰Deschutes River Oxbow																			1		1	1	0	0	1	1	0	1	2	0	1
20. ✰Bates Butte	2	1	2			2	2	1	1	2	0	1	2	2	0	1	2	2	0	2	2	0	2	1	2	3	0	1	2	2	1
ANNUAL TOTAL - # OF YOUNG	8	9	6	4	8	5	11	8	9	13	3	5	13	7	8	8	8	12	15	16	17	15	13	16	14	18	17	20	16	17	18
Annual Total - # of Occupied Breeding Areas	6	8	5	5	6	6	8	8	10	14	13	12	11	14	12	13	15	15	16	14	16	16	18	18	18	18	18	18	19	20	20
Avg # Young /Occupied Breeding Area	1.3	1.1	1.2	0.8	1.3	0.8	1.4	1.0	0.9	0.9	0.2	0.4	0.8	0.5	0.7	0.6	0.5	0.8	0.9	1.1	1.1	0.9	0.7	0.9	0.8	1.0	0.9	1.1	0.8	0.9	0.9
Avg Success Rate/Occupied Breeding Area (%)	83	88	80	60	67	50	75	63	70	50	15	42	73	29	50	46	33	47	69	71	69	63	44	56	56	67	67	78	47	50	60

✰ Bald Eagle Management Plans have been completed for these sites (Bend/Ft. Rock Ranger District, Deschutes Natl. Forest, Bend OR).

☐ An essential habitat evaluation has been conducted for this site (Bend/Ft. Rock Ranger District, Deschutes Natl. Forest, Bend OR).

0 Indicates an occupied breeding area, but no young raised or no young observed.

[1]Nest occupancy and number of young observed is taken from: Isaacs, F.B. and R.G. Anthony. 2002. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1972 through 2002. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis.

Information on Bald Eagle Management Plans furnished by: Burchert, S. Feb. 4, 2001. Written Communication. Bend/Ft. Rock Ranger District, Deschutes Natl. Forest, Bend OR.

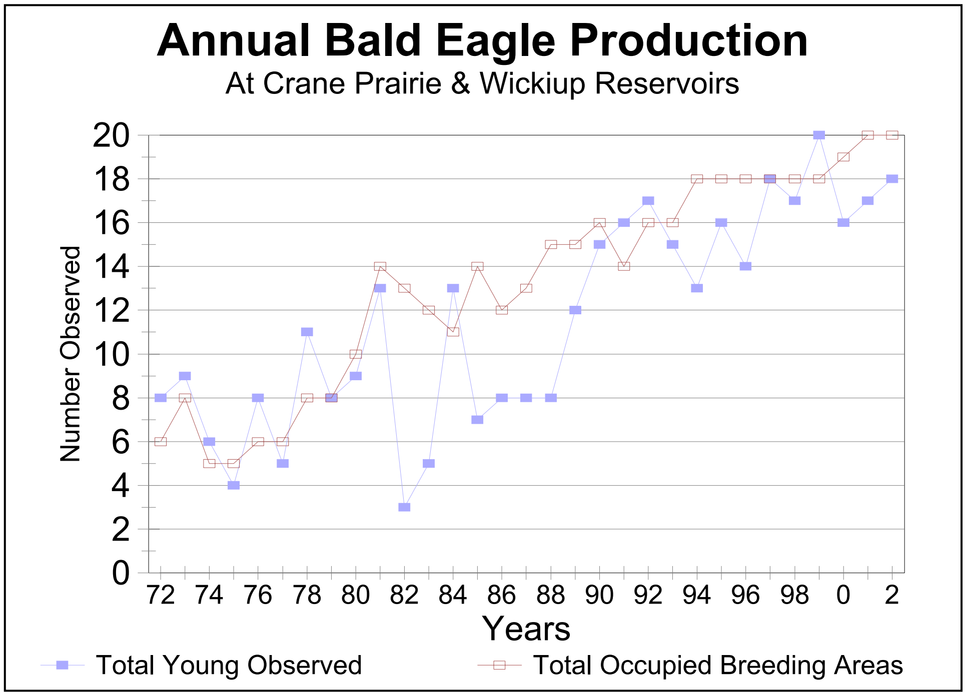

Figure 5-2. Bald Eagle Production Success

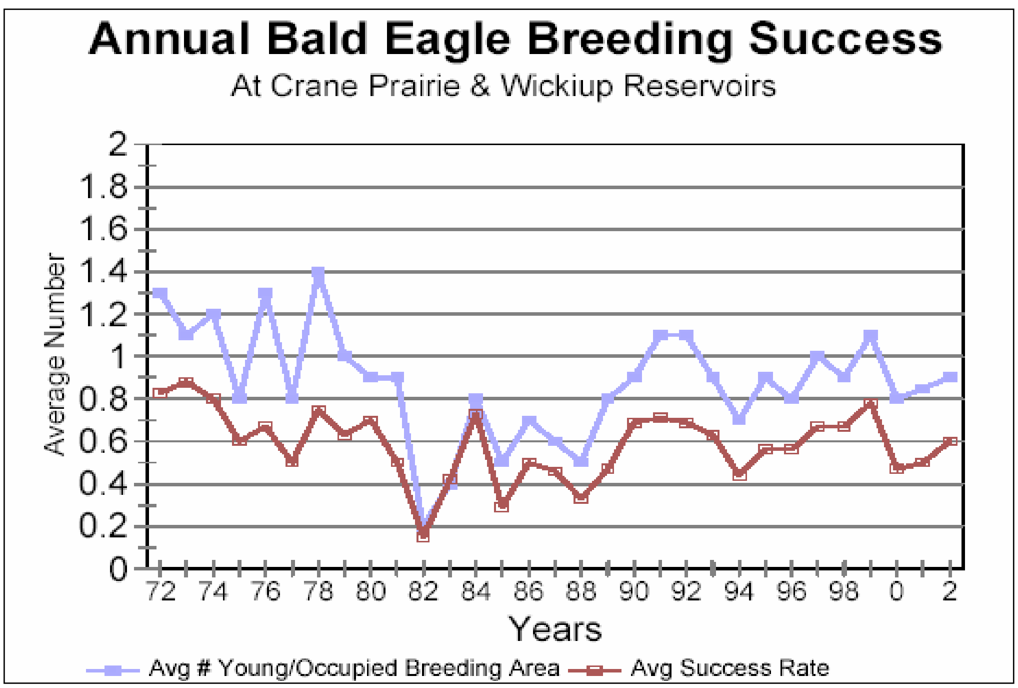

Figure 5-3. Bald Eagle Breeding Success

5.2.2.2 Middle Deschutes River Subbasin

Nesting Bald Eagles

The middle Deschutes River provides only limited habitat for bald eagle nesting because there is a paucity of suitable large conifers for nesting. Many of the nests in this area are associated with the Metolius River and its tributaries (Figure 4-1) as well as the other streams tributary to the west side of Lake Billy Chinook. Two nesting areas are on the upper Metolius, and eight are on the lower drainages immediately west of the Pelton-Round Butte Project reservoirs. The latter are all nest sites located in the upper branches of large ponderosa pine trees. Most of the nest trees are located in canyons or side slopes. There are concerns over human disturbance at nest sites in the vicinity of recreational activities (CTWSRO 1999).

Breeding success and the production of young for nesting territories associated with the Pelton-Round Butte Project are available in Isaacs and Anthony (2002). Although these breeding territories have no direct link to Reclamation projects, a brief summary of nesting and production data is presented here for purposes of the environmental baseline discussion.

The known number of occupied breeding territories in the Pelton-Round Butte Project area increased from 3 in 1989 to 8 in 2000 and remained at 8 during the 2001 and 2002 breeding seasons (CTWSRO and PGE 2002). The recent 5-year (1998 through 2002) average is 7.6 occupied breeding territories and 5.0 successful territories. The number of young produced annually from 1989 through 2002 varied from 3 to 12 and the recent 5-year average is 7.4. The 5-year ratio of success versus occupied territories is 66 percent and the number of young/per occupied territories is 1.02–these are both slightly higher than the Oregon (1998 through 2002) averages of 64 percent and 1.01 (Isaacs and Anthony 2002).

Nesting pairs directly associated with Lake Billy Chinook have generally had good breeding success over the period of record. Other sites removed from Lake Billy Chinook have had mixed success (CTWSRO and PGE 2002). The reasons for unsuccessful nests are only partly known. In some years, breeding pairs have occupied their nesting territory, but for unknown reasons appear to have chosen not to nest. In a few instances, nests have blown out of the nest trees, resulting in nesting failure. Eggs and/or young have been observed early in the nesting season, but have been destroyed or disappeared altogether for unknown reasons prior to hatching or fledging.

A devastating, lightning-caused wildfire in mid-July 2002 severely impacted the bald eagle habitat associated with Lake Billy Chinook (CTWSRO and PGE 2002). The Eyerly Fire, which started initially on the Warm Springs Indian Reservation near the upper end of the Metolius Arm of Lake Billy Chinook, spread south across the reservoir to Federal and private forest lands burning more than 18,000 acres and destroying the Eyerly, Spring

Creek, and Fly Creek nest sites. A fourth nest site in Big Canyon may have also been damaged or destroyed.

Fish comprise the greater part of the diet for the nesting eagles in the middle Deschutes River subbasin. There is a strong dependence on kokanee from Lake Billy Chinook (CTWSRO 1999). Suckers, bass, mountain whitefish, and other fish species are also utilized along with bird species and small mammals.

Wintering Bald Eagles

The majority of bald eagle sightings in this area occur during the fall, winter, and spring months when eagles are wintering or migrating through the area. A migrant population of bald eagles has been frequenting the Metolius Arm of Lake Billy Chinook for many years to feed on kokanee, a reliable and predictable food source. Counts exceeding 200 birds have been recorded in this area (CTWSRO 1999).

All of the resident bald eagles in this area roost in their territories and in nest trees during the fall and late winter. Two winter communal roosts are found along the Metolius River arm of Lake Billy Chinook, near Spring Creek. These roosts are in a coniferous old-growth stand, with an abundance of snags, in close proximity to foraging areas with some thermal cover from the surrounding topography. A separate fall communal roost used by migrating eagles is located near the confluence of the Metolius River with Lake Billy Chinook. The two bald eagle winter roost sites near Perry South Campground and Spring Creek burned in the July 2002 fire discussed above (CTWSRO and PGE 2002).

5.2.2.3 Crooked River Subbasin

Nesting Bald Eagles

Isaacs and Anthony (2002) list 12 known nesting territories in Crook County, most of which are in the Crooked River subbasin (Figure 4-1). Seven of the territories are located at higher elevations upstream of project lands and reservoirs. One of these nests is located on Ochoco Creek, a few miles above Ochoco Reservoir. Three additional nests are located to the north of Prineville, a considerable distance from Crooked River Project lands. The only nesting territory in the vicinity of Reclamation project lands or facilities is at Prineville Reservoir, consisting of two nest sites. The traditional nest is located on north Alkali Flat, within ½-mile of the south side of Prineville Reservoir. While bald eagles had occasionally been observed at Prineville Reservoir during the summer months, the Alkali Flat nest, first reported in 1996 (Table 5-2), was the only nest documented in the area until the 2002 nesting season (Isaac and Anthony 2002; Soules 1999).

Table 5-2. Bald Eagle Nest Production - Vicinity of Prineville Reservoir

North Alkali Flat Bald Eagle Nesting Territory	Number of Young Observed 1996 – 2002						
Year	96	97	98	99	00	01	02
# of Young	1	0	1	1	0	2	0
# of Occupied Breeding Areas	1	1	1	1	1	1	1

The nest site on Alkali Flat is not directly influenced by recreational activities on the reservoir and is on BLM-administered lands. The nest is in a dead snag and is in poor physical condition. It may not provide a good nesting site for much longer (Zakrajsek 2002, Clowers 2002). BLM has not prepared a formal Bald Eagle Management Plan for this nest site, but roads are closed and access in the vicinity of the nesting site is restricted during the breeding season (Dean 2002).

Suitable nesting trees are scarce near the reservoir. Bald and golden eagles have been observed using a tree located on the south side of the reservoir at Sanford Creek. This tree has potential to become a nest tree, but would be very close to recreational boating activities on the reservoir.

Zakrajsek (2002) and Clowers (2002) have suggested that the Alkali Flat nesting pair appears to be defending the entire reservoir against other potential new pairs. The female is showing signs of age and it is expected that there will be a change in the composition of the nesting pair in the near future.

In 2002, the Alkali Flat resident pair of bald eagles established an alternate nest at Owl Creek, on the north side of the reservoir, also on BLM-administered lands. The nesting attempt was unsuccessful. The tree selected is not well suited to breeding and nesting; it is too small for breeding activity and is beginning to fail structurally. It is also within line of sight of and less than ¼-mile from an established recreation access road. It has been speculated that the nest may have been built by the Alkali Flat pair as a defensive act and is probably used by the birds to help discourage other potential bald eagles from using this area (Zakrajsek 2002). Reclamation cooperated with the BLM, ODFW, and Oregon State Parks to close access roads in the immediate vicinity of the new nest during the nesting season.

