Anadromous Fish and Bull Trout Management in the Upper Deschutes, Crooked, and Metolius River Subbasins

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FOREWORD

The Native Fish Conservation Policy (NFCP) of the Oregon Department of Fish and Wildlife (ODFW) requires that Conservation Plans be prepared by fish species for each Species Management Unit. The purpose of the NFCP is to ensure the conservation and recovery of native fish in Oregon.

The Oregon Fish and Wildlife Commission have adopted statewide species plans for Chinook and coho salmon, steelhead, trout, and warmwater gamefish. These plans guide the development of localized plans for species management units, and individual river basins. Subbasin fish management plans have been adopted for the Upper Deschutes, Metolius, Crooked, and Lower Deschutes River subbasins.

Subbasin fish management plans serve several functions. They present a logical, systematic approach to conserving our aquatic resources, establish management priorities, and direct attention to the most critical problems affecting our fisheries so that the department's funds and personnel can be used accordingly. They inform the public and other agencies about the department's management programs and provide them with the opportunity to help formulate those programs.

Plan Contents

The purpose of this document is to amend the Upper Deschutes, Crooked, and Metolius River subbasin plans with regard to anadromous fish management, more specifically the reintroduction of anadromous fish into the upper Deschutes River Basin above the Pelton Reregulating Dam. The following elements are included in the amendment, consistent with the Native Fish Conservation Policy:

a. Identification of species management unit and its constituent populations.
b. Description of the desired biological status relative to biological attributes.
c. Description of current status relative to biological attributes.
d. Assessment of the primary limiting factors causing the gap between current and desired status.
e. Description of short and long-term management strategies most likely to address the primary limiting factors.
f. Description of monitoring, evaluation, and research necessary to gauge the success of corrective strategies and resolve uncertainties.
g. Process for modifying corrective strategies based on monitoring, evaluation, and research results.
h. Define measurable criteria indicating significant deterioration in status, triggering plan modification to begin or expand recovery actions.
i. Identification of annual and long-term reporting requirements necessary to document data, departures from the plan, and evaluations necessary for adaptive management, in a format available to the public.
j. A description of potential impacts to other native fish species.

Purpose of Plan Amendment

This plan is intended to set fish management direction for the next five to ten years or beyond within the specified water bodies of the basin. The policies and objectives within each section define the core management program and describe the fundamental direction that will be pursued. These are implemented through specific actions, which may include (but are not limited to) restoring or improving habitat, developing angling regulations, and hatchery operations. Because of funding uncertainties, a wide variety of actions are described, but not all may be implemented. This document amends the four existing basin plans developed for the Crooked River, Metolius River, upper Deschutes River and lower Deschutes River subbasins. These plans identify action items to conduct feasibility studies to determine if anadromous fish could be reintroduced into these subbasins. This document modifies the existing basin plans by presenting specific management options for managing summer steelhead, spring chinook, sockeye salmon, bull trout, and pacific lamprey in the Deschutes River Basin upstream from the Pelton-Round Butte Hydroelectric Project.

Oregon Fish and Wildlife Commission Action

This plan amendment will be presented to the Oregon Fish and Wildlife Commission (OFWC) for approval. Following a 60 day comment period, in which further public review may take place, the plan amendment will be finalized to reflect the OFWC decisions, and is adopted as an Oregon Administrative Rule.

GENERAL CONSTRAINTS

Legal Considerations

As with subbasin fish management plans, plan amendments must also conform to other established constraints, such as federal acts (e.g., Wilderness, Endangered Species), state statutes, administrative rules, memoranda of understanding, and other policies.

ODFW interacts with federal, state, local agencies and tribal governments while dealing with fish habitat issues. Although the U.S. Forest Service is the major public land manager in the planning area, several federal and state entities have jurisdictions over activities that affect fish habitat. These include the U.S. Fish and Wildlife Service (USFWS), the U.S. Department of the Interior’s Bureau of Land Management (BLM), U.S. Department of the Interior's Bureau of Reclamation (USBOR), National Oceanic and Atmospheric Administration (NOAA), Oregon State Police (OSP), Natural Resource Conservation Service (NRCS), U.S. Army Corps of Engineers (COE), Oregon Division of State Lands (DSL), the Oregon Department of Environmental Quality (ODEQ), the Oregon Department of Water Resources (ODWR), the Department of Geology and

Mineral Industries (DOGAMI), and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO).

State regulatory actions that affect habitat

The Oregon Water Resources Commission regulates water use throughout the state. The Oregon Department of Environmental Quality (ODEQ) has developed state water quality standards that are in compliance with federal water quality standards. ODEQ administrative rules (Chapter 340, Division 41) address water quality standards for individual basins.

The Oregon Forest Practices Act (ORS 527.610 to 527.730) was adopted in 1972. Commercial timber operations on state and private lands are regulated by the act, which is administered by the Oregon Department of Forestry. Forest management activities on U.S. Forest Service and Bureau of Land Management lands are designed to comply with Forest Practices Act rules and state water quality standards.

The Oregon Division of State Lands oversees the Oregon Removal-Fill Law. A permit is required for the removal or filling of 50 cubic yards or more of material in natural waterways.

ODFW goals and policies for commercial and sport fishing regulations, fish management, and the Native Fish Conservation Policy and Fish Hatchery Management Policy are adopted as Oregon Administrative Rules (OAR). These policies along with the Oregon Plan for Salmon and Watersheds provide guidance on the development of fisheries management options for water bodies throughout the state.

The Oregon Riparian Tax Incentive Program of 1981 provides a tax exemption to land owners for riparian lands included in a management plan developed by the land owner and ODFW personnel. The Oregon Watershed Enhancement Board gives both private individuals and organizations an opportunity to become involved in watershed rehabilitation projects.

Wild and Scenic Waterway Issues

Sections of the Metolius, Deschutes, and Crooked Rivers are designated a "scenic waterway" under the Oregon Scenic Waterways Program. The scenic waterway includes the river and its shoreline and all tributaries within a quarter of a mile of its banks, excluding the river and its tributaries within the boundaries of the Confederated Tribes of the Warm Springs Reservation of Oregon and off-reservation tribal trust land. The program protects the free-flowing character of designated rivers for fish, wildlife, and recreation. Dams, reservoirs, impoundments, and placer mining are not allowed on scenic waterways. The program is designed to protect and enhance scenic, aesthetic, natural, recreation, scientific, and fish and wildlife qualities along scenic waterways.

New development or changes in existing uses proposed within a scenic waterway are reviewed before they may take place.

In addition, the Metolius, Deschutes and Crooked River reaches just upstream from Lake Billy Chinook are all federally designated Wild and Scenic Rivers administered by the USDA Forest Service and the USDI Bureau of Land Management. Management plans have been prepared for all three rivers by the appropriate agency. Projects proposed within Wild and Scenic River corridors cannot "invade the area or unreasonably diminish the Outstandingly Remarkable Values" for which the Wild and Scenic River was established.

Tribal Authority to Co-Manage Fish and Wildlife in the Basin

The Confederated Tribes of the Warm Springs Reservation of Oregon is the modern-day political successor to the seven bands of Wasco- and Sahaptin-speaking Indians of the mid-Columbia area whose representatives were signatories to the Treaty with the Tribes of Middle Oregon of June 25, 1855, 12 Stats. 963. Article I of the treaty describes the 10 million acre area of eastern Oregon ceded by the tribes to the United States and sets out the boundaries of the Warm Springs Indian Reservation. Article I also contains the express reservation by the tribes to "the exclusive right of taking fish in the streams running through and bordering said reservation...and at all other usual and accustomed stations, in common with citizens of the United States."

Streams running through and bordering the reservation to which the tribes have exclusive fishing rights pursuant to Article I of the treaty include the Deschutes, Metolius, Shitike, and Warm Springs River systems. Streams within the ceded area where the tribes have primary off-reservation rights at usual and accustomed fishing stations include the John Day River, Fifteenmile Creek, Crooked and Hood River. Additionally, the tribes claim off-reservation rights at usual and accustomed stations on streams outside of the ceded area, which may be primary, secondary, or co-equal with the treaty rights of other tribes. The role of the CTWSRO as a management entity for purposes of subbasin planning in the upper Columbia River Basin is based on the tribes' exclusive fishing rights in the Deschutes, Warm Springs, Crooked River, and Metolius river systems; primary fishing rights in the John Day River, Fifteenmile Creek, and Hood River; and on the provisions of the recently executed Columbia River Fish Management Plan.

The CTWSRO manage their fisheries consistent with conservation of indigenous species. The CTWSRO are co-managers in meeting subbasin management plan objectives and will be involved in fish management activities in the lower Deschutes River subbasin at all levels. All action items will be conducted in cooperation with CTWSRO as co-managers of the resource.

Introduction

The purpose of this report is to outline issues and options associated with passage restoration for resident and anadromous native fish species in the Deschutes Watershed with specific emphasis on passage at the Pelton Round Butte hydroelectric project. The primary focus will be to provide background information to the Oregon Fish and Wildlife Commission to assist in determining how adult fish from below the hydroelectric project will be managed in upstream areas. Passage issues include feasibility of collection and passage of downstream migrating fish, genetic management, and risk to resident fish species in the upper subbasin from exposure to new pathogens. Secondary issues are effects of reconnecting resident fish and reintroduction of anadromous populations on existing fish populations and fisheries upstream of the project.

The geographic scope of this report and proposed management includes all areas of the Metolius, Crooked, and Deschutes River subbasins accessible to anadromous fish if passage is provided at the Pelton Round hydroelectric project. Specific areas include the Deschutes River and tributaries upstream to Big Falls, the entire Metolius River subbasin including the Suttle and Blue Lake complex, and the Crooked River and tributaries upstream to Bownman and Ochoco Dams (Figure 1).

Background

Fragmentation of fish populations has been a major factor in decline of cold water species throughout much of the Deschutes River Watershed. Primary contributors include physical barriers from dams associated with water management for irrigation use or power generation, and other anthropogenic activities that have affected water quality and quantity and created thermal or flow associated barriers and habitat limitations.

Historically, anadromous and resident fish populations had free access to most of the Deschutes Watershed including the Crooked River, Metolius River, and the Deschutes River subbasin upstream to Big Falls. Indigenous fish species addressed in this Basin Plan amendment include; chinook salmon, summer steelhead, bull trout, sockeye salmon, and lamprey.

On the Deschutes River, Big Falls is considered to have been the upstream limit of anadromous fish migration (Nehlsen 1995). The Deschutes River upstream to Big Falls and Squaw Creek traditionally supported runs of summer steelhead and spring chinook salmon. Squaw Creek was a major producer of summer steelhead. In the 1950's, the number of steelhead counted in Squaw Creek ranged from 62 to a high of 619 in 1953; counts dwindled to zero in the late 1960's (Nehlsen 1995). Prior to the 1950's, information on summer steelhead runs in Squaw Creek is lacking. Spring chinook salmon spawning ground counts were conducted in Squaw Creek through 1960. Records of spawning salmon and redds in Squaw Creek from 1951-1960 showed a high count of 30 in 1951 and 0 by 1960 (Nehlsen 1995). Spring chinook were observed in the

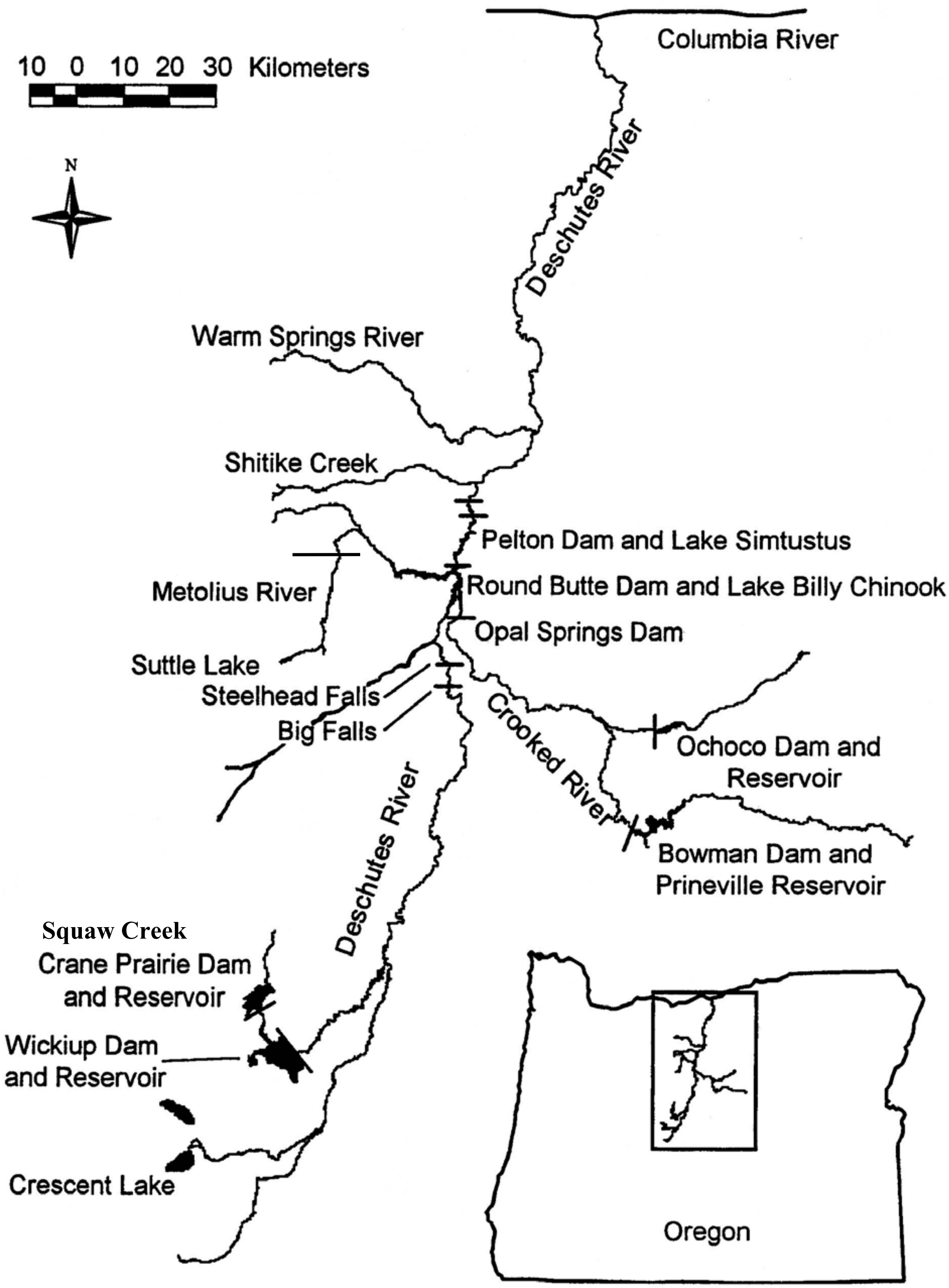


Figure 1. The Deschutes River Basin of central Oregon.

The Metolius basin historically produced runs of spring chinook and sockeye salmon. The spring chinook run was on the order of several hundred spawning adult fish annually (Wallis 1960). Counts of spawning salmon in the Metolius River and tributaries (Lake, Spring, and Jack creeks) and Squaw Creek, plus salmon trapped at the Fish Commission weir on the Metolius, totaled 765 fish in 1951 and 512 in 1953, the highest years recorded. The presence of spring chinook was last documented by spawning ground counts in 1967. Sockeye salmon also migrated up the Metolius River and into the Lake Creek-Suttle Lake complex to spawn, but this anadromous run also no longer exists. The last sizable run of sockeye in the Metolius was 227 adults reported in 1955 however most of these adults likely were hatchery returns from the Oregon Fish Commission's Metolius Hatchery on Spring Creek (Nehlsen 1995). Oregon Department of Fish and Wildlife's records to indicate that steelhead were once in the basin. Current trends in redband trout abundance suggest that the Metolius Subbasin has good potential for steelhead production.

The historical abundance and distribution of spring chinook salmon in the Crooked River is largely unknown. Stories and photos of huge catches of salmonids in the lower Crooked River are found in historical records of the early 1900's (USDI 1992 cited in ODFW 1996). Ogden's journals in the 1820's first documented salmon in the Crooked River when the explorer found an Indian barrier for taking salmon below the confluence of the North and South forks of the Crooked River (Ogden 1950; Buckley 1992 cited in ODFW 1996). Summer steelhead were historically present throughout much of the Crooked River basin with the exception of the North Fork Crooked River above Upper and Lower Falls. Steelhead were still present in the Crooked River up until the mid to late 1950's, and were occasionally caught by anglers. The OSGC reported that salmonids migrated the entire length of the Crooked River during late winter and early spring when flows were suitable (OSGC 1951). In the two years that surveys were conducted, 1952 and 1953, summer steelhead were documented in nine tributaries and the mainstem, and as far upstream as 120 miles from the mouth of the Crooked River.

Pacific lamprey probably historically occurred in the Crooked and Deschutes rivers above the Round Butte-Pelton project. There were no physical barriers to prevent their access into the same areas inhabited by other anadromous species. Very little is known about the life history, and historical and present abundance and distribution of pacific lamprey in the Deschutes River basin although they are thought to have similar distribution as steelhead. These fish were, and are still, an important food fish for Native Americans of the CTWSRO and are a state protected species.

Fisheries Management

Fish management authority and associated activities conducted by ODFW are provided and directed by statute, rule, and policy. ODFW is authorized by Oregon Revised Statute (ORS) to manage the fish and wildlife resources of the state (ORS chapter 496). Within the Oregon Administrative Rules (OAR's), Division 007 rules provide directives associated with fish management and hatchery operations. Specific Division 007 policies include the Native Fish Conservation Policy (OAR 635-007-0502), General Fish Management Goals (OAR 635-007-0510), and Control of Fish Disease (OAR 635-007-0550). Additional guiding policies are found within OAR Division 415 and 412 rules for Fish and Wildlife Habitat Mitigation and Fish Passage and Division 500 rules for fish management plans.

The Native Fish Conservation Policy provides overarching goals to the Department with respect to ensuring the conservation and recovery of native fish in Oregon. The policy identifies conservation of native fish in areas they are indigenous as the Department's principle obligation for fish management. The policy has three areas of emphasis. First is to avoid serious depletion of native fish. Second is to actively restore and maintain native fish at population levels that provide ecological and societal benefits, and third is to ensure opportunities for fisheries and other societal resource uses are not unnecessarily constrained when consistent with native fish conservation.

Current fish management in the Deschutes Watershed is directed by four ODFW subbasin fish management plans. These plans follow the requirements of Oregon Administrative Rule (OAR) 635-07-515, which states: Resources of the state shall be managed according to plans which set forth goals, objectives and operating principles for management of species, waters, or areas. Such plans are a primary means of implementing ODFW policies regarding fish management. Specific plans associated with the Deschutes Watershed include: the Lower Deschutes River Subbasin Plan (July 1997), Upper Deschutes River Subbasin Fish Management Plan (October 1996), Crooked River Basin Plan (May 1996), and the Metolius River Basin Fish Management Plan (December 1996). Policies, objectives, and actions the plans have been adopted as OAR's by the Oregon Fish and Wildlife Commission. Basin plans are intended to guide fish management within their respective management boundaries for a period of between five and 10 years.

Management Objectives set in subbasin plans for the three Upper Deschutes River subbasins direct the Department to assess feasibility of restoring anadromous and resident fish passage to areas upstream of the Pelton Round Butte hydroelectric project.

Management Direction adopted within the Crooked River Basin Plan include: 1.Restore anadromous and migratory resident fish to their historic range in basin by improving upstream and downstream passage over artificial barriers and: 2. Reconnect isolated and fragmented populations of redband trout by restoring and improving passage over manmade barriers. Actions within the plan include: 1. Conduct a feasibility study to determine if it is physically and biologically possible to restore spring chinook and summer steelhead to their native range above the Pelton/Round Butte Dam complex. Bull trout passage would also be examined to reconnect populations currently fragmented by the Pelton-Round Butte Hydroelectric Project.

Policy 4 within the Metolius River subbasin plan states that reintroduction of anadromous populations of spring chinook and sockeye salmon in the Metolius River will be pursued if the opportunity is physically, ecologically, and economically feasible. Action 8.1

directs the Department to conduct a feasibility study to determine if it is physically and biologically possible to restore spring chinook and sockeye salmon to the Metolius River. Similar to the Metolius plan, Management Objectives for the Deschutes River and tributaries between Lake Billy Chinook and Steelhead Falls include direction to determine feasibility of restoring anadromous fish above Round Butte Dam.

