Klamath River Basin, Oregon
Fish Management Plan

by
Oregon Department of Fish and Wildlife

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INTRODUCTION

This Klamath River Basin Fish Management Plan, adopted by the Oregon Fish and Wildlife Commission on August 22, 1997, is one of many throughout Oregon that has been prepared by the Oregon Department of Fish and Wildlife (ODFW) to guide fish management within the next ten years. As the name implies, this plan addresses all of the public waters within the Klamath River Basin in Oregon, Figure 1. Streams within the basin have been put in six groupings based on their commonalties, particularly regarding the life history of redband trout. This plan also addresses 22 lakes and reservoirs within the basin. The great majority of these waters are managed by the ODFW's Klamath/Lake Fish District, but the far western parts of the basin, including Howard Prairie and Hyatt reservoirs, are managed by the Upper Rogue Fish District.

This plan contains four major sections: Habitat Management, Fish Management, Fish Management Direction and Alternatives, and Angler Access. In addressing these subjects, it is not intended to be an exhaustive compilation of information on these basin resources. Rather, it is intended to be an adequate overview with sufficient detail to guide decisions and future management.

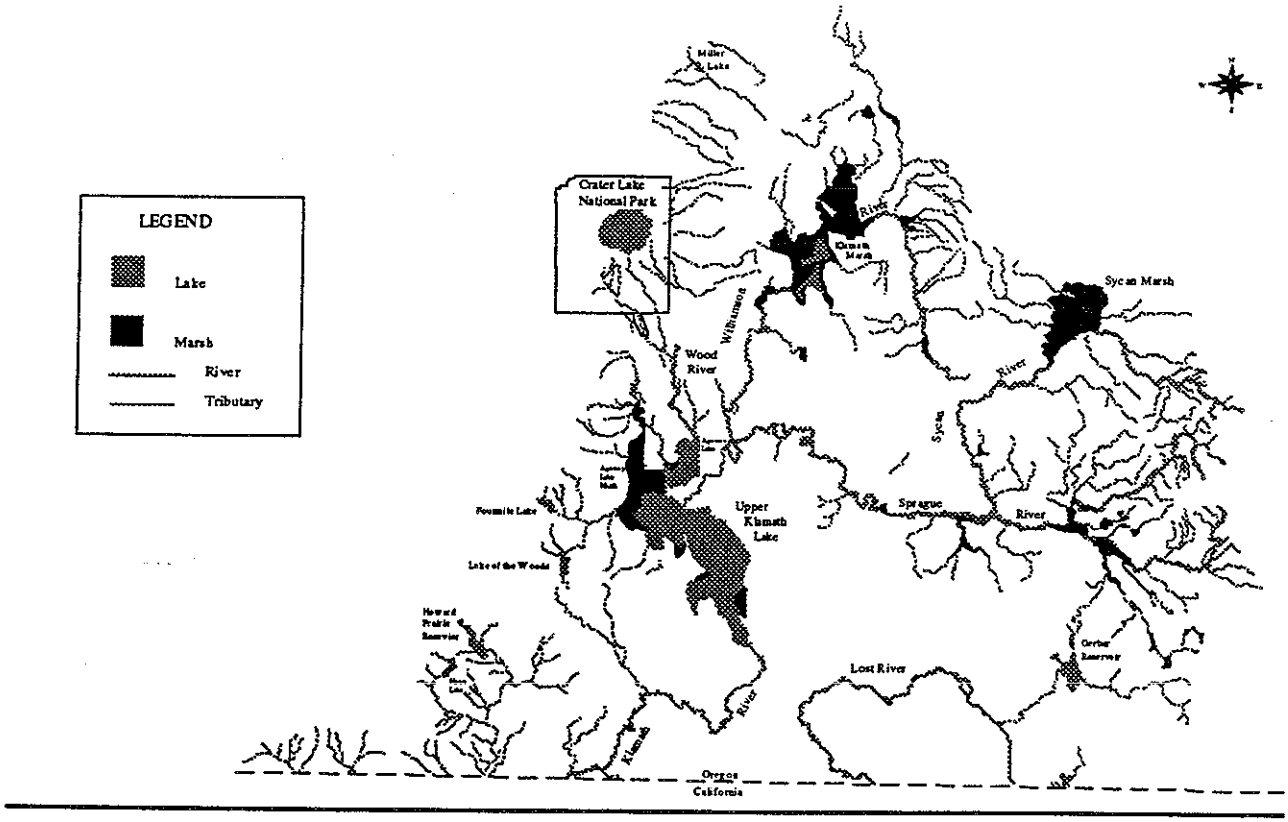
The Habitat Management section addresses the history of the basin and its present status. Important habitat management considerations and limiting factors are described in general; then the habitat and the limitations of each stream and water body is briefly described. These are followed by policies and objectives for habitat management.

The Fish Management section begins with a brief historical perspective of the basin's fish resources followed by descriptions of the life history and distribution of each fish species within the Klamath River Basin.

The heart of the plan is in the Fish Management Direction. For each water, this section lays out unique management considerations followed by the management direction with specific policies, objectives and actions for management that will be the Department's path in the near future. The Department's Wild Fish Management Policy (ODFW, 1992) is the basic guide for determining management direction or alternatives; it calls for choices between Wild Fish, Wild and Hatchery Fish, and Hatchery Fish. Further, management options for angler opportunities have been selected according the guidelines provided in the Oregon Trout Plan (ODFW, 1987a) including Wild Fish, Featured Species and Water, Trophy Fish, Basic Yield, and Intensive Fishery; the Warmwater Fish Plan (ODFW, 1987b) including Basic Yield, High Yield, Quality, and Trophy; and the Steelhead Management Plan, (ODFW, 1986). Further information on these options can be found in Appendixes 3 and 4.

Lastly, the Angler Access section describes the status of access for anglers to the various waters in the basin. This section concludes with the policies, objectives and actions intended to enhance angler access to basin waters.

Figure 1. Klamath River Basin of Oregon



Klamath River Basin Fish Management Plan

EXECUTIVE SUMMARY

The Klamath River Basin in Oregon is the headwaters of Klamath River which runs through northwestern California to the Pacific Ocean. The upper basin was once geologically isolated; during that time, a number of fish evolved producing the unique species and stocks indigenous to the basin. Klamath Basin bull trout and redband trout developed during that period. Eventually the upper basin was connected to the ocean via Klamath River allowing coastal stocks to invade. Redband trout rearing in Klamath River and Klamath Lake were influenced by the coastal rainbow trout. Pacific lamprey, chinook salmon and steelhead trout established populations in upper Klamath Basin, by the early 1900's dams built on Klamath River had precluded their migrations and those stocks have been lost. A number of non-game fish species are indigenous to the upper basin, most of them are unique to the area including five species of suckers, three minnows, three sculpins and four lamprey species. These unique and diverse fish species and stocks are the focus of fish management set out in this plan in accordance with the General Policies for Natural Production Management (OAR 635-07-522). Those policies call for the protection and promotion of natural production of indigenous species and, where desirable, foreign fishes, but the overriding responsibility, through management of individual populations, is to prevent the serious depletion of any indigenous species. To the extent consistent with that mandate, the policy further directs that fish be managed for optimum economic, commercial, recreational, and esthetic benefits for present and future generations. Within that direction and constraints of that policy, this plan provides for a diversity of consumptive and nonconsumptive angling opportunities for natural and hatchery produced game fish.

Exotic species have been introduced to the basin that have affected native fish, and still do. Although opportunities are limited, this plan attempts to mitigate the influence of those introduced species.

Without good habitat it is not possible to sustain healthy fish populations that will support consumptive fisheries. For more than a century, various land use practices have eroded the quality of fish habitats within many areas of the basin. Foremost among those uses are livestock grazing practices, diversion of water for irrigation, and draining of wetlands. Though the Department has little direct management of fish habitats, this plan encourages the protection and restoration of those habitats through coordination and cooperation with other agencies, entities and landowners.

Adequate and appropriate angler access is necessary in order to utilize the diverse angling opportunities provided in this plan. Klamath Basin waters generally have good access for anglers; however, additional sites and facilities are needed to optimize angler opportunities and distribution. Those needs are outlined in this plan so other agencies and landowners may be aware of them. The Department, given adequate funding, will pursue the purchase and development of those sites, either alone, or in cooperation with other agencies and landowners.

Much of the fish management direction in this plan is a reflection of current management. Where it was believed to be feasible, alternatives were proposed that provide choices in angling opportunities such as management for Trophy Fish, Featured Species, Intensive Fishery and Quality Fishery Options (ODFW, 1987a, b).

The management direction in this plan was adopted by the Oregon Fish and Wildlife Commission on August 22, 1997.

Following are the plan's management directions with accompanying policies addressing sub-basins and individual water bodies.

HABITAT MANAGEMENT

Management Direction: Habitat protection, restoration and improvement.

Policies
Policy 1. Habitat that is critical to the natural production of indigenous fish populations will be protected; proactive conservation shall be preferred over habitat restoration.

FISH MANAGEMENT

Klamath River Basin, all waters

Management Direction: for bull trout, Lost River and shortnose suckers, non-game fish, warmwater game fish, crayfish and bull frogs.

Policies

Policy 1. Bull trout, within the Klamath Basin, shall be managed for natural production consistent with the Wild Fish Management Option; angling regulations shall prohibit the take of bull trout within the Klamath Basin.

Policy 2. Lost River and shortnose suckers, classified as Endangered, shall be managed according to the adopted Recovery Plan for those species; angling regulations shall identify them as protected species.

Policy 3. Non-game fish species, within their native habitats, shall be managed exclusively for natural production.

Policy 4. Except where there are policies specific to individual sub-basins or waters, warmwater game fish shall be managed for natural production and stocked fish under the Basic Yield Management Option (ODFW, 1987b).

Policy 5. Crayfish and introduced bull frogs shall be managed for natural production only.

Klamath River: State line to Upper Klamath Lake, including Spencer Creek, Lake Ewauna and Link River

Management Direction: Natural Production, Wild Fish Option

Policies

Policy 1. Redband trout in Klamath River, including Spencer Creek, Lake Ewauna and Link River shall be managed for natural production only consistent with the Wild Fish Management Option (ODFW, 1987a).

Policy 2. No hatchery trout shall be stocked in Klamath River, including Spencer Creek, Lake Ewauna and Link River.

Upper Klamath and Agency lakes including all tributaries, or portions there of, contributing redband trout production to the lakes' rearing population: Williamson River below the falls (RM 23) and tributaries (Spring, Larkin and Sunnybrook creeks); Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries below the outlet of Sycan Marsh, North Fork Sprague River up to RM 12 and tributaries, South Fork Sprague River up to RM 10 and tributaries); Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile Creek (north), Crystal Creek, Recreation Creek, Thomason Creek, Harriman Creek, Odessa Creek, and Short Creek.

Management Direction: Natural and Hatchery Production; Trophy and Basic Yield Management Options

Policies

Policy 1. Redband and introduced brown trout in Upper Klamath and Agency lakes, Williamson River below the falls (RM 23) and tributaries, Wood River and tributaries, Sevenmile Creek and tributaries, and Fourmile (north), Crystal, Recreation, Thomason, Harriman, Odessa, and Short creeks, shall be managed for natural production only consistent with the Trophy Fish Management Option (ODFW, 1987a). Introduced brook trout shall be managed for natural production only consistent with the Basic Yield Management Option (ODFW, 1987a) in these waters.

Policy 2. Redband trout and introduced brown trout where they occur in Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries up to the outlet of Sycan Marsh, North Fork Sprague River and tributaries up to RM 12, and South Fork Sprague River and tributaries up to RM 10) shall be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a). Intoduced brook trout in these waters shall be managed for natural production only under the Basic Yield Management Option (ODFW, 1987a).

Policy 3. Stocking of hatchery fish in Spring Creek shall be limited to yearling rainbow trout of a stock susceptible to *Ceratomyxa shasta* and they will be managed under the Intensive Use Management Option (ODFW, 1987a).

Policy 4. No hatchery trout will be stocked in Upper Klamath and Agency lakes; Williamson River below the falls (RM 23) and Larkin and Sunnybrook creeks; Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile (north), Crystal, Recreation, Thomason, Harriman, Odessa, and Short creeks; and Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries up to the outlet of Sycan Marsh, North Fork Sprague River and tributaries up to RM 12 and South Fork Sprague River and tributaries up to RM 10).

Williamson River above the falls (RM 23) and tributaries

Management Direction:. Natural production; Wild Fish and Basic Yield Options

Policies

Policy 1. Redband trout shall be managed for natural production only consistent with the Wild Fish Management Option (ODFW, 1987a) while introduced brook and brown trout shall be managed for natural production only consistent with the Basic Yield Management Option (ODFW, 1987a).

Policy 2. No hatchery fish will be stocked in these waters.

Sycan River above the outlet of Sycan Marsh and tributaries, including Long and Coyote creeks;
North Fork Sprague River (above RM 12) and tributaries;
South Fork Sprague River (above RM 10) and tributaries, including Deming Creek:
Cascade Mountain streams: Sink, Cottonwood, Scott, Sand, Threemile, Cherry, Rock, Fourmile, Moss, and Denny creeks;
Jenny, Fall, Scotch, Cottonwood, Grouse, Long John, and Cow creeks.

Management Direction: Natural Production; Wild Trout and Basic Yield Options

Policies
Policy 1. Redband and steelhead trout in these waters shall be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. Introduced brook and brown trout in these waters shall be managed for natural production consistent with the Basic Yield Management Option (ODFW, 1987a).

Policy 3. No hatchery trout will be stocked in these waters.

Lost River and tributaries

Management Direction: Natural Production; Wild Trout Option

Policies
Policy 1. Redband trout in Lost River and tributaries will be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. Hatchery trout will not be stocked in Lost River and tributaries.

Fourmile Lake

Management Direction: Natural and hatchery production; Basic Yield and Trophy Fish Options

Policies

Policy 1. Fourmile Lake will be managed for natural production of brook trout and kokanee salmon and for hatchery reared redband trout under the Basic Yield Management Option in the Trout Plan (ODFW, 1987a).

Policy 2. Lake trout will be introduced to Fourmile Lake and managed for natural production under the Trophy Fish Management Option in the Trout Plan (ODFW, 1987a).

Lake of the Woods

Management Direction: Natural and hatchery production; Basic Yield and Quality Options

Policies

Policy 1. Lake of the Woods will be managed for natural and hatchery production of kokanee salmon, and redband and brown trout under the Basic Yield Management Option, (ODFW, 1987a).

Policy 2. Lake of the Woods will be managed for natural production of brook trout, black crappie, yellow perch and brown bullheads under the Basic Yield Management Option, (ODFW, 1987a,b).

Policy 3. Lake of the Woods will be managed for natural production of largemouth bass under the Quality Management Option, (ODFW, 1987b).

Miller Lake and Miller Creek

Management Direction: Natural and hatchery production; Basic Yield Option

Policies

Policy 1. Miller Lake will be managed for natural production of kokanee salmon and for hatchery reared redband and brown trout under the Basic Yield Management Option in the Trout Plan, (ODFW, 1987a).

Policy 2. Miller Creek will be managed for natural production of redband (rainbow) and brown trout under the Basic Yield Management Option in the Trout Plan (ODFW, 1987a).

Cascade and Gearhart Mountain lakes

Management Direction: Hatchery Production; Basic Yield Option

Policy 1. Cascade and Gearhart Mountain lakes within the Klamath River Basin shall be managed for selected species of hatchery reared trout and managed for the Basic Yield Management Option, (ODFW, 1987a).

Howard Prairie Reservoir

Management Direction: Natural and hatchery production; Basic Yield Option.

Policies
Policy 1. Howard Prairie Reservoir shall be managed primarily for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW, 1987a).

Hyatt Lake

Management Direction: Natural and hatchery production; Basic Yield Option.