Reclamation recently completed a resource management planning process for lands surrounding Prineville Reservoir (Reclamation 2003b). As part of that planning process, Reclamation assessed the effects of land management practices on the bald eagles at the reservoir. Reclamation concluded that implementation of the resource management plan may affect, but is not likely to adversely affect bald eagles. USFWS concurred (2003) with Reclamation's assessment based on the following measures which Reclamation is committed to implement to reduce potential human conflicts with bald eagles in the Prineville Reservoir area:

1. Vehicle access around the reservoir will be controlled by seasonal road closures, barrier, signs, and increased enforcement. In addition, an annual review of current eagle activities at known nests will be used to determine the opening dates for some winter road closures.

2. A bald eagle management plan will be developed in cooperation with ODFW, BLM, and USFWS.

3. A comprehensive monitoring plan will be developed for bald eagle nest and roost sites.

4. Dispersed camping at most of the popular camping areas around the reservoir will be limited to defined, designated campsites.

Wintering Bald Eagles

Bald eagles are mostly winter visitors to the Prineville and Ochoco Reservoir areas from December through April (Reclamation 1992). Weekly eagle counts between January and April have regularly observed bald eagles throughout the upper Crooked River drainage as well as the upper Prineville Reservoir area. Three winter communal roost sites have been identified on the steep slopes along the south side of Ochoco Reservoir, well upstream of the dam (Reclamation 1993). Waterfowl and fish, both available at Ochoco Reservoir, are important prey for wintering bald eagles.

A study conducted by Isaacs et al. (1993) on eagles wintering along the upper Crooked River upstream of Prineville Reservoir in 1986 and 1987 found wintering/migrating bald eagles to be most abundant during the first 2 weeks of March, peaking at 115 birds. Eleven communal night roosts were identified in large conifers with one in a cottonwood. Deer and cattle carcasses were the primary food source for these eagles during January and February, while ground squirrels provided an important source of food during March and April.

Bald eagles winter in the downstream Crooked River corridor below Bowman Dam (Prineville Reservoir). Historical reports indicate that the corridor supported their nesting in the past (BLM 1992). Observations of wintering eagles in the canyon have shown a steady increase. In recent years, counts have ranged between 8 to 10 birds, with the majority of them being bald eagles. Resident fish species (i.e., redband trout, hatchery rainbow, mountain whitefish, brown trout, bass, brown bullhead, sucker, and northern pikeminnow) in Prineville Reservoir and in the lower Crooked River, along with small mammal prey and carrion, provide winter forage for these eagles.

5.2.3 Bald Eagle Foraging Habitat and Prey Base

5.2.3.1 Upper Deschutes River Subbasin

Nesting bald eagles in the upper Deschutes ecosystem rely heavily on the abundant prey base of resident fish populations in the streams, lakes, and reservoirs. Common species of prey include rainbow trout, brown trout, coho salmon, kokanee, and whitefish (USFS 1996). Waterfowl and other birds and small mammals are incidental to fish prey.

The availability of prey varies according to habitat conditions, production success, and annual stocking rates. Of the foregoing, habitat conditions in the project reservoirs are closely associated with reservoir operations. Dry year cycles, in particular, reduce the quality and quantity of available aquatic habitat, which may adversely affect fish production and/or longevity. Low reservoir levels and streamflows concentrate fish and make them more susceptible to predation. While this may be initially advantageous for bald eagles, it may lead to reduced fish populations in following years.

Crane Prairie Reservoir

Foraging habitat for nesting bald eagles at Crane Prairie Reservoir consists primarily of the open water area of the reservoir surface and several small tributary streams. The reservoir has a maximum capacity of about 55,300 acre-feet covering about 4,900 surfaces acres. At full pool, the average depth is 11 feet with a maximum of 20 feet. The shoreline has a length of about 22.3 miles. It is 4.9-miles-long and 2.2-miles-wide. The reservoir has no minimum pool restrictions, but the outlet structure is screened to prevent fish losses.

The reservoir storage content has varied considerably from year to year and season to season depending on the water year and on withdrawals for irrigation (Figure 3-2). The reservoir storage at the end of October (going into the winter season) is critical for sustaining a productive reservoir fishery. The average end-of-October carryover has been about 23,000 acre-feet (about 42 percent full).

Fish prey are the most sought after prey for nesting eagles at Crane Prairie Reservoir. The eight bald eagle nesting pairs associated with Crane Prairie Reservoir must compete, not only among themselves, for the available fish prey, but also with high numbers of other piscivorous birds and anglers.

Fies et al. (1996a) reported that bull trout, redband trout, and mountain whitefish were the indigenous fish species present in the Deschutes River when Crane Prairie Reservoir was first created in 1922. Bull trout are no longer found in this upper reach of the river. Crane Prairie Reservoir presently contains hatchery rainbow trout, brook trout, kokanee, mountain whitefish, largemouth bass, tui chub, and three-spined stickleback. Rainbow trout and kokanee are stocked in the reservoir on an annual basis. The other fish species are self-sustaining from previous stocking or illegal introductions.

Crane Prairie Reservoir has long been recognized by ODFW (Fies et al. 1996a) and anglers as one of Oregon's premier trout producing waters. The fishery has been managed as "basic yield" (using natural productivity with or without addition of hatchery stocks) for hatchery and naturally produced trout, whitefish, and largemouth bass. It is especially well known for producing large rainbow trout. Rainbow trout up to 13 pounds have been taken and 3-5 pound fish are common.

Fies, et al. (1996a) stated that the "fish production potential in Crane Prairie Reservoir for all species is, apparently, limited primarily by reservoir pool level." Current population levels of tui chubs and largemouth bass may also be a factor in limiting trout production. There is no minimum pool level for fish life; however, the reservoir typically stays above 10,000 acre-feet. A minimum of 9,470 acre-feet was recorded in 1980 (Reclamation 2003a). Another factor influencing reservoir pool levels is excessive water loss from the reservoir by leakage through broken lava flows along the shoreline (particularly at high storage levels). In fact, seepage can actually exceed annual irrigation releases (Reclamation 2003a).

Reduced reservoir levels during poor water years results in loss of (1) aquatic food production, (2) cover for juvenile fish rearing, and (3) access to spawning areas (Fies et al. 1996a). The annual loss of trees in the reservoir has also resulted in the loss of fish and wildlife habitat. Standing dead timber in the reservoir is lost at an accelerated rate during low water years. Exposure to the air accelerates wood decay and trees are subsequently sheared at water level by a combination of ice and wind.

An additional concern raised by anglers (Fies et al. 1996a) is predation on trout by a variety of fish-eating bird species. The primary species of concern have been cormorants and osprey. Other fish-eating birds present, in addition to bald eagles, include great blue herons, mergansers, kingfishers, gulls, grebes, and goldeneyes. Biologist have learned that water levels appeared to be the key factor in determining numbers of cormorants at Crane Prairie Reservoir. When the reservoir was low, more cormorants came to the reservoir to take advantage of the concentrated food supply. For example, a high count of 730 cormorants was reached in 1981, a poor water year (11,260 acre-feet at end of September). In 1982, a good water year (33,160 acre-feet at end of September), the high count was 295 cormorants.

The tributaries of Crane Prairie Reservoir provide varying amounts of trout spawning and rearing habitat for both reservoir and resident fish populations (Fies et al. 1996a). Of the approximately 13.5 total miles of tributary habitat available in Cultus and Deer Creeks and in Cultus, Quinn, and Deschutes Rivers, over three quarters of it is in the Deschutes River. Consequently, the small amount of habitat available in each stream, except the Deschutes River, may in itself limit the amount of potential fish production.

Wickiup Reservoir

Foraging habitat for nesting bald eagles at Wickiup Reservoir consists primarily of the open water area of the reservoir surface, the Deschutes River (above and below the reservoir), and several small tributary streams. The reservoir has a maximum capacity of about 200,000 acre-feet covering about 11,200 surfaces acres. At full pool, the average depth is about 20 feet with a maximum of 70 feet in the original Deschutes River channel. The shoreline has a length of about 50.5 miles. It is over 6.5-miles-long and 4.5-miles-wide, not including the Deschutes River or Davis Creek arms of the reservoir. The reservoir has no minimum pool restrictions. The outlet structure is unscreened and allows fish to escape when water levels are drawn down. The outlet's depth is approximately 70 feet which rules out the use of conventional fish screening. Fies et al. (1996a) stated that "It does not appear to be technically feasible to screen such an outlet at this time."

As stated above for Crane Prairie Reservoir, Wickiup Reservoir storage content has also varied considerably from year to year and season to season depending on the water year and on withdrawals for irrigation (Figure 3-7). When the reservoir level drops below 40,000 acre-feet of storage (20 percent full), fish become concentrated in the Deschutes River channel of the reservoir and the loss of fish through the outlet increases (Fies et al. 1996a). The average end-of-October carryover has been between 50,000 and 60,000 acre-feet, 25 to 35 percent full.

Fish prey are also the most sought after prey for nesting eagles at Wickiup Reservoir. The nine bald eagle nesting pairs associated with Wickiup Reservoir compete among themselves for the available fish prey and with other piscivorous birds (especially ospreys) and anglers.

Fies et al. (1996a) reported that bull trout, redband trout, and mountain whitefish were the indigenous fish species present in the Deschutes River before the construction of Wickiup Reservoir in 1949. Bull trout are no longer found in this upper reach of the river. In addition to the indigenous mountain whitefish and a small population of redband trout, the reservoir and its tributaries currently contain introduced brown trout, kokanee, coho salmon, brook trout, largemouth bass, and tui chub. Brown trout and coho salmon (as available) are still stocked in the reservoir on an annual basis. The other fish species are self-sustaining from previous stocking or illegal introductions.

Wickiup Reservoir and its tributaries are heavily used by anglers throughout the season (Fies et al. 1996a). Both the reservoir and its tributaries have been managed as "basic yield" fisheries for indigenous whitefish, introduced hatchery and naturally-producing populations of brown, rainbow, and brook trout; kokanee; and coho salmon. The reservoir has a reputation for producing large brown trout; however, the primary angling is for kokanee and coho.

Fies et al. (1996a) stated that, for Wickiup Reservoir, "the fish production potential is limited by reservoir pool level." More recent evidence suggests that illegally introduced populations of bass and tui chubs may also be limiting trout production. There is no designated minimum pool level for fish life. Reservoir storage records (Reclamation 2003a) show that the reservoir typically stays above 25,000 acre-feet. A recent recorded minimum of 15,600 acre-feet occurred in 1994. Average end-of-September carryover is 61,000 acre-feet.

As previously discussed above, "When the reservoir drops below 40,000 acre-feet of storage, the loss of fish through the unscreened outlet increases...These are primarily kokanee and coho, fish with strong migrational tendencies (Fies et al. 1996a)." Thousands of kokanee and coho salmon and lesser numbers of brown trout can be lost from the reservoir annually.

"During a period of high water years, natural production of kokanee results in too many fish for the available food supply and the size of the fish declines rapidly. Conversely, in the low water cycles, fish losses through the outlet increase and remaining fish have an abundant food supply resulting in larger fish (Fies et al. 1996a)."

As at Crane Prairie Reservoir, Wickiup Reservoir also experiences an annual loss of tree stumps resulting in lost aquatic food production and fish cover. This problem is especially severe in low water years. Projects to replace structural habitat (i.e., rocks, whole trees, root wads) have been undertaken, but are relatively small in scope compared to the amount of habitat lost. With continued loss of stump habitat, the overall fish production capability of the reservoir may decline in the future (Fies et al. 1996a).

Browns Creek, Davis Creek, Sheep Springs, and the Deschutes River (between Crane Prairie Dam and Wickiup Reservoir) provide spawning habitat for brown and rainbow trout, kokanee, whitefish, and brook trout. Coho salmon, although present at Wickiup Reservoir, have never been observed spawning in the tributaries--possibly because water temperatures are too cold for coho production (Fies et al. 1996a). Stream habitat in the Deschutes River varies in length due to fluctuations in Wickiup Reservoir pool, but averages about 2.5 miles. It may be up to 6 miles in late summer when the Wickiup

Reservoir pool level is down. While this reach of the Deschutes River is characterized by generally good water quality (Fies et al. 1996a), it can be adversely affected in mid-summer because of warm water releases, accompanied by extensive amounts of algae, from Crane Prairie Reservoir. Flow fluctuations can also significantly alter the amount of useable spawning gravel and trout rearing cover in this reach of river.

Deschutes River (Downstream of Wickiup Reservoir)

The Deschutes River and tributaries below Wickiup Reservoir provide foraging habitat for three bald eagle pairs which nest along the river and possibly other pairs with overlapping territories (i.e., the Wickiup Dam nesting territory). Flows in this reach of river are characterized by large, demand-based seasonal fluctuations as a result of reservoir operations and irrigation diversions (Figure 3-8). During irrigation season, when releases from upstream reservoirs increase to meet downstream irrigation demands, Deschutes River flows greatly exceed historic “natural” flows. During the fall and winter, flows are reduced below historic “natural” flows as the reservoirs are refilled (see Chapter 3).