This document presents specific options for Management Direction of anadromous and migratory resident fish in the upper Deschutes River subbasin.

Passage Opportunity

The Pelton Round Butte Hydroelectric Project (Federal Energy Regulatory Commission, Project No. 2030) constructed at river mile (RM) 100 on the mainstem Deschutes River creates the primary barrier to anadromous fish attempting to reach spawning and rearing areas in the upper basin. The facility is a 429.5-megawatt, 3-dam complex that in combination inundates approximately 20 RM of the Deschutes River, 13 RM of the Metolius River, and 6.5 RM of the Crooked River. Completed in 1964, the project was constructed with passage facilities, however, unsuccessful collection of downstream migrants resulted in abandonment of passage attempts and hatchery operations were implemented to mitigate lost salmon and steelhead production in upstream areas. In June 2001, Portland General Electric (PGE) and the Confederated Tribes of the Warm Springs Reservation of Oregon submitted a joint application to the Federal Energy Regulatory Commission (FERC) for new licenses for the project. As part of the application, the applicants are proposing to re-establish fish passage at the facility. This effort provides the primary opportunity for reintroduction and reestablishment of anadromous fish species into the upper Deschutes River subbasin.

Through the hydropower relicensing process, ODFW has requested the licensees fund and implement a long-term program to establish sustainable anadromous fish runs of chinook, steelhead and sockeye and reconnect the full complement of native anadromous and resident fish above and below the Project over the life of the new license.

Managed Species of Special Interest

Summer Steelhead (*Oncorhynchus mykiss*)

Species Management Unit

ODFW has not yet defined a Species Management Unit (SMU) for summer steelhead in the Deschutes River or developed a Conservation Plan as directed by the newly adopted NFCP. It is reasonable to assume the SMU would be consistent with or similar to the Evolutionary Significant Unit (ESU) for Deschutes River summer steelhead as developed by NOAA Fisheries. This distinct group of steelhead includes all naturally spawned populations in tributaries of the Columbia River from Hood River and Wind River upstream to, and including the Yakima River. Deschutes River summer steelhead are listed as a Threatened Species under the Federal Endangered Species Act and within the Middle Columbia River ESU. Management policies and objectives identified within this plan will be consistent with key elements outlined in the NFCP (OAR 635-007-0504 and OAR 635-007-0505).

Desired Biological Status

The intent of this plan is to consider reintroduction and re-establishment of the summer steelhead populations into historic spawning and rearing areas upstream of Deschutes River Mile 100, above the Pelton-Round Butte Hydroelectric Project. Specific areas under consideration for reintroduction include the Metolius River and tributaries, Deschutes River and tributaries from Lake Billy Chinook upstream to Big Falls, and the Crooked River and tributaries upstream to Bowman and Ochoco Dams.

The goal for reintroduction is to develop a sustainable population of naturally produced native summer steelhead with all life history stages represented. The upper Deschutes River subbasin historically supported sustainable populations of steelhead, however this population was lost after passage was abandoned in the 1960's. Re-establishment of a summer steelhead population in the upper basin will contribute to species conservation and recovery of threatened species, and eventually provide additional fisheries opportunities in the Deschutes River. Uncertainties regarding reintroduction continue to exist with respect to ability to effectively collect and pass juveniles downstream through the hydropower complex and potential effects of introducing new diseases to resident fish populations in the upper basin.

Beamesderfer (July 2002) modeled estimated potential summer steelhead production in the upper Deschutes subbasin based on existing habitat capacity for smolt production and passage efficiencies through the Pelton Round Butte hydroelectric complex. He estimates a rearing capacity of 9,400 smolts for currently available habitats which includes primarily the mainstem Deschutes below Steelhead Falls and Squaw Creek and predicted very little steelhead spawning and rearing to occur in the Metolius River. This estimate increases to 20,500 steelhead smolts if passage is provided at Opal Springs hydroelectric facility at River mile 1 on the Crooked River. Modeling results, with passage efficiency of 90% and an estimated smolt to adult ratio if 5.4% (assumed natural and anthropogenic mortality), average steelhead escapement is estimated to be 438 individuals for currently available habitats (Beamesderfer 2002). It should be noted that smolt to adult ratios have often been less than 1 for Round Butte Hatchery releases. Modeling estimates increase by 218% to 955 adults with passage at Opal Springs. The authors qualify these estimates as preliminary and unverified pending more comprehensive analysis.

Records from spawning ground counts and weir captures in Squaw Creek from 1950 through 1965 provide some indication of potential steelhead production in Squaw Creek. Montgomery estimated that a minimum of 582 steelhead used Squaw Creek in 1952 (461 counted) and 1,000 spawned in 1953 (619 counted) (Montgomery 1952 and 1953)(Nehlsen 1995). Numbers of steelhead passed over Pelton Dam between 1956 and 1960 ranged from 323 to 1,619 adults (Ratliff and Schulz, 1999). All use was noted downstream of Camp Polk, approximately 3 river miles downstream of Sisters. With adequate passage and screening on irrigation diversions in Squaw Creek, substantially more habitat is available in upstream areas.

Steelhead use was documented through much of the Crooked River subbasin but not well quantified. In spite of severe habitat limitations from over allocation of water, lack of screening and passage, and habitat degradation, the Crooked River retained the capacity to support the steelhead life history. The Bureau of Commercial Fisheries estimated about 3,000 summer steelhead could spawn in the lower Crooked River if water quantity and quality were suitable (Bureau of Commercial Fisheries 1966 cited in ODFW 1996). It should be noted that this estimate was based on spawning gravel availability and did not reflect other habitat constraints. Additionally, Nehlson (1995) points out that many more steelhead were counted passing Pelton Dam in 1957-1965 than could be accounted for by observation in Squaw Creek, the Upper Deschutes, or Crooked River.

From 1957-1969, approximately 270-1620 summer steelhead were passed annually over Pelton Dam (ODFW 1996). Steelhead were still present in the Crooked River up until the mid to late 1950's, and were occasionally caught by anglers. The OSGC reported that salmonids migrated the entire length of the Crooked River during late winter and early spring when flows were suitable (OSGC 1951). In the two years that surveys were conducted, 1952 and 1953, summer steelhead were documented in nine tributaries and the mainstem, and as far upstream as 120 miles from the mouth of the Crooked River. In a reference to Ochoco Creek, Borovicka noted the stream contains steelhead which use the stream for spawning purposes but the many dams and impassible barriers located in the vicinity of Prineville make the spawning act rather difficult (OSGC, 1950).

Production estimates previously described are based on current habitat capacity. High potential exists to increase spawning and rearing capacity in the upper basin for summer steelhead and other salmonids through habitat enhancement activities. Specific attention to streamflow restoration, streambank stabilization, and passage and screening of diversion dams should be the primary areas of emphasis. There are a number of substantial ongoing efforts to improve habitat throughout the upper Deschutes subbasin. The Upper Deschutes Watershed Council, Crooked River Watershed Council, Oregon Water Trust, Deschutes Basin Land Trust, Deschutes Resources Conservancy, State Agencies through the Oregon Plan, and others have all placed priority emphasis on restoring habitat for salmonids.

<u>Current Status</u>

At the present time, summer steelhead releases in the upper Deschutes River basin have been for experimental purposes only as part of the Pelton-Round Butte Hydroelectric

Table 1 Estimated number of steelhead that migrated past Sherars Falls, by run year (French and Pribyl 2003).

Run Year	Wild	Round Butte Hatchery	Stray Hatchery	Total Hatchery
1977-78	6,600	6,100	900	7,000
1978-79	2,800	3,200	300	3,500
1979-80	4,200	5,400	600	6,000
1980-81	4,100	5,500	500 a/	6,000
1981-82	6,900	3,800	1,200 a/	5,000
1982-83	6,567	3,524	1,249 a/	4,773
1983-84	8,228 b/	7,250	7,684 a/	15,443
1984-85	7,721 b/	7,563	3,824 a/	11,770
1985-86	9,624 b/	7,382	5,056 c/	12,106
1986-87	6,207 b/	9,064	9,803 c/	18,358
1987-88	5,367 b/	9,209	8,367	17,623
1988-89	3,546	3,849	2,909	6,336
1989-90	4,278	2,758	3,659	6,504
1990-91	3,653	1,990	2,852	4,786
1991-92	4,826	3,778	8,409	11,859
1992-93	904	2,539	4,261	6,008
1993-94	1,487	1,159	4,293	5,476
1994-95	482	1,781	4,391	6,126
1995-96	1,662	2,708	11,855	12,828
1996-97	3,458	5,932	23,618	28,416
1997-98	1,820	5,042	17,703	22,511
1998-99	3,800	3,527	11,110	15,120
1999-00	4,790	2,628	13,785	15,219
2000-01	8,985	4,380	15,072	19,310
2001-02	8,749	9,373	25,263	31,784
2002-03	9,363	8,880	15,203	23,004

a/ May include some AD CWT marked steelhead that originated from Warm Springs NFH although few of these ever returned to that facility.
b/ May include some unmarked hatchery steelhead outplanted as fry from the Warm Springs River from Warm Springs NFH.
c/ May include adults from a release of 13,000 smolts from Round Butte Hatchery that were accidentally marked with the same fin clip as steelhead released from other Columbia basin hatcheries.

Table 2 Number and percent of wild, stray, and Round Butte Hatchery origin summer steelhead returning to the Pelton Trap, by run year. Includes 3-salts from Round Butte Hatchery (French and Pribyl 2003).

	Wild Origin		Stray Hatchery		Round Butte Hatchery	
Run Year	Number	Percent	Number	Percent	Number	Percent
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
02-03	207	3.3	1,787	28.5	4,284	68.2

Project relicensing effort. At this time only juveniles and gametes that have been screened and cleared of disease are allowed into the upper basin.

Summer steelhead are found throughout the lower Deschutes River and most tributaries downstream of River Mile 100. Based on present habitat, an average fecundity of 5,130 eggs per female, and an assumed egg-to-smolt survival of 0.75%, the maximum steelhead production capacity of the lower Deschutes River is estimated to be 147,659 smolts, with an adult spawning population of 6,575 fish (ODFW 1987). The 6,575 spawner escapement is believed to be adequate to sustain maximum natural production potential during years of good juvenile and adult survival conditions (ODFW 1997).

Escapement estimates have been made at Sherars Falls since the 1977-78 run year. The estimated average annual escapement of unmarked steelhead upstream from Sherars Falls for this period was 4,830 fish, with a range of 482 to 9,624 fish, Table 1 (French and Pribyl 2003). The estimated escapement of wild steelhead for the past five run years has averaged 5,629 fish with a range of from 1,820 to 8,985 fish (French and Pribyl 2003).

Through the twenty-five year period where estimates have been made, there are six years where the 6,575 escapement objective has been met. Three of the years may have included some unmarked hatchery steelhead released as fry into the Warm Springs River from the Warm Springs National Fish Hatchery. Numbers of wild steelhead passing Sherars Falls exhibited a general downward trend in numbers for the period between the early 1980's to the early 1990's. Following a series of good water years in the mid to late 1990's and favorable ocean conditions, wild steelhead numbers passing Sherars Falls have improved dramatically.

Wild steelhead returns to the Pelton Trap have ranged from a low of 27 in the 1994-95 run year to 814 in the 1983-84 run year, Table 2 (French and Pribyl 2003). Overall, numbers of wild steelhead captures at the trap dropped very low through the drought cycle in the early 1990's. Returns of Round Butte Hatchery origin steelhead have exceeded 1,000 fish in all but four years since the 1981-82 run year. The 1993-94 run year is the lowest recorded when 190 RBH origin fish were captured at the trap. Current hatchery production is from Round Butte Hatchery origin summer steelhead returning to the Pelton trap.

Although reduced from historic levels, the upper Deschutes River subbasin continues to have the baseline capacity to support self-sustaining populations of summer steelhead. Areas of the Crooked River and Squaw Creek are severely degraded with respect to streamflow and habitat conditions however efforts are underway to restore habitat conditions in support of resident trout, anadromous salmonids, and other aquatic resources. Upper basin habitat conditions overall are likely more favorable at this time than when passage was discontinued in the 1960's.

Primary Factors for Disparity Between Desired and Current Status

A number of factors have contributed to the decline and extirpation of summer steelhead from the upper Deschutes subbasin. Dramatic declines have occurred as a result of habitat loss from surface water over allocation for off-stream use and associated infrastructure in the form of diversion facilities built without fish passage or protection devices. Widespread livestock grazing in riparian and upland areas has contributed to loss of riparian vegetation, streambank erosion, and channel modification. More recently, development of irrigation storage reservoirs and hydroelectric facilities have further fragmented and isolated populations. Ultimately summer steelhead were eliminated from the upper Deschutes subbasin when passage was discontinued at the Pelton-Round Butte Hydroelectric Project following failed passage attempts. The loss of upper basin production has contributed to increased conservation risk to the greater Deschutes basin steelhead population from reduced numbers and decreased genetic variability.

Crooked River Subbasin

The Crooked River subbasin is modified with respect to streamflow, riparian condition, channel modification, passage barriers, and unscreened diversions. Water rights in the Crooked River date back to the mid 1800's. The basin is generally over-appropriated with respect to water availability. ODFW has recommended instream flows between 170 and 335 cfs to provide optimum habitat for salmonids in the Crooked River between Bowman Dam and Lake Billy Chinook. Minimum recommended streamflows to support conservation levels of salmonids for the same section range between 75 and 255 for the same river reach. Instream water right flow recommendations for the Crooked River are based on the Oregon Method. This methodology evaluates how water depth, velocity, wetted area, and pool-riffle combinations serve fish needs. Instream water rights for the Crooked River from Bowman Dam to Lake Billy Chinook are currently under protest.

Current water allocations for Prineville Reservoir are 46 percent (68,273 acre-feet) contracted space for irrigation and 54 percent (80,360 acre-feet) uncontracted space. The current authorization mandates a minimum streamflow release of 10 cfs below Bowman Dam. Bureau of Reclamation representatives have worked cooperatively to maintain target minimum flows of 75 cfs from uncontracted storage from the reservoir. Minimum flows during the winter of 2002-03 were approximately 60 cfs below Bowman Dam. Downstream of the National Forest, some reaches in McKay and Ochoco Creeks go dry in summer months in all but the wettest years due to diversion for irrigation use. The state of Oregon holds instream water rights on some of these streams but the priority date is junior to other water rights.

Infrastructure associated with off-stream water use has resulted in widespread fragmentation of fish populations at diversion structures and entrainment of fish into unscreened diversions in the Crooked River and tributaries. Good progress has been made toward implementing passage and protection devices on most diversions associated with the Ochoco Irrigation District. However a number of barriers and unscreened diversions remain within the proposed reintroduction area. Specifically, People's Irrigation District, Rice Baldwin and Stearns dams on the mainstem and Ochoco Lumber’s dam on Ochoco Creek are in need of fish passage facilities. The Crooked River subbasin has been degraded by extensive over grazing that has resulted in reduced production capacity. There have been good efforts at protecting large sections by corridor fencing along the river but many miles of degraded habitat remain. In recent years, additional riparian impacts have resulted from urban development within the floodplain.

Upper Deschutes Subbasin

Squaw Creek suffers many of the same impact as the Crooked River. Modification of streamflow, passage barriers, unscreened diversions, and channel alteration contribute to reduced productivity of the system. Most streamflow in Squaw Creek is diverted for irrigation use during summer months. For many years sections of the stream through the town of Sisters have gone dry or are so minimal that little habitat remains. Springs in the Camp Polk area supplement streamflows approximately 3 river miles below Sisters. Recently the Oregon Water Trust purchased 1.61 cfs of senior water rights that is used to maintain connectivity between diversions and where spring flows enter Squaw Creek. Upstream of Sisters there are 7 irrigation diversions with combined water rights of approximately 250 cfs. Currently, none of the irrigation diversions are equipped with screens nor is progress being made to implement screens. Passage barriers exist at several of the diversions. Key locations needing ladders include the abandoned Squaw Creek Irrigation Diversion located just downstream of the existing diversion, the Sokol diversion dam, and the Leithauser diversion. Spring inflows in the lower 1.5 miles of Squaw Creek above the confluence with the Deschutes River provide adequate water quantity and quality to sustain coldwater fish populations.

Squaw Creek was also heavily modified following the 1964 flood. Following the flood, the Army Corps of Engineers channelized approximately 11 miles of Squaw Creek effectively removing all wood material and natural pools through the reach. In recent years the stream has been attempting to re-establish a more natural meander pattern and the ACOE flood control efforts are being gradually undermined. However, with continuing extensive development in the area, there is a constant conflict between landowners desiring to confine the channel for erosion control and the need to allow the stream to meander to provide natural stream function.

Metolius Subbasin

Potential steelhead production in the Metolius River is largely an unknown due to lack of historical documentation on steelhead presence in the subbasin. Potential steelhead production areas in the subbasin would include Lake Creek, Abbot Creek, and Canyon Creek. Overall habitat conditions are favorable except for several unscreened diversions along Lake Creek.

Prior to construction of the Pelton-Round Butte Hydroelectric Project summer steelhead had unimpeded access to the upper Deschutes River basin. Other major passage barriers upstream of the Pelton Project include the Opal Spring hydroelectric facility, Ochoco Dam, and Bowman Dam, all in the Crooked River subbasin. The combination of these facilities has effectively eliminated baseline natural production by restricting access to upstream spawning and rearing areas in addition to direct inundation of many miles of habitat. Opal Springs dam was increased in height in 1982 effectively eliminating passage at the site. Ochoco Dam was constructed in 1922, and Bowman Dam in 1961, both without passage facilities. Passage and screening at the Round-Butte Hydroelectric Project and Opal Springs Hydroelectric Project are the two highest short-term habitat restoration priorities in the basin. Correcting passage deficiencies at Pelton Round Butte Hydroelectric Project is critical to re-establishing sustainable steelhead populations in the upper basin. Long-term priorities should focus on passage restoration at Ochoco and Bowman Dams with consideration of Ochoco Dam as the highest priority due to better upstream habitat conditions.

Predation
It is unknown to what extent predation will effect the success of reintroduction. Once passage is complete for all species, the new biomass of the prey base may lessen the impact of predation. Key species that could prey on steelhead smolts include smallmouth bass and bull trout in Lake Billy Chinook and the Metolius River and northern pikeminnow in the Crooked River arm of Lake Billy Chinook and Lake Simtustus. Estimates of potential predation of steelhead juveniles by smallmouth bass and northern pikeminnow have not been developed. Another unknown factor is predation by anadromous fish that may residualize in Lake Billy Chinook.

Bull trout have been identified as a potential key predator on rearing juvenile salmonids and emigrating smolts. A bioenergetics study was conducted on bull trout from Lake Billy Chinook and the Metolius River between 1997 and 1998. Modeling estimates indicate for every 1,000 bull trout ≥200 mm fork length, 971 Kg of kokanee, 56 kg of bull trout, 29 kg of rainbow trout, 108 kg of mountain whitefish, 364 kg of unidentified salmonids, 52 kg of other fishes, and 1,668 kg of benthic invertebrates were consumed annually in Lake Billy Chinook (Beauchamp 1999). Although these figures indicated bull trout consume large numbers of salmonids, specific effects on juvenile steelhead in Lake Billy Chinook remain unknown. With primary production areas for bull trout in the Metolius River subbasin and predicted steelhead production in the Squaw Creek and Crooked River subbasins there may be limited overlap in distribution and habitat use by the two species.

Harvest
Harvest of steelhead in the hydroelectric project reservoirs was identified as a major escapement concern for steelhead smolts. Creel census conducted in 1959 in Pelton Reservoir (Lake Simtustus) identified the capture of 1,147 immature steelhead on opening day of fishing season, 22% of the total trout catch (OSGC 1959). Biologists at the time considered delaying opening day of angling season to late May to reduce this harvest. It is likely that most incidental harvest would occur in the kokanee and trout fishery in Lake Billy Chinook.

Angler surveys on Lake Billy Chinook between 1990 and 1993 provide insight to the present character of the fishery. Estimates indicate that over 95,000 hours were spent annually to harvest between 60,000 and 80,000 kokanee (ODFW 1995). Effort for kokanee peaked in July. Brown trout and rainbow trout were primarily harvested in the Deschutes and Crooked River Arms of the reservoir. Estimated rainbow trout harvest was 1,638 fish in 1990, 872 fish in 1991, and 823 in 1992. Steelhead smolts would be most vulnerable to harvest between March and June when they are actively migrating through Lake Billy Chinook and attempting to exit the reservoir. Incidental harvest of adult and juvenile summer steelhead in the project reservoirs and tributaries will be assessed during reintroduction. Fisheries in Lake Billy Chinook and Lake Simtustus may require additional regulation to improve escapement of juvenile steelhead to facilitate reintroduction if high harvest levels are detected.