Policies
Policy 1. Rainbow trout shall be managed for hatchery production consistent with the Basic Yield Management Option, (ODFW 1987a).

Policy 2. Largemouth bass shall be managed for natural production consistent with the Basic Yield Management Option unless it is determined that the Quality Fish Management Option is beneficial, (ODFW 1987b).

Little Hyatt Lake

Management Direction: Hatchery production; Basic Yield Management Option.

Policies
Policy 1. Little Hyatt Lake shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW 1987a).

Keene Creek Reservoir

Management Direction: Natural production; Basic Yield Management Option.

Policies
Policy 1. Keene Creek Reservoir shall be managed for natural production of redband trout under the Basic Yield Management Option.

Deadhorse Lake

Management Direction: Hatchery production; Basic Yield Management Option.

Policies
Policy 1. Deadhorse Lake shall be managed for hatchery production of rainbow and brook trout under the Basic Yield Management Option, (ODFW, 1987a).

Holbrook Reservoir

Management Direction: Hatchery production; Basic Yield Management Option

Policies
Policy 1. Holbrook Reservoir shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW, 1987a).

Heart Lake

Management Direction: Hatchery production; Basic Yield Management Option.

Policies
Policy 1. Heart Lake shall be managed for hatchery production of rainbow trout and kokanee salmon under the Basic Yield Management Option, (ODFW, 1987a).

Big Swamp Reservoir

Management Direction: (See Basin Wide management direction for warmwater gamefish)

Lofton Reservoir

Management Direction: Hatchery production; Basic yield Management Option.

Policies
Policy 1. Lofton Reservoir shall be managed for hatchery production of rainbow trout under the Basic Yield Management Option, (ODFW, 1987a).

J. C. Boyle Reservoir

Management Direction: Natural production of redband trout; Wild Fish Option. Natural production of warmwater gamefish; Basic Yield Option.

Policies

Policy 1. Redband trout in J. C. Boyle Reservoir will be managed for natural production under the Wild Fish Management Option (ODFW, 1987a).

Policy 2. No hatchery reared fish shall be stocked in J. C. Boyle Reservoir.

Gerber Reservoir

Management Direction: Natural production of all fish species; Wild Trout and Basic Yield Options.

Policies

Policy 1. Redband trout in Gerber Reservoir shall be managed for natural production consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. All gamefish species other than redband trout in Gerber Reservoir shall be managed for natural production consistent with the Basic Yield Management Option (ODFW, 1987b).

Policy 3. No stocking of fish shall be done in Gerber Reservoir.

Willow Valley Reservoir

Management Direction. Natural and hatchery production of Lahontan cutthroat trout; Basic Yield Management Option.

Policies
Policy 1. Lahontan cutthroat trout in Willow Valley Reservoir shall be managed for natural and hatchery production under the Basic Yield Management Option, (ODFW, 1987a).

Devil Lake

Management Direction: Hatchery production of rainbow trout, Basic Yield Management Option.

Policies
Policy 1. Devil Lake shall be managed for hatchery production of rainbow trout.

Campbell Reservoir

Management Direction: Natural production; Basic Yield Option

Policies
Policy 1. Campbell Reservoir shall be managed for natural production of redband trout until the Deming Creek diversion is screened when management will be changed to hatchery production of rainbow trout; under either management direction, it will be managed under the Basic Yield Management Option (ODFW 1987a).

Bumpheads Reservoir
Upper Midway Reservoir
Dog Hollow Reservoir
Round Valley Reservoir
Smith Reservoir

Management Direction: See Basin Wide Management Direction for warmwater gamefish, ie. natural production and stocked fish; Basic Yield Management Option.

ANGLER ACCESS

MANAGEMENT DIRECTION: Provide for diverse angler access opportunities.

Policies
Policy 1. Barrier free access to angling opportunities shall be provided for the angling public where it is appropriate and feasible.

Management considerations, summaries of management direction along with accompanying objectives and actions are presented in the body of this plan, refer to the Contents to find specific streams, lakes, or reservoirs.

ECOLOGICAL CONSIDERATIONS

Management of fish resources must be considerate of potential ecological consequences; this has not always been the case in the past. Maintenance or restoration of indigenous species is of foremost importance and is the guiding principle for this plan. No management direction proposed in this plan is expected to have any additional detrimental affect on any indigenous species.

The Endangered Species Act is the driving force behind the management of water and habitat in the Klamath Basin as it directs the recovery of Lost River and shortnose suckers (Stubbs and White, 1993); intent of that plan is to guide the recovery of those species throughout their distribution. Any management activities are constrained by their possible effects on those fish. Logically, management action intended to improve habitat for those native suckers will also benefit other indigenous species.

In the past, some "official" introductions of exotic species have impacted the native fauna; examples of such were the release of bull frogs in the basin, the stocking of brook trout in bull trout habitat, and the planting of yellow perch, pumpkinseeds and brown bullheads in Klamath Lake. More recently, illegal or accidental introductions have been a major problem such as the proliferation of fathead minnows in Klamath and Agency lakes and their likely impact on native suckers and minnows. Unfortunately, once established, there is often little that can be done to reverse the impact of exotic species except to optimize habitat conditions for the native species and encourage the harvest of exotic game species in an effort to reduce their level of competition

Any new introductions of fish species must first be reviewed and approved by the Department of Fish and Wildlife's (ODFW) Fish Introduction Committee, then approved by the head of the Fish Division and, ultimately, the Oregon Fish and Wildlife Commission (OFWC). Ecological consequences are the prime consideration in review of any introduction proposal. Future stocking of fish in wilderness lakes will be considerate of native fish and wildlife and will be addressed in development of wilderness management plans in conjunction with USFS. Further, actions to preclude impacts to indigenous species have been identified in the bull trout conservation plan (Light, et al, 1996) and Klamath sucker recovery plan (Stubbs and White, 1993).

HABITAT MANAGEMENT

Overview

The Klamath River Basin in Oregon is the headwaters of Klamath River. From it's origin at Klamath Falls (RM 250), Klamath River flows southwest to the state line (RM 208) and on through northern California to the Pacific Ocean. It lies east of the southern end of the Cascade Mountains in the Basin and Range Province. Elevations vary from 2,755 feet in Klamath River canyon at the state line to 9,495 feet on Mt. McLoughlin in the Cascades and 8,364 feet on Gearhart Mt. at the eastern edge of the basin. Most of the drainage tributaries funnel through Upper Klamath Lake, elevation 4,139, before spilling into Link River and Lake Ewauna at the head of Klamath River.

This basin lies in the rain shadow of the Cascade Mountains and experiences relatively low levels of precipitation; Klamath Falls averages about 13 inches per year, mostly in the form of snow. Because of the low level of precipitation, stream flows and lake levels are largely dependent on the water content of the annual snow pack. Fortunately, there is a generous amount of ground water coming to the surface in the form of springs that are the origin of several streams and help to sustain perennial flows in others.

The basin contains a variety of waters and, therefore, a variety of fish habitats. Standing waters range from small, high elevation wilderness lakes to turbid reservoirs in semi-arid lands; in between are larger, clear mountain lakes and the largest natural lake in Oregon, Upper Klamath Lake which is a remnant of the ancient, isolated pluvial Lake Modoc (Dicken, 1980). Stream types run the gamut from small, meandering mountain creeks to the steep, mainstem of Klamath River and from cold, clear spring-fed streams to warm, sluggish, channelized rivers.

Since the late 1800's, land uses in the basin have been dominated by timber harvest, livestock grazing and irrigated farming. All of these activities have had detrimental impacts on native fish populations. Timber harvesting and associated road-building practices, for many years, resulted in loss of streamside shade and instream cover and contributed excessive loads of sediment. Long term, season-long grazing on both private and public lands caused loss of riparian vegetation resulting in unstable, wide and shallow stream channels with warm water and lacking instream cover. Diversion of water from streams for irrigation of crops and pasturelands has reduced instream flows below those needed to sustain healthy fish populations or, in some cases, dries up the stream entirely. Such low flow conditions result in reduction of a stream's carrying capacity for fish by falling below the levels needed to support fishes' life history requirements. Dams and ditches associated with diversion of water, lacking fish ladders and screens, have also caused fish passage problems and loss of fish production.

Currently, impacts of timber harvest have been greatly diminished with administration of the Oregon Forest Practices Act and similarly improved practices on federal forest lands. A new awareness and voluntary conservation strategies on the part of some private landowners are showing important improvements in stream and watershed conditions. Impacts of livestock grazing continue to be a major problem in some areas but there have been improvements in other areas with administration of grazing practices and construction of riparian fences excluding livestock from access to streams. Reduction of streamflows by irrigation diversions is an ongoing problem on some streams that will not likely improve unless the land use changes or significant water conservation practices are implemented. Passage over dams and screening of ditches is being addressed by the ODFW Fish Screening and Passage Programs and progress is being made to alleviate those problems; however, many of these problems have yet to be resolved.

Background

Development in the Klamath River Basin in Oregon began in late nineteenth century with the inception of agricultural practices and timber harvest. Grazing of cattle and sheep was the primary use in the basin in those early years. In the early 1900's, the Klamath Project was developed by the Bureau of Reclamation (BOR) to facilitate the expansion of irrigated farming. A-canal and its system of laterals was developed to distribute waters diverted from Upper Klamath Lake. The majority of Tule and Lower Klamath lakes were drained and converted to agriculture. Link River Dam was built at the outlet of Upper Klamath Lake to store and divert water for agricultural uses. Wilson Dam and the Lost River Diversion Canal were built so that water could be managed between Lost and Klamath rivers. The Klamath Project area supports the majority of crop rearing in the basin, mainly grain, potatoes, alfalfa hay and sugar beets. Cattle production is the largest agricultural industry in the basin and dominates uses in Williamson, Sprague, Sycan and Wood river sub-basins. Water diverted from these streams is used to irrigate pastures for summer grazing and production of alfalfa.

Harvest of algae from Upper Klamath Lake and downstream diversions from the lake has become a major business. If considered an "agricultural" product, it would surpass livestock production as the greatest in value. Harvest of algae has both potentially negative and positive influences on fish management.

Timber harvest has remained an important industry through the years. It has been largely supported by selective harvest of large Ponderosa pine trees. In recent years, as the supply of large pines dwindled, cutting of lodgepole pine and white fir has become more common.

Water use policy in the Klamath River Basin is governed by the Klamath River Compact, an agreement between the states of Oregon and California and the federal government. Under the Compact priorities, irrigation use is second only to municipal and domestic uses and ahead of recreation, fish and wildlife uses. Water rights (permits) in the basin have not yet been fully adjudicated but it is probable that waters of the basin's streams have been fully allocated for out-of-stream uses. No instream minimum flows have ever been adopted for fish or maintenance of water quality. ODFW has applied for instream water rights for fish on 35 streams; these flows, should they be adopted, would be junior to any previous applications.

The development area of the City of Klamath Falls and suburbs is by far the most significant urban area in the basin with a population exceeding 40,000 people. Merrill, Malin, Bonanza, Keno, Chiloquin, Sprague River and Bly are smaller communities. Rural residential uses are popular in some area and are most intense near Keno, Chiloquin and Sprague River along the Klamath, Williamson and Sprague rivers, respectively.

Except for hydroelectric generation, industrial use of water is quite light in the basin. The City of Klamath Falls is proposing the development of an electrical co-generation plant adjacent to Klamath River near the crossing of Hwy 97. That plan would use treated water from the Klamath Falls sewer plant for cooling processes; that process is expected to have beneficial influences on water quality in Klamath River.

Future residential and industrial development in the basin is expected to be concentrated in the Klamath Falls urban area. Pressures for more rural-residential development will continue. Development of a large recreational resort and residential area is beginning near the southwest corner of Upper Klamath Lake. The Klamath Tribes (TKT) is undertaking development of a casino adjacent to lower Williamson River near Chiloquin that will likely attract more development to that location.

Habitat Data Base

The Department's stream inventory program makes physical and biological surveys to provide information about instream and riparian habitat conditions and fish populations that reside in them. That information can be used to guide management of aquatic ecosystems. Through 1995, 114.7 miles of streams have been surveyed for documentation of physical habitat; on 27.5 miles of those streams, the fish populations were also inventoried.

Habitat Management Considerations

Land-use factors that affect instream and riparian habitat are concerns to fishery management. Resource extraction activities such as timber harvest, grazing and irrigation have altered natural habitat to the detriment of fish. Of particular concern are the ways these activities affect riparian zones, water quantity and quality and interfere with natural movement of fish. Because fish habitat is not directly managed by ODFW, coordination of habitat management activities is also a major concern. These issues are addressed further in the following discussions.

Habitat Limiting Factors, General

Water Quantity and Quality

The amount and quality of water available has obvious implications for the welfare of fish species and their populations. Quantities mainly relate to amounts necessary to meet fish's life history needs, that is, for spawning, rearing and movement. Streamflow must provide for adequate depth and velocity over gravel for trout spawning. Wetted area, depth and velocities govern food production and rearing area. Water depth and velocity over riffle areas must be adequate to provide unimpeded movement within streams.

Beyond the specific life history requirements of fish is the larger role of a stream's hydrograph, annual variation in flow including periodic out-of-bank events, and its complex influence on channel structure, length, and maintenance of riparian vegetation. These relationships govern the ecological diversity and fishery potential of any stream. Where natural streamflow regimes are lacking it is imperitive that those aquatic ecosystems be protected from further damage by man's activities.

Streamflow quantities in the Klamath Basin are often limited by the natural lack of precipitation but the amount of water available for fish production is further limited by out-of-stream diversions for irrigation of agricultural lands. Some stream segments may be completely dewatered below diversions.

Water quality determines to a large extent the species of fish a stream segment, lake or reservoir can support. The distribution of trout is a reflection of water quality, primarily temperature, dissolved oxygen, pH, sedimentation and turbidity. Some land uses practices such as livestock grazing, timber harvest, road building, and wetland reclamation, for example, cause changes in the watershed resulting in unnatural increases in nutrients entering the basin's waterways. Those elevated nutrient levels have led to the water quality limitations in Upper Klamath and Agency lakes and some streams.

Sedimentation reduces available spawning habitat, impeding spawning and reducing egg survival. Sedimentation also reduces food production by siltation of the stream substrate while turbidity limits the penetration of sunlight and resulting primary production. Sediment can result from removal of riparian vegetation, leaving streambanks vulnerable to erosion during high flows; from animal trampling, hoof slide and streambank cave-in that causes direct inputs

of sediment; from surface runoff originating from improperly placed or poorly maintained roads; and from disturbed or inadequately vegetated uplands. The lack of streamside vegetation also prevents the trapping of sediments and rebuilding of streambanks, (Platts, 1983).

Riparian Habitat:

Riparian habitat conditions directly influence instream habitat that affects the stream's ability to maintain stable streambanks, good water quality and late-season stream flows. Effects on fish habitat from loss of riparian vegetation include rises in water temperature, loss of cover, increased erosion, and a general shallowing and widening of the stream channel. Loss of perennial streamflow can also occur with destruction of riparian habitat.

Effects of water temperature extremes, too hot in summer and too cold winter, are lessened by the presence of healthy riparian vegetation. Dissolved oxygen concentration decrease as water temperatures rise. This causes problems for fish because their metabolic rates and oxygen requirements rise with increases in water temperature. Streams lacking adequate riparian vegetation are susceptible to anchor ice. This phenomenon can result in adult fish deaths and interruption of intergravel oxygen exchange leading to loss of eggs in the gravel, (Platts, 1983).

Riparian vegetation is important to the food chain of aquatic systems. Leaves and litter from riparian vegetation contribute to organic material entering the stream that is consumed by organisms eventually eaten by fish. Terrestrial insects associated with riparian vegetation also contribute to the fish diet, (Platts, 1983).