During the nonirrigation season, a minimum of 20 cfs is normally maintained at the gaging station about 1,000 feet downstream from the dam (Reclamation 2003a). This minimum was set by the Oregon State Engineer as a result of a hearing held in September 1954 on the amended application to increase the storage in Wickiup Reservoir. Flows higher than 20 cfs can usually be supplied in a series of wet years without risk to refill, as was the case from 1997 to 2001.

This combination of wide seasonal fluctuations, sustained high summer flows, sustained low winter flows, and the rapid transition from each to accommodate seasonal irrigation needs is the current primary source of aquatic and riparian habitat degradation (i.e., bankline erosion, sediment load, high turbidity levels, loss of spawning habitat, loss of riparian vegetation) and limitations on overall productivity of fish prey in the Deschutes River from Wickiup Dam to Bend.

During the eagle nesting season, flows in this reach of river are generally high from spring runoff and from irrigation releases. The prey base in this reach of the Deschutes River consists, primarily, of the same fish species which exist in Wickiup Reservoir. Resident fish and fish flushed through the dam (as described earlier) provide needed forage for the nesting eagles which forage along the river. Although, higher than natural flows may restrict foraging success. Low water in the winter period (dry and average years) does not directly influence foraging of nesting eagles, but it does limit habitat available to resident fish, resulting in reduced fish populations.

5.2.3.2 Crooked River Subbasin

Prineville Reservoir

The nesting pair of bald eagles at Prineville Reservoir rely primarily on the abundant prey base of resident fish populations in the reservoir. Common species of prey may include rainbow trout, smallmouth and largemouth bass, brown bullhead, largescale and bridgelip suckers, and black crappie. Waterfowl and other birds and small mammals are incidental to fish prey.

The availability of prey varies according to habitat conditions, production success, and annual stocking rates. Of the foregoing, habitat conditions in Prineville Reservoir are closely associated with reservoir operations. Dry year cycles, in particular, reduce the quality and quantity of available aquatic habitat, which, in turn, may adversely affect fish production and/or longevity. However, dry cycle effects at Prineville Reservoir are rare.

Foraging habitat for nesting bald eagles at Prineville Reservoir consists primarily of the open water area of the reservoir surface and the Crooked River above and below the reservoir. The reservoir has an active capacity of about 148,640 acre-feet covering about 3,070 surfaces acres. Maximum depth is about 230 feet, with an average annual drawdown of 25 to 30 feet. The shoreline has a length of about 43 miles. The reservoir is over 12 miles in total length but varies from less than ¼-mile-wide to about ¾-mile-wide. The reservoir has no minimum pool restrictions, but the uncontracted space (83,000 acre-feet) serves to maintain a minimum pool in most years. The recent recorded minimum pool was 22,450 acre-feet in 1993 (Reclamation 2003a). The reservoir storage content is fairly predictable for most years (Figure 3-23). The average end-of-October carryover storage is about 83,000 acre-feet (about 56 percent of full).

Prior to inundation in the winter of 1960-61, the Crooked River at the site of Prineville Reservoir supported a very low abundance of native redband trout and MCR steelhead, brown bullhead, and assorted nongame species. The riverine ecosystem was extremely degraded by land and water management practices at the time (Stuart et al. 1996).

Stuart et al. (1996) reported that "Prineville Reservoir is probably moderately nutrient rich, but unproductive due to the high turbidity which limits sunlight penetration." The reservoir is impacted by high quantities of suspended sediments resulting from erosion occurring on the mainstem Crooked River and tributaries above the reservoir as well as shoreline erosion of the reservoir caused by the wave action from wind and boats.

Nongame species presently dominate the fish population in Prineville Reservoir. Suckers and chiselmouth are the most abundant. Stuart et al. (1996) reported that hatchery rainbow trout are stocked in the reservoir in early to mid-May and are the primary game fish in the reservoir.

Largemouth and smallmouth bass are sustained by natural reproduction. Largemouth are generally found in the upper half of the reservoir while smallmouth bass are common throughout the reservoir. The generally poor condition of bass species in the reservoir indicate an insufficient prey base (Stuart et al. 1996). Production may also be limited by reservoir drawdowns in the early spring. ODFW and Reclamation have cooperated on projects to improve bass habitat in the reservoir, including the placement of juniper trees for fish cover (Reclamation 2003a).

Crooked River Below Bowman Dam

Cold water releases (Figure 3-24) from Prineville Reservoir have created a tailrace fishery through the Chimney Rock section (about 12 miles) of the lower Crooked River. This reach of river supports a mix of native redband trout, hatchery rainbow trout, and mountain whitefish. Hatchery fish stocked in Prineville Reservoir sometimes pass through the dam to the Crooked River below. High entrainment rates appear to correspond with severe drawdown of the reservoir or when the reservoir is high enough that water flows over the spillway (Stuart et al. 1996). Small amounts of smallmouth and largemoth bass, brown bullhead, and nongame fish also occur in the river below the dam.

Informal minimum releases up to 75 cfs (usually 30-35 cfs during extreme drought conditions) from the uncontracted storage space have helped sustain the downstream fishery during the nonirrigation season.

Ochoco Reservoir

Ochoco Reservoir is a privately-owned facility that is operated in coordination with Reclamation’s Bowman Dam operations.

Wintering bald eagles at Ochoco Reservoir utilize the prey base of resident fish populations in the reservoir to supplement their diet of big game and livestock carrion. Common species of fish prey may include rainbow trout, brown bullhead, and bridgelip suckers. Waterfowl, other birds, and small mammals are incidental to fish prey and upland carrion in the eagles winter diet.

The availability of prey varies according to habitat conditions, production success, and annual stocking rates. Of the foregoing, aquatic habitat conditions in Ochoco Reservoir are closely associated with reservoir operations. Dry year cycles, in particular, severely reduce the quality and quantity of available overwintering aquatic habitat, which, in turn, may adversely affect fish numbers during the winter period.

Foraging habitat for wintering bald eagles at Ochoco Reservoir consists primarily of the open water area of the reservoir surface and Ochoco Creek above the reservoir. The reservoir has a capacity of about 44,266 acre-feet covering about 1,060 surfaces acres. Maximum depth is about 100 feet with an average annual drawdown of 25 to 50 feet. The reservoir is about 3.5 miles in total length with a maximum width of 0.5 miles. The reservoir has no minimum pool restrictions; the entire useable pool is used to irrigate OID lands.

The reservoir storage content is fairly predictable for most years (Figure 5-4). The average end-of-October carryover storage has been about 14,750 acre-feet or about 33 percent full (Reclamation 2003a).

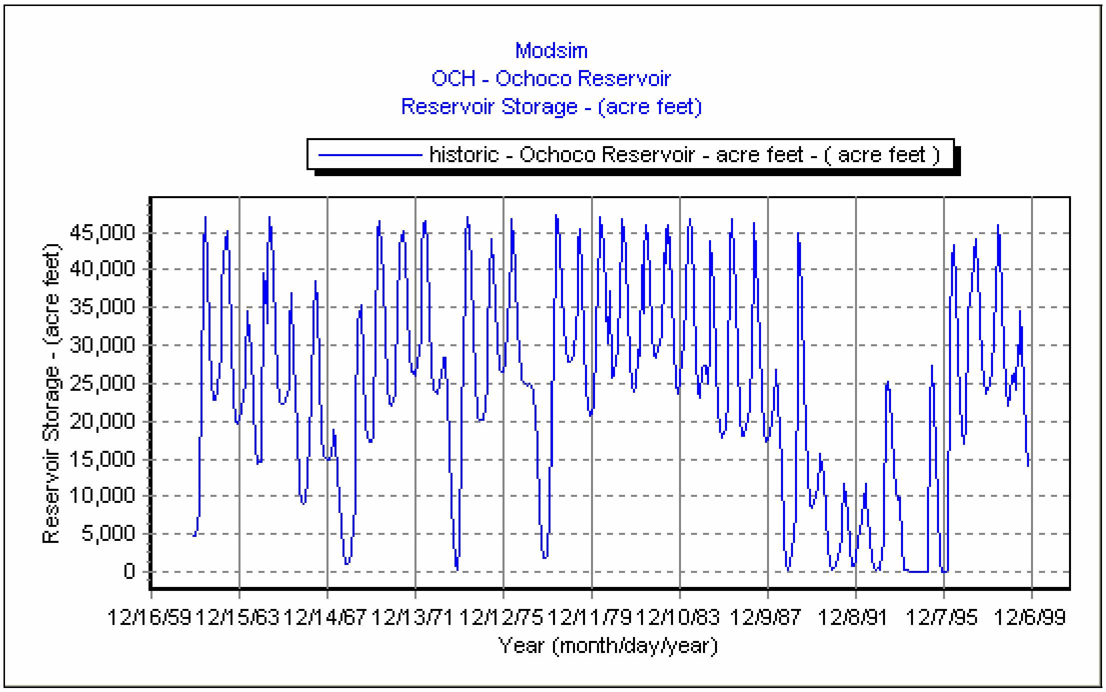

Figure 5-4. Ochoco Reservoir – Historic End-of-Month Elevations

Ochoco Reservoir habitat is characterized by a lack of shoreline vegetation, an expansive mud flat substrate in the upper end, and a boulder and cobble-strewn substrate in the lower end. Additional habitat limitations for fish include only moderate concentrations of nutrients in the water, very low abundance of aquatic vegetation, a lack of structural complexity, and water that is too cold for optimal warmwater fish production and perhaps too warm for optimal trout production (Stuart et al. 1996).

Ochoco Reservoir currently supports populations of rainbow trout, brown bullhead, and bridgelip suckers. Ochoco Creek upstream of the reservoir supports redband trout, bridgelip sucker, sculpins, and dace. Hatchery rainbow trout grow well in the reservoir and have supported the bulk of angler effort since 1958 (Stuart et al. 1996). The reservoir is managed for intensive use and basic yield, with the fishery sustained by a hatchery fingerling rainbow trout program. Since 1980, approximately 100,000 rainbow trout have been stocked in the reservoir, annually; although these numbers have been adjusted downwards in years with anticipated low water conditions.

Ochoco Dam has an unscreened outlet that allows hatchery fish to be entrained into the stilling basin and creek below. When water is shut off following the irrigation season, these fish die unless a salvage is conducted. Some hatchery rainbow pass downstream, rear, and may reproduce in Ochoco Creek. Hatchery fish may also move upstream from the reservoir, rear, and reproduce in Ochoco and Mill Creeks (Stuart et al. 1996).

5.2.3.3 Lower Deschutes River Subbasin

The nesting pair of bald eagles at Clear Lake rely primarily on the fish prey base in Clear Lake and in adjacent streams and lakes. Common species of prey are rainbow trout and kokanee. Waterfowl and other birds and small mammals would be incidental to fish prey.

The availability of prey varies according to habitat conditions, production success, and annual stocking rates. Of the foregoing, habitat conditions in Clear Lake are closely associated with reservoir operations. Dry year cycles, in particular, reduce the quality and quantity of available aquatic habitat, which, in turn, may adversely affect fish production and/or longevity.

Foraging habitat at Clear Lake consists of the open water area of the reservoir surface. The reservoir has an active capacity of about 11,900 acre-feet covering about 557 surfaces acres. The water depth at the dam is about 40 feet at full pool. The shoreline has a length of 5 to 6 miles. It is about 2 miles in total length but varies from less than ¼-mile wide to about 1-mile across its two arms. The reservoir has no minimum pool restrictions, but when the reservoir is drawn down to dead pool, the original natural lake remains (storage content unknown).

The historic record of reservoir storage at Clear Lake is not complete; therefore, only a partial hydrograph can be constructed (Figure 3-31). It is estimated that the average end-of-October carryover storage is about 2,540 acre-feet over and above the natural lake level (Reclamation 2003a). The reservoir is essentially emptied on most drought years, but still leaving the natural lake.

Bald eagles have been commonly seen in the area for years foraging in the Clear Lake, Frog Lake, and Timothy Lake areas (Morehead 1999). A kokanee run above Timothy Lake provides seasonal prey for eagles. Fish as a prey base at Clear Lake itself may be limited, because of annual reservoir drawdowns. Even so, Clear Lake is regularly stocked with legal size rainbow trout and regular stocking is expected to continue into the foreseeable future. Clear Creek below the dam typically has insufficient year-round flows to support a fishery.

Wintering Bald Eagles

The lower Deschutes subbasin value to bald eagles is primarily as wintering habitat. As described for the Crooked River and middle Deschutes River subbasins, bald eagle numbers increase dramatically during the fall, winter, and spring during migrations and wintering periods. Numerous communal roosts are utilized along the river corridor. Prey species include fish which are abundant in the lower river and tributaries, as well as waterfowl, small mammals, and big game and livestock carrion.

Clear Lake freezes over in the winter, so there is no foraging habitat at the lake for eagles or ospreys during that season (Reclamation 1999).