Short and Long-term Management Strategies

Policy options within this plan concentrate on managing disease risk to upstream resident fish populations until a sustainable steelhead population is re-established. The preferred management strategy is to reintroduce summer steelhead by initially moving juveniles and gametes into upstream areas until monitoring and evaluation confirms that sustainable populations can be maintained under existing conditions.

Initial passage studies have relied on the placement or release of only gametes or juveniles upstream of the hydropower complex. This requirement has allowed fish health screening to ensure all transfers have been cleared disease free. Continued fish health monitoring will be required throughout the various passage phases. Fish health monitoring at significant levels will be included with all gametes, juveniles, and adults passed at the facility. Additional monitoring will be required on resident fish populations above and below the project as an early detection system and to document the presence and distribution of disease and associated population risk.

Correcting passage deficiencies associated with the Pelton-Round Butte Hydroelectric Project is necessary to successfully reintroduce a sustainable summer steelhead population into the upper basin. Per ORS 509.585, the owner/operator of the facility is responsible for providing upstream and downstream passage facilities on their artificial obstruction as a condition of relicensing. They will need to develop a comprehensive fish passage plan to ensure adequate efficiencies and survival rates are achieved through the reservoirs and project facilities to meet species conservation goals identified in this fish management plan.

Near term management strategies at the hydroelectric project will focus on developing effective downstream collection and passage for parr and smolt life history stages through the hydroelectric facilities. Conceptual plans identify construction of a Selective Water Withdrawal (SWW) to correct flow patterns in the reservoir that affect juvenile steelhead migration. This structure would be built initially with temporary collection and handling facilities. The applicant has proposed that if greater than 50% efficiency was achieved for collection and passage of smolts entering the reservoir then final collection facilities would be constructed with the assumption that increased efficiencies can be achieved. If less that 50% passage efficiency is achieved, the owner/operator would continue to assess the problem and attempt to find corrections or will need to seek other mitigation measures. At this time construction of the selective water withdrawal is proposed for 2007 with construction of temporary collection and handling facilities in 2008. An adaptive management strategy will continue to be used to implement facility improvements based on monitoring and evaluation with the goal of achieving high passage efficiencies at the barrier. The current proposal is to provide >75% through reservoir and 98% safe passage of captured smolts to lower Deschutes.

Fish passage will also be pursued at the Opal Springs Hydroelectric Project. This facility is located approximately 1 river mile upstream of Lake Billy Chinook on the Crooked River with a dam height of approximately 28 feet. There are no fish passage facilities at the obstruction at this time. Ongoing discussions with the owner/operator and other stakeholders have resulted in development of conceptual passage designs prepared by U.S. Bureau of Reclamation engineers. Work to be completed includes defining jump height specifications, ladder type (pool/weir or vertical slot), and to seek funding for implementation. Completion of this project will open access to approximately 100 river miles of steelhead habitat.

Hatchery production will play a crucial role during the initial phases of reintroduction. All hatchery production will be consistent with the Fish Hatchery Management Policy (ODFW 2003). The logical location for hatchery management is the Round Butte Fish Hatchery located at Round Butte Dam. A draft Hatchery Program Management Plan is presently in development as directed by OAR 635-007-0545. Current management is consistent with the harvest hatchery criteria identified in OAR 635-007-0545(10)(b) by providing fishing and harvest opportunities as mitigation resulting from habitat deterioration and migration blockage. Under a reintroduction option, the hatchery will operate with dual objectives: (1) produce fish for harvest mitigation and (2) produce fish to achieve conservation objectives. Under the conservation function, (OAR 635-007-0545(11)), goals associated with reintroduction would proceed according to OAR 635-007-0545(11)(a) and (b) to meet objectives for supplementation and restoration to areas upstream of the existing blockage at the hydropower complex until a self-sustaining population is achieved. Passage of adults of any origin will be considered once it has been determined that passage is successful and populations are able to sustain themselves. Hatchery responsibilities will include but are not limited to production of juveniles and gametes for upper basin outplants, sorting and selection of adults at the Pelton Trap, transport of adults, and providing harvestable summer steelhead populations in the lower Deschutes River. Specific elements will be developed in a hatchery management plan and should utilize an adaptive approach with flexibility to address unforeseen obstacles.

Preferred stock selection for passage would be from intra-basin naturally produced summer steelhead. Options for stock selection in order of preference include unmarked steelhead captured at the Sherars Falls Trap, those returning to the Pelton Trap, Trout Creek wild stock, or wild stock steelhead from the Warm Springs River. A genetic study should be implemented to assist with identifying the origin of Deschutes steelhead and selection of donor stocks. Round Butte Hatchery stock summer steelhead may provide a suitable alternative to collecting wild fish. This stock was originally derived from adults collected in Squaw Creek and at the Pelton Trap so include a strong genetic component from stocks in the basin prior to construction of the hydroelectric project. Monitoring would be necessary to determine the ability of Round Butte Hatchery stock to spawn and rear in the wild following several generations in the hatchery environment.

Use of multiple stocks may be necessary to best populate the diversity of habitats in the upper Deschutes subbasin. For example, Warm Springs stock may be best suited to repopulate areas of the Metolius subbasin where Trout Creek stock may be most fitted to repopulating areas of the Crooked River. Monitoring and evaluation will be implemented to assess success of stock outplants and donor populations. Donor populations will be monitored to ensure broodstock collection efforts do not compromise protection and conservation of existing populations or fisheries.

It is not currently feasible to readily distinguish unmarked steelhead originating in the Deschutes River from unmarked out-of-basin stray steelhead. Engelking (personal comm.) estimated that approximately 15% of the unmarked steelhead in the system are stray fish from outside the Deschutes River basin. Improved identification methods are needed to differentiate between unmarked steelhead of Deschutes River origin and out-of-basin unmarked steelhead. The general protocol for reintroduction will be to collect adults at the trap, maintain gametes and/or juveniles in the hatchery until certified pathogen free for pathogens of concern followed by outplanting into the upper basin. Downstream migrants will be collected, differentially marked and released below the hydropower complex. Returning adults from this outplant will be specifically identified as upper basin origin fish. During the initial phases of reintroduction finclips such as an adipose clip would be avoided to minimize risk of harvest.

Other short-term management actions will focus on implementing passage and protection facilities on irrigation diversions within the area proposed for steelhead introduction. Good progress has been made in the Crooked River subbasin at completing projects. The Ochoco Irrigation District has implemented screening and passage facilities on all their diversion points including the Ochoco Feed Canal that was completed in cooperation with the U.S. Bureau of Reclamation. Other diversion structures needing passage or screening include the People's Irrigation District, Rice-Baldwin Dam, Stearns Diversion's on the Crooked River, Squaw Creek Irrigation District Diversion, and several smaller diversions on the Crooked River, McKay Creek, and Squaw Creek. An assessment and status report should be completed to document all barriers and screening needs in the Crooked River and tributaries below Bowman Dam to be targeted for passage and protection devices.

Long-term restoration work should focus on flow supplementation, riparian improvements, and channel stability. Flows in the upper Deschutes subbasin have been severely altered by management for off-channel use. Streamflow supplementation will rely on purchase, lease, and water conservation projects to help achieve minimum streamflows. Another flow restoration opportunity may be through the Prineville Reservoir Reallocation process. This process was ongoing through the late 1990's until the process stalled due to apparent lack of funding in 2001. Approximately 80,000 acre-feet of reservoir space is currently uncontracted. The Department should continue to participate in opportunities to acquire or promote management of this water to meet instream needs. Riparian and channel enhancements will be pursued to increase habitat capacity for all life stages of summer steelhead. The Department will work with watershed councils, private landowners, and other stakeholders to meet habitat objectives.

Management direction for the Lower Deschutes will need to be re-assessed to facilitate re-introduction of steelhead into the upper Deschutes River. The Lower Deschutes Subbasin Management Plan (1997) directs the Department to maintain an estimated escapement of 6,575 wild adult summer steelhead over Sherars Falls annually. This goal was adopted to maintain adequate genetic diversity, adaptiveness, and abundance of summer steelhead in the lower river. Additionally, the Department has set an action item to provide a fishery on wild fish if the 6,575 wild fish escapement was met in five consecutive years. Management direction for lower Deschutes River escapement and recreational fishery goals will need to be modified if a decision is made to manage summer steelhead in the upper basin. Conservation and protection of established lower Deschutes River summer steelhead populations takes precedence over use of these fish as donor populations.

Necessary Monitoring Evaluation, and Research to Gauge Success of Corrective Strategies for Summer Steelhead

Hydroelectric facilities provide a means to collect and quantify steelhead numbers in the upper basin to monitor the effectiveness of corrective strategies. ODFW will work with the owner/operators of these facilities to meet management objectives for summer steelhead.

Attributes to be monitored include consumptive and non-consumptive fisheries, juvenile and adult distribution, abundance, habitat utilization, fish health, genetics, and effects of competition and predation. Ultimately, identifying key production bottlenecks and implementing corrective actions will determine the ability to maintain a sustainable population.

Monitoring and evaluation of the effects of hydroelectric project facilities is the responsibility of the owner/operator through ODFW or other 3rd party contractor. Currently the owner/operator contracts hatchery mitigation operations through ODFW. ODFW will assist and provide input toward these efforts through the FERC and State licensing process and by direct coordination with the operator. Increased monitoring responsibility in the upper basin will require increased ODFW personnel allocation to meet objectives or reprioritization of activities for existing personnel.

Specific monitoring should include but not limited to the following:

Juvenile summer steelhead

1. Assess distribution and abundance of rearing juveniles
2. Habitat use and partitioning by species to determine intra and inter-specific competition. Specific identification of areas predisposed to producing either redband trout or summer steelhead
3. Assess smolt migration patterns and timing within tributaries
4. Assess juvenile movement within and through reservoirs
5. Assess passage efficiencies through the hydropower complex
6. Assess juvenile migration and movement through lower Deschutes and Columbia rivers

7. Assess mortality associated with fisheries to determine both harvest and hooking mortality
8. Assess level of predation and competition with other species in tributaries and reservoirs
9. Assess effectiveness of passage and level of entrainment into unscreened irrigation diversions
10. Assess fish health
11. Develop and implement genetic monitoring plan

Adult summer steelhead

1. Assess migration timing of upper Deschutes origin fish in the Lower Deschutes River
2. Assess harvest and hooking mortality on upper Deschutes origin steelhead.
3. Assess upstream passage efficiency at hydropower complex
4. Implement fish health monitoring for adult migrants and resident populations in the upper Deschutes basin
5. Assess effectiveness of upstream passage at other upper basin barriers
6. Assess spawning distribution and abundance in the upper basin
7. Develop and implement genetics monitoring plan
8. Fish health monitoring

Hatchery production

1. Assist with collection and sorting of adults
2. Monitor and implement disease management program
3. Monitor and implement genetic management program
4. Assess hatchery rearing techniques and adaptively manage to maximize survival of outplants
5. Assess effectiveness of release strategies
6. Assess handling mortality of juvenile and adults

Process to Modify Corrective Strategies

An adaptive management approach will be used to identify and implement corrective strategies followed by assessment of effectiveness of those strategies. In some instances corrective strategies may be refined to improve performance or in other instances those strategies will be abandoned in favor of more effective techniques. This plan should avoid locking in all but the most proven management strategies to maintain future options. This plan sets overall programmatic goals and objectives with broad sideboards that allow management flexibility. Specific lower level project and research plans tiered to this plan will be used to assess management options and recommend specific actions consistent with the proposed management direction.

Criteria Indicating Significant Deterioration in Status, Triggering Plan Modification

Basin plans are intended to guide fish management within their respective management boundaries for a period of between 5 and 10 years. It is anticipated that successful reintroduction will require several too many generations for each species affected. It is unlikely that significant status change could be detected or segregated from natural population variability within the life expectancy of this plan prior to review. However, monitoring of existing populations with respect to distribution, abundance, disease, and genetics will be used to detect and assess any direct impacts of reintroduction on those populations. If declines in populations of steelhead in the Deschutes River basin downstream of the Pelton-Round Butte Hydroelectric Project are detected and attributable to reintroduction efforts, management changes will be implemented to adjust the trend within the sideboards of the existing plan. If corrections are outside the scope of the existing plan, management direction modifications with respect to policies and objectives may be recommended.

Annual and Long-term Reporting

Long-term reporting requirements include identification of the Species Management Unit that includes Deschutes River summer steelhead and associated conservation plan as directed by the Native Fish Conservation Policy (2002). Also required will be development of a Hatchery Management Plan as directed by the Fish Hatchery Management Policy (2003). These documents will identify specific annual and long-term reporting requirements for this SMU.

Interim reporting of status on action items identified within the proposed management direction will be through project, research, annual inventory, annual reports, and stock status reports. As noted earlier, ODFW basin plans are scheduled for review following a 5 to 10-year implementation period. Data gathered through the period will be summarized in the updated plan with proposed management changes if warranted. Other agencies, stakeholders, cooperating entities, private landowners, and hydropower owner/operators will be responsible for monitoring and reporting of their activities voluntarily or through license and permit requirements if applicable.

Potential Impacts to Other Native Species

Re-introduction of summer steelhead into the upper Deschutes basin creates some risk to resident fish populations from disease and competition. Effect of disease and competition are often difficult to predict and may not be immediately evident if present.

Competition

Competition between redband trout and juvenile steelhead may occur in areas currently occupied by populations of resident trout. Cramer and Beamesderfer (2001) conclude that predominantly resident *O.mykiss* would be produced in the Metolius Basin, Deschutes River, and Crooked River near Bowman Dam, and primarily steelhead would be produced in Squaw Creek, McKay Creek, Ochoco Creek, and the Lower Crooked River based on temperature and flow. They note that larger resident trout will displace steelhead parr where habitat conditions are favorable for year around rearing.

Disease

Disease generally requires a combination of a susceptible host often in large numbers, pathogenic organisms, and predisposing environmental conditions. Certain disease can often remain in a latent state for years before a combination of conditions occur that causes a fish kill. Holt and Banner (1997) indicate some fish kills are caused directly by acute environmental conditions from natural or anthropogenic sources while other losses are the result of infectious agents producing disease when the fish host is stressed by adverse environmental conditions.

Resident trout upstream of Round Butte Dam have been isolated from the remainder of the Columbia Basin for over 30 years. As such they have not been subject to newly introduced or more virulent disease found downstream. Primary diseases of concern that may effect upstream fish populations include Infectious Hematopoietic Necrosis Virus Type 2 (IHNV2) and *Myxobolus cerebralis* the parasite that causes whirling disease.

IHNV 2 is a virus that affects the blood forming tissues in fish often leading to death, especially in young fish. Fish kills associated with this virus are well documented in wild and hatchery populations across the northwest. Two genetically distinct strains of the virus are found in the Deschutes River system, IHNV type 1 and 2, with type 2 being the more virulent of the two strains. Type 1 found is both above and below the Pelton-Round Butte Project and type 2 is found only downstream. The Type 2 strain of IHNV found in fish below the Pelton Round Butte Project has not been detected in fish examined above the Pelton Round Butte Project during the last five years (Engelking 2001). Although IHNV exists upstream of Round Butte Dam, the strains above and below the hydroelectric project are genetically different. Engelking (2001- PGE Fish Workshop) found the strain of IHNV detected below the project is more virulent to rainbow trout, summer steelhead, spring chinook, and kokanee than the IHNV found in kokanee above the project.

Ongoing disease studies funded by Portland General Electric (PGE) detected 21% incidence of steelhead infected with IHNV Type 2 and included wild, Round Butte hatchery, and stray hatchery summer steelhead. A major factor in managing risk associated with IHNV is that only lethal sampling methods are effective in determining which adults are infected with the virus. This makes it impossible to pass only uninfected adult fish. The only method to reduce risk of IHNV Type 2 at the present time is to not pass fish. Impacts to kokanee populations in Lake Billy Chinook would effects a fishery that provides 130 to 150 thousand angler hours annually and an estimated harvest of 60 to 85 thousand kokanee based on 1990/91 estimates.

Myxobolus cerebralis is a myxosporean parasite and the causative agent for whirling disease. This parasite has a two host life cycle including the fish and an oligochaete worm, *Tubifex tubifex*. The tubifex worm releases the infective triactinomyxon spores which infect the host fish. Infected salmonids can exhibit lesions in skeletal tissues and deformities from destroyed cartilage. The most dramatic example of effects from this parasite comes from the Madison River in Montana where rainbow trout populations are reported to have declined to 25 percent of their former population levels following introduction of the disease.

To date, the only confirmed observations of *M. cerebralis* spores in the Deschutes River basin have come from fish downstream of the Pelton-Round Butte Hydroelectric Project. In sample year 2000, Engelking (2001) examined over 1,900 fish and detected *Myxobolus cerebralis* spores similar to the whirling disease parasite only in anadromous fish below the project. Of fish examined from below the Project, 28 had presumptive infections (spores similar to those of the whirling disease parasite). Six of the 28 presumptively infected fish were determined to have confirmed presence of the disease. No unmarked summer steelhead examined in 2001 had detectable *M. cerebralis* spores. Between 1998 and 2001, Engelking (2003) tested 50 unmarked summer steelhead for whirling disease of which 5 had presumptive infections and 1 was had a confirmed infection. Overall, Engelking (2003, personal comm.) found *M. cerebralis* in 18% of out of basin stray steelhead and 8% of unmarked steelhead.

Susceptibility studies conducted by Sollid et al. (2002) found that Deschutes River rainbow trout had whirling disease susceptibilities similar to the control group, consisting of a known susceptible rainbow trout. They also found that two year classes of steelhead, exposed at different sizes, exhibited fewer clinical disease signs, a lower prevalence of infection, and a lower spore concentration than the rainbow trout control group. They conclude that indigenous salmonids above and below the Pelton-Round Butte Hydroelectric Project are susceptible to infections, and that rainbow trout would be most at risk should introduction of the disease occur in the system. Bartholemew (2001) reported at both high and low exposure doses, all of the Deschutes River redband trout examined at 5 months post-challenge were infected with *M. cerebralis*. In order of susceptibility, rainbow trout (redband) have the highest, followed by steelhead, kokanee, chinook, with bull trout having the lowest susceptibility. Other work by Bartholemew (2003, personal comm.) indicates that *T. tubifex* found above the project do support the parasite. Ongoing work is being done to determine the host susceptibility of *T. tubifex*.

Potential effects of whirling disease on resident redband trout populations is a major consideration regarding re-introduction of anadromous fish into the upper Deschutes basin. At risk are one of the most esteemed redband populations and trout fisheries in Oregon in the Crooked River tailwater section, a robust population in the Deschutes River between Big Falls and Lake Billy Chinook, and the Metolius River redband population which has rebounded dramatically since stocking was discontinued in 1996. The abundance of trout in the Crooked River combined with spawning timing, and juvenile emergence put this population at high risk if *M. cerebralis* is introduced into the subbasin. Recent recreation reports by the Bureau of Land Management indicate the Crooked River below Bowman Dam receives approximately 92,000 recreation days annually, most of which are trout anglers.

Passing only Deschutes River origin fish or adults known to have been reared in an *M. cerebralis* free environment minimizes risk of introducing the pathogen to areas upstream of Round Butte Dam. Non-selective passage maximizes risk from introducing *M. cerebralis*. The current strategy of passing only gametes and juvenile summer steelhead is a strategy that is reversible and hedges risk to resident fish until the success of maintaining a sustainable population of summer steelhead upstream of the hydroelectric project is assured.

In addition to risk to other native species, introduction of new pathogens upstream of Round Butte Dam would increase disease risk at Round Butte Hatchery potentially impacting production.

Management Direction
Summer Steelhead - Selective Passage

Policies

Policy 1. *Only specific pathogen free hatchery reared eggs or juvenile summer steelhead will be released into the upper Deschutes River subbasin until they return as adults to the Pelton Trap.*

Policy 2. *Only summer steelhead adults known to have originated upstream of Round Butte Dam or reared in a M. cerebralis free environment will be released above the dam until passage measures are proven successful.*

Policy 3. *Summer steelhead of any origin may be considered for passage upstream of Round Butte Dam once it has been determined the population is able to sustain itself.*

Policy 4. *The upper Deschutes River subbasin will be managed for native summer steelhead consistent with the Native Fish Conservation Policy (OAR 635-007-0503).*

Objective 1. Maintain self-sustaining populations of naturally produced summer steelhead upstream of Round Butte Dam. A stock recruitment model will be developed for native summer steelhead to determine specific escapement numbers necessary to meet conservation goals.