Cover is another component of fish habitat that is affected by presence or absence of riparian vegetation. Riparian vegetation is crucial to building and maintaining stream structure conducive to productive aquatic habitat, (Platts, 1983). Overhanging vegetation provides shade and security. Large woody material instream provides hiding cover, pool habitat and bank stability. Binns (1979) found cover was highly significant in determining fish biomass in Wyoming streams; as cover increased, fish increased.

Loss of riparian vegetation with resulting temperature extremes, lack of cover, and increased erosion limits water quantity and quality and; therefore, restricts potential fish production in the Klamath Basin.

Fish Passage

Fish need to be able to move freely within the streams and lakes to find suitable spawning and rearing areas or escape stressful conditions. Free passage is also important, over time, for allowance of genetic exchange among stocks, thus avoiding habitat segregation and promoting genetic diversity. Dams built on streams to divert water for irrigation may impede or block such passage if adequate fish passage facilities are not provided. There are a number of such dams within the Klamath Basin that, at least seasonally, present barriers to fish movement. ODFW has developed a data base of such fish passage problems that includes those in the Klamath Basin. The Department will be, on a priority basis, working with landowners or diverters to resolve those problems that are the most significant obstacles to fish movement in the basin.

Downstream movement is also critical to fish. Adults must be able to return to rearing areas from spawning areas and juveniles must be able to disperse from spawning areas to rearing areas in streams or lakes. If water diversions are not adequately screened, fish moving downstream are subject to being entrained into the diversions where they are likely to be stranded and killed. There are many diversions in the Klamath Basin that are not screened; they are included on the Department's data base. Diversions of 30 cfs or greater are solely the responsibility of the owner for providing screening. Smaller diversions fall under the state's

program for cooperation with the owners for installation and maintenance of fish screens. That program is ongoing and is to be implemented by priority or with volunteers as funding is available. Details of the state screening program may be obtained through the Department's Fish Division.

Coordination

Although the Department has primary responsibility for management of fish resources in the state, it does not have direct control over the habitat that supports those resources. It is, therefore, imperative that there be good coordination between the Department and various land owners and land and water managers in order to maintain, restore or improve habitat for fish. There are a number of agencies within the Klamath Basin that have responsibilies that may influence the quality of fish habitat, including: Winema National Forest (WNF) and Fremont National Forest (FNF), Bureau of Land Management (BLM, Lakeview and Medford Districts), BOR, United States Fish and Wildlife Service (USFWS), Oregon Department of Forestry (ODF), Klamath County, and TKT. In addition, private companies and large landowners such as PacificCorp (PC) and U. S. Timberlands (UST) are major entities influencing fish habitat in the Klamath Basin. It is important that survey and inventory information be shared and be compatible among these resource managers. Such information is needed for monitoring these resources and guiding habitat management.

It is also important that the Department be active in cooperation and coordination with other private landowners and organizations to assist and guide conservation, restoration and improvement of fish habitats. This may be done one-on-one with ODFW District personnel or through the Department's Restoration and Enhancement Program (R&E), or Salmon Trout Enhancement Program (STEP).

Habitat Descriptions and Limitations

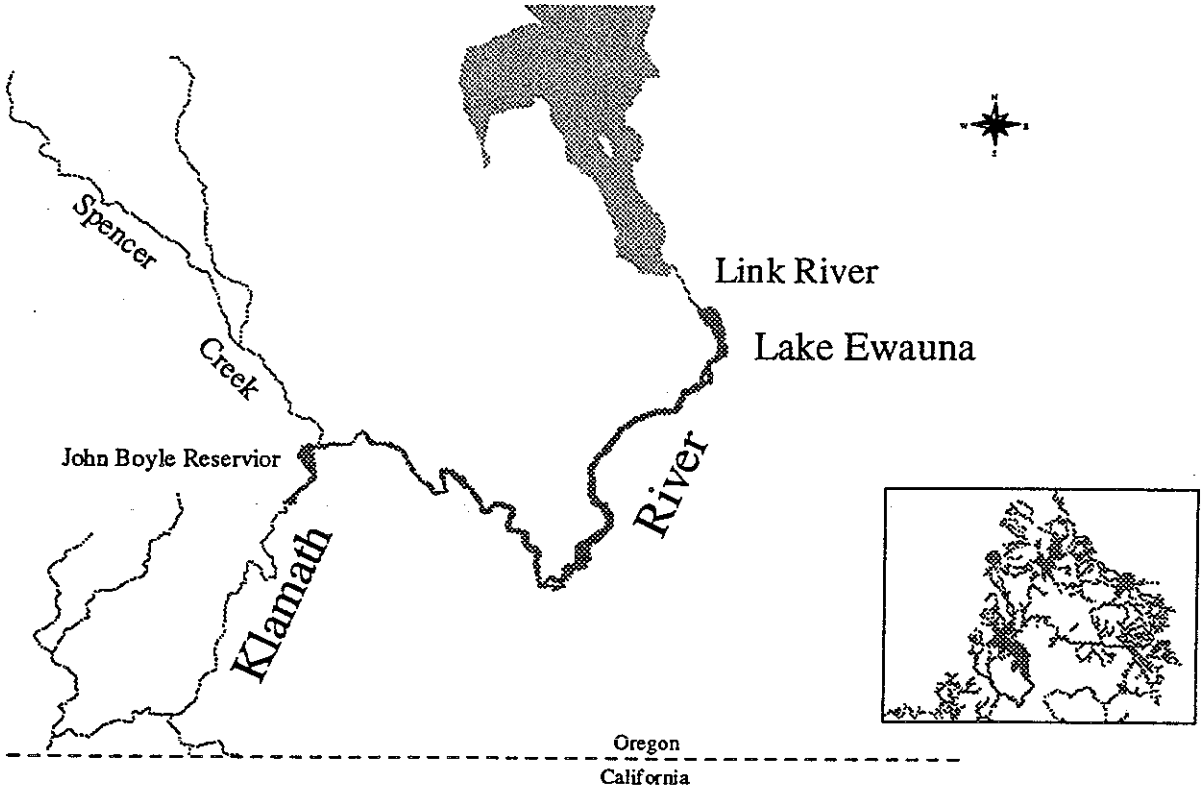
These habitat descriptions are organized by sub-basin groups and or individual water bodies which follow the fish management direction in this plan.. These sub-basin groupings are based on differences in the genetics, life history and distribution of redband trout in the Klamath River Basin. These groupings may be further divided by the need for separate management direction.

Upper Klamath Lake to state line: Link River, Lake Ewauna and Klamath River, including Spencer Creek (Figure 2)

Link River

Link River, the outlet of Upper Klamath Lake, flows from Link River Dam for less than a mile to Lake Ewauna. The flow of Link River is regulated at Link River Dam by the BOR in coordination with PC. Flows are designated to be released from the dam to meet demands for irrigation and to meet designated minimum flows below Irongate Dam in California. PC diverts a major portion of that release into its West and East Link River diversion for hydro-electric generation; those diverted flows return to the lower end of Link River. Higher flows may be released through the dam for lake level management. Although there is no designated minimum flow in Link River required by PC's hydro-electric license, PC has agreed to maintain at least 90 cubic feet per second (cfs) in the channel downstream to the Eastside plant and at

Figure 2. Klamath River: State line to Upper Klamath Lake



least 450 cfs below Eastside plant to sustain aquatic life and provide fish passage (Personal Communication, Frank Shrier, PacificCorp, January 1997).

Water quality may be poor in summer when the lake waters are thick with algae and having high water temperature and pH. Link River channel is largely bed-rock and at lower flows breaks into smaller braided channels; it is the site of "Klamath Falls", which is not a classic water fall, but is a substantial rapids that may impede fish passage at lower flows. The fish ladder on Link River Dam is old and has poor attraction and passage characteristics; the fluctuating level of Upper Klamath Lake makes flow regulation in the ladder difficult and, therefore, further detracts from the ladder's effectiveness.

Lake Ewauna

Lake Ewauna, receiving water from Link River, is not so much a lake as it is a widened portion of the head of Klamath River. Summer water quality is generally poor having heavy growths of algae, high temperatures and pH and cycles of low dissolved oxygen (DO). The nutrient level is raised by addition of domestic effluent from the Klamath Falls urban area.

Klamath River

Klamath River fish habitat is varied by terrain, land uses and streamflow manipulation. The upper reach, from Lake Ewauna to Keno Dam (RM 250-231.5), is essentially a long narrow reservoir. The water level and rate of flow is controlled by Keno Dam where the water elevation may be regulated to divert water into the Lost River drainage via the Lost River Diversion Canal and to provide for irrigation uses along the river. Lost River Diversion Canal may also carry excess water from Lost River to Klamath River. At the head of this reach, water quality is similar to that in Lake Ewauna but downstream, it is also influenced by industrial log storage and handling and by run-off from agricultural land uses. Although there is generally a slight improvement in water quality as it proceeds downstream, periodic, critical oxygen sags are not unusual in summer.

The Keno Reach of Klamath River runs through a canyon between Keno Dam and the head of J. C. Boyle Reservoir (RM 231.5-227) at a gradient of 50 ft./mi. The channel is generally broad with rapids, riffles and "pocket water" among the rubble and boulders. Keno Dam is the facility that makes the final regulation of water to reach the Klamath River in California. PC normally operates Keno Dam to maintain at least 250 cfs in the river downstream except in special circumstances such as extreme drought conditions (Personal communication, Frank Shrier, PacificCorp, January 1997) such as in summer of 1994 when flow was regulated as low as 150 cfs. In that event, water temperatures rose to near 80F. . Abundant nutrients and organic materials are received from upstream sources but the river's turbulence maintains adequate DO. The combination of warm water, adequate DO and abundant nutrients creates a very productive aquatic environment within this reach. Keno Dam has an operational fish ladder that does pass fish but is steeper than the department's current fish passage criteria for trout, 6 inch maximum height per step.

The J. C. Boyle Diversion Reach lies between the J. C. Boyle Dam and Power House (RM 219-223). This reach has a very steep gradient of about 100 ft./mi. The stream is a series of rapids, runs and pools among large boulders. Except for periods of spill over the dam, when flow exceeds 2,400 cfs, stream flow in this reach is limited by the diversion of water for hydro-electric generation. A minimum flow of 100 cfs is released from the dam; that water, coming from the reservoir, is relatively high in productivity but, during summer, also has high temperatures which limit its capacity as habitat for trout. However, beginning about 1/2 mile

below the dam, cool, clear ground water begins to augment the minimum flow until, at the lower end of the reach, stream flow is typically 350 cfs with a summer water temperature of about 65F. Although inflow of spring water modulates high water temperatures, it also dilutes productivity for trout. Because of the high gradient, potential spawning habitat for trout is limited to small pockets of gravel. J. C. Boyle Dam has an operational fish ladder but it is also steeper than current department criteria for trout passage and its location and flow doesn't provide good attraction.

The lower river reach, from J. C. Boyle Power House to the state line (RM 219-208), lies in a deep undeveloped canyon that has both state and federal scenic river designations. It is characterized by steep gradient (35 ft./mi.) and peaking flows from the power house. Stream flow and duration is generally dependent on the operation of the hydro-electric generators at the power house which is governed by the volume of water available and the demand for electricity. The generator turbines have a maximum capacity of about 2,400 cfs. The amount and duration of flow is dependent on the volume reaching and being stored in J. C. Boyle Reservoir and the hours of peak electrical demand. Maximum flows in excess of 10,000 cfs may be experienced during periods of spring run-off when the basin's storage capacity is full and overflowing. A typical summer flow scenario is 750 to 1500 cfs for a few daylight hours with the remaining time having only the flow coming from Boyle Diversion Reach, upstream of the powerhouse, which is typically about 350 cfs. This peaking operation also influences water quality. Waters diverted from Boyle Reservoir during hydro-electric peaking operation carry the high productivity of the upper basin with temperatures in summer exceeding 70F. When the generators are not in operation, the quality of water flowing from the Boyle Diversion Reach is largely influenced by inflow of about 250 cfs of cool, clear ground water. During these periods of "minimum" flow, the river's productivity is reduced, not only by the change in water quality, but by exposure of a large portion of the stream channel when stream flow may vary from 350 to as much as 2,400 cfs daily. During the peaking operation, the spring waters influence water quality by diluting and cooling the waters diverted from the reservoir, making them less productive than in the Keno Reach. No spawning habitat for trout has been identified in this lower reach of Klamath River; because of the steep gradient, there is very little gravel in the stream bed. The daily fluctuation in stream flow during peaking operation further limits any potential reproductive success.

The foregoing descriptions of streamflow, particularly in the Keno and lower river reaches, may be substantially different if subsequent flow release regimes are similar to those of 1996. In 1996, BOR increased releases from the upper Klamath basin in order to meet requests from Native American tribes to provide the FERC designated minimum flows from Irongate Dam for the welfare of salmon populations in lower Klamath River in California. Those releases averaged about 1,000 cfs in the Keno Reach throughout the summer and resulted in longer periods of higher volume flows during peaking operation in the lower river reach downstream from Boyle Powerhouse.

Spencer Creek

Spencer Creek is the only substantial tributary to Klamath River in Oregon. It flows 18 miles from near the crest of the Cascades and enters the upper end of J. C. Boyle Reservoir. A major proportion of its flow comes from springs in the Buck Lake area. The lower 8 miles of this stream have a gentle gradient with a combination of gravel bars and beaver-dammed pools. This stream provides the majority of spawning habitat for trout residing in Klamath River between Keno Dam and the state line. In periods of low precipitation, irrigation withdrawals may limit the stream's carrying capacity. In the past, Spencer Creek suffered from grazing and

timber harvesting impacts but recent improvements in those practices and better watershed management by both private and government land managers is resulting in improved habitat conditions.