5.3 BULL TROUT

5.3.1 Factors Contributing to Species Decline

Bull trout were formerly viewed as a "trash fish" by anglers because they consume juvenile salmon and other game fish and were considered undesirable predators. Many fish and wildlife agencies mounted active campaigns to eliminate bull trout. Even after active efforts to eliminate bull trout ceased, populations continued to decline due to impacts from other human activities. The causes of this decline are many and varied and have worked in concert to cumulatively impact this and other native salmonid species. Impacts on bull trout generally occur from three areas of resource management: 1) land management practices, 2) water management practices, and 3) fisheries management practices. Current recognized threats to bull trout are discussed in the following sections.

5.3.1.1 Habitat Degradation

Loss of riparian vegetation through human activity leads to increased water temperature and siltation. Instream cover is lost due to a reduction in woody debris recruitment and unstable banks that do not allow the formation of undercut banks. Most bull trout spawning strongholds are associated with unmanaged watersheds with near pristine streams.

5.3.1.2 Passage Barriers and Stream Diversions

Dams, irrigation diversions, and other alterations of waterways have interrupted the migration of bull trout. Numerous dams without adequate fish passage have caused some populations with migratory life histories to switch to resident life histories. Where once the migratory bull trout linked resident bull trout to much of the species' gene pool, today, the resident populations are isolated, vulnerable to habitat degradation and may suffer a loss of genetic diversity. If a barrier is high in a drainage, the isolated population may be too small to sustain itself.

On bull trout streams where there are irrigation diversions, at least four potential problems may affect bull trout production. Irrigation diversions reduce instream flows; the water returned to streams tends to be warmer than the water diverted; sediment is added to streams; and unscreened diversions entrain migrating juvenile bull trout to conveyance systems and fields where they die.

Construction of water storage structures appears to have been a significant factor in the reduction of bull trout range and distribution. Construction and operation of these facilities have modified streamflows, changed stream temperature regimen, blocked migration routes, entrained bull trout, and affected bull trout forage bases.

Reservoirs experience substantial drawdowns during drought years. Reduced reservoir volume directly impacts the amount of aquatic environment for all organisms in the food web. Production of phytoplankton, zooplankton, and aquatic insects are all reduced when drawdowns are extreme. Reduction in the food base may reduce the prey available for predator species like bull trout; although, in some cases, forage fish populations may be more concentrated and more available as prey. When reservoir volume is greatly reduced, bull trout and other fish species may be forced into riverine habitats.

Upper Deschutes River

Construction of Crane Prairie Dam in 1922 and Wickiup Dam in 1949 blocked fish passage, reduced instream flows and caused subsequent increases in water temperature, altered streamflow regimes, and inundated spawning and juvenile rearing areas in the upper Deschutes River subbasin (Buchanan et al. 1997).

Although a loss of connectivity, habitat, and forage base due to dam construction may have been detrimental to bull trout populations, this cannot be the sole explanation for their extirpation, for they persisted in the upper Deschutes River subbasin for 16 years after the construction of Crane Prairie Dam.

Lower Deschutes River

The construction of the Pelton-Round Butte Project created a barrier to the upstream movement of bull trout in the mainstem Deschutes River and is also an obstacle to downstream movement. This project has had some effects to flows in the lower Deschutes River, however, it is not known whether or not these effects alter bull trout use of the mainstem Deschutes River (Newton and Pribyl 1994).

5.3.1.3 Competition with Exotic Species

Brook trout were introduced to Oregon and Idaho in the early 1900s (Buchanan et al. 1997). Brook trout not only compete directly with juvenile bull trout for food, but are genetically close enough to the bull trout to permit hybridization. The hybrids are sterile and represent a dead end for bull trout genes. The danger is especially acute when there are few bull trout and the hybrids cannot contribute to the bull trout population.

Other introduced species that provide forage and have different habitat preferences, such as kokanee, may actually benefit bull trout. However, when brown trout, bass, and lake trout are present in the same waters as bull trout, they may depress or replace bull trout populations through competition for prey and may also prey upon juvenile bull trout.

5.3.1.4 Reduced Populations from Overfishing or Eradication Efforts

Some populations of bull trout were eliminated and others have not recovered from overfishing and deliberate efforts to eradicate them. The populations remaining may suffer from a loss of genetic diversity and may not be able to sustain themselves.

Angling and harvest of bull trout influences the current status of this species, which may be vulnerable to overharvest. Although the direct, legal harvest of bull trout has been eliminated or restricted in most states, incidental takes of this species in recreational trout fisheries and by poachers, especially in streams supporting large migratory fish, may further impact bull trout abundance. During a regulated season, the ODFW allows anglers to harvest one bull trout per day with a 24-inch minimum length from Lake Billy Chinook.

5.3.1.5 Catastrophic Events

Catastrophic fire events can drastically alter water quality, water temperature, woody debris, bank vegetation, and streamflow characteristics. Wildfire has been documented as impacting bull trout populations (Burton 1997). Salvage timber sales have a high potential to impact isolated bull trout populations. Drought conditions result in reduced summer streamflows (and reduced reservoir elevations) and increased water temperature and will predictably reduce spawning success and survival of bull trout (Knowles and Gumtow 1996). Climate change as a result of global warming could reduce bull trout spawning success (Knowles and Gumtow 1996).

Environmental stochasticity or the effect of a catastrophic event (such as deep reservoir drawdowns for flood control or during drought conditions) influence the probability of bull trout extinction when population size is small (Rieman and McIntyre 1993).

5.3.1.6 Recovery Efforts

The 1997 “Status of Oregon's Bull Trout” (Buchanan et al. 1997) reports that 81 percent of Oregon's bull trout populations are considered to be at a “moderate risk of extinction,” “high risk of extinction,” or “probably extinct.” This report discusses life history, habitat needs, potential limiting factors, and risks for bull trout populations on a basin-by-basin basis. The report concludes with a section on research and management needs, followed by recommendations.

In the Deschutes River basin, efforts were initiated to protect and enhance bull trout in the Metolius subbasin in 1983. These efforts were initiated by the Metolius Bull Trout Working Group comprised of representatives from ODFW, USFS, CTWSRO, and PGE. Since then the group has been expanded to include the entire Deschutes River basin and additional representatives from USFWS, BLM, Reclamation, Central Oregon Flyfishers, Trout Unlimited, Oregon Department of Forestry, and Oregon State Parks and Recreation Department. Another working group has been formed to work on bull trout in the Odell Lake basin. This group includes representatives from the USFS, ODFW, and resort owners around the lake. Both working groups have been drafting conservation strategies for bull trout in their respective basins (Buchanan et al. 1997).

In November 2002, the draft rule for bull trout critical habitat in the Columbia and Klamath River basins was published in the Federal Register by the USFWS. This proposal includes bull trout critical habitat for the Deschutes River basin. A final rule was expected in October 2003. However, USFWS has postponed further work to develop a final rule until fiscal year 2004 because of lack of funding.

Critical habitat refers to specific geographic areas that are essential for the conservation of a threatened and endangered species. Primary constituent elements are physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. Currently, there are nine primary constituent elements considered for bull trout that describe physical and biological features essential to the conservation of the species. Physical features include temperature, flow regime, water chemistry and habitat constituents such as stream channel type, substrate composition, and migratory corridor considerations. Biological features include consideration of competitive nonnative species interaction and food base and forage requirements. An important consideration for the proposed action is the effect, if any, to the primary constituent elements described above. Since present operations of Reclamation facilities in the Deschutes and Crooked River subbasins reflect ongoing actions that have occurred in the recent past, there will be no effect to the hydrograph and potential physical or biological features associated with critical habitat proposed for bull trout.

The USFWS is expecting completion of final bull trout recovery plans in November 2004. Recovery plans are a much larger blueprint for the recovery and eventual delisting of a species, as it provides recommendations concerning habitat and various other factors that need to be addressed to achieve recovery.

5.3.2 Environmental Baseline Conditions in Project Area

5.3.2.1 Upper Deschutes River Subbasin — Headwaters to Bend

As described earlier in this chapter, bull trout are no longer found in Reclamation project reservoirs (i.e., Crane Prairie, Wickiup) and the upper Deschutes River system, and are thought to be "probably extinct" (Buchanan et al. 1997). Since few studies by management agencies focused on bull trout, basic information is lacking, such as accurate estimates of their historical population sizes and distribution within the upper Deschutes River subbasin. The only population remaining in the upper basin is that associated with Odell Lake, which is not a project facility and is not affected by operation of Reclamation projects. The Odell Lake population is considered to be at "high risk" of extinction. The presence of a public campground on Trapper Creek in the only identified bull trout spawning area in the Odell subbasin may put spawning bull trout at risk from illegal harvest. Harvest management of bull trout is the main conservation management tool used at this time (Marx 2000).

5.3.2.2 Middle Deschutes River Subbasin ― Bend to Lake Billy Chinook

The middle Deschutes River is delineated as the area downstream from the City of Bend at RM 165 to Lake Billy Chinook (RM 120). Below the city of Bend, the Deschutes River changes from forested to desert canyon habitats. Following irrigation development, nearly the entire flow at the North Canal Dam at Bend was diverted during the irrigation season. Flows recorded immediately downstream from Bend during the irrigation season are typically less than 50 cfs.

Streamflows

The Deschutes River from Bend to Lake Billy Chinook does not have an established minimum flow. Reductions in streamflow and changes in flow patterns due to water diversions in Bend and upstream have drastically altered flow in the middle Deschutes River, as well as the aquatic environment.

Prior to reaching Lake Billy Chinook, substantial groundwater discharge occurs along the lower 2 miles of Squaw Creek and the Deschutes River between Lower Bridge (RM 135) and Lake Billy Chinook. These discharges provide substantial cooling to the Deschutes River. A 2001 ODEQ thermal infrared study showed a surface water temperature decrease of approximately 16°F between RM 132 and RM 120.

This discharge of water and subsequent good water quality in this reach of the Deschutes River is likely the reason that bull trout are present from Lake Billy Chinook to Big Falls (RM 132). These groundwater discharge gains occur even during dry periods and the driest months of the year. In 1994 (Caldwell 1998), the streamflow increased by more than 430 cfs from RM 138 to RM 120.

Bull Trout

As described earlier in this chapter, the bull trout populations in the middle Deschutes subbasins occur in the Metolius River subbasin, Lake Billy Chinook Reservoir, the Deschutes River upstream from Lake Billy Chinook to Big Falls, lower Squaw Creek, and the lower part of Crooked River up to the Opal Springs Dam. The Metolius River and its tributaries are the primary spawning and rearing streams, while Lake Billy Chinook and its respective riverine arms (Deschutes, Metolius, and Crooked Rivers) provide foraging habitat for overwintering adults and growing subadults and has produced a trophy-sized bull trout fishery. Life histories of these fish are summarized as follows from Buchanan et al. (1997).

Most bull trout in the Metolius River and tributaries age 5 and older spawn between 15 August and early October, with some individual spawners found between July through late October. It appears that the extremely cold (39° to 46°F) Metolius River tributaries provide the critical spawning and juvenile rearing habitats that support the Metolius River bull trout population.

Juvenile bull trout typically rear in their natal streams for 2 to 3 years before migrating downstream to Lake Billy Chinook. Although migrating juveniles were observed in all months, most migration peaked in May and June. Many of these fish appeared to migrate directly to Lake Billy Chinook when about 8 inches (200 mm) long. Subadult bull trout tagged in the lake at the head of the Metolius arm moved into all available waters. After 2 to 3 years in the reservoir (age 5-6), they migrated back up the Metolius River during April through July. Maturing adult bull trout were captured at the head of the Metolius arm of Lake Billy Chinook beginning in April and continuing through August.

Most maturing bull trout remained in the lower Metolius River until mid-July when they initiated their upstream migration. After migration commenced, most fish quickly moved up the Metolius River and resided near the mouth of the intended spawning tributary. Adult bull trout entered tributary streams beginning in late July and continuing through the last week of September. Migration into the spawning tributary, spawning, and migration back to the Metolius River usually took place within 2 weeks. Most post-spawned bull trout moved back down to Lake Billy Chinook within 4 weeks after spawning, demonstrating an adfluvial life history pattern. However, some bull trout appeared to demonstrate a fluvial life history pattern and remained in the upper Metolius River.

Number of Fish – The number of bull trout redds and number of spawning adults has generally been increasing since the late 1980s. Trends in spawning population size have increased since 1986 from 27 redds to about 760 redds in 2001 (PGE 2002). Estimated population numbers for adult fish system-wide increased from 818 in 1993 to 1,895 in 1994 (Buchanan et al. 1997). Bull trout abundance has increased dramatically in recent years because of restrictive angling regulations, education, and a large forage base of kokanee in Lake Billy Chinook. The healthy Metolius/Lake Billy Chinook bull trout population (Ratliff and Howell 1992) has allowed a limited harvest of trophy fish to continue.

The number of bull trout counted in the Metolius River basin through 2001 suggests that this population is fit and robust enough to prevent excessive inbreeding. Growth rates in Lake Billy Chinook are some of the highest reported in the literature (Riehle et al. 1997).