Assumptions and Rationale

1. Desired levels of genetic diversity, adaptiveness, and abundance of native summer steelhead in the subbasin will be adequately protected by maintaining conservation levels of naturally produced adults upstream of Round Butte Dam.

2. Summer steelhead upstream of Round Butte Dam will be managed consistent with conservation of indigenous species.
3. The operator of the Pelton/Round Butte hydroelectric complex will assist with meeting subbasin management plan objectives by mitigating passage deficiencies through their facilities and project reservoirs.
4. With adequate spawning escapement, currently available habitats in the subbasin will produce an estimated 9,420 summer steelhead smolts. With passage at Opal Springs hydroelectric facility on the Crooked River, an additional 11,110 smolts would be produced.
5. Estimated adult production with 90% downstream passage efficiency and 5.4% smolt to adult ratio equates to production of 438 adult steelhead under current conditions and 955 adults with passage at Opal Springs (Beamesderfer 2002). Numbers of steelhead passed over Pelton Dam between 1956 and 1960 ranged from 323 to 1,619 adults.
6. Actual smolt to adult ratios may be 1-2%
7. Adult production under existing conditions would contribute an estimated 83 steelhead per year to existing fisheries.
8. Passage of adults of known Deschutes River origin will minimize disease risks from *Myxobolus cerebralis* the causative parasite for whirling disease.
9. The incidence of whirling disease in the lower Deschutes has been detected at 18% for out of basin summer steelhead, and 8% for unmarked summer steelhead. Disease studies have not documented whirling disease in fish of known Deschutes River origin.
10. The incidence of INHV Type 2 in the lower Deschutes is approximately 21% for wild, hatchery, and hatchery stray summer steelhead combined.
11. Summer steelhead are at elevated risk from a major loss event from whirling disease due to their inherent susceptibility to the disease, and exposure risk related to their location and timing of spawning and rearing.
12. The ability to identify naturally produced native summer steelhead of Deschutes River origin is uncertain.

<u>Actions</u>

Action 1.1. Develop a stock recruitment model for native summer steelhead in the upper Deschutes River subbasin.

Action 1.2. Implement genetic study to determine true identity of Deschutes River steelhead.

Action 1.3. Work with the operator of the Pelton/Round Butte hydropower complex to insure the following actions related to the relicensing occur: Construct and operate fish passage and protection facilities, fund hatchery and reintroduction programs, monitoring the effects of their facilities and operations, and adaptively manage all aspects of the hydropower complex to meet fish management goals for summer steelhead.

Action 1.4. Escapement goals will be modified upward if passage is provided at the Opal Springs hydroelectric facility.

Action 1.5. Subbasin escapement objectives for the lower Deschutes River will be amended to assist with re-establishment of steelhead upstream of Round Butte Dam.

Action 1.6. Preferred donor stocks for reintroduction in order of preference are naturally produced native steelhead captured from the lower Deschutes River or Round Butte Hatchery stock captured in the Pelton Fish Trap.

Action 1.7. Eyed eggs or swim-up fry will be acclimated and released in known and potential production areas of the mainstem and tributaries as an interim reintroduction program until downstream efficiencies and adult returns can sustain a naturally reproducing population.

Action 1.8. All parr and smolts collected at passage facilities may require marking to assist in identification of returning adults. Marks will be chosen to minimize harvest impacts.

Action 1.9. Once Action 1.6 has been accomplished, selectively pass only known Deschutes River origin adult summer steelhead upstream of Round Butte Dam to manage disease risk.

Action 1.10. Develop improved techniques for identifying steelhead of Deschutes River origin, and for screening adults to identify diseases.

Action 1.11. If harvest is allowed on unmarked steelhead Lower Deschutes River escapement goals will be reassessed.

Action 1.12. Monitor distribution, abundance, and movements of juvenile summer steelhead in the Deschutes River and tributaries upstream Round Butte Dam and through the project reservoirs.

Action 1.13. Monitor summer steelhead spawning distribution and abundance in the Deschutes River and tributaries upstream of Round Butte Dam.

Action 1.14. Monitor recreational fisheries in the Deschutes basin to account for incidental mortality and take of adult and juvenile summer steelhead. Adjust timing and implement special regulations if necessary to meet conservation objectives.

Action 1.15. Work with other agencies, private landowners, and other land managers to improve habitat conditions, and implement passage and protection facilities on barriers and water diversions.

Action 1.16. Develop Hatchery Program Management Plan consistent with the Fish Hatchery Management Policy (ODFW 2003).

Objective 2. Provide a non-consumptive recreational fishery above Pelton if naturally produced summer steelhead spawner escapement exceeds conservation goals in five consecutive years.

Assumptions and Rationale

1. Mortality incidental to targeted recreational catch and release angling will not jeopardize conservation when escapement exceeds conservation goals for adults upstream of Round Butte Dam.

2. A non-consumptive fishery on naturally produced summer steelhead will be considered after five consecutive years of meeting conservation goals for adult escapement.
3. Monitoring of angler distribution and effort by recreation anglers will occur when recreational fisheries are provided to ensure compliance and assess conservation impacts.
4. The operator of the Pelton/Round Butte hydroelectric complex will continue to fund a hatchery program intended to return an average of 1,800 adult summer steelhead of Round Butte Hatchery origin annually to the Pelton Trap to replace production and harvest potential that was lost through construction and operation of the dam complex.
5. The operator of the Pelton/Round Butte hydroelectric complex will assist with meeting subbasin management plan objectives by mitigating passage deficiencies through their facilities and project reservoirs.

Actions

Action 2.1. Monitor upstream adult movement and distribution to assist in managing fisheries if adult escapement exceeds conservation goals.

Action 2.2. Monitor mortality induced by hooking and handling of summer steelhead in recreation fisheries.

Action 2.3. Implement restrictive angling regulations to reduce or eliminate angling induced mortality.

Action 2.3. Develop a cooperative harvest management agreement with CTWSRO.

Action 2.4. Harvest of upper Deschutes River fish will be monitored in the Lower Deschutes fishery.

Chinook (*Oncorhynchus tshawytscha*)

Chinook management in this plan primarily focuses on spring chinook. However it should be noted that "ocean type" chinook (fall/summer run) typically enter the Pelton Trap during June and July. Prior to construction of the hydroelectric project "ocean type" chinook were thought to spawn in areas currently inundated by the project reservoirs and the river areas immediately upstream. Passage and management of this life history pattern will be considered in future updates of this plan.

Species management unit

A Species Management Unit (SMU) for spring chinook in the Deschutes River has not yet been defined as directed by the Native Fish Conservation Policy (ODFW 2003). The Deschutes River population has been identified by ODFW as part of the Mid-Columbia spring chinook gene conservation group that includes the Deschutes and John Day Rivers (ODFW 1995). Gene conservation groups were identified by allozyme analysis. Within the Deschutes River the conservation group is further broken into two populations that include the mainstem Deschutes River and Shitike Creek and another populations comprised of fish from the Warm Springs River.

NOAA Fisheries included Deschutes River spring chinook as part of the Mid-Columbia River Spring-Run ESU that comprised spring chinook populations in the Columbia River and its tributaries from the Klickitat River upstream to the Yakima River (NOAA 1998). ESU's are recognized as a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout. A Species Management Unit for Deschutes River spring chinook will likely be very similar to the Oregon portion of the Mid-Columbia River Spring-Run ESU.

Management policies and objectives identified within this plan will be consistent with key elements outlined for SMU's and their respective conservation plans identified in the NFCP (OAR 635-007-0504 and OAR 635-007-0505).

Desired biological status

Historically, spring chinook were found in most accessible areas of the upper Deschutes basin. Up to several hundred individuals were documented in the Metolius River and tributaries with additional smaller populations found in the mainstem Deschutes River, Squaw Creek, and the Crooked River. Within the scope of this plan, proposed distribution of spring chinook will include the Metolius River and tributaries, Deschutes River upstream to Big Falls including Squaw Creek, and the Crooked River and tributaries upstream to Bowman and Ochoco Dams.

To assess production potential, Oosterhout (1999) developed the Passage Risk Assessment Simulation (PasRAS) model to simulate spring chinook and sockeye salmon life histories. Oosterhout emphasizes that results are not intended to be used as a predictive tool, but meant to assess risk, effect of various management actions, and to prioritize research and habitat improvement efforts. Oosterhout (1999) ran five scenario's using efficiencies of 100% and 60% and assumed various seeding and supplementation rates. Average spawner populations predicted over a 50-year period ranged from 220 to 1,114 spawners. Within the model, key freshwater parameters for chinook were identified as tributary habitat quality, juvenile collection efficiency, Columbia River dam mortalities, and adult mortality in the Deschutes River (Oosterhout 1999).

It is interesting to note that in all the scenario runs there is minimal production attributed to the Metolius River subbasin, which was historically the most productive area for spring chinook. The only production identified in the Metolius subbasin comes from Canyon Creek and in one scenario Link Creek. This lack of Metolius River production is attributed to habitat inputs associated with low density of pool habitat identified in the Metolius River. The protocol used in survey methodology did not adequately capture available pool habitat because USFS considered pools only if they are as long as they are wide which is uncharacteristic of Metolius River pools. Consequently, the Metolius

River production rating was substantially reduced and probably underestimates the amount of pool habitat (and potential chinook production) in the river.

Beamesderfer (2002) estimated chinook numbers using the PasRAS simulation model and input parameters as described in Oosterhout (1999), except habitat inputs were based on numbers provided by Mike Riehle (USFS). Beamesderfer's runs includes only chinook production in currently accessible areas so production in the Crooked River is not reflected due to lack of passage at the Opal Springs Hydroelectric Project. Beamesderfer's total estimated production is 153,600 spring chinook smolts in currently available habitats. Results of the runs predict equilibrium spawner escapements of 200, 310, and 450 fish per year at juvenile passage rates of 60%, 75%, and 90% efficiencies. Passage rates reflect mortality associated with all factors from the reservoir and through the hydroelectric project.

Combining Beamesderfer (2002) estimates for currently accessible areas and Oosterhout (1999) estimates for complimenting sections of the Crooked River and tributaries provides a comprehensive view of relative production potential for all areas targeted for reintroduction. Combined production at 60% passage efficiency is 390 adults and 947 adults when passage efficiencies are 90% (Beamesderfer) for the Metolius and upper Deschutes subbasins and 100% (Oosterhout) for the Crooked River subbasin.

Additional work is ongoing to quantitatively assess the habitat and microhabitat associations of juvenile chinook salmon in the Metolius River and selected tributaries. Data collected will be used to develop an approach for a habitat rating model based on Metolius-specific observations (Lovtang et al. 2002).

Spawning ground and weir counts provide some indication of chinook escapement prior to construction of the Pelton-Round Butte Hydroelectric Project. Between 1951 and 1958 the total fish captured at the Metolius Weir (located below Jack Creek) plus observed spawners in the Metolius River and Squaw Creek ranged from 100 to 648 adults (Montgomery 1958 Annual Report). The highest number of spawners observed were in 1951 and 1953 when 648 and 491 spawners were observed respectively. Based on spawning gravel availability, the Bureau of Commercial Fisheries estimated that about 2,000 spring chinook could spawn in the lower Crooked River if water quality and quantity were suitable (ODFW 1996).

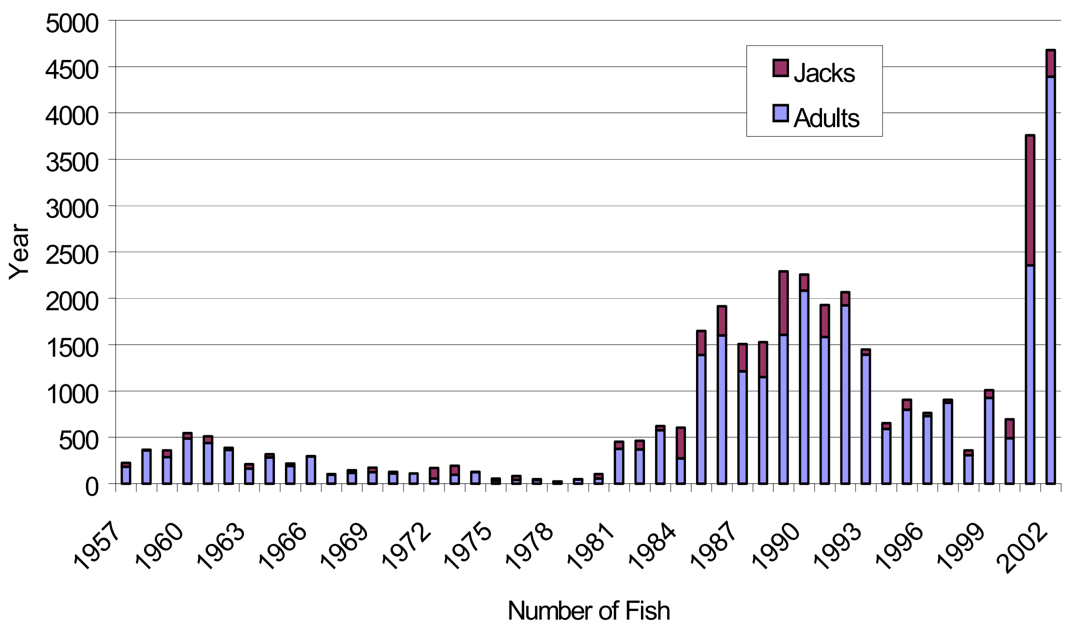
Current status

Spring chinook in the Deschutes River were reviewed for listing by the National Marine Fisheries Service who found on March 9, 1998 that listing was not warranted for the Mid-Columbia River Spring-Run ESU (NOAA 2003). As such, designation of critical habitat and protective regulations were found not appropriate. There is currently no special status assigned to Deschutes River spring chinook at the state or federal level.

At the present time, spring chinook releases in the upper Deschutes River basin have been for experimental purposes only as part of the Pelton-Round Butte Hydroelectric Project relicensing effort. At this time only juveniles and gametes that have been screened and cleared of disease are allowed into the upper basin. Chinook fry from Warm Springs Hatchery and chinook eggs from Round-Butte Hatchery raised to the fry state in streamside incubators were released into the Metolius River to assist with passage and other studies. Approval for movement of these fish was contingent on certifying eggs and fry as disease free.

Spawning distribution for spring chinook in the lower Deschutes subbasin includes Shitike Creek and Warm Springs River. Most wild spring chinook in the Warm Springs River spawn upstream of the Warm Springs National Fish Hatchery. Fish begin arriving in late April and continue through September. All fish must enter a trap before passing the Warm Springs National Fish Hatchery. Spawning in Shitike Creek is estimated to be similar in timing observed in the Warm Springs River. Annual redd counts have been conducted in Shitike Creek since 1978 with the number of redds observed ranging from 6 to 33 (CTWSRO, 2000).

Figure 2.
Spring Chinook Returns to the Pelton Trap



Current Management for the Warm Springs National Fish Hatchery (WSNFH) through their Operational and Implementation Plan 2002-2006 sets a minimum escapement objective of 1300 adult wild spring chinook salmon above the barrier dam at Warm Spring Fish Hatchery (CTWSRO and USFWS, 2002). Spring chinook mitigation requirements for the Pelton Round Butte project call for an escapement of 1200 adults to the Pelton Trap. Approximately 300 adult and 30 jack spring chinook are required for broodstock at the Round Butte Hatchery to meet mitigation goals. Adult escapement to the Pelton Trap (as shown in Figure 2) has ranged from a low of 24 fish (including jacks) in 1978 to a high of 4678 fish in 2002 (French and Pribyl 2003). Average escapement to the Pelton Trap from 1957 to 2002 was 677 adults and 137 jack spring chinook annually, however since 1985 average escapement has averaged 1411 adults and 273.

Round Butte Hatchery relies on returns to the Pelton Trap. Only known Round Butte Hatchery origin fish are spawned. CWT's are read on site before fish are spawned. Unmarked spring chinook have comprised between 5.1% and 39.4% of the broodstock held for spawning from 1985 to 1994 (ODFW 1997). WSNFH stock originated from Warm Springs River wild stock spring chinook. The goal of the WSNFH is to have, on a 10 year average, 10% of the hatchery broodstock of wild fish origin and developed a sliding scale system to direct the number of wild spring chinook infused into the hatchery program, Table 3 (CTWSRO and USFWS, 2002).

Table 3. The goal is to have, on a 10 year average, 10% of the hatchery broodstock of wild fish origin. A sliding scale for wild broodstock retention based on projected wild fish returns will be used as follows (CTWSRO and USFWS, 2002):

Projected Wild Escapement	Wild fish retained for WSNFH brood	Percent of hatchery brood Contributed by Wild Fish
<800	0	0
800-899	31	5
900-999	38	6
1000-1099	45	7
1100-1199	50	8
1200-1299	57	9
1300-1399	63	10
1400-1499	69	11
1500-1599	76	12
1600-1699	82	13
1700-1799	88	14
1800-1899	95	15
1900-1999	100	16
2000-2099	107	17
2100-2199	113	18
2200-2299	120	19
>2300	126	20

<u>Primary factors for disparity between desired and current status</u>

Several factors account for the disparity between desired and current status for distribution and abundance of spring chinook in the Deschutes River watershed including impassible dams, habitat deficiencies, and disease.

The Pelton-Round Butte Hydroelectric Project creates a complete migration barrier to resident and anadromous fish at river mile 100. The project was built with fish passage facilities however passage was abandoned when it was determined the facilities were ineffective at passing juvenile migrants downstream. In 1965, wild salmonids were captured, marked, and released at the head of the Metolius arm of Lake Billy Chinook to assess collection efficiency of passage facilities. Of the marked fish, only 0.3 percent of chinook, 13.7 percent of coho, and 1.0 percent of the steelhead were recaptured at the Round Butte Dam forebay (Ratliff and Schulz 1999). It should be noted that ODFW has no documentation of historic presence of coho in the upper Deschutes subbasin. After several years of evaluation, attempts to maintain anadromous runs upstream of the hydropower project were abandoned. Re-establishing successful passage through the Pelton-Round Butte Hydroelectric Project and project reservoirs is the most critical factor to reintroducing spring chinook into the upper Deschutes River subbasin.

Oosterhout's (1999) PasRAS assessment focused on determining the effects of various management actions to assess their effects on reintroduction of anadromous fish populations. This work demonstrates the importance of high collection efficiencies and productive habitats to achieving sustainable spring chinook populations. Table 4 is a reproduction of Oosterhouts results.

Passage barriers predicted to affect spring chinook upstream of Lake Billy Chinook exist at Bowman Dam, Ochoco Dam, and Opal Spring hydroelectric facility in addition to a number of smaller irrigation diversions situated along the Crooked River and tributaries downstream from Bowman Dam. Both Bowman and Ochoco Reservoir Dams were constructed without passage facilities. Opal Springs, constructed in 1921 was considered a partial barrier until 1982 when the diversion dam was increased in height from approximately 6 feet to 28 feet. The structure is considered a complete barrier through most of the year. Other major passage barriers exist at People's Irrigation Diversion, Rice-Baldwin Dam, and Stearns Dam all located on the Crooked River upstream from Prineville.

Habitat deficiencies are prevalent throughout the upper Deschutes River basin and are associated with modified streamflows from storage and diversion for irrigation and other off-stream uses, reservoir storage, habitat modification from overgrazing, timber and agriculture management practices, and urban development.

The Crooked River, Squaw Creek, and the Deschutes River have been heavily modified by water diversion for irrigation use. Early water development in the Crooked River occurred as far back as the mid-1850's. Water withdrawal left many sections of the river completely dewatered. In 1961, Bowman Dam was built for irrigation storage. The dam was designed to provide approximately 70,000 acre feet of contracted storage space for irrigation use. However the size of the dam was increased creating an additional 80,000 acre feet that remains uncontracted. Within the existing operation guidelines there is a minimum 10 cfs bypass requirement for instream flows. In recent years, Bureau of

Table 4. Spring Chinook Scenario Run Results (Oosterhout 1999)

Scenario	Average Spawner Population over 50 years (s.d.)	Geometric mean R/S (500 replications)	Average reaches still populated, year 50
0. 100% collection efficacy, start at full seeding, supplement as needed for 3 years	843 (878)	0.913	9.81
1. 60% collection efficacy, start at full seeding, supplement as needed for 3 years	368 (528)	0.889	4.45
2. 60% efficacy, start with Pelton Trap returns only (2% of full seeding as defined in Habrate) and supplement as needed for 10 years	220 (72)	0.990	4.37
3. 100% efficacy, start at full seeding, supplement as needed for 3 years, but reduce smolt capacity by 20%	664 (697)	0.912	6.07
4. 60% efficacy, start at full seeding, supplement as needed for 3 years, and use adjusted Lindsay et al. (1989) data for fry-to-parr survival.	1,114 (384)	0.966	9.45

Reclamation representatives worked cooperatively to maintain a portion of the unallocated space to provide additional instream flow up to 75 cfs between October and April. Lack of streamflows due to irrigation use during summer months from the Highway 97 crossing upstream to above Prineville severely reduces rearing habitat and contributes to high water temperatures.