Upper Klamath and Agency lakes including all tributaries, or portions there of, contributing redband trout production to the lakes' rearing population: Williamson River below the falls (RM 23) and tributaries (Spring, Larkin and Sunnybrook creeks); Sprague River mainstem and tributaries (Trout Creek, Sycan River below the outlet of Sycan Marsh, North Fork Sprague River up to RM 12 and tributaries, South Fork Sprague River up to RM 10 and tributaries);. Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile Creek, Crystal Creek, Recreation Creek, Thomason Creek, Harriman Creek, Odessa Creek, and Short Creek (Figure 3)

Upper Klamath and Agency lakes

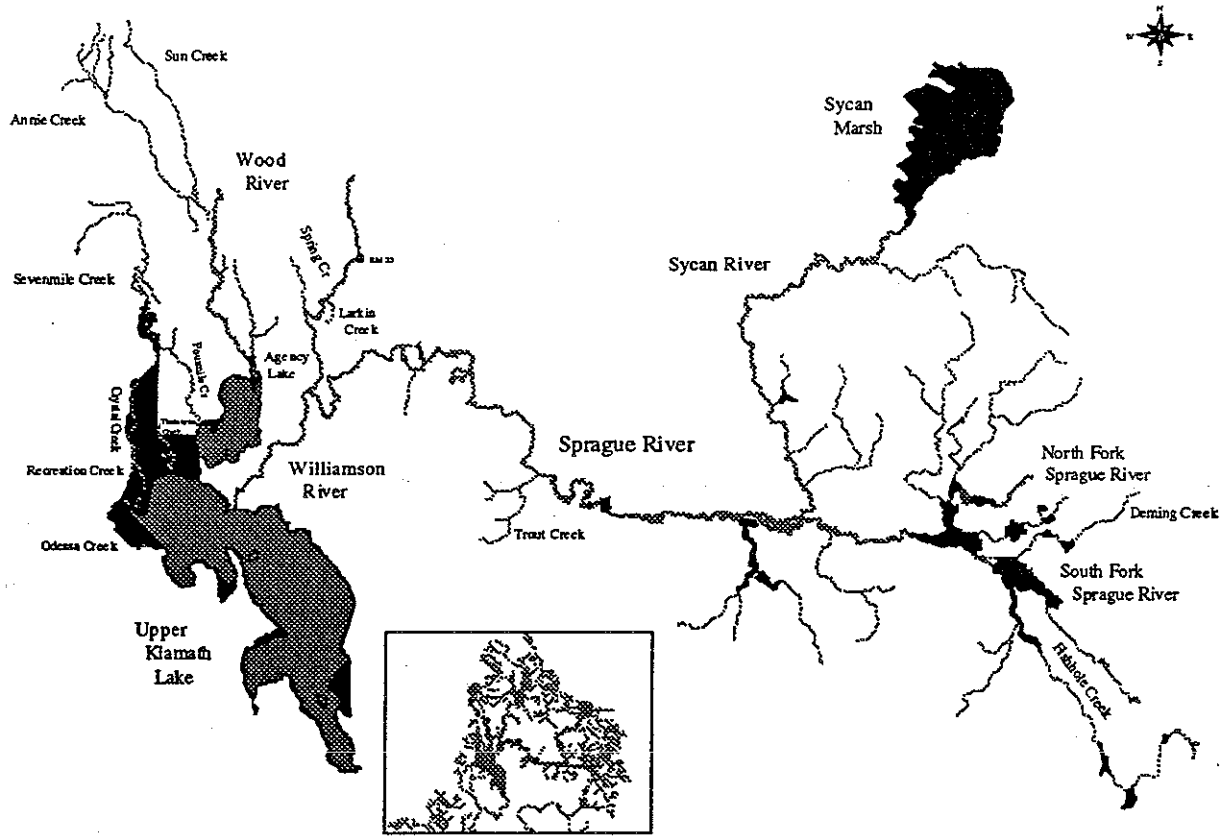
Upper Klamath and Agency lakes are the collection point for the majority of the Klamath Basin drainage. At elevation 4,143.3 feet, they have a surface area of 92,000 acres. Klamath Lake has a maximum depth of about 50 feet, but only in a small area along the west side, adjacent to Eagle Ridge. Most of the lake is quite shallow, producing an average depth of around 8 feet. Agency Lake is essentially a northern extension of Upper Klamath Lake connected by a narrow strait. Agency Lake is even shallower, averaging less that 6 feet deep. The elevation of both lakes is governed by water regulation at Link River Dam at the outlet of Upper Klamath Lake and may fluctuate between 4,137 and 4,143.3 feet in elevation. Link River Dam was built by Copco (PC's predecessor) in 1923 at which time ownership was transferred to BOR (Personal communication, Frank Shrier, PacificCorp, January 1997).

These lakes are classified as hypereutrophic, being highly productive. They are above average in conductivity and concentrations of ions. They are particularly high in concentrations of phosphorus coming from natural spring sources and surface runoff. Abundant sediments in these lakes are also rich in nutrients that may be released by wind action in these shallow waters. This abundance of nutrients leads to massive blooms of the blue-green algae *Aphanizomenon flos-aquae* from late spring through early fall (Johnson, et al, 1985). Periodic decomposition of these blooms causes serious water quality problems for fish life. In addition to water temperatures in the high 70F's, pH levels often exceed 10.5 and DO may drop to zero near the bottom. These conditions preclude habitation by trout and may result in die-offs of other species such as suckers and chubs. Tributary and spring inflows in northern areas of the lakes are not subjected to the critical algae blooms and provide refuge areas for trout. During late fall, winter and early spring, water quality improves and allows for migration and rearing of trout throughout these lakes.

Recently, Gebhart, et al (1995) studied nutrient loading sources and contributions, including internal and external loading processes. Their findings indicate that phosphorus loading from natural springs is minor compared to the influences of man's activities, and a number of factors such as pH and lake elevation strongly influence release of sediment bound nutrients.

Lake levels are drawn down in summer by diversion of water for agricultural irrigation and release of flows to lower Klamath River. The A-canal, just north of Link River Dam, is the largest diversion with a capacity of over 1,150 cfs. The west and east side hydroelectric

Figure 3. Tributaries of Upper Klamath and Agency Lakes which contribute rainbow trout production to the lakes' rearing population



diversions at Link River Dam have a combined capacity of about 1,450 cfs. All of these large diversions are lacking screening to prevent entrainment of fish. A full review of entrainment issues and impacts at the Link River facilities is addressed in BOR's PacificCorp biological assessment (BOR,1996) and the USFWS Biological Opinion (USFWS,1996).

Williamson River, lower

Williamson River (below the falls, RM 23) is the largest tributary to Upper Klamath Lake carrying all of the flows from its watershed including all of the Sprague River drainage. Flows from the upper Williamson River basin, upstream of RM 23, are usually absorbed in the summer by Klamath Marsh and diversions for irrigation, but springs entering just downstream of the falls provide a substantial flow that sustains the stream in that upper reach. Spring sources flowing from Larkin, Sunnybrook and Spring creeks further augment the river down to the mouth of Sprague River, RM 11, where they combine to flow on to Upper Klamath Lake. Williamson River, between the falls and the lake, has a gentle gradient but provides substantial spawning habitat for trout, mainly near the head of this reach and in a two-mile section downstream of Spring Creek.

Williamson River, from the falls to its mouth, is influenced by a mixture of bordering land uses varying from isolated, forested canyon-lands, to residential development, to agricultural pasture and crop-lands. Riparian conditions vary from excellent to poor but are generally good with an improving trend due mainly to the efforts of some ag-land owners to protect riparian areas. Instream cover is good in some areas but lacking in others; there have been recent efforts that are improving that important habitat element. The lower five miles of Williamson River have been largely channelized in the development of crop lands. That action reduced channel length and eliminated riparian and marsh lands habitat, thereby greatly reducing its original carrying capacity, especially for juvenile fish. The Nature Conservancy now owns the Tulana Farms portion of lower Williamson River, along its north shore up to about RM 5, where they are working with both private and public entities toward wetland and channel restoration.

Spring, Larkin and Sunnybrook creeks

Spring Creek, a major tributary to lower Williamson River, carries a flow of about 300 cfs of clear, cold (40F) water. This stream is only two miles long with the upper mile essentially a large, clear pool with waters supersaturated with nitrogen. In the lower mile the channel narrows and provides good spawning and rearing habitat. Spawning habitat improvement projects have increased its capacity by the addition of 100's of cubic yards of suitable gravel. Rearing habitat has been increased with the placement of additional trees instream in the Collier Park area.

Larkin and Sunnybrook creeks are smaller spring-fed tributaries to Williamson River. They also provide spawning and rearing areas for trout. Although these streams have water diverted for irrigation and have some areas impacted by grazing and residential development, there are also ongoing efforts by some landowners to improve habitat conditions.

Sprague River, mainstem

Mainstem Sprague River flows 84 miles from the confluence of the North and South Forks Sprague River, NW of Bly, to where it enters Williamson River at Chiloquin. Over much of its length, it meanders over a broad valley floor with a low gradient. There are several spring sources along the mainstem and in its tributaries that help sustain summer streamflows

but the majority of its volume comes from surface runoff, mainly dependent on high-elevation snowpack.

From the standpoints of fish habitat, hydrologic function and watershed condition, this stream is the poorest in the Klamath Basin. This status is mainly the result of historic and ongoing livestock grazing that has eliminated riparian vegetation from miles of stream banks and resulted in exposed channels that are either incised or wide and shallow or both. These conditions are conducive to erosion and high sediment and nutrient loads flowing downstream. Hydrologic function and fish habitat has been further restricted by channelization and diking (Corps of Engineers, circa 1960's) of large sections of this stream intended to control flooding within the valley. Recently, cooperative landowner and agency efforts have begun to protect riparian areas along a few segments of the river. Extensive, long-range improvements will be required to correct the current condition of this stream and its watershed.

Summer streamflows are often very low, particularly during drought years, as a result of water being diverted for irrigation uses and loss of historically perennial flow from tributaries where channels have been downcut, loosing their floodplain connections with associated bank storage. The lack of healthy riparian zones along the mainstem also exacerbates low flow conditions. Low flows and poor channel conditions severely restrict this stream's capacity to rear fish. That ability is further reduced by the resulting poor water quality: high water temperatures, elevated pH and ammonia levels and low DO.

Chiloquin Dam (RM 1) has an operating fish ladder but its flow and attraction characteristics are substandard. A rotory drum screen was installed in 1995 on the diversion ditch from Chiloquin Dam by ODFW and Modoc Irrigation District. The status of screening on numerous pump-diversions is largely unknown but many are likely substandard or lacking.

Sycan River, lower

Sycan River downstream from Sycan Marsh flows through a variety of landscapes. From the marsh down through Coyote Bucket, it is mainly on the FNF and WNF where it flows through forested rim-rock canyons and open meadows; this reach has been classified as a Federal Scenic River. Below the Forest boundary, it flows into an open valley floor where it enters Sprague River. Except for spring runoff of snow-melt, streamflow is generally quite low. Little or no water escapes from Sycan Marsh during summer where it is diverted for irrigation of pasturelands or stored in the marsh. Torrent Springs at RM 26.5 sustains a modest flow below that point but it is further reduced by withdrawals for irrigation after it exits the forested area.

This stream has also suffered from livestock grazing in the past that has resulted in poor riparian and instream habitat conditions. Land use plans recently adopted by the FNF and WNF contain standards that address improvements in grazing and timber harvest that should improve fish habitat on those lands. Riparian and stream conditions on much of the privately owned land are similar to those described in the Sprague River valley.

North Fork Sprague River, lower

North Fork Sprague River up to RM 12 is mainly within the Sprague River valley area and the riparian and instream condition of this section of stream is much the same as described on the mainstem Sprague River having also been subjected to long-term livestock grazing. Streamflow entering this reach is largely from high-elevation forest lands and is augmented by springs, so water quality is relatively good. But water is also diverted from this stream section to irrigate pasturelands which results in streamflow that is well below optimum for fish habitat. Diversion dams are lacking fish ladders and are likely hampering fish passage. Diversion ditches are unscreened and are diverting fish in addition to water. Recently,

cooperative efforts with a major landowner were made to improve fish habitat by addition of riparian fencing and instream wood for cover and erosion prevention.

Fivemile and Meryl creeks

Fivemile and Meryl creeks are tributaries to lower North Fork Sprague River. After the spring runoff, these streams are fed by springs. Both of these streams have been subjected to long-term grazing with the resulting loss of riparian and instream cover. They both have water diverted from their lower reaches for irrigation purposes with accompanying concerns for fish passage and screening. A substantial amount of fence has been built to protect riparian areas on Fivemile Creek; those sections are showing improvements in fish habitat quality.

South Fork Sprague River, lower

South Fork Sprague River up to RM 10 lies entirely within the head of Sprague River valley bordered by private ranch lands. Much of this reach was channelized and diked in the name of flood control in the 1960's. Cattle grazing has been the dominate land use for many years which, along with the channelization, has resulted in an almost total lack of riparian cover and instream structure. Stream flow is diverted to irrigate pasturelands. Fish passage and screening facilities are lacking on diversion structures. Low stream flow and lack of riparian cover and function leads to elevated water temperatures. During periods of high streamflow in the spring, the same poor riparian condition and lack of a functioning flood plain results in transport of excessive loads of sediment and nutrients to the lower basin.

Fishhole Creek

Fishhole Creek is the largest tributary to the lower reach of South Fork Sprague River and it shares all of the fish habitat problems described for that reach of river. In summer, virtually no water reaches the mouth of the creek despite the storage of water in several small headwater reservoirs. This stream has its source on the west slope of Fishhole Mt., nearly 7,000 feet in elevation, so, overall has a higher gradient but it alternately "stairsteps" through sections of forest and meadow areas which provides a variety of habitats. The potential of these habitats is substantially reduced by the previously cited conditions. The FNF has pursued fish habitat improvements by fencing off sections of stream corridor from livestock, planting of trees and shrubs in the riparian area, and placement of wood structure in the stream channel.

Wood River

Wood River is the second largest tributary to Upper Klamath and Agency lakes, entering at the north end of Agency Lake. It is a low gradient stream flowing 17 miles from its spring source at Kimball State Park. Its initial water quality is pristine, being crystal clear and cold (40F). Melting snow feeds Annie Creek in the spring and early summer and carries a substantial load of sediment to Wood River at RM 15. Trout utilize spawning habitat in the upper two miles of this stream. Only a few brown trout redds have been documented in the river downstream from Annie Creek.

Wood River flows through ranch lands that have been developed for intensively-used summer pasture for cattle. Long-term grazing has resulted in poor riparian habitat condition along many segments of this stream. In some areas, banks were diked and riprapped which resulted in additional areas of poor riparian and instream cover. The lower mile of Wood River was channelized and diked, reducing its length and changing the hydrology. Recently, some landowners have been installing fences and placing large wood structure along the river, managing for improvement of riparian conditions and instream cover. The BLM now owns

lands along the lower portion of the river and, working with Oregon Trout, has implemented a program to allow the river to resume more natural hydrologic function. Damage to streambanks from motorboat wakes on lower Wood River is detrimental to restoration efforts. Water is diverted from the river into a complex system of ditches that flood-irrigates and drains the pastures. Return flows carry elevated concentrations of nutrients. Fish passage facilities have been provided at the major diversion dams. Some large water diversion ditches remain unscreened.

Crooked Creek

Crooked Creek meanders about 7 miles across the east side of Wood River valley before entering the river near its mouth. Crooked Creek gains its flow from a series of springs, the largest being Hatchery Spring at the ODFW's Klamath Fish Hatchery. Land use along this stream has been dominated by livestock grazing which resulted in poor riparian condition along unprotected streambeds. Fences were recently built along the ODFW property boundary and some adjacent private land; that protection is resulting in improved riparian conditions on those lands. Other private landowners have shown interest in providing similar protection. Water is diverted for irrigation of pasturelands. One diversion has had a fish screen installed; the status of other diversions needs to be determined and screened accordingly. Crooked Creek provides spawning habitat for trout; improved riparian condition should enhance both spawning and rearing productivity.

Fort Creek

Fort Creek flows about 4 miles from its source at Reservation Spring to Wood River. The upper half of this low-gradient stream flows primarily through forested lands before emerging into pasture lands. Grazing has impacted the riparian areas, particularly in the lower reach. Instream cover is generally good within the forested area. Water is diverted for irrigation but streamflow remains adequate for fish production. Fort Creek diversion dam is passable but the ditch needs to be screened.

There was a dam built in the early 1900's that impounded water over the upper 1/2 mile of this stream, up to the spring. That dam, used to divert irrigation water, was largely impassable to fish and the small reservoir provided very little fish production. In 1992, that old dam failed and the former reservoir area has reverted to a stream that is providing excellent spawning habitat. Vegetation in the riparian zones along this reach is reestablishing rapidly with corresponding improvement in rearing habitat potential. Pumps have been installed to provide irrigation water from the former dam site, temporarily at least. Reconstruction of a dam at that location is being considered by the land owner and irrigator; that action would result in a significant loss of productive fish habitat.

Annie Creek

Annie Creek, and its tributary Sun Creek, have their sources near the rim of Crater Lake and carry a combination of spring waters and surface runoff to the upper end of Wood River. After emerging from the forested lands, they are heavily diverted to irrigate pastures, totally depleting their flows before reaching the river in the summer. None of the diversion ditches are screened. The small diversion dams may not pose passage obstacles but need to be evaluated. Portions of each of these streams have recently been fenced and that action will provide future protection to those riparian areas. However, the remaining majority of these stream channels, flowing through grazed lands, remain unprotected and in poor condition. Parts of the lower reaches of these streams have been channelized. Spring runoff from Crater

Lake National Park (CLNP), flowing through unprotected stream channels, carries the major load of sediment entering Wood River.