Habitat Conditions/Water Quality – Because of low streamflows, land management activities, and multiple uncontrolled variables such as air temperatures from Bend to about 30 river miles downstream, water quality does not meet State standards. Water quality problems include high water temperatures, low dissolved oxygen, high pH, high nutrient loading, high fecal coliform, high toxins (pesticides, fertilizers), moderate turbidity and high sedimentation. High volumes (about 500 cfs) of cold spring water substantially improve the water quality in the remaining 12 miles to Lake Billy Chinook. The influence of these springs provides a relatively cool and stable year-round water temperature for bull trout that inhabit this reach of the river.

5.3.2.3 Crooked River Subbasin

While there is no historical documentation of bull trout spawning in the Crooked River subbasin, Metolius basin bull trout used the lower Crooked River for juvenile rearing and adult holding areas.

The apparent absence of bull trout from the remainder of this basin is consistent with the habitat requirements of the species, which is generally found in watersheds that receive substantial year-round flow from cold water springs.

Currently, bull trout in the lower Crooked River are confined to Lake Billy Chinook and in the river upstream to the Opal Springs Dam and hydroelectric facility, an impassible barrier since 1982. There are no records of their abundance in the lower Crooked River. Similar to the Deschutes River upstream from Lake Billy Chinook, the lower Crooked River experiences significant groundwater inflow between RM 6 to RM 14. Caldwell (1994) documented gains of up to 1,006 cfs in this reach. During summer and fall periods, lower Crooked River flows upstream from the groundwater discharge sites is typically very low with warm water temperatures. Near the mouth of the Crooked River, contributions from Opal Springs provide good water temperatures and refugia for bull trout during extreme summer and winter temperatures.

5.3.2.4 Lower Deschutes River Subbasin

The lower Deschutes River is delineated as the area downstream from Pelton Reregulating Dam at RM 100.1 to the mouth.

Streamflows

The lower Deschutes River is a remarkably uniform and stable river (Fassnacht et al. 2002, and Figures 3-17 and 3-19). Russell (1905, cited in O'Connor et al. 1999) noted that the Deschutes River exhibited "certain peculiarities not commonly met with." Henshaw et al. (1914 cited in O'Connor et al. 1999) recognized the uniform and stable flows in the Deschutes River and O'Connor et al. (1999) attributed the steady flow of the Deschutes River to "the poorly integrated drainage system in the southern and western portions of the Deschutes Basin, and the substantial groundwater storage in the young volcanic fields along the flanks of the Cascade Range." Daily average streamflows in cfs in the lower Deschutes River on a monthly basis for the period 1990 to 2001 at USGS streamflow gaging stations at Madras and Moody, located at RM 100.1 and 1.4, respectively, are shown in Table 5-3. The period 1990 to 2000 was selected to represent current conditions, and includes some wet, dry, and "normal" water years. This more recent time period does not include some extremely dry years that occurred in the 1930s, but does reflect current baseline environmental conditions and operations for this consultation. The State of Oregon instream flow recommendations based on Aney et al. (1961) are met or exceeded year round in this reach where bull trout occur, when compared to the average flow from 1990-2001.

Table 5-3. Daily Mean Flows (cfs) for USGS Streamflow Gages in the Lower Deschutes River near Madras and Moody, OR

Madras, OR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg 1990-2001	5,185	5,523	5,378	5,067	4,456	4,296	3,968	3,917	3,955	4290	4,699	5,010
Recommended Annual Flows (Aney et al. 1967)	4,500	4,500	4,500 4,000	4,000	4,000	4,000	4,000 3,500	3,500	3,500 3,800	3,800	3,800	4,500
Percent Exceedance												
90%	4,055	3,952	3,906	3,739	3,637	3,643	3,424	3,586	3,566	3,708	4,053	4,023
50%	4,591	4,836	4,775	4,149	4,081	3,923	3,777	3,832	3,773	3,977	4,305	4,525
10%	9,600	8,974	7,732	7,643	5,807	5,899	4,863	4,695	4,911	5,410	5,714	7,253
Moody, OR												
Avg 1990-2001	6,747	7,807	7,064	6,613	5,778	5,170	4,517	4,367	4,373	4,762	5,476	6,236
Percent Exceedance												
90%	4,873	4,595	4,418	4,560	4,166	3,988	3,606	3,748	3,809	4,167	4,652	4,446
50%	5,425	5,503	6,717	5,494	5,604	4,731	4,309	4,302	4,110	4,410	5,043	5,389
10%	14,981	16,981	9,512	9,880	7,717	7,297	5,715	5,351	5,285	5,860	6,716	11,312

Bull Trout

Dams and lack of fish passage greatly restricted and eliminated migrations of upriver groups of bull trout into the lower Deschutes River and tributaries. The majority of bull trout in the lower Deschutes River subbasin exhibit a fluvial life history pattern and are found from Sherars Falls upstream to the Pelton Reregulating Dam (Brun and Dodson 2001). Adult bull trout spawn near the headwaters of the Warm Springs River and Shitike Creek. Brun and Dodson (2001) found that adult bull trout leave the Deschutes River and enter the spawning tributaries from early May through mid-June. Juvenile bull trout rear from 2 to 3 years in these streams before migrating to the Deschutes River. The majority of juveniles were documented leaving Shitike Creek beginning early March and continuing through mid-June (Brun and Dodson 2001).

Results from a 1999-2000 telemetry study (Brun and Dodson 2001) confirm that Shitike Creek is a major spawning tributary for bull trout residing in the lower Deschutes River. Prior to spawning migration, lower Deschutes River bull trout move little during the winter through early spring. During May and June, they make a quick migration to Shitike Creek where they hold and later spawn (Brun and Dodson 2001). Following spawning in September, they rapidly emigrated back to the Deschutes River. This migration timing appears similar to the adjacent Lake Billy Chinook-Metolius populations (Thiesfield et al. 1996).

The estimated number of spawning bull trout for the Warm Springs River has remained about the same with 232 reported in 1998 and 260 in 2002 (Brun 2003). In Shitike Creek, 269 bull trout were estimated to have spawned in 1998 and 469 bull trout in 2002 (Brun 2003). Bull trout abundance has increased in recent years because of restrictive angling regulations and education.

Bull trout monitoring studies conducted on the Warm Springs River found that 80 adult bull trout were documented passing the Warm Springs National Fish Hatchery weir in 2001, which was the second highest recorded since 1995 (Brun and Dodson 2001).

5.4 MIDDLE COLUMBIA RIVER STEELHEAD

5.4.1 Factors Contributing to Species Decline

Some factors contributing to the decline of MCR steelhead populations include hydropower development, which affect both juvenile and adult passage; water diversion/withdrawal; agricultural land use activities, such as livestock grazing; predation; harvest; and hatchery effects, including interactions between hatchery and wild steelhead (NMFS 1996). Some habitat constraints to production of wild steelhead in the Deschutes River basin include sedimentation below the White River, streambank degradation, and low flows and high water temperatures in tributaries (NPPC 1990).

Hydropower development has been a major factor contributing to decline of MCR steelhead (NMFS 1996). Construction of dams has blocked access to miles of previously productive habitat. Modification of natural flow regimes by dams has resulted in increased water temperatures, changes in fish community structure, and increased travel time of migrating adults and juveniles. The Corps, Portland District, has funded extensive juvenile and adult salmonid studies for many years at mainstem Columbia and Snake River dams, including The Dalles and Bonneville Dams. The Deschutes River population of the MCR steelhead ESU pass through these two dams on their downstream and upstream migration. Other populations in this ESU further upstream pass through additional dams. Juvenile fish from upstream from McNary Dam may be collected and transported during their outmigration.

The Dalles Dam has less effective juvenile fish passage facilities compared to other Columbia River projects and mortality of inriver outmigrants passing the project is greater than at other Columbia River projects (Ploskey et al. 2001). The Dalles Dam does not have a mechanical screen juvenile bypass system (NMFS 2000b). Spillway passage generally has higher survival than turbine passage (Whitney et al. 1997, cited in Giorgi et al. 2002) and sluiceway passage (Ploskey et al. 2001). The Dalles Dam spillway is located on what was a shallow basalt bluff (NMFS 2000b). Spill survival at The Dalles Dam for juvenile salmonids was lower than that for other Columbia River projects, and in some cases actually decreased with increasing levels of spill. Spillway survival through The Dalles Dam ranged from 76 to 100 percent since 1997, depending on spill volume, season, and year (NMFS 2000b). BioSonics (1999 cited in NMFS 2000b) estimated juvenile spring passage at 40.7 and 25.8 percent for 30 and 74 percent spill, respectively, and juvenile summer passage at 35.2 and 26.2 percent for 30 and 64 percent spill, respectively. Juvenile passage rates in the spring were slightly higher in the morning during these spill tests. Studies done to date have been limited to yearling and subyearling Chinook salmon and coho salmon. Spill survival of outmigrating juvenile steelhead may be of the same magnitude.

Fish that pass through turbines experience higher mortality rates than those that pass hydropower projects via a mechanical bypass or in spill (NMFS 2000b). Iwamoto and Williams (1993 cited in NMFS 2000b) noted that turbine survival averaged approximately 90 percent per dam. When fish pass through bypass systems, mortality is generally less; survival for steelhead passing Little Goose Dam on the lower Snake River in 1997 was estimated at 95.3 percent (Muir et al. 1998 cited in NMFS 2000b). Survival of juvenile salmonids was highest in spill, ranging from about 98 to 100 percent, dependent in part on spill level.

Adult MCR steelhead probably experience a 5 to 10 percent mortality per project, rates similar to spring and summer Chinook salmon. However, during low flow cycles, mainstem mortality can be substantially higher. Some mortality may occur when adults fall back through the turbines. Since adult steelhead generally do not feed during their upstream migration, delays due to ineffective powerhouse facilities, powerhouse and spillway operations, and poor flow and water quality conditions may contribute to mortality rates by depleting limited energy reserves. Turbulent water conditions near dam bypasses, turbine outfalls, water conveyances, and spillways may disorient juvenile fish and make them more vulnerable to predation.

Warm, slackwater reservoirs create ideal conditions for the growth and abundance of the native piscivorous northern pikeminnow (*Ptychocheilus oregonensis*) and introduced predator gamefish such as walleye (*Sander vitreus*), smallmouth bass (*Micropterus dolomieu*), and channel catfish (*Ictalurus punctatus*). Although smallmouth bass are present in Lake Billy Chinook and the Columbia River, they are not present in the lower Deschutes River. They were only documented there for one season after a large flood in 2000 caused by a rain-on-snow event. Numbers remained low and they were no longer found in the river after about September. Smallmouth bass probably do not survive well in the lower Deschutes River due to unfavorably cool water temperatures and the steep gradient (Pribyl 2002).

Biologists also cite interactions between hatchery and wild steelhead as a major cause of decline (Reisenbichler 1996, Chilcote 1999). About 80 percent of downstream migrant steelhead passing Lower Granite Dam are hatchery steelhead. Juvenile steelhead released from hatcheries could potentially interact adversely with native wild juvenile steelhead in the migration corridor, the estuary, and the ocean (NMFS 1999). Although many of these hatchery produced smolts are transported, some migrate inriver. Many steelhead hatcheries include composite stocks that have been domesticated over a long period of time with an associated loss or reduction of fitness.

5.4.2 Environmental Baseline Conditions in Project Area

5.4.2.1 Lower Deschutes River Subbasin

The lower Deschutes River is delineated as the area downstream from Pelton Reregulating Dam, located at RM 100.1.

Streamflows

The lower Deschutes River is a remarkably uniform and stable river (Fassnacht et al. 2002). Russell (1905, cited in O'Connor et al. 1999) noted that the Deschutes River exhibited "certain peculiarities not commonly met with." Henshaw et al. (1914, cited in O'Connor et al. 1999) recognized the uniform and stable flows in the Deschutes River and O'Connor et al. (1999) attributed the steady flow of the Deschutes River to "the poorly integrated drainage system in the southern and western portions of the Deschutes Basin, and the substantial groundwater storage in the young volcanic fields along the flanks of the Cascade Range." Daily average streamflows in cfs in the lower Deschutes River on a monthly basis for the period 1990 to 2001 at USGS streamflow gaging stations at Madras and Moody, located at RMs 100.1 and 1.4, respectively, were shown in Table 5-3. The period 1990 to 2001 was selected to represent current conditions, and includes some wet, dry, and "normal" water years. This more recent time period does not include some extremely dry years that occurred in the 1930s, but does encompass a range of flow conditions and reflects current baseline environmental conditions and operations for this consultation. Table 5-3 illustrates the relatively uniform and stable flow regime in the lower Deschutes River. With inflows into the lower Deschutes River from several major and numerous minor tributaries, the measured flows at the USGS Moody gage are higher than at the Madras gage, as expected. Irrigation diversions from the lower Deschutes River are primarily from tributaries.

Summer Steelhead

Evaluating the status of wild Deschutes River summer steelhead is a complex task because four different groups of steelhead occur in this basin (Chilcote 1998, NMFS 2000b). They include hatchery fish produced within the basin at Round Butte Hatchery, hatchery strays from the Snake and upper Columbia River basins, wild strays also from these upriver locations, and wild fish produced within the Deschutes River basin. The Deschutes River also contains conspecific resident rainbow/redband trout (Behnke 1992).