Squaw Creek is currently over-appropriated during summer months by water management for irrigation use. Upstream of the town of Sisters there are approximately 250 cfs of existing water rights resulting in appropriation in excess of available flows. For many years the stream through Sisters was completely dry. Recently the Oregon Water Trust in 1998 purchase 1.61 cfs that is managed instream to maintain live flow and connectivity between upstream users and the Camp Polk area where spring flows contribute additional flow to Squaw Creek. Other water conservation projects are being undertaken by the Squaw Creek Irrigation District in part supported by public dollars that should result in additional supplemental instream flow in Squaw Creek. Spring inflows in the lower 1.5 miles of Squaw Creek above the confluence with the Deschutes River provide adequate water quantity and quality to sustain coldwater fish populations.

Disease is a factor known to impact both wild and hatchery spring chinook in the Deschutes basin and could impact attempts to reintroduce fish into the upper basin. Specific pathogens of concern include *Renibacterium salmoninarum* (causative agent for Bacterial Kidney Disease), *Ceratomyxa shasta*, *Myxobolus cerebralis* (causative agent for Whirling Disease), and Infectious Hematopoietic Necrosis Virus (IHNV). Bacterial Kidney Disease (BKD) has been found throughout the Pelton-Round Butte Project area and found in kokanee, bull trout, and spring chinook. The disease is spread both vertically and horizontally. Dead and dying bull trout have been found with clinical signs of BKD in Lake Billy Chinook. Potential effects of BKD on reintroduction are unknown at this time however this pathogen has caused mortalities in spring chinook adults and juveniles at the hatchery. There are not effective vaccines for this disease. Fish can be treated with antibiotics to slow the course of BKD, but not entirely prevent it. Spring chinook receive regular treatment for the disease at Round Butte Hatchery. Spring chinook brood fish are injected with erythromycin to keep them alive until spawning, juveniles are fed the drug.

Ceratomyxa shasta is a parasite that infects the intestinal tract of salmonids often leading to death from tissue destruction. Studies on migrating spring chinook smolts in the Deschutes River documented mortalities associated with Ceratomyxa shasta in May and June (Engelking unpublished 2002). *C. shasta* is the major reason Round Butte Hatchery is located at Round Butte Dam and not below the Reregulating Dam. C. shasta was associated with steelhead and chinook mortalities at the Pelton Pilot Hatchery and killed chinook rearing in Lake Simtustus during natural rearing experiments in the early 1970's (Ratliff and Schulz 1999).

IHNV is consistently found in Deschutes River spring chinook and kokanee. This viral disease affects and destroys the blood forming tissues in fish including the kidney and spleen often resulting in severe losses of juvenile fish. Two genetically distinct strains of the virus are found in the Deschutes River system, IHNV type 1 and 2, with type 2 being the more virulent of the two strains. Type 1 found is both above and below the Pelton-Round Butte Project and type 2 is found only downstream. Disease studies by Engelking (personal comm. 2003) detected more than 30% incidence of IHNV Type 2 in unmarked Deschutes River spring chinook. Currently, non-lethal detection methods are not available for IHNV.

Harvest in the Deschutes River occurs primarily in the three mile river reach near Sherars Falls. Harvest rates in the Deschutes River average 32% for wild spring chinook and 36% for hatchery spring chinook from 1977 through 1993 (ODFW 1997). Currently there is little or no harvest on wild spring chinook. Beamesderfer (2002) estimates reintroduction of spring chinook into currently available habitats in the Upper Deschutes subbasin would contribute an average of 80, 130, and 190 fish to Deschutes River fisheries at passage efficiencies of 60%, 75%, and 90% at a 30% exploitation rate.

Spring chinook produced upstream of the hydropower complex would also be subject to tribal fisheries.

Short and long-term management strategies

Primary restoration work will focus on developing effective passage for downstream migrants through the project reservoirs and at the Pelton-Round Butte Hydroelectric Project. During preparation of this plan relicensing negotiations were ongoing for the projects. Mitigation for fisheries resources was focused on restoring passage at the project. The project owner/operator has proposed construction of a selective water withdrawal to draw water from the surface of the reservoir in an attempt to focus surface currents toward the dam and juvenile collection facilities. As of this writing, construction of the selective water withdrawal is expected to be complete by 2007. Temporary juvenile trapping and collection facilities will be constructed to assist with evaluation of passage efficiencies through Lake Billy Chinook. Final passage facilities would be constructed pending the results of testing and verification studies of the interim collection facility.

The preferred passage strategy is to initially move eggs or fry into upstream production areas. These life history stages can be evaluated for presence of disease prior to transfer and provide a safety mechanism until there is some assurance that sustainable populations can be maintained. Downstream migrants will be collected and marked at the collection facility in Lake Billy Chinook, transported downstream to below the hydroelectric project and released into the lower Deschutes River. Differential marking will be used to specifically identify upper Deschutes River origin fish. Coded Wire Tags (CWT's) may provide an effective means to mark fish for identification without using identifying marks that would subject these fish to harvest. The use of PIT tags (Passive Integrated Transponder) would serve a similar function and provide a considerable amount of additional information to assist with reintroduction. Only returning adults of known Deschutes River origin will be passed upstream.

Hatchery supplementation will be used to assist in meeting sustainability goals until a naturally produced self-sustaining population is achieved. Hatchery production and supplementation efforts associated with reintroduction of spring chinook will be developed consistent with the Hatchery Management Policy and guidelines (ODFW 2003). Preferred spring chinook parental stocks for reintroduction include Warm Springs wild origin and Warm Springs Hatchery origin if these stocks area available, and/or Round Butte Hatchery spring chinook.

Specific stock used for reintroduction is contingent on availability of adults, and monitoring of stock performance results. Stock development will utilize an adaptive strategy loop to assess management actions and take corrective actions to meet objectives.

Implementation of fish passage and screening on the mainstem Crooked River and Ochoco Creek is a critical factor to successfully reintroduce spring chinook into the basin. Short-term actions for the Crooked River will target passage at the Opal Springs Hydroelectric Project, screening and passage at the People's Irrigation District diversion, passage at the Rice-Baldwin Diversion, and passage at the Stearns Diversion. Additional barriers needing passage devices are located on Ochoco Creek at the Ochoco Lumber Mill and the Prineville Country Club. An assessment and status report should be completed to document all barriers and screening needs in the Crooked River and tributaries below Bowman Dam to be targeted for passage and protection devices.

Long-term management actions will address habitat deficiencies associated with riparian and stream channel enhancement including instream flow requirements. Riparian restoration efforts will focus on protection from overgrazing and encroachment by development. Stream channel protection and restoration are needed through extensive sections of the lower Crooked River, Ochoco Creek and portions of Squaw Creek. Instream flow enhancement should initially focus on maintaining critical base flows to provide consistent fish production levels. Long-term efforts should attempt to achieve target minimum streamflows and preferably optimum streamflows identified in water rights and water right applications within areas of proposed reintroduction. Two water right applications, for the Crooked River from Bowman Dam to Lake Billy Chinook and Deschutes River from Bend to Lake Billy Chinook, have been protested and need resolution.

Once this plan is adopted, Management Direction within the Lower Deschutes River Subbasin Fish Management Plan, 1997 may need to be modified to facilitate reintroduction of spring chinook into the upper Deschutes subbasin.

Necessary monitoring, evaluation, and research to gauge success of corrective strategies

Hydroelectric facilities provide the best opportunity to collect and quantitatively document spring chinook numbers in the upper basin and monitor corrective strategies. ODFW will work with the owner/operators of these facilities to meet management objectives for spring chinook.

Specific fish management activities will include the following: monitoring habitat utilization, production capacity and fisheries to ensure escapement objectives are met based on population conservation goals. Fishery monitoring on both consumptive and non-consumptive fisheries, monitoring of juvenile and adult distribution, abundance, and habitat utilization, fish health, genetics, and effects of competition and predation. These activities will include continuation of ongoing monitoring efforts in the lower Deschutes River and require development of these activities in the Upper Deschutes subbasin.

Ultimately, the ability to identify key limiting factors and implement corrective actions will determine the success of maintaining sustainable populations of spring chinook upstream of the project. Monitoring and evaluation of the effects of hydroelectric project facilities is the responsibility of the owner/operator through ODFW or other 3rd party contractor. Currently the owner/operator contracts hatchery mitigation operations through ODFW. ODFW will assist and provide input toward these efforts through the FERC and State licensing process and by direct coordination with the operator and other parties to the relicensing. Increased ODFW monitoring responsibility in the upper basin will require increased personnel allocation to meet objectives or reprioritization of activities for existing personnel.

Specific monitoring activities should include but are not limited to the following:

Juvenile spring chinook

1. Assess distribution and abundance of rearing juveniles
2. Habitat use and partitioning by species to determine intra and inter-specific competition. Identification of specific areas predisposed to producing spring chinook, redband or summer steelhead
3. Assess smolt migration patterns and timing within tributaries
4. Assess juvenile movement within and through reservoirs
5. Assess passage efficiencies through the hydropower complex
6. Assess juvenile migration and movement through lower Deschutes and Columbia rivers
7. Assess mortality associated with fisheries to determine both hooking and harvest mortality
8. Assess level of predation and competition with other species in tributaries and reservoirs
9. Assess effectiveness of passage and level of entrainment into unscreened irrigation diversions
10. Develop and implement genetic monitoring plan
11. Implement fish health monitoring for migrating and rearing juveniles

Adult spring chinook

1. Assess migration timing of upper Deschutes origin fish in the Lower Deschutes River
2. Assess harvest and hooking mortality rates associated with catch and release angling in lower and upper basin fisheries
3. Assess upstream passage efficiency at hydropower complex
4. Implement fish health monitoring for adult migrants and resident populations in the upper Deschutes basin
5. Assess effectiveness of upstream passage at other upper basin barriers
6. Assess spawning distribution and abundance in the upper basin
7. Develop and implement genetic monitoring plan

Hatchery production

1. Assist with collection and sorting of adults
2. Monitor and implement disease management program

3. Monitor and implement genetic management program
4. Assess hatchery rearing techniques and adaptively manage to maintain survival advantage of outplants
5. Assess effectiveness of release strategies
6. Assess handling mortality of juvenile and adults

Process to modify corrective strategies

An adaptive management approach will be used to identify and implement corrective strategies followed by assessment of effectiveness of those strategies. In some instances corrective strategies may be refined to improve performance or in other instances those strategies will be abandoned in favor of more effective techniques. This plan should avoid locking in all but the most proven management strategies to maintain future options. This plan sets overall programmatic goals and objectives with broad sideboards that allow management flexibility. Specific lower level project and research plans tiered to this plan will be used to assess management options and recommend specific actions consistent with the proposed management direction.

Criteria indicating significant deterioration in status, triggering plan modification

Basin plans are intended to guide fish management within their respective management boundaries for a period of between five and 10 years. It is anticipated that successful reintroduction will require several too many generations for each species affected. It is unlikely that significant status change could be detected or segregated from natural population variability within the life expectancy of this plan prior to review. However, monitoring of existing populations with respect to distribution, abundance, fish health, and genetics will be used to detect and assess any direct impacts of reintroduction on those populations. If declines in populations of spring chinook in the Deschutes River basin downstream of the Pelton-Round Butte Hydroelectric Project are detected and attributable to reintroduction efforts, management changes will be implemented to adjust the trend within the sideboards of the existing plan. If corrections are outside the scope of the existing plan, management direction modifications with respect to policies and objectives may be recommended.

Annual and long-term reporting

Long-term reporting requirements include identification of the Species Management Unit that includes Deschutes River spring chinook and associated conservation plan as directed by the Native Fish Conservation Policy (2002). Also required will be development of a Hatchery Management Plan as directed by the Fish Hatchery Management Policy (2003). These documents will identify specific annual and long-term reporting requirements for this SMU.

Interim reporting of status on action items identified within the proposed management direction will be through project, research, annual inventory, and annual reports. As noted earlier, ODFW basin plans are scheduled for review after a 5 to 10-year implementation period. Data gathered through the period will be summarized in the updated plan with proposed management changes if warranted. Other agencies, stakeholders, cooperating entities, private landowners, and hydropower owner/operators will be responsible for monitoring and reporting of their activities voluntarily or through license and permit requirements if applicable.

Potential impacts to other native species

Re-introduction of spring chinook above Round Butte Dam has the potential to affect other native species through introduction of new and more virulent pathogens, competition for spawning and rearing habitat and predation.

Historical spring chinook spawning and rearing areas include most of the Metolius, Deschutes, and Crooked River subbasins below natural barriers. Native gamefish present in the upper basin that may be affected by spawning and rearing spring chinook are bull and redband trout. Competition between spring chinook and bull trout for spawning and rearing area is predicted to occur in the mainstem Metolius River and it's tributaries. Competition for rearing space may occur in areas of the Deschutes River, Crooked River, and Squaw Creek.

Spawn timing for spring chinook in the Warm Springs River begins in late August and peaks near the middle of September. This timing coincides directly with spawn timing for bull trout in the Metolius River creating potential competition for holding and spawning areas. Chinook spawning areas identified by Montgomery (1958) included primarily the mainstem Metolius and Jack Creek. Records do not clearly identify the extent to which spawning surveys were conducted for spring chinook in other areas extensively utilized by bull trout such as Candle, Canyon, Roaring, and Jefferson Creeks. Competition between bull trout and spring chinook for rearing space is unknown. Spring chinook distribution and habitat utilization studies by Lovtang (2003) are in progress and will provide important information necessary to assess overlap of bull trout and spring chinook rearing areas. CTWSRO biologists are currently working with USFWS biologist conducting chinook and bull trout distribution and habitat utilization studies similar to Lovtang in Shitike and the Warm Springs River.

Spring chinook released in the Metolius River to support passage studies have been observed sharing rearing space with juvenile redband trout (ODFW inventory). Data is lacking to show specific effects of this interaction and if increased density of spring chinook would displace juvenile redband trout. Potential also exists for competition between redband trout and spring chinook in Squaw Creek and the Crooked River. Both areas currently support strong populations of redband trout. Again, it is difficult to predict effects of migrating and spawning spring chinook adults and rearing juveniles on redband trout populations.

Fish health risks are associated with reintroducing spring chinook to the upper Deschutes River Basin. Spring chinook entering the Deschutes River are known carriers of *Myxobolus cerebralis* the causative parasite for whirling disease and IHNV Type 2. Fish health studies by Engelking (2002) confirmed 1 case of *M. cerebralis* infected and 6 presumptively infected of 114 unmarked spring chinook tested between 1997 and 2000. Unmarked fish could represent Deschutes River fish, unmarked stray hatchery fish, or unmarked stray wild fish. No confirmed cases were identified from 60 hatchery stray spring chinook between 1998 and 2000 however 6 presumptive infections were identified. Although chinook are a low risk species for high levels of infection, establishment of the parasite in the upper Deschutes could become a significant source of mortality for redband trout and steelhead which are highly susceptible species. Kokanee and sockeye are also susceptible to whirling disease and could be impacted.

Bartholomew (2003) identified innate susceptibility and spawn timing and location as primary factors contributing to the high susceptibility redband trout and steelhead to *M. cerebralis*. These species would be spawning and emerging when high levels of the triactinomyxon spore, the infective stage of *M. cerebralis* would be present. Exposure studies by Bartholomew (2001) resulted in infection of all Deschutes River redband trout at both high and low exposure doses of *M. cerebralis*. Deschutes River steelhead had infection rates of 33 and 53% at low exposure doses and 72% at a high level dose. No signs of infection were detected in bull trout. Table 5 is a reproduction of Bartholomew (2001) exposure study results.

Passing of only Deschutes River origin adults will minimize risk of introducing *M. cerebralis* into the upper Deschutes subbasin. The current strategy of passing only gametes and juvenile spring chinook is a strategy that is reversible and hedges risk to resident fish until the success of maintaining sustainable populations of spring chinook and other anadromous species upstream of the hydroelectric project is assured.

IHNV Type 2 is the second pathogen of concern for fish upstream of Round Butte Dam. IHN virus is known to infect most salmonids and has been documented in spring chinook, kokanee, steelhead, redband trout, and other fish species in the Deschutes River subbasin. The disease typically causes mortality in juvenile fish but mortality in adults has been documented. Currently, only IHNV Type 1 has been documented upstream from Round Butte Dam. The Type 2 is found in the lower Deschutes and infects approximately 30% of the unmarked spring chinook and 25% of hatchery spring chinook (Engelking 2003). Because Type 2 IHNV is more virulent than Type 1, fish upstream are at risk. Compounding this risk is that only lethal detection methods are presently available making it impossible to pass only uninfected fish. Kokanee and sockeye are at greatest risk due to their high level of susceptibility. Risk comparison developed by Engelking (2003 - power Point) estimated 38 to 99 percent risk of a major loss event occurring over a 30 year period with either selective passage of know Deschutes origin adults or unrestricted passage. Without passage, the predicted risk of a major loss event occurring over a 30 year period is estimated to range from 3.6 to 32 percent (Engelking 2003).

Table 5. Number of infected fish, presence of clinical signs, severity of cranial lesions and concentration of *Myxobolus cerebralis* spores found in Crooked River redband rainbow trout (Oncorhynchus mykiss), Metolius River kokanee salmon (O. nerka), Deschutes River steelhead trout (O. mykiss), Rapid River chinook salmon (O. tshawytscha), Deschutes River chinook salmon (O. tshawytscha), and Mt. Lassen control rainbow trout (O. mykiss) 5 months following exposure to infectious stages of *M. cerebralis*.

	% with spores (% with signs)		Mean Lesion Score		Mean Spore Count (Method)	
Species	**Low Dose**	**High Dose**	**Low Dose**	**High Dose**	**Low Dose**	**High Dose**
Redband rainbow trout	100 (0)	100 (21)	2.0	4.5	3.6×10^5 (H)	8.2×10^5 (H)
(0.7g)	100 (17)	100 (12)	2.0	5.0	1.8×10^5 (H)	9.2×10^5 (H)
Control rainbow trout	100 (0)	100 (88)	4.7	4.9	2.4×10^5 (H)	1.2×10^6 (H)
(0.7g)	93 (0)	100 (95)	3.7	5.0	2.6×10^5 (H)	1.6×10^6 (H)
Kokanee salmon	29 (0)	13 (0)	0.8	0.1	8.6×10^3 (H)	5.2×10^3 (H)
(1.5g)	9 (0)	33 (0)	0.5	0.8	2.8×10^3 (H)	1.3×10^4 (H)
Control rainbow trout	75 (0)	96 (0)	2.6	4.2	6.0×10^4 (H)	2.2×10^3 (H)
(1.8g)	75 (0)	100 (0)	2.4	3.0	4.4×10^4 (H)	1.1×10^5 (H)
Steelhead trout-1999	33 (0)	72[3] (0)	2.4	1.2[5]	3.0×10^3 (H)	6.2×10^4 (H)
(1.0g)	53 (0)		0.6		5.8×10^3 (H)	
Control rainbow trout	100 (5)	100[3] (44)	4.8	4.8[5]	2.8×10^4 (H)	9.4×10^4 (H)
(1.2g)	100 (10)		3.9		2.2×10^4 (H)	
Steelhead trout-2000	4 (0)	70 (13)	0.9	2.4	6.6×10^4 (P)	2.0×10^4 (P)
(0.3g)	16 (0)	33 (0)	0.6	2.3	2.0×10^4 (P)	2.0×10^4 (P)
Control rainbow trout	92 (13)	92 (42)	3.9	4.2	2.2×10^5 (p)	7.8×10^5 (P)
(0.6g)	100 (10)	30 (9)	4.1	0.8	2.0×10^5 (P)	4.6×10^4 (P)
Deschutes River chinook salmon (1.0g)	0 (0)	0 (0)	0.0	0.0	ND (P)	ND (P)
	0 (0)	0 (0)	0.0	0.0	ND (P)	ND (P)
Control rainbow trout	92 (13)	92 (42)	3.9	4.2	2.2×10^5 (p)	7.8×10^5 (P)
(0.6g)	100 (10)	30 (9)	4.1	0.8	2.0×10^5 (P)	4.6×10^4 (P)

Notes:
1. 25 fish exposed in each replicate group.
2. Only one group of this species was exposed at the high dose.
(H): Processed by homogenation
(P): Processed by pepsin-trypsin digest

Management Direction
Spring Chinook - Selective Passage

Policies

Policy 1. *Only specific pathogen free hatchery reared eggs or juvenile spring chinook will be released into the upper Deschutes River subbasin until they return as adults to the Pelton Trap.*

Policy 2. *Only spring chinook adults known to have originated upstream of Round Butte Dam or reared in a M. cerebralis free environment will be released above the dam until passage measures are proven successful.*

Policy 3. *Spring chinook of any origin may be considered for passage into habitats upstream of Round Butte Dam once it has been determined the population is able to sustain itself.*

Policy 4. *The upper Deschutes River subbasin will be managed for native spring chinook consistent with the Native Fish Conservation Policy (OAR 635-007-0503).*

Objective 1. Maintain conservation levels of self-sustaining populations of naturally produced spring chinook upstream of Round Butte Dam. A stock recruitment model will be developed for spring chinook to determine specific escapement numbers necessary to meet conservation goals.