Sevenmile Creek

Sevenmile Creek starts above Sevenmile Marsh near the crest of the Cascades and flows 20 miles to Agency Lake. In its upper 8 miles, it is a typical mountain stream flowing from the Winema National Forest. It then enters the valley floor where grazing is the predominant land use. The lower 6 miles have been channelized and diked. Most of the stream banks in the valley have poor riparian condition because of long-term grazing. Recently, at least one landowner has begun providing protection with construction of fencing. The Sevenmile Ditch, near RM 13, diverts virtually all flow for irrigation in dryer years. Between RM 11 and 8, several spring sources, including Blue Spring and Short Creek, revive the streamflow but between there and the mouth more of the flow is diverted. There is a head-works at the mouth of the creek that controls the water level in the canal to facilitate water diversions. There are no screens on any of the irrigation diversions. Fish passage conditions at the diversion dams are marginal, at best; these conditions need evaluation and appropriate passage provided. There is a functional fishway at the headworks. There is at least one connection between the water diversions on Wood River and lower Sevenmile Creek that is open to fish migration; these situations need to be evaluated for possible remedial actions.

Fourmile Creek (north)

Fourmile Creek (north) begins at Fourmile and Jack springs at the base of the Cascades and flows through marsh and pasture lands before entering Agency Lake. Within about 3 miles of its source, it is turned into the Fourmile Canal, channelized and diked. Water is diverted from this stream for irrigation of adjacent pastures. Until recently, there were no screens or fishways on these diversions; some have now been installed but the system needs to be surveyed to see if additional facilities are needed. Of the three water diversion wiers in the channel, the lower two are not considered barriers to fish passage and a fishway was recently installed on the upper wier. Height of all wiers is lowered after the irrigation season, thereby reducing the depth of these impoundments.

Crystal, Recreation, Thomason, Harriman, Odessa and Short creeks

Crystal, Recreation, Thomason, Harriman, Odessa and Short creeks are all spring fed streams flowing into the northwest corner of Upper Klamath Lake either from the base of the Cascades, or in the case of Thomason Creek, from within Upper Klamath Marsh. All of these streams have virtually flat gradients that may be influenced by the regulation of water elevation on Upper Klamath Lake. At high lake levels, they are inundated. These streams provide high quality water to the lake when, in summer, the majority of the lake is uninhabitable for trout.

Williamson River above the falls (RM 23) and tributaries (Figure 4)

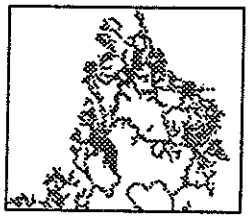
Williamson River, upper

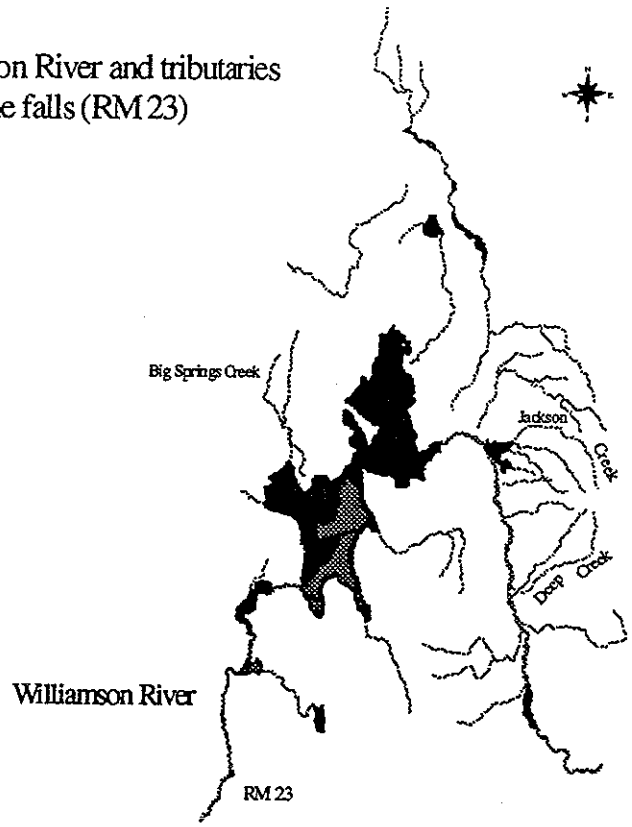
This upper portion of Williamson River has its origin at the Head of the River Spring, near RM 86, where it begins its meandering course toward Klamath Marsh. This stream is fed by surface runoff in the spring of the year but is sustained by ground water, mainly at its source and at Wickiup Spring, near RM 80. It enters the Klamath Marsh area at about RM 57, flowing through the marsh and Solomon Flat to Kirk Reef at RM 27. At the reef, it drops into a

narrow canyon where, at its lower end, a series of falls define the end of this segment of Williamson River.

Diversion of streamflow for irrigation begins very near the source and continues downstream through Solomon Flat. Typically, at least in late summer, there is no streamflow

Figure 4. Williamson River and tributaries above the falls (RM 23)





below Kirk Reef so that four-mile segment between the reef and the falls has no value as game-fish habitat. The falls are impassable to fish and effectively separate the river into upper and lower areas. Much of the river has been channelized or is indistinct where it passes through the marsh area. Within the uppermost five miles, much of the streamflow has been diverted from its original channel to facilitate irrigation of pastures.

Throughout its length, except for the lower canyon this stream has been subjected to livestock grazing for many years. That practice resulted in poor riparian and in-stream cover conditions leading to wide, shallow, exposed channels and elevated water temperature as the flow progressed downstream away for its cool spring sources. In the past two decades, there have been a number of efforts made on both public and private lands to improve those conditions including fencing of riparian areas and strategic placement of trees along the channel to encourage narrowing of the stream, and changes in grazing management on federal lands to reduce damage by cattle. These actions have resulted in incremental improvements in riparian and instream conditions in the treated areas. Yet, there are stream segments on private lands that remain unprotected and in poor condition.

The watershed is dominated by pumice soils. Logging, road building and grazing impacts have contributed to excessive sediment transport to the river. Recent improvements in these practices should reduce the erosion problems.

Fish passage at diversion dams and screening of ditches and pumps needs to be evaluated and appropriate facilities installed.

Deep, Irving, Jackson, and Big Spring creeks

Deep, Irving, Jackson, and Big Spring creeks are perennial tributaries to upper Williamson River but they are totally diverted for irrigation of pastures during most of the year. Only at spring runoff do any of these streams reach the river. Livestock grazing has impacted the riparian condition of parts of all of these tributaries. Fish passage and screening needs should be evaluate on these steams.

Sycan River above the outlet of Sycan Marsh (RM 37) and tributaries, including Long and Coyote creeks (Figure 5)

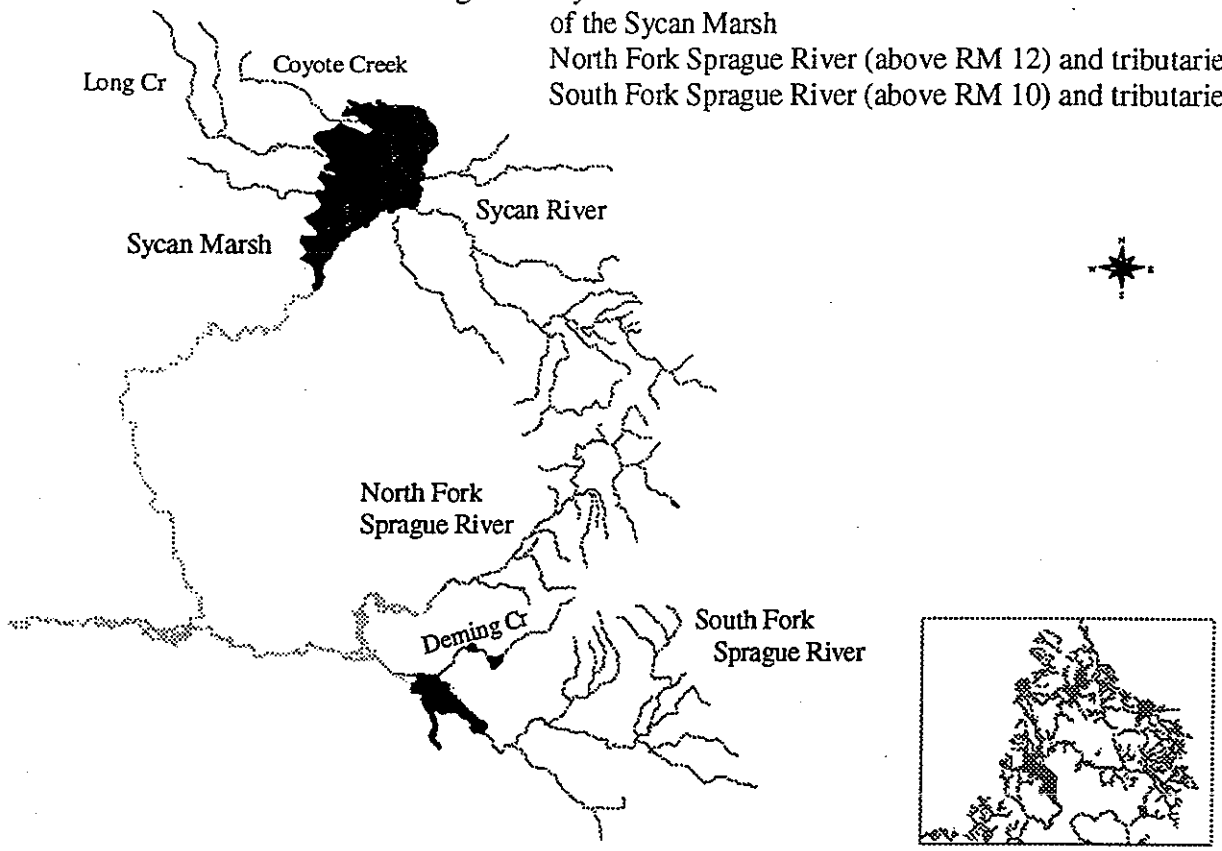
Sycan River, upper

Sycan River originates (RM 71) near 7,000 feet on the eastern edge of the Klamath Basin. Within its first 12 miles, it is fed by a number of small, perennial tributaries. It flows through high elevation meadows and forest lands to Sycan Marsh at RM 46. This segment of the upper river has been designated as a federal Scenic River.

From RM 46 to RM 36, the river flows through Sycan Marsh; this segment has been designated a federal Recreational River. Within the large marsh area, it has been heavily diverted to irrigate pastures that have been developed by draining major portions of the original marsh. There is virtually no flow exiting the marsh during the summer.

The condition of riparian areas has been degraded to some degree by livestock grazing throughout the upper Sycan River and its tributaries, particularly in the meadow areas. The FNF has fenced parts of the meadow areas to provide protection to riparian areas. Standards adopted in the FNF Land Use Plan should result in recovery of other riparian zones. The Nature Conservancy (TNC) now owns the majority of Sycan Marsh and is taking action to restore the marsh's natural function which could, eventually, result in perennial flow from the marsh. Diversion dams and ditches need to be evaluated for fish passage and screening.

Figure 5. Sycan River and tributaries above the outlet of the Sycan Marsh
North Fork Sprague River (above RM 12) and tributaries
South Fork Sprague River (above RM 10) and tributaries



Long and Coyote creeks

Long and Coyote creeks are tributaries to the west side of Sycan Marsh, flowing from the east slope of Yamsi Mt. Most of their lengths are within timber lands. As they enter the marsh area, both are diverted for irrigation of pastures and are essentially cut off from the river. Cattle grazing has also degraded the riparian condition of these streams but recent actions by the landowners are beginning to provide protection from those impacts. Watershed condition should improve with the implementation of more conservative forest practices by the private landowners and the FNF. Fish passage and screening at irrigation diversions needs to be installed as necessary.

North Fork Sprague River (above RM 12) and tributaries (Figure 5)

North Fork Sprague River, upper

North Fork Sprague River rises from Head of River Spring (RM 34) on the north side of Gearhart Mt. at about 6,900 feet in elevation. Several small, mainly spring fed, streams flow into this upper portion of the North Fork. The upper 10 miles of this stream meanders mainly through high-elevation meadow lands before it drops into a narrow canyon that confines it until emerging near the valley floor. The streamflow is further augmented by springs deep within the canyon.

Livestock grazing has been the primary land use impacting this stream and its tributaries; the resulting conditions lead to excessively high water temperatures and lack of cover. Timber harvest and road construction have also been detrimental to some degree by disrupting the watershed, therefore contributing sediment to the river. A small hydro-electric project in the canyon diverts up to 100 cfs of flow from the river for about a mile; a series of minimum flows are stipulated to be maintained within the project area. Road and pipeline construction for this project disturbed the watershed and have been a source of sediment to the river. Fish passage over the projects diversion dam needs to be evaluated and improved, if necessary.

Improvements in riparian condition are being pursued by private land managers and the FNF by fencing some stream segments and changes in grazing management. Forage-use standards adopted by the FNF have yet to make much improvement in other areas along the river and tributaries. Improved forest practices have reduced the impacts of timber harvest and roads.

The upper 15 miles of the North Fork have been designated as a federal Scenic River.

South Fork Sprague River (above RM 10) and tributaries, including Deming Creek (Figure 5)

South Fork Sprague River, upper

South Fork Sprague River begins (RM 32) in the southeast corner of the Gearhart Wilderness Area and is soon joined by Corral and Camp creeks coming from the same area. The upper few miles meander through stringer-meadows and forest lands before being confined by forested canyons for most of the remainder of this reach. Several other tributaries feed the South Fork along its length, including Buckboard, Whitworth and Brownsworth creeks.

In the past, practices associated with timber harvest and associated road building had detrimental impacts on these streams and their fish habitat, mainly in the tributary watersheds, by causing erosion of excessive sediment to the steams and exposing the streams to solar

radiation. More recently, improvements in forest practices and watershed management are minimizing these problems. Grazing of livestock has, over time, reduced riparian and instream cover on some segments of these streams. Changes in grazing management are addressing those conditions on FNF and private timber lands.

Deming Creek

Deming Creek is included with this reach of the South Fork because it also originates in the wilderness but in its lower end is diverted and channelized and apparently has no direct link to the river. After running about 5 miles from its source through forest lands, it is diverted to Campbell Reservoir for much of the year. Below that first ditch, in the summer, it is spread further to irrigate pastures. None of these diversions are screened; they need to be evaluated for screening and passage requirements. Livestock grazing has degraded riparian areas. Grazing management has changed recently on national forest and private forest lands with the intent of improving riparian conditions. The natural stream channel downstream of the Campbell Reservoir diversion is within private pasture lands and continues to be impacted by grazing livestock; this portion of the stream has good potential for restoration if it were provided protection. Several beaver ponds in this lower segment provide rearing habitat that could be enhanced with improved riparian condition.

Cascade Mountain streams: Sink, Cottonwood, Scott, Sand, Threemile, Cherry, Rock, Fourmile (south), Moss and Denny creeks (Figure 6)

Sink and Cottonwood creeks

Sink and Cottonwood creeks flow off the timbered eastern slopes of the Cascades in the northwestern corner of the basin. Upon reaching the flatter ground east of the mountains, they are absorbed by the deep pumice soils in that area and have no direct connection with other streams.

Scott and Sand creeks

Scott and Sand creeks flow from the east side of CLNP. Springs augment the surface runoff in these streams that run through forested watersheds. Much of their flows are also soaked up by pumice soils but some of their volumes are diverted to irrigate pasture lands on the east side of the Klamath Marsh area. On Scott Creek, a private dam and water diversion is lacking fish passage and screening and needs to be evaluated for installation of those facilities.