Number of Fish

The number of adult steelhead captured at the Sherars Falls trap has fluctuated substantially since 1977, with a substantial increase in 2001 (Table 5-4 and Figure 5-5) (ODFW 2002). In 2001, 3,904 hatchery and 957 wild steelhead were captured there compared to 1,635 hatchery and 931 wild steelhead in 2000. The proportion of hatchery to wild steelhead in the Deschutes River has increased substantially since 1977, with over 80 percent of the fish being hatchery fish since 1991, except for 1999 and 2000 (Table 5-4). In 2001, 80.31 percent of the 4,861 steelhead captured at the Sherars Falls trap were hatchery-origin, while 19.69 percent were wild. In 1995, 90.56 percent of the 1,950 steelhead captured were hatchery-origin, which was the highest for the period of record.

Table 5-4. Wild and Hatchery Steelhead Captured at the Sherars Falls Trap

Year	Wild	Hatchery	Total	% wild	% Hatchery
1977	673	744	1417	47.49	52.51
1978	437	772	1209	36.15	63.85
1979	386	1,142	1528	25.26	74.74
1980	461	1,102	1563	29.49	70.51
1981	686	778	1464	46.86	53.14
1982	362	320	682	53.08	46.92
1983	417	934	1351	30.87	69.13
1984	238	422	660	36.06	63.94
1985	364	767	1131	32.18	67.82
1986	412	1,424	1836	22.44	77.56
1987	372	785	1157	32.15	67.85
1988	374	992	1366	27.38	72.62
1989	455	1,287	1742	26.12	73.88
1990	294	801	1095	26.85	73.15
1991	293	1,278	1571	18.65	81.35
1992	196	1,120	1316	14.89	85.11
1993	190	991	1181	16.09	83.91
1994	55	398	453	12.14	87.86
1995	184	1,766	1950	9.44	90.56
1996	299	2,311	2610	11.46	88.54
1997	166	1,218	1384	11.99	88.01
1998	391	1,645	2036	19.20	80.80
1999	695	1,939	2634	26.39	73.61
2000	931	1,635	2566	36.28	63.72
2001	957	3,904	4861	19.69	80.31

Information adapted from table 7 and 8 ODFW 2002

Number of Hatchery Strays

Adult steelhead escapement estimates for the Deschutes River demonstrate a significant increase in out-of-basin strays since the early 1990s (ODFW 2002). The percentage of stray hatchery fish as determined by fin marks at Sherars Falls has exceeded 70 percent of the hatchery component from 1993 to 2000 but decreased to 67.7 percent in 2001 (Table 5-5); 32.3 percent of the hatchery fish were of Round Butte Hatchery origin. From 1988 to 1992, stray hatchery-origin steelhead at the Sherars Falls trap ranged from 32.8 to 67.4 percent. During the same period (1988 to 1992) the percentage of wild fish ranged from 14.9 to 27.4 percent (Table 5-4). While some of the stray steelhead that enter the Deschutes River are known to leave and return eventually to their streams of origin elsewhere in the Columbia basin prior to spawning (preliminary findings from a tagging study by Bjornn and Jepson [NMFS 2000a]), the evidence suggests that the majority of the stray steelhead migrating past Sherars Falls spawn in the Deschutes River basin. ODFW (2002) estimated recently that the percentage of wild fish in the Deschutes basin that are strays is about 3 percent (Table 5-6, adapted from ODFW 2002 Table 14).

Straying has been observed during periods when the water of the Deschutes River is cooler than that of the Columbia River. The cooler water provides a thermal refugium for upstream-migrating adult steelhead. Straying behavior may occur as steelhead seek cooler water, it may be associated with transportation, and may be an evolutionary adaptation that enhances survival (NMFS 2000b). Peery and Bjornn (2002) reported that evidence suggests that some salmon and steelhead will delay their upstream migration to avoid warm water conditions.

Redd Counts

Redd counts for Buck Hollow Creek, Bakeoven Creek, and Trout Creek have exhibited an increasing trend from 1990 to 2002 (Table 5-7, adapted from ODFW [2002] Table 11; Table 5-8, adapted from ODFW [2002] Table 12; and Table 5-9, adapted from ODFW [2002] Table 13, respectively). In Buck Hollow Creek, although the same sites were not surveyed every year, early in the time series starting in 1990, redd counts were low, ranging from 8 to 85 from 1990 to 1996; from 1997 to 2002, redd counts increased and ranged from

110 to 445 in 2001. The number of redds decreased to 221 in 2002. If one looks at one site such as the Powerline/Mouth site, the number of redds ranges from 7 in 1994 to 241 in 2001. Overall, the increase in number of redds from 1997 to 2002 compared to the number of redds from 1990 to 1996 seems to indicate an increase in the number of spawning steelhead. In Bakeoven Creek, there was also a low number of redds from 1990 to 1996 with a steady increase from 1997 to 2002, with a high of 480 redds in 2001, followed by a decrease to 214 in 2002. In Trout Creek, starting in 1994, redd numbers per mile are low until 2000, when the number increases dramatically from that seen from 1994 to 1999, reaching a high of 16.3 per mile in 2001, with a decrease to 13.3 in 2002. This is the same temporal pattern of recently increased numbers of redds documented in Buck Hollow and Bakeoven Creeks, although units differ. These counts include redds from both wild and hatchery summer steelhead.

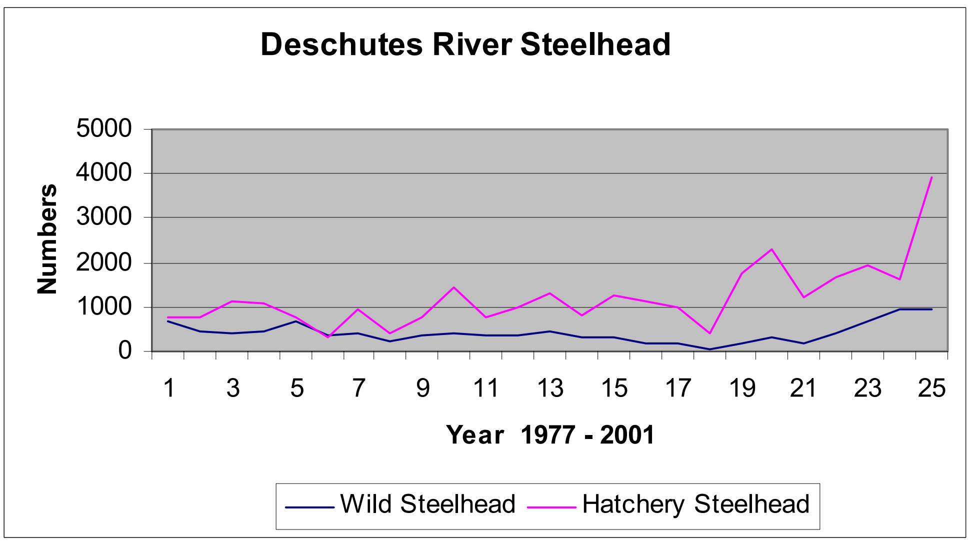

Figure 5-5. Wild and Hatchery Steelhead Captured at the Sherars Falls Trap

Table 5-5. Number and Percent of Round Butte Hatchery Origin and Stray Hatchery-Origin Summer Steelhead as Determined by Fin Mark, Captured at the Sherars Falls Trap, By Year

Trap Year	Round Butte Hatchery		Stray Hatchery-Origin	
	Number	% Total Catch	Number	% Total Catch
1988	665	67.2	324	32.8
1989	521	40.5	776	59.5
1990	352	44.0	448	56.0
1991	417	32.6	861	67.4
1992	506	45.2	614	54.8
1993	196	19.8	795	80.2
1994	118	29.7	280	70.3
1995	458	25.9	1,308	74.1
1996	649	28.1	1,662	71.9
1997	280	23.0	936	77.0
1998	423	25.8	1,220	74.3
1999	465	24.0	1,474	76.0
2000	483	29.6	1,147	70.4
2001	1,262	32.3	2,642	67.7

Source: (Prybil 2002).

Table 5-6. Number and Percent of Wild, Stray, and Round Butte Hatchery-Origin Summer Steelhead Returning to the Pelton Trap, By Run Year.

Run Year	Wild Origin Number	%	Stray Hatchery Number	%	Round Butte Hatchery Number	%
81-82	245	11.3	156	7.4	1,760	81.3
82-83	344	16.7	167	8.8	1,547	74.6
83-84	814	17.3	1,452	33.0	2,439	49.7
84-85	603	12.9	795	17.0	3,278	71.1
85-86	686	14.4	943	19.7	3,153	65.9
86-87	467	10.7	1,538	33.4	2,640	57.6
87-88	160	6.6	796	32.1	1,484	61.3
88-89	123	7.4	300	17.7	1,247	74.9
89-90	136	9.1	524	35.2	829	55.7
90-91	82	7.4	428	35.8	606	56.8
91-92	101	4.4	849	36.7	1,365	58.9
92-93	59	3.6	427	26.0	1,157	70.4
93-94	65	12.0	288	53.0	190	35.0
94-95	27	2.0	642	53.0	753	45.0
95-96	32	1.6	976	48.6	1,000	49.8
96-97	126	2.2	2,001	34.9	3,605	62.9
97-98	194	3.8	2,459	48.3	2,440	47.9
98-99	155	6.0	1,284	49.9	1,135	44.1
99-00	83	4.4	768	40.4	1,050	55.2
00-01	114	4.1	1,103	39.2	1,593	56.7
01-02	282	3.2	3,674	41.3	4,942	55.5

Information adapted from ODFW 2002 Table 14

Table 5-7. Summer Steelhead Redd Counts, Buck Hollow Creek, By Section, By Year

Stream section	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hauser/Bronx								4	0	2	5	ns*	ns
Bronx/Finnegan										1	2	1	3
Finnegan/Mays										5	5	39	1
Spears/Bronx							5						
Bronx/Mays	5			3		0	3	7	10				
Mays/Powerline	7			5	1	5	9	63	36	37	64	164	78
Powerline/Mouth	73	72	34	40	7	64	48	62	133	107	34	241	
Powerline/ Webb fence													139
Webb fence/ Mouth													ns
Total	85	72	34	48	8	69	65	136	179	152	110	445	221

Information adapted from ODFW 2002 Table 11.

Table 5-8. Summer Steelhead Redd Counts, Bakeoven Creek, By Section, By Year

Site	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sugarloaf	1	0	-	2	-	7	14	18	11	33	22	154	23
Powerline	21	8	9	19	13	13	21	39	57	56	61	326	191
Total	22	8	9	21	13	20	35	57	68	89	83	480	214

All survey dates were in March except for 1993, 1994, and 1997 when the surveys were conducted in April.
Information adapted from ODFW 2002 Table 12.

Table 5-9. Results of Summer Steelhead Redd Surveys in the Trout Creek Drainage, By Year

Year	Miles Surveyed	Number Fish	Number Redds	Fish Per Mile	Redds Per Mile
1988	9.4	17	23	1.8	2.5
1989	10.5	24	23	2.8	2.2
1990	14.4	22	42	1.5	2.9
1991	16.9	3	16	0.2	1.1
1992	16.4	6	6	0.4	0.4
1993	28.2	4	15	0.1	0.5
1994	16.25	0	0	0.0	0.0
1995	18.25	0	8	0.0	0.4
1996	12.5	6	14	0.5	1.1
1997	23.5	21	50	0.9	2.1
1998	21.0	13	44	0.6	2.1
1999	22.95	12	59	0.2	2.6
2000	54.1	39	461	0.7	8.5
2001	36.6	56	595	1.5	16.3
2002	65.2	95	866	1.5	13.3

Starting in 1993, surveys were conducted only above the confluence with Foley Creek. Data should not be compared before and after 1993. 1996 data all downstream from Foley Creek.

Information adapted from ODFW 2002 Table 13.

Juvenile Outmigration

Deschutes River hatchery and wild steelhead generally outmigrate in the spring as 2-year-old fish, and pass The Dalles Dam and Bonneville Dam. As discussed above, The Dalles Dam has no mechanical juvenile fish bypass system, so juvenile fish pass the dam via spill, through the turbines or the sluiceway. Zabel et al. (2001) reported that for combined hatchery and wild juvenile Snake River-origin steelhead, the estimated survival from John Day Dam tailrace to Bonneville Dam tailrace averaged 0.753 (s.e. 0.063). Estimated survival for juvenile steelhead decreased as the migration season progressed from early May to the end of May. Although no specific information is available for The Dalles Dam, the Zabal et al. (2001) estimate might be representative of survival of outmigrating Deschutes River juvenile steelhead, with the exception that they would not have been exposed to the same level of predation and other potentially unfavorable environmental conditions in The Dalles pool as those fish migrating downstream from the John Day Dam tailrace. The Deschutes River enters the Columbia River at RM 205, a little less than half the distance from The Dalles Dam to John Day Dam.