Assumptions and Rationale

1. The Deschutes River subbasin upstream of the Pelton/Round Butte hydroelectric complex historically supported natural populations of spring chinook.
2. Desired levels of genetic diversity, adaptiveness, and abundance of native spring chinook will be adequately protected by maintaining conservation levels of naturally produced spring chinook upstream of Round Butte Dam.
3. Eggs or fish will be available from hatchery or wild donor stocks for use in reintroduction.
4. Estimated production capacity for the Deschutes and Metolius Rivers and their tributaries upstream of Round Butte dam is 153,562 smolts under existing habitat conditions and 330,907 with passage at Opal Springs Dam on the Crooked River.
5. Estimated adult production with 90% downstream passage efficiency for juveniles through the hydropower complex is approximately 450 adults under existing conditions and 1000 adults with passage at Opal Springs.
6. Adult production under existing conditions and 90% passage would contribute approximately 190 fish per year to existing fisheries.
7. If harvest is allowed on unmarked steelhead Lower Deschutes River escapement goals will be reassessed.

8. The low inherent susceptibility to Whirling Disease coupled with the predicted timing and location of chinook spawning and rearing tend to reduce disease exposure risk to other species.
9. The incidence of Whirling Disease is approximately 8% for out of basin spring chinook and 5% for unmarked chinook. Disease studies have not documented infection with the Whirling Disease parasite in fish of known Deschutes River origin.
10. Selective passage of adults of only Deschutes River origin fish will minimize disease risks from *M. cerebralis* the causative parasite for whirling disease.
11. The incidence of IHNV Type 2 is 26% for wild, hatchery, and hatchery stray spring chinook combined.
12. The risk of disease from IHNV 2 is the same for selective and non-selective passage strategies.
13. ODFW pathologists estimate that approximately 5% of unmarked spring chinook may be stray fish from outside of the Deschutes River basin.

Actions

Action 1.1. Work with the operator of the Pelton/Round Butte hydropower complex to complete the following including but not limited to: Construct and operate fish passage and protection facilities, fund hatchery and reintroduction programs, monitoring the effects of their facilities and operations, and adaptively manage all aspects of the hydropower complex to meet fish management goals for spring chinook.

Action 1.2. Preferred stock for reintroduction of spring chinook upstream of the Pelton/Round Butte hydroelectric project in order of preference are Warm Springs wild chinook or Warm Springs hatchery chinook if they are available, or Round Butte hatchery spring chinook.

Action 1.3. Only eyed eggs or swim-up fry from adults screened and cleared for disease will be passed upstream of Round Butte Dam until conservation level escapement is met in 3 consecutive years to the Pelton Trap.

Action 1.4. Eyed eggs or swim-up fry will be acclimated and released in known and potential production areas of the mainstem and tributaries as an interim program until downstream efficiencies and adult returns can sustain a naturally reproducing population.

Action 1.5. All parr and smolts collected at passage facilities may be differentially marked to assist in identification of returning adults. Marks will be chosen to minimize harvest mortality.

Action 1.6. PIT tagging and single fin mark, or other marking may be used to assist with identification of Deschutes origin fish, and gain important life history information.

Action 1.7. Selectively pass only known Deschutes River origin adult spring chinook upstream of Round Butte Dam will be used to manage disease risk.

Action 1.8. Develop improved techniques for identifying chinook brood stock of Deschutes River origin.

Action 1.9. Develop improved techniques for screening and monitoring for diseases of concern.

Action 1.10. Monitor distribution, abundance, and movements of juvenile chinook in the Deschutes River and tributaries upstream Round Butte Dam.

Action 1.11. Monitor chinook spawning distribution and abundance in the Deschutes River and tributaries upstream of Round Butte Dam.

Action 1.12. Develop methodology to calculate annual preseason run size estimates using most accurate methods available.

Action 1.13. Work with other agencies, private landowners, and other land managers to improve habitat conditions, and implement passage and protection facilities on barriers and water diversions.

Objective 2. Provide opportunity to harvest spring chinook if spawner escapement goal is exceeds conservation goals in five consecutive years.

Assumptions and Rationale

1. Estimated minimum escapement of 450 chinook is needed to adequately seed available habitat under existing conditions and 1000 chinook escapement is needed if passage is provided at Opal Springs hydroelectric project.
2. Spawner escapement through the hydropower complex can be accurately measured.
3. A restrictive harvest of spring chinook when escapement exceeds conservation population levels for spawners will not jeopardize conservation objectives.
4. Differential marking will assist in identifying Deschutes River origin spring chinook.
5. Adipose fin marking may subject upper Deschutes River chinook to harvest in the lower Deschutes, Columbia River, and ocean salmon fisheries.

Actions

Action 1.1. A consumptive fishery will be considered for naturally produced chinook when escapement exceeds conservation needs for spawners in three consecutive years and preseason forecasts predict similar escapement.

Action 1.2. Subbasin harvest objectives for the lower Deschutes River may need to be amended to assist with re-establishment of chinook upstream of Round Butte Dam. This is contingent on stock used and the ability to uniquely mark fish.

Action 1.3. The operator of the Pelton/Round Butte hydropower complex will continue to provide hatchery mitigation for spring chinook.

Action 1.4. Monitor recreational fisheries in the Deschutes Basin to account for incidental hooking mortality and harvest of chinook.

Action 1.5. Monitor effort and catch of spring chinook if a season is offered.

Action 1.6. Work with the operator of the Pelton/Round Butte hydropower complex to: complete construct and operate fish passage and protection facilities, fund hatchery and reintroduction programs, monitor the effects of their facilities and operations, and adaptively manage all aspects of the hydropower complex to meet fish management goals for spring chinook.

Sockeye Salmon (*Oncorhynchus nerka*)

Species management unit

Sockeye salmon in the Deschutes River subbasin are thought to have been extirpated in the 1940's by barriers on Lake Creek, tributary to the Metolius River. Kokanee however continue to inhabit the subbasin in Suttle Lake and Lake Billy Chinook. A species management unit has not been identified for these populations.

If a sustainable sockeye population is re-established into the Deschutes basin it will likely function as an independent species management unit. Other sockeye populations in the Columbia River basin include the Okanogan River, Lake Wenatchee, and Snake River populations. These three populations have been identified as genetically distinct populations and are Evolutionary Significant Units as determined by NOAA Fisheries (1997). The Snake River population is listed as endangered. Other Columbia River populations lack special status under ESA. Sockeye were once found in the Grande Ronde River and Wallowa Lake but were lost due construction of a barrier on the outlet of Wallowa Lake in 1916 (ODFW 1995).

Desired biological status

Sockeye salmon in Suttle Lake were an indigenous species (Fies and Robart, 1988.; Fulton 1970; NOAA No. 618). Sockeye used Link Creek for spawning and Suttle Lake for rearing. The native run of sockeye in Suttle Lake and Link Creek were reported extinct by 1940, probably due to impassable dams on Lake Creek (Frey 1942), especially at the outlet of Suttle Lake (Nehlsen 1995). Hatchery sockeye were planted in the late 1940's and 1950's in the hope of rebuilding the runs (Wallis 1960). The former Metolius Hatchery (opened in 1947) released sockeye into the Metolius River and Suttle Lake from 1948 to 1961. In the 1950's, a small artificial run of sockeye and kokanee utilized Suttle Lake and its tributaries. Marked sockeye salmon were released by the Department into Suttle Lake beginning with the 1953 brood. In 1958, 10,000 blueback salmon (sockeye) eggs were placed in baskets in Link Creek to evaluate survival. Survival ranged from 62 to 91%.

Numbers of sockeye salmon returning to the Pelton Trap may provide some insight to historic run size returning to the Suttle Lake complex. Counts of adult sockeye at the Pelton trap (Deschutes River) from 1955 to 1962 varied from 30 to 332 adults. The hatchery program for sockeye salmon was not continued and the return of native fish ranged from 7 to 35 from 1957-59 (Nehlsen 1995). No effort to continue the sockeye run was attempted after Round Butte Dam was constructed in 1964.

Since sockeye salmon were indigenous to Suttle Lake and Link Creek, it is reasonable to believe a residual sockeye (kokanee) population existed as well. The 1940 lake survey (Newcomb 1941) reported that land-locked Blueback salmon were abundant. It is unknown if the indigenous form of kokanee are still present in Suttle Lake. Samples have been collected for electrophoretic analysis, but results are pending. Kokanee stocks from Colorado, Montana, and British Columbia were released in Suttle Lake and the present stock may be a blend of the three plus any influence from indigenous stocks.

Since construction of Round Butte Dam, a strong population of naturally produced kokanee has developed. These fish may have originated from the original sockeye population from Suttle Lake. Favorable spawning and rearing conditions in Lake Billy Chinook and tributaries for kokanee indicate good potential for sockeye production in the system if downstream passage constraints can be resolved.

Modeling of potential sockeye production was completed by Oosterhout (1999) using the Passage Risk Assessment Simulation (PasRAS) for Lake Billy Chinook and tributaries based on downstream passage efficiencies and incorporates simulated life-cycle survival. Oosterhout (1999) ran four scenarios using collection efficiencies between 60% and 100%. Predicted spawner populations ranged from 17,472 spawners with a starting population of 1-3,000 adults and supplementation to 209,476 spawners with collection efficiencies of 100% and full seeding with supplementation (Table 6). Probability of extinction ranged from 0 to 1% for a 50 year modeling period. The most significant freshwater parameters for sockeye production in order of importance were egg-to-fall survival, juvenile collection and transport efficiency, spawner success, and over-winter survival (Oosterhout 1999). Again, it should be noted that the PasRAS model is primarily intended for assessing passage options. In this model run, passage efficiency and habitat capacity are shown to be key variables in achieving sustainable populations upstream of Round Butte Dam.

Thiesfeld et al (1999) utilized euphotic volume, photosynthetic rate, total dissolved phosphorus, and zooplankton biomass to estimate number of smolts produced, smolt biomass produced and number of returning adults produced to predict a range of sockeye production in Lake Billy Chinook. Estimated smolt production in Lake Billy Chinook using four methods produced an average of 31,000 kg (19 kg/ha) biomass and a range from 10,385 kg (6.4 kg/ha) to 46,390 kg (kg/ha) (Thiesfeld et al 1999). Using regressions developed by Koenings (1987) and Fryer's (1995), Thiesfeld et al (1999) estimated Lake Billy Chinook could produce 2.9 million smolts, a smolt biomass of 10,385 Kg, and an annual average return of 40,600 adult sockeye. Thiesfeld et al (1999) also estimated that 58,000 to 145,000 spawners would be required to produce 2.9 million smolts assuming 98% mortality from egg deposition to the first fall for age 0 kokanee.

Table 6. Summary of sockeye scenario results (Oosterhout 1999)

Scenario	Average Spawner Population (s.d.)	Arithmetic mean R/S (500 replications)	Probability of extinction (50 years)
0. 100% collection efficacy, start at full seeding, supplement as needed for 3 years	209,476 (474,395)	1.053	0
1. 60% collection efficacy, start at full seeding, supplement as needed for 3 years	68,731 (215,182)	0.919	1%
2. 60% efficacy, start with 1,000 to 3,000 spawners and supplement as needed for 3 years.	17,472 (49,692)	0.947	1%
3. 60% efficacy, start with 1,000 to 3,000 spawners and supplement as needed for3 years, but increase smolt capacity by 20%	18,350 (50,214)	0.966	0.40%

Current status

Sockeye salmon are not present in the upper Deschutes Basin at this time however several resident populations of kokanee exist. Kokanee populations found within the proposed area of anadromous reintroduction include the Lake Billy Chinook/Metolius River, Lake Simtustus, Suttle Lake/Link Creek, and Wickiup Reservoir populations. Sockeye are caught annual in the Pelton Fish Trap however the numbers are low. These fish are thought to be out-of-basin strays or kokanee that emigrated from Lake Billy Chinook. At this time, there are no hatchery sockeye or kokanee stocked in the upper Deschutes subbasin that would influence populations in the Lake Billy Chinook/Metolius River or Suttle Lake/Link Creek Populations.

Kokanee in Suttle Lake spawn in Link Creek in September and October each year. Actual numbers of spawners are unknown however several hundred fish were observed spawning a short distance downstream of Blue Lake in 2002. The number of fish from the Suttle Lake/Link Creek population emigrating to the Metolius River and Lake Billy Chinook is unknown.

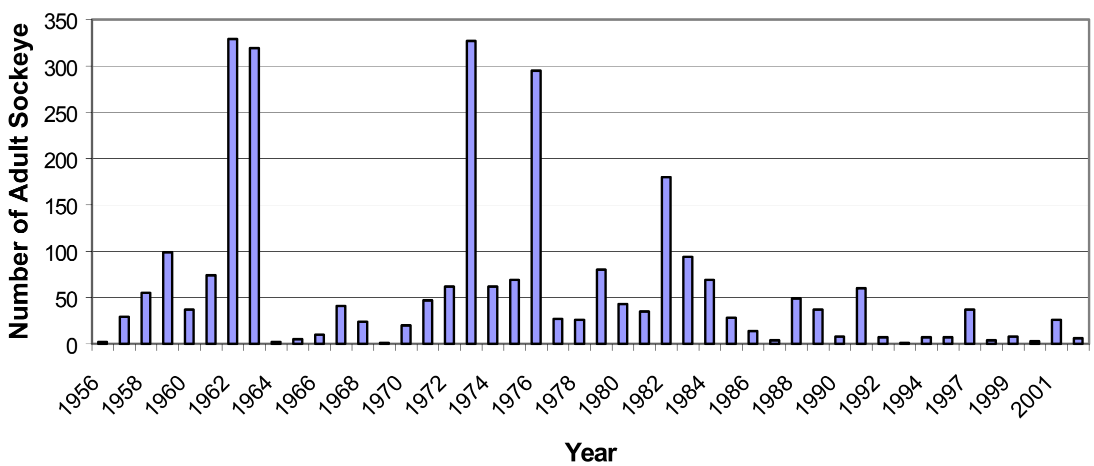
Kokanee from Lake Billy Chinook spawn primarily in the Metolius River and tributaries and to a lesser extent in the Deschutes and Crooked Rivers above the reservoir. Spawning typically begins in early September and ends in early to mid November. Peak spawning occurs in early to mid October. Numbers of spawners between 1997 and 2000 ranged from 153,851 in 1998 to 569,201 in 2000 with corresponding egg deposition estimates of 39,750,116 and 56,817,667 respectively (Thiede et al. 2002). Due to the high number of spawners, superimposition of redds is prevalent. Kokanee fry emergence occurs between January and April with downstream migration beginning in January, peaking in late March to early April, and extending to June. Estimated recruitment in 2000 was 2,167,813 fry to the reservoir (Thiede et al. 2002). Growth of age-0 kokanee in Lake Billy Chinook varies between years and by population density. In 1999, age-0 kokanee grew from 33 mm in April to 175 mm in October and from 33 mm to 150 mm between April and October in year 2000 (Thiede et al. 2002). Next to egg to fry survival, Thiede et al. (2002) found the highest mortality in kokanee (92% in 1999 and 2000) was within the age-0 year class and occurred between July and October. They found that mortality of Age-1 kokanee was low until they entered the fishery at 250mm.

Kokanee production also occurs in Wickiup Reservoir upstream of Bend. Kokanee populations vary directly with water year with strong populations occurring following a series of good water years. During drought years, large numbers of young kokanee actively migrate from the reservoir. Bypass trap sampling associated with the COID Siphon Power Project resulted in the capture of 25,960 kokanee in 1989 with an estimated 58,625 entering the trap at a louver efficiency of 70% (Craven 1991).

Each year sockeye salmon are captured in the Pelton Trap. Numbers of sockeye returning to the Pelton Trap have ranged from a high of 329 adults in 1962 to 1 returning adult in 1993, Figure 3 (Round Butte Hatchery Records). The origin of these fish is unknown and could be from kokanee that successfully emigrated from Lake Billy Chinook or out-of-basin stray fish. Returns in the early 1960's may have originated from hatchery releases by the Oregon Fish Commission from the Metolius Hatchery on Spring Creek. Since 1990, low numbers of sockeye have returned to the Pelton Trap and ranged between 1 and 60 adults. Between 1995 and 1999 Ratliff and Schulz (1999) observed kokanee in the gatewells at the powerhouse at Round Butte Dam. Most fish observed passed through Round Butte Dam in February and March and emigrated at Age-1+ (Ratliff and Schulz 1999). In 1999, Ratliff and Schulz (1999) estimated 135,868 yearling kokanee, or about 10% of the population, exited Lake Billy Chinook through the Round Butte Dam Turbines.

Zimmerman and Ratliff (1999) looked at maternal origin of sockeye salmon returning to the Pelton Fish Trap. Based on strontium/calcium ratios in the sockeye otoliths, they determined that of 35 otoliths examined, 33 of the fish returning to the Pelton Trap in 1997 originated as sockeye and the other two originated as kokanee. Origin of the kokanee was uncertain but strontium/calcium ratios in the primordia were similar to kokanee from Lake Billy Chinook (Zimmerman and Ratliff 1999).

Figure 3. Sockeye Salmon Returns to the Pelton Trap
1956-2002



<u>Primary factors for disparity between desired and current status</u>

As noted earlier, the original sockeye population from Suttle Lake was thought to be extinct by the 1940's. Two barriers were attributed with the extinction, one barrier approximately 4-5 feet in height at the outlet of Suttle Lake and the other at Lake Creek Resort where water was diverted into a pond within the resort complex. The Suttle Lake barrier has since been reduced in height and now could be considered only a partial barrier or migration delay for sockeye. The diversion structure at the Lake Creek Resort has also been reduced in scale and likely could not be considered a barrier.

The Pelton-Round Butte Hydroelectric Complex is the primary barrier that prevents sockeye from accessing the upper Deschutes Subbasin at this time. The owner/operator of the project is currently working facility designs to modify the existing intake structure to facilitate downstream passage of juvenile migrants. The primary design includes constructing a selective water withdrawal to keep surface currents in the reservoir moving toward collection facilities near the face of Round Butte Dam. The existing project configuration is a hypolimnetic release that draws cold water from the bottom of the reservoir to feed the turbines. Surface currents generally move toward the dam and then swing up the Metolius Arm of the reservoir taking fish with them and away from existing collection facilities and was ultimately responsible for passage abandonment in the 1960's.

Kokanee populations in Lake Billy Chinook exhibit high mortality levels between egg deposition until first fall. Thiede et al. (2002) estimated egg to recruitment to first autumn at 0.6% in 1999 and 0.18% in 2000 and conclude that time period ultimately drives the kokanee population in Lake Billy Chinook. They estimated egg to recruitment to the reservoir survival between 2% to 7% for years 1997 and 2000. Superimposition is one source of mortality on the spawning grounds. Kokanee spawn over a two-month period and in years of high abundance the incidence of superimposition increases. Predation by other fish and avian predators may at times be a large source of mortality. Bull trout specifically have been shown to consume large numbers of kokanee. Beauchamp and Van Tassell (1999) estimated for every 1,000 bull trout greater than or equal to 200mm, 971 kg or numeric losses of 13,876 kokanee consumed annually. They also estimated abundance of 200mm or greater bull trout at between 3,600 and 8,400 fish.