Threemile, Cherry and Rock creeks

Threemile, Cherry and Rock creeks originate in the Sky Lakes Wilderness area and flow easterly through forested slopes to the base of the mountains where they are either diverted for irrigation of pasture lands or go sub-surface in their rocky deltas. Each of these streams has been impacted to some degree by past timber harvest and road construction practices but are now recovering. Irrigation diversions need evaluation for screening needs.

Fourmile Creek (south)

Fourmile Creek is the natural outlet of Fourmile Lake but most of the flow from the lake is diverted to the Rogue River Basin via the Cascade Canal. Fourmile Creek receives only

rare spill from the lake when it is completely full before the irrigation season. Spring runoff from Seldom Creek, outlet of Lake of the Woods, and intermittent Lost and Fare creeks also feed Fourmile Creek. This stream flows through commercial forest lands before reaching Upper Klamath Lake in the Pelican Bay area.

Moss Creek Moss Creek originates in the Mountain Lakes Wilderness Area and tumbles down through virgin and commercial forest before reaching a flat rocky delta where is disappears below the surface.

Denny Creek

Denny Creek is a small stream starting from springs just east of the Mountain Lakes Wilderness Area. It flows through lands used for commercial timber production and livestock grazing. Near its lower end, its water is largely diverted to power a small hydro-electric plant. From the tailrace of that plant, it is channelized and diverted for irrigation of pasture lands.

Jenny, Fall, Scotch, Cottonwood, Long John, Grouse and Cow creeks (Figure 7)

Jenny Creek

Jenny Creek begins near Griffin Pass on the Klamath-Rogue Divide and flows 25 miles south across the Oregon-California state line to Irongate Reservoir on Klamath River in California. Near its headwaters, Howard Prairie and Hyatt reservoirs impound waters of Grizzly and Keene creeks, respectively. Except when full and spilling, which is a rare event, those impounded waters are diverted to the Rogue River Basin to provide for irrigation needs. Jenny Creek still carries a substantial flow as a result of a number of springs and small tributaries. It traverses public and private timberlands; portions of the stream corridor are also grazed by livestock. This stream has experienced excessive sediment from roads and landslides. Recent efforts by BLM and private parties have been targeting restoration of some riparian areas. In the lower third of the stream, more water is diverted for irrigation of pasture lands. A falls near the state line is impassable to fish migration and has isolated populations above the falls for thousands of years.

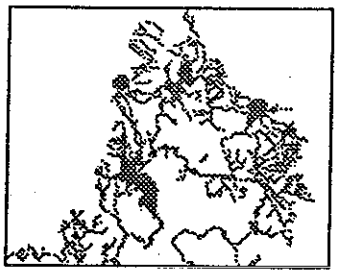
Fall Creek

Fall Creek is a short, mainly spring-fed stream that flows from just north of the state line to Klamath River near the head of Irongate Reservoir. Timber harvest and livestock grazing are principle land uses within its watershed. Some water is diverted for irrigation of pasture land; in California it is further diverted for hydro-electric generation.

Scotch, Cottonwood, Grouse, Long John and Cow creeks

Cottonwood, Grouse, Long John and Cow creeks are small headwater streams flowing from just north of the Oregon state line to Klamath River in California. The upper reaches of these streams are characterized by steep, forested slopes and granitic soils. The lower reaches are in oak savana. Cottonwood Creek traverses some pasturelands in its lower end and is paralleled by railroad tracks.

Figure 6. Cascade Mountain Streams



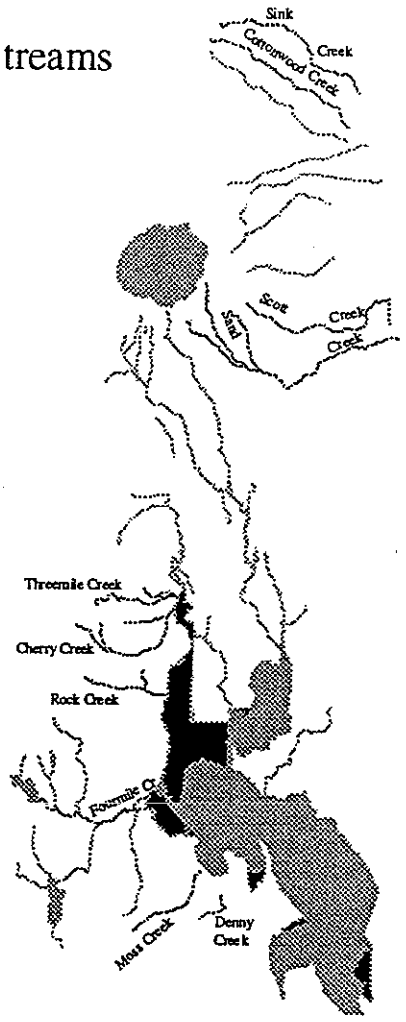
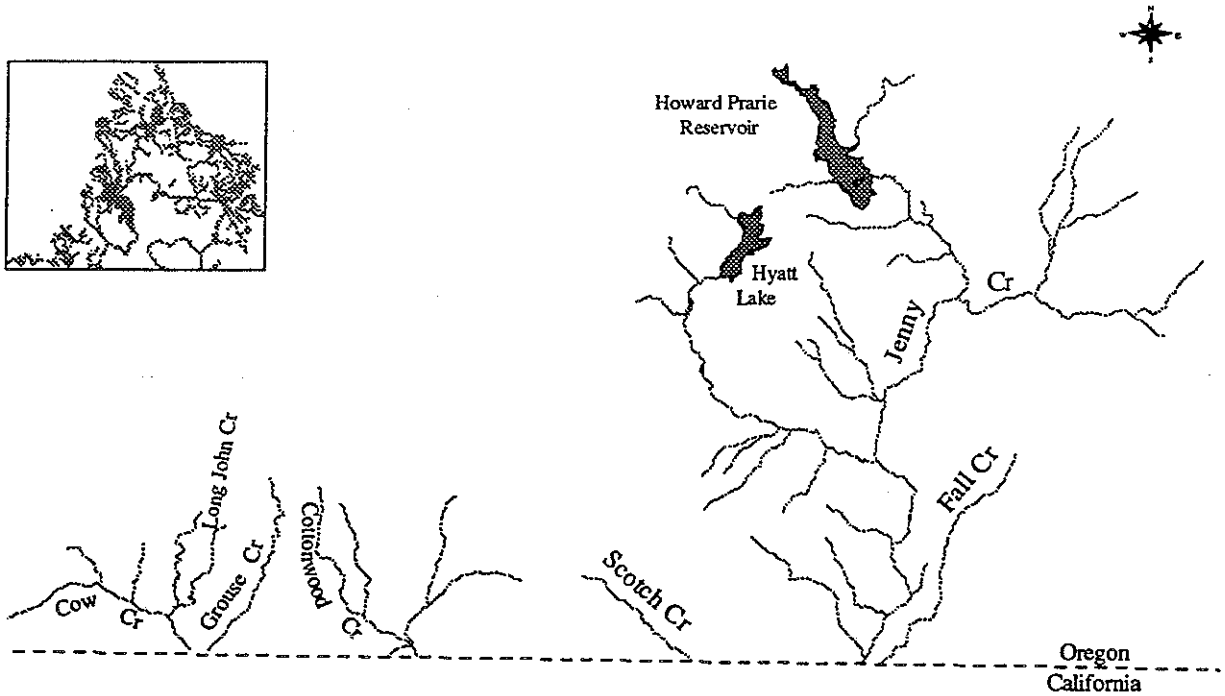


Figure 7. Jenny, Fall, Scotch, Cottonwood, Grouse, Long John, and Cow Creeks



Lost River and tributaries (Figure 8)

Lost River

Lost River has its origin at Clear Lake, in California, from which it flows north across the state line through Langell Valley, east through Poe Valley and Olene Gap and then turns south back into California to its terminus, Tule Lake. Historically, it had a high-water connection to Klamath River via the Klamath Strait. Most of Tule and Lower Klamath lakes were drained for development of agricultural lands which cut off that natural drainage. Excess drainage is still pumped through the strait to Klamath River above Keno.

Originally a slow meandering steam, Lost River is now essentially a conveyance for irrigation and drainage waters. Clear Lake and Gerber Reservoir are large impoundments, along with several smaller reservoirs, that store much of the runoff from the upper watershed so that outside of the irrigation season the river has a minimal flow. In the Langell and Poe valley areas during the irrigation season, most of the flow is from irrigation drainage. Big Springs at Bonanza has, historically, been the exception providing a substantial source of spring water to the river. However, during the recent period of drought, Big Springs has essentially dried up. Just south of Olene Gap, Wilson Dam regulates flows as part of the BOR's Klamath Irrigation Project. Downstream of Wilson Dam flows are high in the summer and low in the winter, providing for irrigation water demands. Between the operation of Wilson Dam and Keno Dam on Klamath River, waters may be manipulated between the two rivers via the Lost River Diversion Canal; depending on the need, excess waters may be drained from Lost River or additional irrigation water may be diverted from Klamath River to Lost River.

Water quality in Lost River is often poor, largely because of the high proportion of drainage from agricultural runoff. Large segments of the river have been channelized and much of the land bordering the river channel is either farmed or grazed. Most of the riparian areas are in poor condition.

Barnes Valley, Barnes and Ben Hall creeks

Barnes Valley, Barnes, and Ben Hall creeks are intermittent tributaries to Gerber Reservoir that drain high elevation lands receiving small amounts of precipitation. These streams have been subject to long term livestock grazing which resulted in poor riparian condition contributing to the lack of perennial stream flow. Most of these lands are administered by BLM who has recently implemented changes in grazing management aimed at riparian restoration.

Miller Creek

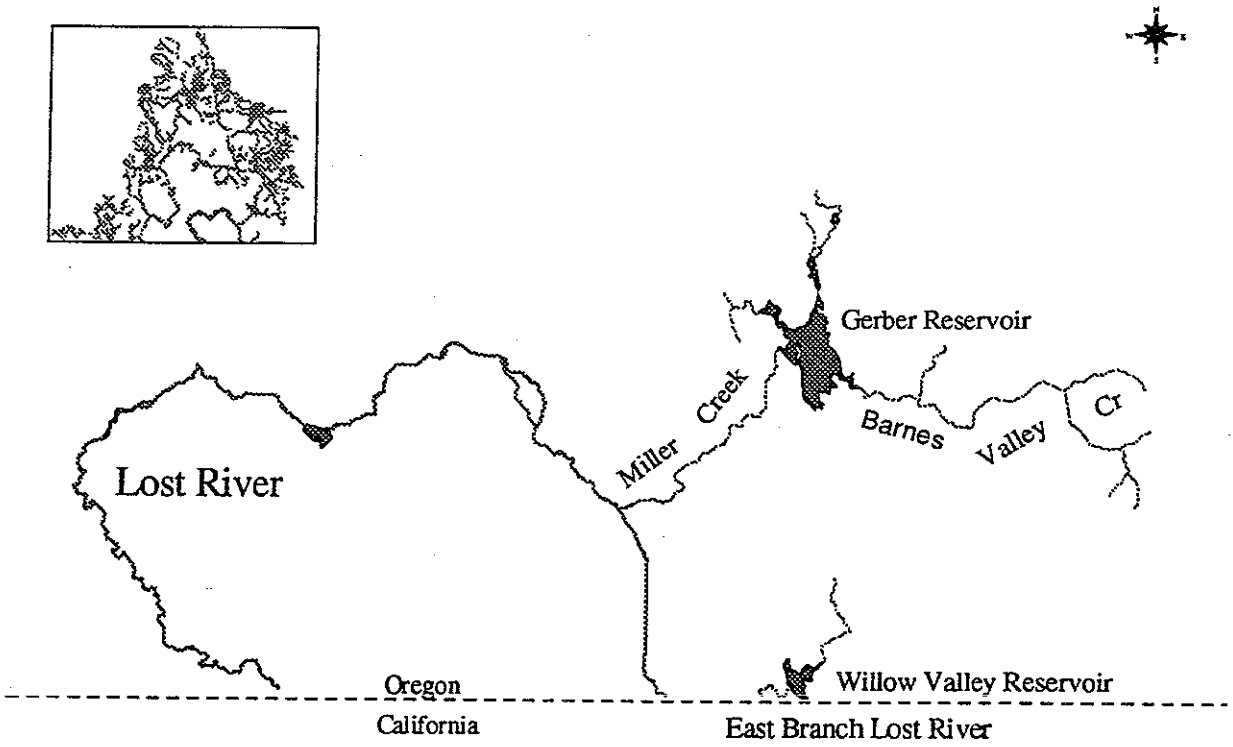
Miller Creek is the outlet from Gerber Reservoir and its flows are subject to the storage and release of waters for irrigation purposes. Therefore, this stream typically has its high flow in the summer and is cut off in the winter and spring except for some ground water that may trickle in within the canyon area. Toward the lower end of the creek, the flow is diverted into irrigation canals so, only in periods of spring runoff when Gerber Reservoir is full does Miller Creek reach Lost River. BOR has fenced the lower 2.5 miles of Miller Creek and is working toward provision of minimum instream flows, screening, and fish passage options (Personal communication, Mark Beuttner, BOR, January 1997).

East Fork Lost River

East Fork Lost River (Antelope Creek) drains the Rocky Plateau area during spring runoff but is limited to a short section fed by Duncan Springs during most of the year. That

perennial segment lies within a rimrock canyon and generally has good cover provided by boulders, shrubs and trees. Historically, it suffered from excessive livestock grazing but cooperative efforts have been made in the past 20 years to protect the perennial section and have resulted in improved riparian condition. This stream flows into Willow Valley Reservoir where its waters are stored for irrigation purposes. The condition of the stream channel between the reservoir and Lost River is unknown but, since it is mainly a conveyance for irrigation waters, it probably has little value as fish habitat.

Figure 8. Lost River and tributaries



Lakes and Reservoirs

Fourmile Lake

Fourmile Lake lies in a natural lake basin but has been enlarged with the addition of a dam on its outlet. The first temporary dam was built in 1908 when its waters were first diverted for irrigation. In 1922, a larger permanent structure was constructed that was rehabilitated by the BOR in 1956. The stored water, 15,600 af, is diverted to the North Fork Little Butte Creek watershed on the west side of the mountains where it flows down to serve the Rogue Valley Irrigation (RVID) and Medford Irrigation (MID) districts. The natural drainage from Fourmile Lake is down Fourmile Creek to Upper Klamath Lake, but it only flows, rarely, when the lake is full in the spring before the water diversion is opened. Fourmile Lake has 740 surface acres with a maximum depth of 175 feet and holds a volume of 41,100 af. It has about seven miles of shoreline. The maximum and minimum pool elevations are 5,747 and 5,724 feet, respectively. The bottom composition is largely of rock and gravel, (Johnson, et. al., 1085).

The Fourmile Lake watershed encompasses 10 square miles of high elevation coniferous forest. The lake's water quality is quite pristine. The highest surface water temperature recorded was 67F. In summer, a thermocline forms between 20 and 50 feet. The pH is near neutral and the conductivity has been measured at 13 umhos/cm3. The Secchi disk visibility has been between 28 and 36 feet. These measurements put Fourmile Lake into the oligotrophic classification, having low productivity. Damming of the outlet did result in a feature that has increased productivity for fish; that being the many trees left standing that were flooded. Those trees, either down or standing, provide substantial additional area for insect production and fish cover.

An analysis of the zooplankton in August 1977 found a rather sparse population. A total of 1,883 animals per cubic meter was counted. Genera present were *Bosmina, Daphnia, Diaptomous,* and *Cyclops* in order of abundance. Crayfish are present in the lake but no measure of their abundance is available.

Habitat Limitations

1. Naturally low productivity, oligotrophic.

2. Drawdown of the water level for irrigation uses exposes shoreline and shoal areas, thereby drying up the most productive rearing areas in the lake.