5.4.2.2 Wild Deschutes River Steelhead

Wild Deschutes River steelhead are characteristic of A-run summer steelhead (Pribyl 2002; Busby et al. 1996). One of the major factors limiting wild steelhead in the Deschutes River is the migration blockage created by the Pelton and Round Butte Dams (NMFS 2000a; Pribyl 2002), completed in 1957 and 1964, respectively. These dams have eliminated access to spawning and rearing habitats in the middle Deschutes, Metolius, and Crooked River systems (Figure 9-1). Fish passage was attempted at these dams soon after construction but with limited success. Passage of adults upstream was relatively successful, but dowstream migrating smolts became disoriented once they entered Lake Billy Chinook. It became apparent that upriver salmonid runs could not be sustained naturally with these facilities; therefore, efforts to maintain naturally spawning salmonid populations were abandoned. Historically, Big Falls on the middle Deschutes River at RM 132 created a natural barrier that prevented access to the upper Deschutes River subbasin by steelhead and other anadromous salmonids. Apparently Big Falls at RM 132 was passable in some years, although it is now considered the upstream extent of essential fish habitat for Chinook salmon in the upper Deschutes River, as discussed in Chapter 9.

As described in Chapter 7 of this BA, ODFW and others are actively studying ways to restore anadromous fish runs (including wild steelhead) above the Pelton-Round Butte Project in conjunction with the Federal Energy Regulatory Commission relicensing of the project. This BA does not address any aspect of efforts to restore anadromous salmonid populations above the Pelton-Round Butte Project. A major obstacle to establishing viable self-sustaining anadromous salmonid runs above the project is getting outmigrating juvenile salmonids back downstream. There are complex currents in Lake Billy Chinook due to temperature and density differences and inflows that disorient migrating juvenile salmonids, preventing them from easily locating an exit or outflow. Also, Ochoco and Bowman Dams remain migration obstacles further up the system, blocking potential passage to historic spawning habitats in the upper Ochoco Creek and Crooked River subbasins. However, these areas still have the potential, with substantial stream and riparian rehabilitation efforts, to support summer steelhead (Marx 2000).

Deschutes River adult summer steelhead enter the lower river from June through October. Steelhead pass Sherars Falls from July through October, with peak movements normally occurring in late September. Summer steelhead spawn in the mainstem Lower Deschutes River, the Warm Springs River system, Shitike Creek, Skookum Creek, Wapinitia Creek, Eagle Creek and Nena Creeks, the Trout Creek system, Bakeoven Creek system, and the Buck Hollow Creek system (CTWSRO 1999). Warm Springs River is a significant steelhead producer, as is Shitike Creek (Pribyl 2002). Aney et al. (1967) reported that less than 1 percent of the lower Deschutes River provides suitable spawning habitat, and most of that is localized in the region downstream from RM 100.1 to about Shitike Creek. Potential spawning habitat in the White River is limited to the lower 2 miles by an impassable falls. ODFW does not routinely survey the White River and is uncertain whether steelhead occur in this area (Pribyl 2002), although a 2001 BLM and USFS biological assessment indicated that spawning occurs there (BLM and USFS 2001), as do Cramer and Beamesderfer (2001). The Warm Springs National Fish Hatchery operates a collection weir at RM 9 on the Warm Springs River, where it sorts migrating adult salmonids and retains sufficient fish for hatchery production. The hatchery releases wild steelhead back into the river to spawn naturally (Pribyl 2002). Good quality spawning habitat exists upstream from the Warm Springs National Fish Hatchery.

Spawning in the relatively warmer eastside tributaries, such as Trout Creek and Bakeoven Creek, occurs from January through mid-April. Spawning in the lower Deschutes River and the cooler westside tributaries such as Warm Springs River and Shitike Creek, usually begins in April and continues through May (CTWSRO 1999). Westside tributaries are generally colder than eastside tributaries since their flows mostly originate from snowmelt on the eastern slopes of the Cascades, while eastside tributaries are mostly groundwater fed (Pribyl 2002). Eastside tributaries also likely have reduced flows during the hotter part of the summer. Steelhead appear to be opportunistic and in some years ascend small tributaries during short periods of high water to spawn in late winter and spring. The majority of the juvenile steelhead rear for 2 years before smolting and emigrating to the ocean. However, smolt ages can vary from 1 to 4 years. Steelhead generally rear in the ocean for 2 years before returning to the Deschutes River system as adults to spawn.

Chilcote (ODFW 2002) reported that the estimated preharvest abundance of wild steelhead in the Deschutes River at Sherars Falls has generally increased in the last few years from lows in the early 1990s (Table 5-10).

Chilcote (1998) hypothesized that the potential for ecological and genetic interactions between resident rainbow/redband trout and naturally spawning steelhead in the Deschutes River may also be a significant factor in the decline of wild steelhead numbers. However, Zimmerman and Reeves (2000) reported that native wild steelhead and rainbow/redband trout appear to be reproductively isolated in the Deschutes River.

Table 5-10. Estimated Preharvest Abundance of Wild Steelhead in the Deschutes River at Sherars Falls.

Run year/spawn year	Numbers
1994/1995	547
1995/1996	1887
1996/1997	3862
1997/1998	2067
1998/1999	4240
1999/2000	5274
2000/2001	9493
2001/2002	9273

Cumulative Risk Initiative Modeling for Deschutes River Steelhead

McClure et al. (2000) in their Cumulative Risk Initiative modeling indicated that the steelhead populations in the Deschutes River, Shitike Creek, and Warm Springs National Fish Hatchery had a λ (lambda or population growth rate) of 0.96, 0.93, and 0.91. These rates assumed zero percent success of hatchery fish spawning in the wild. Under various scenarios in a Dennis Extinction Analysis, with the assumption that hatchery fish reproduce at 20 and 80 percent the rate of wild fish, for the Deschutes River summer steelhead, there is a probability of 1.0 that Deschutes River summer steelhead will decline 50 percent in 24, 48, and 100 years, as well as decline by 90 percent in 24, 48, and 100 years (McClure et al. 2000). For the MCR steelhead ESU as a whole, NMFS (2000a) estimated that the median population growth rate (lambda) over the base period ranged from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of wild fish. McClure et al. (2000) estimated the risk of absolute extinction within 100 years for the Deschutes River summer steelhead as 1.00, assuming that hatchery fish spawning in the wild do not successfully reproduce (i.e., hatchery effectiveness = 0) (Table B-5 in McClure et al. 2000); assuming that the hatchery fish spawning in the wild do reproduce as successfully as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years for the Deschutes River summer steelhead is also 1.00 (Table B-6 in McClure et al. 2000). McClure et al. (2000) used data from brood years 1980 to 1994, so their analysis does not consider recent increases in adult steelhead returns.

Overall, evidence appears to indicate that the wild Deschutes River steelhead may remain at some risk, especially when environmental factors are less favorable (i.e., reduced ocean productivity and conditions in migration corridor of the Columbia River). Data over time have shown that there is an upward trend in populations numbers when environmental conditions improve, such as the recent increased returns of salmon and steelhead to the Columbia River in 2001 and 2002 thought to be mediated by substantially improved ocean conditions (lower water temperature and increased prey populations and abundance, among other factors). The decadal-scale fluctuations in ocean productivity and environmental conditions were not considered in the McClure et al. (2000) extinction analysis.

Interim Abundance and Productivity Targets

The NMFS has set interim abundance and productivity targets for naturally produced Deschutes River steelhead population. The target is 6,300 naturally produced spawners below Pelton Dam, and since the MCR steelhead ESU is currently below recovery levels, lambda will need to be greater than 1.0 over a 40-48 year period (4 April 2002 letter from Mr. Bob Lohn to Mr. Frank L. Cassidy). The NPPC (1990) noted that the objective for summer steelhead is to provide 5,000 to 11,000 fish for recreational and tribal fisheries, and a spawning escapement of 10,000 natural spawners and 600 to 1,000 hatchery brood stock all through a return of 16,000 to 22,000 summer steelhead annually to the Deschutes River. These levels of wild and hatchery adult steelhead returns have not yet been achieved (Table 5-4).

Instream flow studies for the lower Deschutes River in the 1960s indicated that while flows in the lower Deschutes River may be mostly adequate to sustain anadromous salmonid populations (e.g., steelhead), improved (or higher) flows would be beneficial to habitat maintenance and would increase usable spawning habitat (Pribyl 2001). The lower Deschutes River is fortunate to have fairly stable and uniform flows (NPPC 1990, Fassnacht et al. 2002). On below-average flow years, reduced flows may result in reduced habitat and water velocity for salmonids. In high water years, upstream diversion may actually be beneficial in reducing peak flows that reduce juvenile habitat along the edges of the lower river. While drought may also have contributed to reduced steelhead production, this may be less important as a factor contributing to decline, partly because during the same time period the resident/redband trout population has apparently remained stable. There remains the concern by ODFW that there may be the loss in reproductive capacity of wild Deschutes River steelhead due to genetic mixing with large numbers of out-of-basin, out-of-ESU strays, as well as reduced survival of wild fish due to interactions between hatchery and wild steelhead (ODFW 2003).

Habitat Conditions

NMFS has formulated a matrix of pathways and indicators that contribute to determining whether watersheds are properly functioning, at risk, or not functioning properly. The six pathways with their associated indicators are shown in Table 5-11, adapted from NMFS Matrix of Pathways and Indicators. Complete details regarding these pathways and indicators are available at <http://www.nwr.noaa.gov/1habcon/habweb/pubs/matrix.pdf>. We use the matrix to address major habitat features in the lower Deschutes River.

Discussed below are the pathways and indicators and summarized or referenced information relevant to evaluating the potential effects of the continued operation and maintenance of Reclamation's Deschutes River basin projects on steelhead for these pathways and indicators. Some of this information is reiterated from above discussions.

Table 5-11. NMFS Matrix of Watershed Pathways and Indicators.

Pathway	Indicators
Water quality	Temperature Sediment/Turbidity Chemical contaminants/ Nutrients
Habitat Access	Physical barriers
Habitat Elements	Substrate Large woody debris Pool frequency Pool quality Off-channel habitat Refugia (remnant habitat)
Channel Conditions and Dynamics	Width/Depth ratio Streambank condition Floodplain connectivity
Flow/Hydrology	Change in peak/base flows Increase in drainage network
Watershed conditions	Road density and location Disturbance history Riparian reserves

Water Quality

Water temperature data for the lower Deschutes River near Madras, Oregon, for the period 1972 to 1988 were compiled by Huntington et al. (1999) and provide a reasonably comprehensive assessment of recent water temperatures (Table 5-12). These average water temperatures are less than the ODEQ criteria of 64°F (17.8°C) for anadromous salmonids.

Table 5-12. Mean Weekly Water Temperatures for the Lower Deschutes River at the USGS Gage near Madras, OR, 1972-1988, (by month)

Month	Number of weeks	Mean weekly	S.E. (Standard Error)
October	54	12.5°C	0.10
November	59	10.3°C	0.10
December	61	8.1°C	0.11
January	63	6.6°C	0.09
February	60	6.2°C	0.07
March	68	6.9°C	0.08
April	68	8.0°C	0.09
May	68	9.6°C	0.10
June	69	11.3°C	0.13
July	62	12.7°C	0.14
August	58	13.5°C	0.11
September	52	13.6°C	0.09
Data extracted from Huntington et al. 1999, Table 6.			

The White River below Lower Falls is listed as exceeding the water temperature standard of 64°F (17.8°C) for 100, 58, and 72 days in 1992, 1993, and 1994, respectively. However, ODFW has not documented use of the lower 2 miles of the White River by steelhead. Raymond et al. (1998) reported that the river temperature during their May study period averaged 12.5°C and about 16°C in July. Deschutes River water temperatures increased downstream from the Pelton Reregulating Dam to the mouth by about 2.5°C in May and September, and by 7.5°C in July. As reported by Aney et al. (1967), the majority of suitable spawning habitat is located in the Deschutes River downstream from RM 100.1 to Shitike Creek. Water temperatures for spawning, incubation, and early rearing are suitable in this reach of the river. The Deschutes River from its mouth upstream to the White River is 303(d) listed for pH and summer water temperature.

Sediment/Turbidity – O'Connor et al. (2002) provide an extensive review of sediment sources and the sediment budget of the Deschutes River basin. There are low rates of sediment delivery to the Deschutes River due to steady streamflows with low sediment supply. Sediment recruitment has been reduced by diversions, lakes, and dams. Sources of sediment to the lower Deschutes River are limited (Fassnacht and Grant 1995). Trout Creek, Warm Springs River, and the White River are likely the principal sources of sediment to the lower Deschutes River (O'Connor et al. 2002). The White River gaging station at Tygh Valley recorded an annual suspended sediment load of 108,821.96 tons during the 1983 water year (Fassnacht and Grant 1995), one of the major contributors of sediment to the lower Deschutes River since sediment contributions from the Crooked River are now for the most part retained in Lake Billy Chinook. The White River transports large quantities of glacial material to the lower Deschutes River (Fassnacht et al. 1995; Pribyl 2002).