Pathogens are another factor driving kokanee populations in the Deschutes Basin and would likely impact sockeye production. Specific pathogens that would affect sockeye salmon include IHNV Type 1 and 2, Bacterial Kidney Disease (BKD), and whirling disease. IHN virus affects the blood forming tissues in salmonids with epizootics known to kill high numbers of juveniles in hatcheries. Two strains of IHN virus are found in the Deschutes, the Type 1 strain which is found both above and below Round Butte Dam and type 2 which is only found downstream. Susceptibility studies have determined that type 2 is more virulent than the Type 1 strain. Kokanee above the project were found to have intermediate susceptibility to IHNV Type 1 and were highly susceptible to IHNV Type 2. Kokanee mortality has been documented in Lake Billy Chinook from IHN however assessment of the impact is very difficult to quantify due to the size of the reservoir and an assumed high incidence of predation on impaired or moribund fish by avian predators and bull trout. Studies by Engelking (2002) found approximately 50% incidence of IHN in kokanee adults collected in the Round Butte Skimmer in March 2001, and 20% in kokanee spawning at the head of the Metolius. Kokanee in the skimmer were moribund or dead fish from IHN virus and/or cold water disease, or BKD bacteria. Since examinations began in the 1970's, 90-100% of spawning kokanee were IHN virus positive.

BKD is found above and below the hydroelectric project reservoirs. Dead and dying bull trout and kokanee have been have found with clinical BKD in Lake Billy Chinook. In 2001, the BKD antigen was found in all fish populations tested from Lake Billy Chinook. Of fish tested, 79 had high levels of BKD antigen and included bull trout and kokanee from above the project and spring chinook and sockeye from below the hydroelectric project (Engelking 2002). Engelking (2002) concluded that based on incidence and prevalence of antigen found in fish surveyed, mortality likely occurs in fish that become susceptible through stress or other factors.

There are no presumptive or confirmed infections with the whirling disease parasite upstream of Round Butte Dam however a number of confirmed cases have been documented downstream of the project reservoirs. Sampling by Engelking (2002) from 1997-2000 found 105 presumptive infections and 25 confirmed infections from *M. cerebralis* from 642 summer steelhead, spring chinook, and sockeye salmon. Four out-of-basin (stray) sockeye salmon were tested with 1 confirmed infection with the whirling disease parasite. Susceptibility studies found that kokanee from the Metolius River had a lower prevalence of *M. cerebralis* infection than control group rainbow, a known stock susceptible to whirling disease (Sollid et al. 2002).

Habitat quality in spawning and rearing areas in the Metolius River/Lake Billy Chinook and the Suttle Lake/Link Creek areas should provide favorable habitat for sockeye salmon. However, as of this writing, approximately 91,000 acres has burned in the Metolius River subbasin. Spawning areas traditionally used by kokanee were not burned but headwater areas in the system were subject to burning that ranged from extremely intense to little effect. Roaring Creek and Candle Creek are two streams that received intense burning. At this time there is potential risk from erosion and sediment inputs instream until vegetative ground cover is re-established. The long-term prospects for recovery are favorable given the condition of the Metolius subbasin, lack of grazing, and ongoing protective management that should facilitate re-vegetation.

Short and long-term management strategies

Management strategies will initially focus on developing effective passage through the Pelton-Round Butte Hydroelectric Project. Relicensing negotiations are currently ongoing for the projects and mitigation for fisheries resources is focusing on restoring passage at the project. The project owner/operator has proposed construction of a selective water withdrawal to draw water from the surface of the reservoir in an attempt to focus surface currents toward the dam and juvenile collection facilities. The timeline for construction of the selective water withdrawal is 2007. Temporary juvenile trapping and collection facilities will be constructed to assist with evaluation of passage efficiencies through Lake Billy Chinook. Final passage facilities would be constructed following evaluation of the facility.

The preferred passage strategy is move smolts originating from kokanee adults through the hydroelectric complex and released into the lower Deschutes River. Downstream migrants will be collected and marked at passage facilities, transported downstream to below the hydroelectric project. Differential marking will be used to specifically identify upper Deschutes River origin adults. Coded wire tagging and/or PIT tagging may provide an effective means to mark fish for identification and assist with minimizing the handling of adults without using identifying marks that would subject these fish to harvest although recreational harvest in freshwater is expected to be minimal. Returning adults of known Deschutes River origin will be passed upstream.

Hatchery supplementation may be considered in meeting sustainability goals if it is clearly determined that sustainable populations cannot be developed from natural production using existing kokanee populations. Naturally produced kokanee from Lake Billy Chinook would be the preferred stock to build a sockeye run. Hatchery programs will be developed consistent with the Hatchery Management Policy.

Necessary monitoring, evaluation, and research to gauge success of corrective strategies

Hydroelectric facilities provide the best opportunity to collect and quantitatively document sockeye numbers in the upper basin and monitor corrective strategies. ODFW will work with the owner/operators of these facilities to meet management objectives for spring chinook.

Specific fish management activities will include the following activities: monitoring habitat utilization, production capacity, and fisheries to ensure escapement objectives are met based on population conservation goals. Activities will include fishery monitoring on both consumptive and non-consumptive fisheries, monitoring of juvenile and adult distribution, abundance, and habitat utilization, fish health, genetics, and effects of competition and predation. Ultimately, identifying key limiting factors and implement corrective actions will determine the ability to maintain a sustainable population. Monitoring and evaluation at hydroelectric projects is the responsibility of the owner/operator. ODFW will assist and provide input toward these efforts through the FERC and State licensing process and by direct coordination with the operator. Increased monitoring responsibility in the upper basin will require increased personnel allocation to meet objectives or reprioritization of activities for existing personnel.

Specific monitoring should include but not limited to the following:

Juvenile sockeye salmon

1. Assess distribution and abundance of rearing juveniles throughout the entire river.
2. Habitat use and partitioning by species to determine intra and inter-specific competition.
3. Studies should be designed and implemented to assess species interactions and their effect since potential sockeye numbers could greatly exceed their historical abundance.
4. Assess smolt migration patterns and timing within tributaries
5. Assess juvenile movement within and through reservoirs
6. Assess passage efficiencies through the hydropower complex
7. Assess juvenile migration and movement through lower Deschutes and Columbia rivers
8. Assess level of predation and competition with other species in tributaries and reservoirs
9. Develop and implement genetic monitoring plan
10. Implement fish health monitoring for migrating and rearing juveniles
11. Assess the abundance and/or distribution of juvenile fall chinook, spring chinook, steelhead, and resident rainbow trout in the lower Deschutes River, in order to examine the effects of sockeye.

Adult sockeye salmon

1. Assess migration timing of upper Deschutes origin fish in the Lower Deschutes River
2. Assess harvest mortality rates in lower and upper basin fisheries
3. Assess upstream passage efficiency at the hydropower complex
4. Implement fish health monitoring for adult migrants and resident populations in the upper Deschutes basin
5. Assess spawning distribution and abundance in the upper basin
6. Assess potential effects of superimposition of sockeye redds on bull trout and spring chinook redds
7. Develop and implement genetic monitoring plan
8. Assess adult life history and migratory patterns.

Hatchery production (if utilized)

1. Assist with collection and sorting of adults
2. Monitor and implement disease management program
3. Monitor and implement genetic management program
4. Assess hatchery rearing techniques and adaptively manage to maintain survival advantage of outplants
5. Assess effectiveness of release strategies
6. Assess handling mortality of juvenile and adults

Monitoring needs will be influenced by management alternative selected and success of reintroduction. The potential exists to greatly exceed historic abundance of sockeye salmon in the Deschutes Basin and influence existing native fish populations. It may be necessary to restrict further passage of sockeye once desired management objectives are met to reduce the effect of sockeye on other native fish species.

<u>Process to modify corrective strategies</u>

An adaptive management approach will be used to identify and implement corrective strategies followed by assessment of effectiveness of those strategies. In some instances corrective strategies may be refined to improve performance or in other instances those strategies will be abandoned in favor of more effective techniques. This plan should avoid locking in all but the most proven management strategies to maintain future options. This plan sets overall programmatic goals and objectives with broad sideboards that allow management flexibility. Specific lower level project and research plans tiered to this plan will be used to assess management options and recommend specific actions consistent with the proposed management direction.

<u>Criteria indicating significant deterioration in status, triggering plan modification</u>

Basin plans are intended to guide fish management within their respective management boundaries for a period of between 5 and 10 years. It is anticipated that successful reintroduction will require several to many generations for each species affected. It is unlikely that significant status change could be detected or segregated from natural population variability within the life expectancy of this plan prior to review. However, monitoring of existing populations with respect to distribution, abundance, fish health, and genetics will be used to detect and assess any direct impacts of reintroduction on those populations. If corrections are outside the scope of the existing plan, management direction modifications with respect to policies and objectives may be recommended.

Annual and long-term reporting

Long-term reporting requirements include identification of the Species Management Unit that includes Deschutes River sockeye salmon and associated conservation plan as directed by the Native Fish Conservation Policy (2002). Also required will be development of a Hatchery Management Plan as directed by the Fish Hatchery Management Policy (2003). These documents will identify specific annual and long-term reporting requirements for this SMU.

Interim reporting of status on action items identified within the proposed management direction will be through project, research, annual inventory, and annual reports. As noted earlier, ODFW basin plans are scheduled for review after a 5 to 10-year implementation period. Data gathered through the period will be summarized in the updated plan with proposed management changes if warranted. Other agencies, stakeholders, cooperating entities, private landowners, and hydropower owner/operators will be responsible for monitoring and reporting of their activities voluntarily or through license and permit requirements if applicable.

Potential impacts to other native species

Re-introduction of sockeye to the upper Deschutes River subbasin has the potential to impact other native species by competition for spawning and rearing habitat and introduction of new and more virulent disease.

Density dependent factors have been identified in kokanee populations in Lake Billy Chinook. Thiede et al. (2002) observed that numbers of recruits increased with numbers of spawners between 1996 and 1998 then decreased in 1999 when carrying capacity was exceeded. The decline in number of recruits is attributable to increased superimposition of redds with high numbers of spawners. They also observed that from 1996-2000, kokanee in Lake Billy Chinook exhibited declines in size, number of eggs per female, and age-0 survival as a function of increased spawner numbers (Thiede et al. 2002). These observations could become even more pronounced if high numbers of sockeye are introduced on top of the kokanee population however it is difficult to predict if sockeye production will offset kokanee production or be cumulative. Assessment will be needed to determine the degree of competition for spawning and rearing habitat, and production in Lake Billy Chinook to quantify these impacts.

Additional habitat overlap may occur between spawning sockeye salmon, spring chinook, and bull trout. Bull trout spawning in the Metolius River and tributaries typically begins in late August and continues through mid-October with peak spawning occurring in mid-September. Kokanee spawning typically begins in early September and continues through late November with peak spawning occurring near mid-October. Biologist during annual bull trout spawning ground inventories have identified substantial overlap in spawning distribution and superimposition of kokanee redds over bull trout redds in Heising Springs and the lower reaches of Canyon, Candle, and Jefferson Creeks. Current protocol for bull trout redd inventories is to include a mid-September count designed specifically to identify bull trout redds prior to kokanee spawning. Affect of superimposition of kokanee spawning over bull trout redds has not been quantified. We anticipate that sockeye salmon would impact bull trout and spring chinook redds to a greater degree than kokanee due to their larger size and potential site selection for depth and velocities similar to bull trout.

Historic sockeye runs were very similar in timing to Lake Billy Chinook kokanee. Sockeye migrating past the Pelton project had peak runs in August with spawning noted to occur from mid-September to November (Nehlson 1995). Spring chinook surveys conducted by Montgomery (1951) found peak spawning to occur in mid-September. Spawning for spring chinook occurred in the mainstem Metolius River from approximately Candle Creek upstream to the headwaters and to a lesser extent in Lake Creek, Spring Creek and Jack Creek. As with bull trout, we predict that spawning sockeye may directly impact spring chinook spawning by redd superimposition. Assessment will be necessary to determine overlap of spawning distribution for bull trout, spring chinook, and sockeye to quantify the magnitude of redd superimposition. Management actions may be necessary to control numbers of sockeye if superimposition of redds is determined to be a factor in limiting spring chinook or bull trout production.

Kokanee and sockeye are species known to be susceptible to IHN virus and the whirling disease parasite, the two pathogens with highest risk to resident fish populations upstream of Round Butte Dam. Engelking (2002) found 1 presumptive *M. cerebralis* infection in sockeye below the Pelton-Round Butte Hydroelectric Project. IHNV was found in summer steelhead and spring chinook below the hydroelectric project but not in mountain whitefish, redband trout, or sockeye sampled (Engelking 2002). IHNV Type 1 is found in Kokanee upstream of the Pelton project. The difficulty with both of these pathogens is that only lethal means are available to determine if fish are carriers making it impossible to only pass only uninfected fish. Preventing exposure to the pathogen is the only method of control.

Susceptibility studies found that Deschutes River redband trout were the most susceptible species to the whirling disease parasite and exhibited susceptibilities similar to the control group rainbow trout, a known susceptible species (Sollid et al. 2002). Kokanee from Lake Billy Chinook also became infected with the whirling disease parasite but less severely than the control group (Sollid et al. 2002). Both redband trout and kokanee provide high profile fisheries in the upper Deschutes Subbasin that could be impacted if

M. cerebralis is introduced and established above the hydroelectric project with reintroduction of anadromous salmonids. Bartholomew (2003) identified the Crooked River as a high risk area for establishment of *M. cerebralis* due to high susceptibility of redband trout combined with spawn timing, and juvenile emergence and watershed conditions favorable to the parasite.

Newly developed Tribal and sport fisheries will likely impact other species such as summer steelhead and spring and fall chinook. Monitoring will be necessary to determine the effect and magnitude of these impacts.

Management Direction – Sockeye Salmon
Selective Adult Passage with Hatchery Supplementation into Metolius River

Policies

Policy 1. *Sockeye salmon will be introduced into the Metolius River and tributaries including Suttle Lake and Link Creek through the release of hatchery reared specific pathogen free gametes and smolts into the Metolius and its tributaries.*

Policy 2. *Adult sockeye arriving at the Pelton Ladder that are from a freshwater lineage will be spawned to provide the source of gametes and smolts for introduction into the Metolius River and its tributaries.*

Policy 3. *Only selected adults of known Metolius River origin will be released upstream of Round Butte and Pelton Dams until passage measures are proven successful.*

Policy 4. *Sockeye salmon of any origin may be considered for passage upstream of Round Butte Dam once it has been determined the population is able to sustain itself.*

Policy 5. *The upper Deschutes River subbasin will be managed for hatchery and naturally produced sockeye in the Metolius River and tributaries consistent with the Native Fish Conservation Policy (OAR 635-007-0503).*

Objective 1. Achieve and maintain a self-sustaining population of naturally produced sockeye salmon in the Metolius River and its tributaries.

Assumptions and Rationale

1. Sockeye will return to the Metolius River as adults.
2. Freshwater survival is adequate to provide for population replacement.

3. The Metolius River population may occasionally require supplementation with hatchery reared fish to continue persistence.
4. Anadromous forms of the kokanee currently spawning in the Metolius River will provide the source of fish best adapted to spawning in the Metolius River.
5. The population level necessary to be self-sustaining will not impair natural production of spring chinook, summer steelhead, or resident trout.

Objective 2. Manage for a population level that allows for a naturally established equilibrium between resident kokanee and sockeye salmon in the Metolius River.

<u>Assumptions and Rationale</u>

1. Equilibrium populations of kokanee and sockeye will be compensatory in nature and not additive.
2. With passage of adult sockeye, the ratio of resident kokanee and sockeye adults will reach equilibrium.
3. Equilibrium will not significantly reduce kokanee fishing opportunity in Lake Billy Chinook.
4. Establishing sockeye salmon from the existing kokanee population will present less of a potential for conflicts with re-establishing chinook salmon.

Objective 3. Sockeye salmon in the lower Deschutes River will be managed to produce a fishery opportunity after recruits per spawner ratios have demonstrated a harvestable surplus in 3 successive years or after a predictive model has been established based on escapement.

<u>Assumptions and Rationale</u>

1. The sockeye population above Round Butte Dam will replace itself and provide a harvestable surplus.
2. Measured population parameters will allow for the development of a predictive model.
3. Sockeye will be catchable enough in the lower Deschutes River to provide for a recreational sport fishery.
4. The public desires a recreational sockeye fishery.

Bull Trout (*Salvelinus confluentus*)

<u>Species management unit</u>

A species management unit for bull trout in the Deschutes River basin has not been defined however the population is included as a gene conservation group with populations in the Hood River basin. The Hood/Deschutes gene conservation group includes Deschutes river populations in the Warm Springs River, Shitike Creek, Lake Simtustus, and the Metolius River (ODFW 1995).

<u>Desired biological status</u>

Historically, bull trout were found throughout the Deschutes River basin in large numbers, however, numbers and distribution were dramatically reduced as a result of anthropogenic changes to habitat and overharvest. Primary factors include flow modification and its secondary effects and creation of passage barriers. The last documented bull trout observations in Deschutes River and tributaries upstream of Big Falls were from Wickiup and Crane Prairie reservoirs in the mid 1950's. Reintroduction of bull trout into areas upstream of Big Falls is not considered within this plan amendment because ODFW has not assessed the feasibility of reintroducing them above the falls.

The U.S. Fish and Wildlife Service is currently working to develop a recovery plan for bull trout in the Columbia River basin. Desired biological status has been identified in the draft recovery plan for bull trout in the Deschutes Recovery unit, recovery criteria include (USFWS 2003):

1. Bull trout distributed among five or more local populations in the lower Deschutes Core Area. Spawning and rearing populations would be found in Whitewater River, Jefferson/Candle/Abbot Creek complex, Canyon/Jack/Heising/mainstem Metolius River complex, Warm Springs River, and Shitike Creek.

2. Estimated annual average abundance of at least 1,200 spawning adults with at least 400 adults spawning in Warm Springs River and Shitike Creek, and 800 in the Metolius River Basin.

3. Adult bull trout exhibit stable or increasing trends in the recovery unit; based on a minimum of 10 years of monitoring data.

4. Connectivity criteria will be met when migratory forms are present in all local populations in core areas providing opportunity for genetic exchange and diversity.

Current status

Deschutes River bull trout populations along with other Columbia River populations were listed as a threatened species under the Endangered Species Act in June 1998 by the U.S. Fish and Wildlife Service. Bull trout are recognized as sensitive species at the state level.

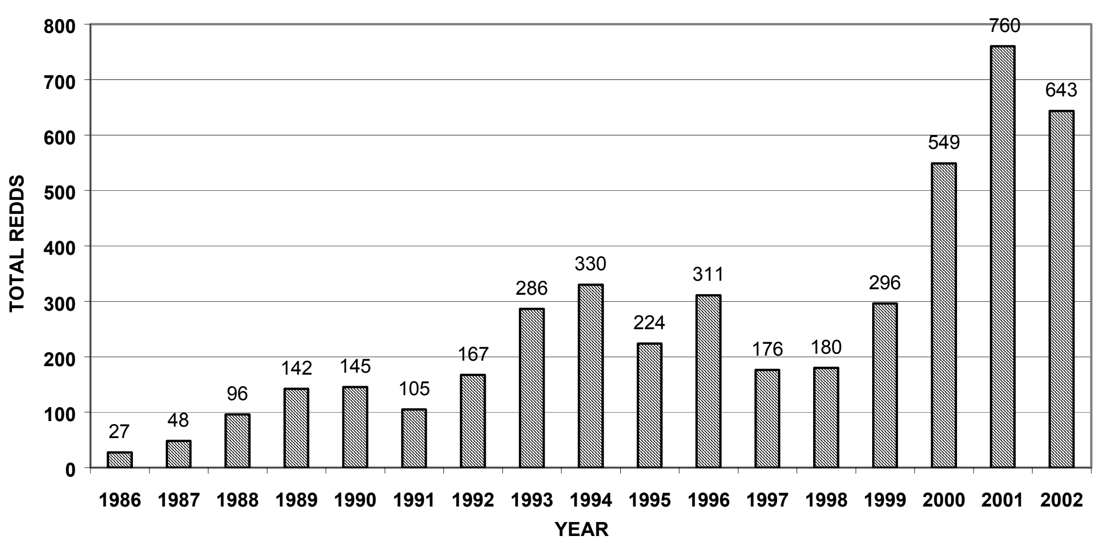
Current distribution includes the Metolius River and tributaries, Deschutes River upstream to Big Falls (RM 132), Squaw Creek, Crooked River upstream to Opal Springs, Warm Springs River, and Shitike Creek. Primary spawning areas include Jefferson, Candle, Canyon, Roaring, and Jack Creeks and Whitewater River in the Metolius subbasin, and Warm Springs River and Shitike Creek. Some spawning occurs in the mainstem Metolius River along with recent documentation of redds in Spring Creek, a tributary to the Metolius. Adult and subadult bull trout are found in Squaw Creek, the Deschutes River, and Crooked River however there is no documentation of spawning in these areas. Upper and lower Deschutes bull trout populations are currently isolated from one another by the Pelton-Round Butte Hydroelectric Project.