3. Productivity will decline as the old flooded timber degenerates.

4. Stream-type spawning habitat is lacking which limits natural production of trout, particularly rainbow trout.

Lake of the Woods

Lake of the Woods has a surface area of 1,146 acres at elevation 4,949 feet. It has a maximum depth of 55 feet and an average depth of 35 feet; its volume is about 30,500 af. There is substantial shoal area, mainly at the north and south ends and in Rainbow Bay. The eastern shore has gravely beaches while the western shore is steeper and more rocky.

Bottom type composition is about as follows: detritus - 52%, sand - 19%, vegetation - 15%, rock - 11%, and mud 3%.

Surface water temperature reaches the low 70's F in mid-summer. A thermocline typically develops between 20 and 35 feet. Dissolved oxygen is high except there may be some depletion below the thermocline. Water transparency is above average at 27 feet. Conductivity is about 27 mmhos/ cm^3, pH is neutral, and phosphorus levels are low to medium. Density of phytoplankton is moderate. The lake is classified as mesotrophic, medium productivity, but the trophic level may have been influenced by human development around the lake, (Johnson et al, 1985).

The lake has been shown to be relatively unproductive in terms of invertebrate animal populations. Bottom sampling conducted between 1958 and 1976 found an average benthic food level of 42 pounds per acre. Sampling of zooplankton done in August, 1977 revealed a density of 5,550 individuals per cubic meter; genera found in descending order of abundance were: *Diaptomous, Cyclops, Daphnia,* and *Bosmina.*

Lake of the Woods has a watershed area of 26 square miles that is largely covered with coniferous forest. Three tributaries enter the lake. Rainbow Creek, a small perennial stream enters from the south; Billie Creek, which usually flows year-around but in dry years may not reach the lake, enters from the north; and Dry Creek, and intermittent stream, that enters from the northwest. Trout have, historically, spawned in both Rainbow and Billie creeks to some degree. Streamflow volumes are limiting in these small streams, particularly in the fall of the year. Road construction and beaver activity have modified the lower channels and complicated fish access to these streams. The lake's outlet is Seldom Creek which flows mainly during the spring runoff period. Seldom Creek runs through a large wet meadow, Great Meadow, and ultimately flows into Fourmile Creek which enters Upper Klamath Lake near Rocky Point.

Habitat Limitations

1. The lake has relatively low levels of benthic and zooplankton production.

2. The amount and quality of spawning habitat available for trout is very limited and not capable of sustaining adequate natural production of these species.

Miller Lake

The Miller Lake watershed is a disjunct portion of the Klamath River Basin which historically flowed to the upper Williamson River drainage in the Klamath Marsh area. The present lake watershed covers 11 square miles. It is mainly made up of steep slopes covered with coniferous forest. The majority of the watershed is in the Mount Thielsen Wilderness Area.

Several small spring-fed streams enter the lake; the largest is Evening Creek at the northeast end. Water temperatures of these tributaries rarely exceed 50F. Miller Creek is the outlet of Miller Lake and flows about 10 miles toward Beaver Marsh before being absorbed by the deep pumice soils.

"Overall, the water quality in Miller Lake is exceptionally good and it is classified as oligotrophic. The water contains low concentrations of ions. The phosphorus concentration is about average for Cascade mountain lakes, while the chlorophyll concentration and plankton populations are less than average. Water transparency is about average (29.2 feet).....,"

(Johnson et al, 1985). Surface water temperature rarely exceeds 65F. By mid-summer, a thermocline develops between 30 and 70 feet of depth.

Inventory of zooplankton done from June through October, 1976 found an average density of 30,000 individuals per cubic meter. The Cladoceran *Bosmina* made up 99% of the population. *Daphnia* and *Cyclops* comprised the remainder. Numbers of *Daphnia* peaked in mid-October. Analysis of bottom organisms sampled in 1958 found about 78 pounds per acre; the most abundant animals were shrimp, worms and midge larvae.

Habitat Limitations

1. Naturally low productivity, oligotrophic.

2. Tributary streams are small and largely inadequate for trout spawning habitat.

3. The relatively small amount of shoal area limits productive rearing habitat.

Cascade and Gearhart Mountain Lakes

The Cascade and Gearhart Mountain lakes program relies on the natural productivity of each lake to grow stocked fingerling trout to legal-size fish in one to two years. Consequently, the success of the program is contingent on maintaining the productivity of these waters. Management of lands and resources surrounding the Cascade and Gearhart Mountain lakes addressed here is described in the Winema and Fremont National Forest Land and Resource Management Plans, respectively.

National forest management of land designated as Wilderness and Semi-primitive Recreation Area, where these lakes are located, is generally compatible with ODFW management guidelines for primitive or semi-primitive fisheries. These lands do not have programmed timber harvest but do allow other activities associated with range, and fire management that may affect the natural productivity of these lakes (Meehan, W. R., 1991).

Natural factors may limit the productivity of fish populations. Habitat deficiencies may include a lack of abundant food resources, lack of cover, (a common limiting factor) and prolonged periods of ice cover resulting in periodic winter kill.

Howard Prairie Reservoir

At elevation 4,526, Howard Prairie Reservoir has a surface area of 2,070 acres with an average depth of 35 feet and a maximum depth of 80 feet. This irrigation reservoir was formed by construction of a dam on Grizzly Creek by the BOR in 1959 as part of the Talent Irrigation District (TID). The natural drainage is down Jenny Creek to Klamath River but this project diverts stored water to the Rogue River Basin for irrigation uses. The reservoir is subject to annual drawdown. It has a relatively high shoreline development with several bays and islands. Shoal areas cover 14% of the surface area. The reservoir's productivity is classified as mesotrophic, or moderate, (Johnson, D. M., et. al., 1985).

Hyatt Lake

Hyatt Lake lies at elevation 5,016 feet where it has a surface area of 957 acres and a maximum depth of 38 feet but averaging 18 feet. Completed in 1923, the reservoir was formed on Keene Creek and has the capacity to store 16,900 acre feet of water for irrigation use in the Medford area by the TID. Maintained by the BOR as part of the TID, this irrigation reservoir diverts water from the Klamath River Basin to the Rogue River Basin. Water enters Hyatt Lake from four tributaries. The average annual inflow from these sources is 6,500 acre feet. The reservoir's waters are well mixed and water transparency is limited to about 5-6 feet. Productivity is classified as eutrophic, or high, (Johnson, D. M., et. al., 1985). Released water enters Keene Creek and then Keene Creek Regulating Reservoir approximately 4 miles downstream. Fish screens were installed in the Hyatt Dam outlet in 1960.

Clearing of vegetation in the reservoir when the pool area was initially constructed resulted in the loss of potential aquatic food production and a loss of fish rearing habitat. The annual water drawdown limits habitat by reducing food production and space.

Little Hyatt Lake

Little Hyatt Lake has a surface area of 13 acres at elevation 4,620 feet with a maximum depth 14 feet. This lake was used in conjunction with Howard Prairie and Hyatt reservoirs to provide irrigation water for TID but has since been abandoned for this use. The dam is now owned by BLM and water levels are not manipulated.

Keene Creek Reservoir

Keene Creek Reservoir has a surface area of 14.5 acres and a depth of 36 feet at full pool, elevation 4,406 feet. Keene Creek Reservoir is a re-regulating reservoir on Keene Creek downstream from the outlet of Little Hyatt Lake. It regulates and keeps a constant flow of water in the TID system. TID fills and drains the reservoir once each week. Because of the wide fluctuations in reservoir level required by the irrigation district operations, it is generally poor fish habitat.

Deadhorse Lake

Deadhorse Lake lies at the far eastern edge of the Klamath Basin at elevation 6,500 feet. It covers 43 acres and has a maximum depth of 23 feet. Water quality is typical of such a high altitude lake with cool water temperatures and high dissolved oxygen levels. It has a small watershed but generally experiences heavy snow fall. There are no significant tributary streams nor is there an outlet.

Holbrook Reservoir

Holbrook Reservoir is an irrigation water storage impoundment near the head of Fishhole Creek. At elevation 5,435 feet, it has a surface area of 50 acres and a maximum

depth of 21 feet. Land ownership around the reservoir is mostly private with the remainder on FNF.

Being used for storage of irrigation water, it is subject to annual drawdown and may be drained if necessary. It is downstream from and receives any water releases made from Lofton Reservoir. Holbrook Reservoir often fills and spills during spring run-off.

Heart Lake

Heart Lake has a surface area of 18 acres and a maximum depth of 33 feet, yielding a capacity of 261 acre feet. Its surface elevation is 5,720 feet. Two small intermittent drainages enter the lake. This lake is in the headwaters of the Fishhole Creek drainage. It was formed in a natural basin by the construction of a dam across a narrow channel to provide storage of water for irrigation. It is subject to drawdown to deliver water for irrigation and the fish population may suffer winter-kill periodically.

Thermal stratifications may form during the summer that result in depletion of dissolved oxygen in the deeper portions of the lake. However, the surface waters remain cool enough and with adequate oxygen for salmonid production. Although this small lake is relatively deep, it also has some shoal areas that support emergent vegetation that produces food and provides cover for fish.

Big Swamp Reservoir

Big Swamp Reservoir was formed with the impoundment of a tributary to upper Fishhole Creek. At elevation 5,750 feet, it covers 34 acres but is only 8 feet deep. Its purpose is for storage of irrigation water and is, therefore, subject to drawdown although it has been used rarely in the recent past.

Lofton Reservoir

Lofton Reservoir is an impoundment at the head of Fishhole Creek for storage of irrigation water. It was re-constructed in 1961, bringing its surface area to 55 acres. It has a maximum depth of 22 feet and a volume of 550 acre feet. ODFW has a water right for minimum pool of 299 acre feet. Shoal areas support abundant emergent vegetation producing food and providing cover for fish. There is no spawning habitat suitable for trout reproduction.

J. C. Boyle Reservoir

J. C. Boyle Reservoir was created when the dam was built in 1957 on Klamath River for hydro-electric production. At elevation 3,783, it covers a surface area of 380 acres. Its maximum depth is 45 feet. Having 57% shoal area, average depth is only 11 feet. It receives much of its inflow from Upper Klamath Lake via Klamath River and, therefore, shares many of its chemical and biological traits. It is highly eutrophic. Inflow is governed by regulation of water use upstream, (Johnson, et al, 1985). Daily fluctuations are roughly two feet during project peaking operations that typically occur from May through December (Personal communication, Frank Shier, PacificCorp, January 1997).

Gerber Reservoir

Gerber Reservoir was created in 1925 with the construction of a dam on Miller Creek by BOR to store water for agricultural irrigation. When full, it has a surface area of 4,047 acres at elevation 4,825. Its average depth is 27 feet with a maximum of 65 feet. The volume of 94,000af is equivalent to about two years of normal run-off from the 159 sq. mi. watershed, (Johnson, et al, 1985). Tributaries include Barnes Valley Creek, Ben Hall Creek and Barnes Creek; these streams are often intermittent.

The waters of Gerber Reservoir are low in ion concentrations but high in calcium and sulphates and above average in phosphorus. Productivity is high and is classified as eutrophic. Depth is adequate to form thermal stratification which may result in depletion of dissolved oxygen in the lower zones. Water transparency is limited by phytoplankton and suspended sediment, (Johnson, et al, 1985). Annual fluctuations in water level and the "muddy" water results in very few aquatic plants in the reservoir.

Willow Valley Reservoir

Willow Valley Reservoir was formed by the construction of a dam on East Fork Lost River in about 1920 to provide storage for agricultural irrigation. At elevation 4,526, it has a surface area of 588 acres. Depth of the reservoir averages 12 feet, with a maximum of 25 feet, providing a volume of 6,800 acre feet. The reservoir is classified as eutrophic. Levels of phosphorus are high. Water transparency is low because of algae and suspended sediments. The lack of light penetration does not allow growth of much aquatic vegetation, (Johnson, et al, (1985). Flooded juniper trees and rocks provide cover elements. The reservoir is virtually dried up periodically by draw-down for irrigation releases, leaving only the small inflow from East Fork Lost River.

Campbell Reservoir.

No physical description is available for Campbell Reservoir. At elevation 4,758, it has an estimated surface area of 160 acres. It is shallow; the estimated maximum depth is 15 feet. It receives overland drainage from a small watershed (about 7 square miles) but is primarily filled by water diverted from Deming Creek. No water quality data are available for this reservoir. It has the "murky" water, caused by suspended sediment, that is typical of reservoirs in this area. It is lacking in growth of aquatic plants.

Devil Lake

Devil Lake is a small irrigation storage reservoir. It has a surface area of 70 acres at elevation 4,820 feet with a maximum depth of 19 ft., averaging 11 ft. Water levels fluctuate because of withdrawals for irrigation that are directed down Fishhole Creek, but there is a residual pool. Biological productivity is high but suspended sediments cloud the water transparency and prevent the growth of rooted vegetation, (Johnson, et al, (1985). The watershed is less than a square mile but probably receives ground water because, according to early descriptions, the reservoir was formed over a spring-fed meadow, (personal communication, Alton Knutson, 1971).

Bumpheads Reservoir

Bumpheads Reservoir is a small, shallow irrigation storage reservoir constructed in 1950 within the watershed of Willow Valley Reservoir. At elevation 4,740, it has a surface area of 89 acres; its depth averages 8 feet when full and is 15 feet at its deepest point. Inflow is from intermittent surface drainage. Water levels fluctuate from irrigation withdrawals and has been dried up in some years of drought conditions. Biological productivity is high, eutrophic; water transparency is limited by suspended sediment and algal blooms, (Johnson, et al, (1985).

Upper Midway Reservoir

No information is available on the physical parameters of Upper Midway Reservoir, but it has an estimated surface area of 40 acres with depths down to about 10 feet. It was built for storage of irrigation water but has not been used as heavily as other near-by reservoirs. It was drained in 1994 to repair the outlet gate. Being shallow, it has a high proportion of shoal area that supports growths of emergent aquatic plants. Willows growing along the dam provide shade and cover at higher water levels.

Dog Hollow Reservoir

Dog Hollow Reservoir is another small irrigation storage impoundment. It has a surface of 88 acres at full pool, a maximum depth of 16 feet and a volume of 444 acre feet. No information is available on the water quality but it appears to be typical of other small reservoirs in the Gerber area, fairly productive but with suspended sediment clouding the transparency. This reservoir is also subject to periodic draining for irrigation purposes.

Round Valley Reservoir

When full, Round Valley Reservoir has about 310 surface acres but is only 6 feet deep, averaging 5 feet deep. It is fed by intermittent run-off from its 3 square mile watershed. This reservoir is eutrophic. Although water transparency is limited to 2-3 feet, aquatic plants grow profusely. Physical cover is provided by the emergent vegetation and flooded juniper trees along some shoreline areas. Drainage is directed toward Gerber Reservoir via Wildhorse Creek.

Smith Reservoir

Near full pool Smith Reservoir has a surface area of between 80-100 acres and a maximum depth of about 14 feet. It has a small watershed near the top of Bryant Mountain at elevation 5,196 feet. Its impounded waters are drawn off toward Langell Valley for irrigation of agricultural lands.

Habitat Management Policies and Objectives

Management Direction: **Habitat protection, restoration and improvement.**

Policies

Policy 1. Habitat that is critical to the natural production of indigenous fish populations will be protected; proactive conservation shall be preferred over habitat restoration.

Objectives

Objective 1. Protect and restore riparian habitats throughout the Klamath Basin.

Assumptions and Rationale

1.1 Good, healthy riparian habitats are the single most important resources for sustaining production of fish populations. (See text, Riparian Habitat).

1.2 To conserve and restore riparian areas, they must be protected from consumptive and intrusive land use practices and other destructive activities.

1.3 Planting of vegetation and placement of instream structures are largely ineffective, over time, as riparian restoration measures.

1.4 Since ODFW has little direct control of land and water use management, it is vital to establish and maintain good relationships and coordination with landowners and managers that do control the management of those resources.