Nutrients and Contaminants – As discussed in the water quality report (Appendix B), water quality in the lower Deschutes River in large part is driven by operation of the Pelton-Round Butte Project and the seasonal dynamics of environmental conditions in the reservoirs. The water quality in the Pelton-Round Butte Project reservoirs is generally good, even though there are phosphorous and silicon inputs from natural sources in tributaries to the reservoirs and introduced nitrogen from upstream anthropogenic activities that create seasonal algal blooms that somewhat degrade reservoir water quality. The reservoirs of the Pelton-Round Butte Project retain water from the nutrient-rich tributaries, the Deschutes, Crooked, and Metolius Rivers in the epilimnion during the summer when biological activity is at its peak, and discharge cooler water with lower nutrient concentrations downstream. Groundwater recharge offsets some of the adverse effects of upstream uses on water quality in the reservoirs.

A 3-year limnological study of the Pelton-Round Butte Project found that the concentration of nitrogen in the Deschutes River downstream from the project was lower than the expected concentration (PGE 2002). Pollutants from agricultural activity and private land use in the Wapinitia Project area have a minimal affect on water quality in the lower Deschutes River.

Dissolved Oxygen – From the Pelton Reregulating Dam to the mouth of the White River, the Deschutes River is on the Oregon DEQ 303(d) list of water quality limited waterbodies because it fails to meet the dissolved oxygen standard for spawning salmonids (11 mg/L or 95 percent saturation) from 1 October to 31 July (Lewis and Raymond 2000). Dissolved oxygen levels have sometimes been below the existing standard for coldwater aquatic life (8 mg/L or 90 percent saturation) from mid-summer to early fall (Lewis and Raymond 2000). Lewis and Raymond (2000) reported that mean ambient dissolved oxygen concentrations for four sites in the Deschutes River from just downstream from the Pelton Reregulating Dam to Trout Creek increased from 7.46 to 9.22 mg/L in September 1999. Under various spill scenarios, dissolved oxygen concentrations increased, but not proportional to the volume of spill. Spill provided some reaeration of the river water, but the effect diminished progressively downstream.

Habitat Access

Steelhead reportedly migrated as far as 140 miles up the Crooked River, and up the Deschutes River to Big Falls at RM 132. Access to the upper Deschutes River and other tributaries was eliminated with the construction of Pelton Dam. Except for some attempts at passing adult fish around the Pelton-Round Butte Project in the 1960s and an ongoing hatchery steelhead operation, steelhead are now restricted to the lower Deschutes River downstream from Pelton Reregulating Dam at RM 100.1. Steelhead have unrestricted access to the major and minor tributaries to the lower Deschutes River, such as Shitike Creek, Warm Springs River, Trout Creek, Bakeoven Creek, and Buck Hollow Creeks.

Habitat Elements

Substrate – Aney et al. (1967) reported that the lower Deschutes River is mostly coarse rubble, boulders, and bedrock. They note that in the 100-mile lower river, gravel areas for suitable fish spawning make up less than 1 percent of the total stream bottom. The highest amount of spawning gravel is located in the reach of the lower river downstream from the Pelton-Round Butte Complex to Shitike Creek, where about 9 percent of the total streambed is suitable for spawning. Areas downstream from Shitike Creek have substantially less suitable spawning gravels as a percentage of the total streambed. Tributaries downstream contribute sediment that reduces the quality of spawning habitat. The White River and other tributaries contribute substantial sediment in the form of silt and sand. Some areas of the river near the mouth and between Maupin and Twin Tunnels is nearly all basalt bedrock.

Large Woody Debris – Very large woody debris (> 50 ft in length) is sparse in the lower Deschutes River (Minear 1999). In 1995, 13 occurrences of very large wood were recorded in the 100 miles of the lower Deschutes River, compared to 7 pieces in 1944. Most of this wood was located in the main channel of the river, and more was associated with curves than straight sections of the channel. Large wood (> 13 ft in length), not including estimated pieces of wood in logjams and rootwads, was more abundant in the upper 30 miles of the lower river and less so between RM 50 and 70, and had an overall density of 31.5 pieces per river mile (Minear 1999). By including the estimated amount of wood pieces in logjams and rootwads, the amount of wood increased to 53.4 pieces per mile. Most of this large wood (88 percent) occurred in the main channel. However, after the 1996 flood event, less wood was present in the upper 50 miles of river compared to the lower 50 miles of river, and there was less wood overall, 24.5 pieces per river mile compared to 31.5 prior to the flood. Minear (1999) described the source of large woody debris to the lower Deschutes River, its composition, and stated that the results of her study indicated that there is a greater abundance of large wood in the lower Deschutes River than is typical of other streams in the region. One possible reason for this is that the constant base flow of the river does not subject the riparian vegetation to annual periods of desiccation that occurs in many other high desert streams, so the relatively abundant riparian vegetation, including white alder and cottonwood, contribute to a greater supply of in-channel wood.

Refugia – Islands that are formed as a result of the input of large wood, contributing to localized changes in geomorphology and creation of more complex and heterogeneous habitat, can provide refugia for fish and other aquatic organisms (Minear 1999).

Channel Conditions and Dynamics

Width/Depth Ratio – The channel width of the lower Deschutes River averaged 219 feet and increased with distance downstream (Minear 1999). Aney et al. (1967) reported a lower Deschutes River average width of 236 feet, with a range from 30 to 560 feet. Sherars Falls is the most constrained point on the lower river. No data on depth in the Deschutes River were available comparable to the width information reported by Aney et al. (1967). A modified IFIM study was conducted under contract, but was limited to a wadable depth (Pribyl Sept. 3, 2003), so there are no complete cross-sectional profiles available for the lower Deschutes River that could provide data to estimate a width/depth ratio.

Streambank Condition – Over 100 years of livestock grazing seriously degraded the streambanks of the lower Deschutes River and caused extensive loss of riparian vegetation. Grazing has been excluded from the lower 25 miles of the lower river since 1985, and riparian vegetation has increased substantially since that time (Minear 1999). At 14 sites along the lower Deschutes River, from RM 87.0 (the mouth of Trout Creek) to RM 30.5, Minear (1999) reported improved riparian conditions at 10 sites, and no change at 4 sites, relative to historic conditions documented in old photographs. Some of the riparian white alder and cottonwood contribute to the large wood found in the river.

Floodplain Connectivity – The river is mostly constrained in a deep canyon and has a relatively limited floodplain. The Deschutes River is unique in that it is a high desert stream originating from snowmelt on the east side of the Cascade Mountains, with some snowmelt-sourced tributaries on the west side and some smaller groundwater-fed tributaries on the east side.

Flow/Hydrology

Change in Peak/Base Flows – Fassnacht et al. (2002) reported that the lower Deschutes River has a relatively uniform and stable flow. One report indicated that the difference from minimum to maximum flow at the mouth of the Deschutes River was only about 6 times, indicating a very stable and steady flow. Some large floods have occurred historically; in recent times large flood events have occurred in 1964, 1996, and 2000, with 1996 being the largest with an instantaneous flow of 70,300 cfs on 8 February. Table 5-3 shows daily mean flows in cfs on a monthly basis along with 10, 50, and 90 percent exceedance values.

Increase in Drainage Network – Since the lower Deschutes River is a component of a relatively stable watershed and is constrained in a relatively steep and stable canyon, there is little opportunity for any increase or change in the drainage network at this time.

Watershed Conditions

Road Density and Location – The lower 25 miles of the Deschutes River is nearly roadless; there is a gravel road on the east side restricted to authorized vehicle use only, but open to hikers, bicyclists, and horseback riders. An unrestricted road exists from near Sherars Falls to Mack's Canyon for recreational access to the river, and there is a paved highway along the river from Sherars Falls to Maupin. There are some gravel access roads upstream from Maupin, but in general the river has limited road access. There are additional paved roads further upstream. Road construction can be a source of sediment to the river, degrading water quality, altering hydrologic regimes, and restricting the width of the riparian area (Minear 1999).

Disturbance History – In the early part of the 20th century, two competing companies attempted to build railroads up both sides of the canyon from the Columbia River. The railroad curently operates mostly on the west bank to approximately 12 miles north of Madras. Sidecasting of material during railroad construction may have altered the riverine geomorphology, but it is unknown to what degree this occurred. Livestock grazing has disturbed the watershed, especially the riparian area, as has road construction. Livestock grazing has been restricted in some reaches of the lower river, and the condition of the riparian zone has improved notably (Pribyl 2002).

5.5 CANADA LYNX

5.5.1 Factors Contributing to Species Decline

Although over-trapping in the 1980s drastically reduced lynx numbers, it is the destruction and modification of important lynx and hare habitat that is the main threat to Canada lynx survival within the United States (BLM and USFS 2001; Federal Register

65:16052; USFWS 2000a). According to the USFWS, in the Cascades Region 99 percent of lynx forest types (totaling 4.1 million acres) is managed by the USFS. The remaining 1 percent is divided between the BLM and other ownership. Eighty-seven percent of lynx forest types managed by government agencies occur in non-developed land allocations. Forests are changed through timber harvest, fire suppression, and conversion to agricultural land. However, as a very large proportion of lynx type forest within the Cascades Region occurs on Federal lands managed in non-developmental status, it is determined that regional effects of timber harvest and land conversion are at levels non-threatening to the Canada lynx (Federal Register 65:16052).

5.5.2 Current Status

There is no evidence of self-maintaining populations of Canada lynx in the state of Oregon (Verts 1998). Lynx have probably always occurred intermittently in Oregon, although the historical or current presence of resident populations within the State has not been confirmed (USFWS 2000a). Their Oregon presence may be a result of migrating individuals in search of better foraging opportunities as prey populations in the northern lynx range decline (Federal Register 65:16052).

In 1999, lynx surveys were conducted on the Deschutes and Ochoco National Forests using a survey designed to attract lynx to a site to “cheek rub” on a carpet pad, leaving hair that was collected for DNA analysis. These surveys resulted in no lynx detections. This same survey was repeated in 2000 and 2001, but results are not yet available (BLM and USFS 2001).

The second edition of the LCAS, released in August 2000, identified one Lynx Analysis Unit on the Deschutes National Forest, based on primary habitat requirements (vegetation providing denning, foraging, and cover opportunities) (BLM and USFS 2001). This Lynx Analysis Unit is located southwest of Sisters, west of Bend, and north of Crane Prairie and Wickiup Reservoirs, outside of any Reclamation project O&M impact area. The USFS and USFWS have mapped the scrub habitats west, north, and east of Wickiup Dam as potential secondary habitat due to the likely existence of snowshoe hares. These habitat areas consist of dry, second-growth lodgepole/bitter brush and perennial grasses communities. Vegetation density ranges from sparse to dog hair thickets (dense, stagnated stand of small diameter trees).

According to data collected by the Oregon Natural Heritage Information Center (ONHIC), Canada lynx occurrences within Oregon are uncommon, with only five sightings in the past two decades within the Deschutes River basin. Insufficient evidence exists to determine whether or not these lynx were resident (ONHIC 2002a).

5.6 NORTHERN SPOTTED OWL

5.6.1 Factors Contributing to Species Decline

Loss and fragmentation of suitable habitat is the primary threat to the northern spotted owl (Federal Register 55:26114 and 57:1796; Tuchmann 1996; BLM and USFS 2001). This is due primarily to timber harvest practices, particularly when even-aged (i.e., clearcutting) rather than mixed-aged techniques are used. At the time of listing, more than 90 percent of the timber harvest throughout the range of the northern spotted owl was accomplished using clearcutting methods that produced even-aged stands. In addition, timber management regimes at that time indicated it was most economically beneficial to harvest stands aged 60-90 years, the approximate age at which these stands are beginning to support northern spotted owls. This reduction in habitat forces northern spotted owls to crowd into areas that can support the species. If alternate suitable habitat does exist, it will often be forced over carrying capacity, reducing the viability of the northern spotted owls residing therein (Federal Register 55:26114).

5.6.2 Current Status

The final rule for the designation of critical habitat for the northern spotted owl identifies 190 areas, encompassing a total of nearly 6.9 million acres. Within Oregon, 76 CHUs totaling 3.2 million acres were specified; 2.2 million acres occur on USFS land and 1.0 million acres occur on BLM land (Federal Register 57:1796). Three CHUs occur near the action area; OR-2 near Wasco Dam and Clear Lake, OR-6 near Crane Prairie Dam and Reservoir, and OR-7 near Wickiup Dam and Reservoir. Late-successional reserves established by the Northwest Forest Plan, totaling 7.4 million acres, generally overlap critical habitat areas. In fact, OR-2 has 90 percent overlap acres, OR-6 has 100 percent overlap acres, and OR-7 has 99 percent overlap acres (BLM and USFS 2001). The Oregon Natural Heritage Information Center provided the most comprehensive data for northern spotted owl occurrences (nesting, roosting, foraging territories). According to the Oregon Natural Heritage Information Center, there are approximately 150 nesting, roosting, and foraging territories within the Deschutes River basin, including several near Wasco Dam and Clear Lake and Crane Prairie Dam and Reservoir (ONHIC 2003b).