Bull trout numbers in the Metolius River/Lake Billy Chinook population have increased dramatically since 1986 when redd counts were first initiated, Figure 4. In 1986, 27 total redds were found in Jefferson, Candle, Canyon, Roaring, and Jack Creeks. Redd counts steadily increased until 1996 when numbers dropped by approximately 40%. In 1996, a 100 year flood event occurred that may have resulted in direct loss of bull trout and certainly impacted kokanee numbers, the major food supply for large bull trout. It is likely that reduced numbers of kokanee reduced the condition factor on bull trout and consequently the number of repeat spawners in consecutive years. Since 1997, redd counts have exhibited a net upward trend to a high count of 760 redds in 2001. Ongoing redd counts for 2003 are on track to exceed the 2001 count. Spawning distribution continues to expand with increase numbers of fish. Trapping efforts in the early 1990's documented a 5-year average of 2.3 adults per redd in Metolius River tributaries. Using this ratio, we have exceeded draft USFWS recovery goals for annual average abundance of spawning bull in the Metolius subbasin since the year 2000.

Increasing redd counts and fish numbers in the Metolius River bull trout population are attributed to implementation of exceedingly more conservative angling regulations, long term habitat protection efforts, and presence of kokanee as a prey base. Hydrology in the Metolius basin is relatively untouched except for Lake Creek, which has been modified to assist with water diversion for irrigation use. Irrigation diversion are also present on Jack Creek although these did not result in major channel alterations. Another factor contributing to bull trout success is most primary spawning tributaries originate or are highly influences by inflow from springs so maintain cold temperatures throughout the year. Since the early 1970's, the kokanee population has flourished and provides an abundant food supply for bull trout. Beauchamp and Van Tassell (1999) estimated that 13,876 kokanee are consumed annually for every 1,000 bull trout greater than or equal to 200mm. They also estimated abundance of 200mm or greater bull trout at between 3,600 and 8,400 fish. As noted earlier, the decline in redd counts observed in 1997 was partly due to reduced food availability from loss of kokanee during the 1996 flood.

The primary factor contributing to increases in bull trout abundance has been the implementation of successively more restrictive harvest restrictions. Key changes include the 1983 requirement to release all wild trout unharmed in the Metolius River and the 1992 requirement to allow the harvest of only 1 bull trout per day in Lake Billy Chinook, and the implementation of the 24 inch minimum length and sanctuary area in

Figure 4.
METOLIUS RIVER AND TRIBUTARIES
BULL TROUT SPAWNING SURVEYS
1986 TO 2002



1997 (Table 7). Current regulations in Lake Billy Chinook allow the harvest of 1 bull trout per day greater than 24 inches. Estimated angling effort directed toward bull trout during March and April has increased from 4,376 hours in 1991 to 8,108 hours in 1993 to 16,331 hours in 2002. Bull trout harvest for the March and April in same years was estimated to be 338 in 1991, 413 in 1993, and 383 in 2002. Number of bull trout released in March and April was 169 in 1991, 1579 in 1993, and 5303 in 2002. Catch in 2002 included the release of 619 legal sized bull trout, fish over 24 inches.

Bull trout in the Deschutes River downstream of the Pelton-Round Butte Hydroelectric Project are found in the mainstem Deschutes, Warm Springs River and Shitike Creek. Until recently, bull trout were only known to inhabit areas upstream of Sherars Falls however recently one bull trout was captured in the Sherars Falls Trap and another in the dipnet fishery below Sherars Falls (Pribyl, S. personal comm. 2003). Spawning and rearing occur in the Warm Springs River and Shitike Creek. Redd counts averaged 101 redds in Shitike Creek and 88 redds in the Warm Springs River between 1998 and 2001 (Brun and Dodson 2000)(USFWS 2003). Bull trout harvest on the lower Deschutes River is currently prohibited.

Table 7. A chronology of protective regulation changes enacted in the Metolius River/Lake Billy Chinook system to prevent overharvest of native trout.

Year	Location	Regulation Change
1980	All Oregon Streams	Trout bag limit reduced from 10/day to 5/day
1983	Metolius River	All wild trout including bull trout must be released unharmed
1988	Lake Billy Chinook	Trout bag limit reduced from 10/day to 5/day
1988	Metolius River tributaries (except Lake Creek)	Closed to angling from August 15 through 3rd Saturday in April
1992	Lake Billy Chinook	Trout bag limit reduced to only one bull trout/day
1994	Metolius River tributaries	All tributaries below Lake Creek closed to angling
1997	Lake Billy Chinook	1. Trout bag limit reduced to 1 bull trout/day greater than 24" in LBC 2. Sanctuary area (no fishing) established at head of Metolius Arm of LBC (approx. 350 yds)

Primary factors for disparity between desired and current status

Passage barriers are the key factor creating the disparity between the current and desired status for bull trout in the Deschutes basin. Specifically, effective passage and protection facilities are needed at the Pelton-Round Butte Hydroelectric Project on the Deschutes River and the Opal Springs Hydroelectric Project on the Crooked River.

Short and long-term management strategies

Correcting passage deficiencies associated with the Pelton-Round Butte Hydroelectric Project is necessary to successfully reconnect bull trout population in the upper and lower Deschutes subbasins. Per ORS 509.585, the owner/operator of the facility is responsible for providing upstream and downstream passage facilities on their artificial obstruction. They owner/operator needs to develop a fish passage facilities plan to ensure adequate efficiencies and survival rates are achieved through the project reservoirs and facilities to meet species conservation goals identified in this fish management plan. Specifically, near term management strategies will focus on developing effective downstream collection and passage for juvenile and adult life history stages through the hydroelectric facilities.

Fish passage will also be pursued at the Opal Springs Hydroelectric Project. This facility is located approximately 1 River Mile upstream of Lake Billy Chinook on the Crooked River with a dam height of approximately 28 feet. There are no fish passage facilities at the obstruction at this time. Ongoing discussions with the owner/operator and other stakeholders have resulted in development of conceptual passage designs prepared by U.S. Bureau of Reclamation engineers. Work to be completed includes defining jump height specifications, ladder type (pool/weir or vertical slot), and to seek funding for implementation. Although the Crooked River is not suitable spawning habitat for bull trout, it provides important seasonal rearing and feeding habitat. Maintaining populations in the margins of their range and water quality limits may be a key factor securing the long-term persistence of the species by protecting a broad spectrum of genetic variability that allows bull trout to adapt to changing habitat conditions.

Necessary monitoring, evaluation, and research to gauge success of corrective strategies

Specific fish management activities will include the following: monitoring habitat utilization, carrying capacity, and fisheries to ensure escapement objectives are met based on population conservation goals. Activities will include fishery monitoring on both consumptive and non-consumptive fisheries, monitoring of juvenile and adult distribution, abundance, and habitat utilization, fish health, genetics, and effects of competition and predation. Ultimately, identifying key limiting factors and implementing corrective actions will determine the ability to maintain a sustainable population. Existing and ongoing monitoring efforts will be continued to provide data needs. New monitoring will be required to assess potential introduction of new pathogens to the upper Deschutes subbasin and to assess effectiveness of passage facilities at hydroelectric projects. Monitoring and evaluation at hydroelectric projects is the responsibility of the owner/operator. ODFW will assist and provide input toward these efforts through the FERC and State licensing process and by direct coordination with the operator.

Process to Modify Corrective Strategies

An adaptive management approach will be used to identify and implement corrective strategies followed by assessment of effectiveness of those strategies. In some instances corrective strategies may be refined to improve performance or in other instances those strategies will be abandoned in favor of more effective techniques. This plan should avoid locking in all but the most proven management strategies to maintain future options. This plan sets overall programmatic goals and objectives with broad sideboards that allow management flexibility. Specific lower level project and research plans tiered to this plan will be used to assess management options and recommend specific actions consistent with the proposed management direction.

Criteria Indicating Significant Deterioration in Status, Triggering Plan Modification

Basin plans are intended to guide fish management within their respective management boundaries for a period of between 5 and 10 years. Monitoring of existing populations with respect to distribution, abundance, disease, and genetics will be used to detect and assess any direct impacts of reconnecting upper and lower Deschutes River bull trout populations. If significant population changes are observed management changes will be implemented to adjust the trend within the sideboards of the existing plan. If corrections are outside the scope of the existing plan, management direction modifications with respect to policies and objectives may be recommended.

Annual and Long-term Reporting

Long-term reporting requirements include defining the Species Management Unit for Deschutes River bull trout with development of a conservation plan as directed by the Native Fish Conservation Policy (2002). These documents will identify specific annual and long-term reporting requirements for this SMU.

Interim reporting of status on action items identified within the proposed management direction will be through project, research, annual inventory, and annual reports. As noted earlier, ODFW basin plans are scheduled for review following a 5 to 10-year implementation period. Data gathered through the period will be summarized in the updated plan with proposed management changes if warranted. Other agencies, stakeholders, cooperating entities, private landowners, and hydropower owner/operators will be responsible for monitoring and reporting of their activities voluntarily or through license and permit requirements if applicable.

Potential impacts to other native species

Reconnecting bull trout populations isolated by the Pelton-Round Butte Hydroelectric Project may lead to increased population numbers that could result in impacts to other native species by increased predation, competition for spawning areas, and potential introduction of new pathogens to the basin upstream of Round Butte Dam.

Bull trout are opportunistic feeders and become increasingly piscivorous as they grow larger. Diet studies in Lake Billy Chinook estimated in 1997 bull trout consumed 13,876 kokanee, 5,273 bull trout, 3,172 mountain whitefish, plus 10,244 unidentified salmonids, and 56,715 other fish (Beauchamp and Van Tassell 1999). They estimated that for every 1,000 bull trout over 200 mm, 971 kg of kokanee, 56 kg of bull trout, 29 kg of rainbow trout, 108 kg of mountain whitefish, 364 kg of unidentified salmonids (not kokanee), 520 kg of other fish, and 1,668 kg of invertebrates were consumed annually. Even with the referenced consumption rates and currently abundant bull trout populations, kokanee numbers in Lake Billy Chinook continue to be high. Qualitative observations following the February 1996 flood, a 100 year event, resulted in reduced numbers of spawning bull trout the following year likely due to reduced numbers of young kokanee in the reservoir and consequent reduced condition factor for bull trout. Bull trout population rebounded with increasing numbers of kokanee along with more restrictive angling regulations implemented in 1997. Diet studies should be repeated to assess bull trout effects on migrating parr and smolt salmonids to assess predatory effects of bull trout on attempts to reintroduce anadromous fish above Round Butte Dam.

Bull trout spawn timing in the Metolius overlaps historic spawn timing of spring chinook in the system. Spring chinook surveys in the Metolius subbasin by Montgomery in the 1950's found most spawning in the mainstem Metolius and to a lesser extent in Lake, Spring, and Jack Creeks (OSGC 1959). Based on current distribution of spawning bull trout there should be some spatial segregation of spawning bull trout and spring chinook.

Risk of disease introduction from passing bull trout from the lower Deschutes to areas upstream of Round Butte Dam is lower than risk associated with passing summer steelhead, spring chinook, or sockeye. Studies in 2001 found that juvenile bull trout are extremely resistant to all strains of IHNV (Engelking 2002). Disease challenges to determine susceptibility of Deschutes River bull trout to *M. cerebralis* found they are susceptible to infection but resistant to clinical disease (Bartholomew 2002). Essentially, bull trout could become infected with whirling disease or IHN Type 2 and passed into the upper Deschutes Basin without detection. At risk from introduction of these pathogens are resident trout and kokanee populations. Kokanee are at risk to both of these pathogens. Impacts to kokanee populations in Lake Billy Chinook would effects a fishery that provides 130 to 150 thousand angler hours annually and an estimated harvest of 60 to 85 thousand kokanee. Redband trout provide very popular and high participation fisheries in the Metolius and Crooked Rivers. Estimated angler use on the Metolius River is 92,000 angler days per year. The abundance of redband trout in the Crooked River combined with spawning timing, and juvenile emergence, and high natural susceptibility put this population at high risk if *M. cerebralis* is introduced into the subbasin.

Bull trout are known carriers of bacterial kidney disease however this pathogen is found throughout the Pelton-Round Butte project area. Dying and dead bull trout and kokanee have been found with clinical BKD from Lake Billy Chinook. This pathogen currently affects hatchery management at Round Butte Hatchery.

Management Direction
Bull Trout Non-Selective Passage

Policies

Policy 1. *Bull trout populations in the upper and lower Deschutes subbasins will be reconnected through passage at the Pelton-Round Butte Hydroelectric Project.*

Policy 2. *The Deschutes River basin will be managed for naturally produced bull trout consistent with the Native Fish Conservation Policy (OAR 635-007-0503)*

Objective 1. Maintain naturally produced self-sustaining populations of bull trout in the Deschutes River basin.

Assumptions and Rationale

1. Bull trout will be managed consistent with conservation of indigenous species.
2. Recovery goals adequately characterize conservation needs for bull trout.
3. Desired levels of genetic diversity, adaptiveness, and abundance of bull trout in the subbasin will be adequately protected by maintaining conservation population levels of naturally produced adults above and below Round Butte Dam.
4. Bull trout in the Metolius River subbasin currently meet spawner escapement, population trend, and distribution objectives.
5. The owner/operator of the Pelton-Round Butte Hydroelectric Project will ensure adequate upstream and downstream passage to achieve connectivity between bull trout populations above and below the projects.
6. Population levels necessary to be self-sustaining will not impair natural production of spring chinook, summer steelhead, kokanee, or other resident trout.

Objective 2. Bull trout in the upper and lower Deschutes subbasins will be managed to provide fisheries opportunities when conservation management objectives are met in 3 successive years. Fisheries opportunities will be assessed by population sub-unit.

Assumptions and Rationale

1. Conservation goals for bull trout populations will be achieved by maintaining an average annual abundance of at least 400 spawning adults in the Warm Springs River and Shitike Creek, and 800 spawning adults in the Metolius River subbasin.
2. Existing monitoring activities adequately assess spawner populations.
3. Restrictive angling regulations are necessary to meet conservation objectives.

Pacific Lamprey (*Lampetra tridentata)*

Species Management Unit

Pacific lamprey are indigenous to the subbasin and found in the subbasin in the lower Deschutes River, Shitike Creek, Beaver Creek, and the Warm Springs River. A species management unit has not been defined for the Deschutes River population. Lack of adequate information on status, distribution, and genetic composition will complicate defining a SMU.

Desired biological status

The desired condition for the Deschutes River population is to maintain naturally produced sustainable populations of pacific lamprey in existing and historic range to meet conservation needs for the species and sustain tribal cultural and subsistence needs. Additional data should be developed to assist with defining a numerically based desired biological status.

Current status

Ammocoetes (larvae) and juveniles were captured annually in July and August in Shitike and Beaver creeks during sampling for juvenile spring chinook salmon in 1986 to 1989. Lamprey are also captured during spring and fall in the juvenile migrant traps in the Warm Springs River and Shitike Creek. Adult Pacific lamprey probably enter the subbasin from June to September one year prior to spawning. The time of lamprey spawning in the subbasin has not been documented, but elsewhere spawning occurs in June and July. Adults die after spawning. Eggs hatch within 2-3 weeks. The ammocoetes burrow into the mud downstream from the nest and may spend up to six years in the mud burrows.

The abundance and distribution of pacific lamprey in the Deschutes subbasin is unknown at this time. Overall, numbers of lamprey in the Columbia River basin have declined in recent years. Pacific lamprey currently ascend the Deschutes River and are known to spawn in Shitike Creek and the Warm Springs River (Graham and Brun 2003). Some Pacific lamprey historically moved upstream above the Pelton Round Butte Project, but the number is unknown. No lamprey have been captured in the Pelton Fish Trap or observed below the Reregulating Dam since the early 1970s.

Lamprey are an important traditional food source for members of the CTWSRO and are harvested annually from June through August in the fish ladder and surrounding area at Sherars Falls. Harvest techniques include hand, dip nets, and, most commonly, hooking. Limited observations of tribal fishers at Sherars Falls suggest a harvest of about 1,000 lamprey per year. Lampreys are consumed fresh, and are also preserved by drying for use throughout the year.

Primary factors for disparity between desired and current status

Factors causing the disparity between desired and current status are unknown although suspected causes for decline include pollution, streamflow modification, predation, and artificial barriers. Juvenile or ammocoete life stages are particularly vulnerable to stream modifications and pollution due to the amount of time they reside in stream substrate. Ammocoetes are also vulnerable to predation.

Short and long-term management strategies

Short-term management strategies will focus on determining the ecology of pacific lamprey with specific attention to limiting factor analysis. Due to the current low population abundance, restoration efforts should focus on securing populations within existing range. Long-term management should assess the effects of the Pelton-Round Butte Hydroelectric Project on lamprey to determine feasibility of re-introduction.

Necessary monitoring, evaluation, and research to gauge success of corrective strategies

Through the effective term of this management plan, efforts should concentrate on determining the ecology of pacific lamprey in the Columbia River and Deschutes River basins. Specific attention should be given to identifying production and survival limitations for this species and assess disease susceptibility. Monitoring should also be developed to assist with detecting changes in status and cause of the change.

Process to modify corrective strategies

An adaptive management approach will be used to develop and implement corrective strategies associated with management of pacific lamprey. In some instances corrective strategies may be refined to improve performance or in other instances those strategies will be abandoned in favor of more effective techniques. This plan sets overall programmatic goals and objectives with broad sideboards that allow management flexibility. Specific lower level project and research plans tiered to this plan will be used to assess management options and recommend specific actions consistent with the proposed management direction.

Criteria indicating significant deterioration in status, triggering plan modification

Basin plans are intended to guide fish management within their respective management boundaries for a period of between 5 and 10 years. Monitoring of existing lamprey populations with respect to distribution, abundance, fish health, and genetics will be used to detect and assess status changes for lamprey populations. Corrective strategies will remain within the scope of this plan. If corrections are outside the scope of the existing plan, management direction modifications with respect to policies and objectives may be recommended.

Annual and long-term reporting

Long-term reporting requirements include identification of the Species Management Unit that includes Deschutes River pacific lamprey with development of a species conservation plan as directed by the Native Fish Conservation Policy (2002). These documents will identify specific annual and long-term reporting requirements for this SMU.

Interim reporting of status on action items identified within the proposed management direction will be through project, research, annual inventory, and annual reports. As noted earlier, ODFW basin plans are scheduled for review after a 5 to 10-year implementation period. Data gathered through the period will be summarized in the updated plan with proposed management changes if warranted. Other agencies, stakeholders, cooperating entities, private landowners, and hydropower owner/operators will be responsible for monitoring and reporting of their activities voluntarily or through license and permit requirements if applicable.

Potential impacts to other native species

Potential impacts to other native species are unknown.

Management Direction
Non-Selective Passage - Pacific lamprey

Policies

Policy 1. *Pacific lamprey will be re-introduced into habitats in the upper Deschutes Basin. Adult lamprey will be passed above the Pelton-Round Butte Hydroelectric Project.*

Policy 2. *Manage pacific lamprey in the Deschutes River and its tributaries for naturally produced sustainable populations consistent with the Native Fish Conservation Policy (OAR 635-007-0503).*

Objective 1. Protect pacific lamprey in the Deschutes River basin.

Assumptions and Rationale

1. The CTWSRO manage their fisheries consistent with conservation of indigenous species. The CTWSRO are co-managers in meeting subbasin management plan objectives and will be involved in fish management activities in the lower Deschutes River subbasin at all levels. All action items will be conducted in cooperation with CTWSRO as co-managers of the resource.
2. Pacific lamprey are present in the lower Deschutes River and are important from an ecological or landscape perspective, as well as important to tribal fishers.
3. Periodic population monitoring will serve as an indicator of species health and adaptiveness.

Actions

Action 1.1. Maintain or enhance fish habitat in the subbasin through implementation restoration projects and habitat protection activities.

Action 1.2. Develop population monitoring strategies for pacific lamprey species in the Deschutes River basin.

Action 1.3. Educate anglers as to the ecological value of these species.

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