Actions

1.1 Work with county governments to adopt Goal 5 Land Use Standards to protect riparian zones.

1.2 Work with landowners, organizations and government agencies and programs to facilitate protection of riparian areas.

1.3 Establish and maintain professional working relationships with staffs of agencies involved in the management of fish resources and their habitats for coordination and sharing of survey and inventory information; these agencies and organizations include; USFS, BLM, BOR, USFWS, ODF, PC and TKT.

1.4 Complete physical and biological surveys of basin streams through the ODFW Aquatic Inventories Project in coordination with land management agencies and landowners.

1.5 Provide up-to-date information on fish habitats and critical limiting factors to private landowners along with technical and financial support, when appropriate and feasible.

1.6 Review land and water management plans and proposed actions that may influence fish resources; provide recommendations for the optimal management of those resources and their habitats.

1.7 Restoration of riparian areas should be pursued throughout the basin but priority will be focused on the following streams: Barnes Valley Creek, Coyote Creek, Deming Creek, Fishhole Creek, Johnson Creek (Jenny Creek), Lost River, Meryl Creek, North Fork Sprague River, Sevenmile Creek, South Fork Sprague River, Sprague River, Sycan River, Williamson River (upper), and Wood River. Additional priority streams are those identified in the bull trout conservaion plan (Light, et al, 1996).

Objective 2. All artificial barriers to fish passage will have adequate facilities installed to provide unimpaired upstream passage.

Assumptions and Rationale

2.1 For optimum fish production, it is imperative that there are no artificial barriers to fish migration.

2.2 Dams and diversions needing assessment of fish passage have been identified on the following streams:

Deming Creek
Klamath River at
- J. C. Boyle Dam
- Keno Dam

Link River Dam
Lost River
Scott Creek
Sevenmile Creek
Sprague River
- Mainstem, Chiloquin Dam
- North Fork, lower
- South Fork, lower

Sycan River

Actions

2.1 Fish passage at these sites needs to be assessed and provided as necessary by continuing to implement the ODFW program.

2.2 Work with PC to evaluate passage facilities on their Klamath Project and rectify any such problems before or within the Federal Energy Regulatory Commission (FERC) licensing process.

Objective 3. All water diversions and water storage facilities will have appropriate screening to prevent entrainment of fish.

Assumptions and Rationale

3.1 To sustain fish populations and provide for optimum fish production, it is imperative that water diversions be screened to prevent entrainment of fish.

3.2 ODFW has established a data base of unscreened diversions, some of the higher priority sites are on the following list:

Klamath Lake, A-canal
Klamath Lake (Link River), West and East Side hydro diversions
Wood River
Sevenmile Creek
Fort Creek
Deming Creek
Long Creek
North Fork Sprague River
South Fork Sprague River
Fivemile Creek
Fishhole Creek
Meryl Creek
Coyote Creek
Sycan River
Cherry Creek
Rock Creek
Threemile Creek
Annie Creek
Sun Creek
Scott Creek

3.3 Unscreened or inadequately screened outlet structures on storage impoundments may lead to loss of fish production within the reservoirs and impacts on native fish residing downstream.

Actions

3.1 Continue and complete the state's fish screening program.

3.2 Coordinate with the owners and managers of the following water storage impoundments to assure that the outlets structures have appropriate screening and that the screens are inspected repaired and cleaned as needed to prevent loss of fish:

Fourmile Lake
Howard Prairie Reservoir
Hyatt Lake
Little Hyatt Lake
Heart Lake
Holbrook Reservoir
Devil Lake

Objective 4. Pursue perennial instream flows throughout the Klamath Basin to improve habitat and natural productiion of indigenous species

Assumptions and Rational

4.1 Perennial instream flows are necessary to sustain populations of indigenous fishes.

4.2 ODFW has made application for Instream Water Rights (IWR) on 35 streams in the Klamath Basin.

Actions

4.1 Continue coordination with Oregon Department of Water Resources to achieve IWR for those steams where applications have been made.

4.2 Pursue opportunities to gain additional instream flows from willing water users through leases, agreements, or grants.

Objective 5. Protect and restore water quality throughout the Klamath Basin as it relates to the maintenance of fish resources.

Assumptions and Rationale

5.1 *Good water quality is essential to the maintenance of healthy fish populations.*

5.2 Good water quality is the product of healthy watersheds, particularly riparian areas.

5.3 Since ODFW has little direct control of land and water use management, it is vital to establish and maintain good relationships and coordination with landowners and managers that do control the management of those resources.

Actions

5.1 Establish and maintain professional working relationships with staffs of agencies involved in the management of land and water resources for coordination of water quality and fish resource concerns; these agencies and organizations include; USFS, BLM, BOR, USFWS, Natural Resources Conservation Service (NRCS), Oregon Department of Environmental Quality (ODEQ), ODF, PC and TKT.

5.2 Review land and water management plans and proposed actions that may influence water quality; provide recommendations for the optimal management of those resources for the benefit of fish resources.

5.3 Protection and restoration of water quality should be pursued throughout the basin but priority will be focused on the Sprague River sub-basin, Wood River, Klamath and Agency lakes, Link River-Lake Ewauna-Klamath River down to Keno Dam, and Lost River.

Objective 6. Protect trout and kokanee salmon spawning and rearing habitat in Fourmile Lake.

Assumptions and Rational

6.1 Current annual lake drawdown for irrigation uses reduces and restricts rearing area for trout and kokanee salmon.

Actions

6.1 Communicate to the irrigators the impacts of drawdown (lower water levels) have on fish resources and encourage them to improve water distribution and application techniques in an effort to use less water more efficiently.

Objective 7. Protect, maintain or improve spawning and rearing habitat for fish in Lake of the Woods and tributaries.

Assumptions and Rational

7.1 Rainbow and Billie creeks, though small, have spawning habitat for trout.

7.2 Beaver activity will be ongoing on lower Rainbow and Billie creeks but beaver dams are generally not a major problem for fish passage and are likely to provide additional rearing habitat.

7.3 Highway-crossing culverts on Rainbow and Billie creeks may create obstacles to fish passage.

7.4 Emergent and riparian vegetation, and large woody debris in the lake and along the shoreline provide benefits to several fish species but are likely to be most beneficial to largemouth bass and brown trout which are most sought after by anglers and also help control the populations of other, more prolific, species.

Actions

7.1 Determine if culverts at highway crossings of Rainbow and Billie creeks are passable, if not, coordinate with the Oregon State Highway Department (OSHD) and the USFS to take appropriate measures to make the culverts passable to fish.

7.2 Coordinate with the WNF and encourage them to maintain existing large woody cover in the lake and along the shoreline.

7.3 Coordinate and cooperate with the WNF to increase and enhance large cover components in the lake and along the shoreline.

Objective 8. Develop habitat in Hyatt Lake to enhance bass and trout populations.

Assumptions and Rationale

8.1 Addition of woody structure and vegetative plantings will result in a net increase in aquatic food and fish habitat in the reservoir.

Actions

8.1. Coordinate funding and volunteer efforts with BLM personnel to develop habitat in Hyatt Lake.

8.2. Administer placement of brush bundles by volunteers to enhance bass and trout habitat.

FISH MANAGEMENT

Background

The upper Klamath Basin was once, in Pleistocene time, dominated by a large lake, pluvial lake Modoc. Lake Modoc, lying in the Basin and Range Province, stretched from near Tule Lake, California, to Fort Klamath, covering 1,096 square miles. Upper Klamath Lake is the largest remnant of that historic body of water, (Dickens, 1980). Although it may always have had an outlet, it provided enough isolation for the evolution of unique species and stocks of fish. Eventually, coastal stocks, such as salmon, steelhead and Pacific lamprey, invaded the basin and influenced genetic development, but at the same time were shaped by the environment of the upper Klamath Basin. As a result of those actions, the basin is home to a number of unique species and stocks of fish.

Anadromous salmon and steelhead once utilized the upper Klamath Basin in Oregon. Spring chinook salmon spawned as far as Bly on the South Fork Sprague River and steelhead were documented up to Link River. By the early 1900's, the majority of these runs were being diverted by fish-racks at Klamathon for fish culture activities. Completion of Copco Dam, just south of the state line, in 1917 brought the end to runs of anadromous fish to Oregon's portion of the Klamath Basin (Fortune, et al, 1965).

The former Klamath Indian Reservation is located in the heart of the upper Klamath River Basin. Although the reservation lands were purchased by the federal government, various court decisions have affirmed the rights of tribal members and their decendents to hunt, fish, and trap on the former reservation lands accessable to them. The reservation area borders part of upper Klamath Lake, Agency Lake, and most of Wood River on the west; it includes the Williamson River watershed and lower portions of the Sprague River watershed to the east. The Tribe regulates their own members on this area and are not subject to state regulations. As directed in the Final Consent Decree, May 13, 1981, state and tribal biologists exchange biological information and often work cooperatively, as co-managers, addressing fish and habitat management issues.

Life history and distribution, Basin wide

Game fish

Redband trout: *Onchorhynchus mykiss newberrii*

An indigenous complex of redband trout is found throughout the upper Klamath Basin with the exception of a few isolated streams. These redband trout are included in the Department's Klamath Lake gene conservation group of the Oregon Basin Redband Trout Complex which is listed as a state sensitive species (ODFW, 1994). Federal agencies recognize redband trout as species of special concern. These redband trout evolved in historic isolation of the basin and have remained isolated in headwater streams of the Williamson River drainage and in Jenny Creek. Invading coastal stocks of rainbow and steelhead trout, introgressed with historic Klamath redbands which resulted in modern day redband trout stocks of Klamath River, Upper Klamath and Agency lakes and the lower reaches of their tributaries. These trout, genetically, fall between classic coastal rainbow trout and redband trout from east of the Cascades. Another trait that separates these redband forms is their resistance to

Ceratomyxa shasta, a myxosporidian fish parasite found in lower Williamson River, Klamath Lake and down the Klamath River. *C. shasta* probably invaded the Klamath Basin with the coastal fish. Indigenous redband trout that live in waters with *C. shasta* are resistant to that disease. Redband stocks that have remained isolated above the influence of coastal rainbow stocks are susceptible to *C. shasta* and die when exposed to it. Most exotic stocks of rainbow trout that have been introduced to the basin, through stocking programs, have also been susceptible to *C. shasta.* The great majority of introduced rainbow trout likely died from that pathogen.

Redband trout in Fall Creek appear to have been introgressed with hatchery rainbow trout.

Redband trout that rear in Klamath and Agency lakes and in Klamath River migrate to tributaries to spawn while redbands in the headwaters spawn in their resident streams without significant instream movement. Redband trout typically spawn in the spring of the year, as most do in this basin. The redband trout population in upper Williamson River has an additional fall spawning component (Personal Communications, Craig Bienz, TKT, January 1997). Redband trout that rear in Klamath and Agency lakes, mainly those utilizing spring-fed streams, may spawn in the fall, winter, spring or even summer. They all spawn in good quality flowing water, with appropriate depth and velocity, over a gravel substrate in which they dig their redds and deposit their eggs.

After hatching and emergence from the gravel, redbands in headwaters disperse and rear to maturity in their resident streams. Young migratory redband trout may stay in their natal tributary for more than a year before emigrating down to the lake or river where they rear to maturity. This migratory behavior is called "adfluvial". Redbands in the headwaters typically mature and spawn at age 3+ years, then die; redbands in upper Williamson River may be multiple spawners. The lake reared redbands also mature at age 3+ but often survive to spawn several times; they return to their natal stream to spawn, a behavior that maintains the integrity of separate stocks within the migratory redband trout group.

A hatchery brood stock has been developed from Williamson River redband trout that spawn at the upper end of lower Williamson River. That brood stock is held at Klamath Fish Hatchery and is maintained with annual infusion of gametes from additional wild fish. This brood stock is Lot 28, commonly known as "Klamath redband trout". Lot 28 fish are used to stock Lake of the Woods, Fourmile and Miller lakes, and some high lakes in the Klamath Basin. They are not currently being used to stock any streams.

Rainbow and steelhead trout: *Onchorhynchus mykiss gairdnerii*

This subspecies is generally native to waters west of the Cascade Mountain Range. Anadromous steelhead trout in Cottonwood Creek, tributary of Klamath River downstream from Irongate Dam, are the only native fish of this subspecies in the Oregon portion of the Klamath River Basin.

Under the current management program, only one stream in the basin is stocked with hatchery-reared rainbow trout. That is Spring Creek which annually receives about 16,000 "legals" of Lot 72, Cape Cod stock rainbow trout.

Bull trout: *Salvelinus malma confluensis*

Bull trout, formerly known as Dolly Varden trout, is the other indigenous trout species of the Klamath Basin. Bull trout are listed as state sensitive species and federal candidate species (category 1), (ODFW, 1994). Because of its historical isolation, bull trout in the

Klamath Basin have been found to be a distinct stock, separate from bull trout native to the Columbia Basin. They probably once had a much wider distribution within the Klamath Basin, perhaps even being adfluvial, but now are found only in the headwaters of a few isolated, spring-fed streams: Sun Creek, Threemile Creek, Long Creek, Boulder and Dixon creeks, Brownsworth and Leonard creeks, and Deming Creek. Within the past decade, bull trout have been seen in Cherry Creek, Coyote Creek, and upper Sycan River but these former populations are likely extinct or nearly so.

Shrinking bull trout populations in the Klamath Basin are thought to be the result of habitat alteration and competition or hybridization with introduced species. Bull trout require high quality, cold water for spawning and, additionally, heavy cover for rearing. Bull trout spawn in the fall. Because they spawn in cold water and then are subjected to winter conditions, their eggs and fry remain in the gravel for an extended period; therefore, they need well oxygenated, sediment free water for successful reproduction. Past timber harvest and grazing practices have led to reduced cover, both instream and overhead, resulting in higher water temperatures and increased sediment. Hybridization with brook trout is likely the primary cause that has depleted bull trout populations in Sun, Threemile, Cherry, Long and Coyote creeks and in upper Sycan River. Brook trout were stocked in these streams as early as 1925. Brown trout compete with bull trout in Brownsworth, Leonard, Boulder and Dixon creeks.

In response to the precarious status of bull trout in the Klamath Basin, the Klamath Basin Bull Trout Working Group was formed. That group is comprised of fish biologists, foresters and other natural resource specialists from government agencies, The Klamath Tribes, and private landowners and organizations. Their goal is to restore bull trout populations while sustaining land uses in the Klamath Basin. They have worked for several years gathering information about the distribution and status of Klamath Basin bull trout populations and the threats to the existence of these fish. Annual work plans have been developed by the group to pursue needed information about these populations and protect them from further deterioration. The major product of the group is the *Upper Klamath Basin Bull Trout Conservation Strategy, Part I, A Conceptual Framework for Recovery* (Light, et al, 1996) Goals established for this recovery plan are "(1) Secure existing bull trout populations, and (2) Expand the populations to some of their former range and numbers." The plan pursues those goals in a three-step approach of assessment, implementation and evaluation.

Brown trout: *Salmo trutta*

Brown trout are an introduced species. The earliest record of their release was in Crystal Creek in 1905. Other records show they were stocked in the lower Williamson and Wood river drainages by 1925. They have become naturalized within the upper Klamath Basin, mainly in Williamson River and tributaries, and in Wood River and Sevenmile Creek and their tributaries where they have established resident populations. Brown trout inhabit a variety of waters ranging from small, cold headwater streams like Dixon Creek to the larger, highly impacted waters of Sprague River. They appear to be most successful in lower Williamson and Wood rivers, at least that is where they grow to the largest size. They are rarely found in upper Klamath Lake or Klamath River.

Brown trout spawn in the fall of the year like bull trout, so they may compete for spawning and rearing habitat in streams where they coincide.

Hatchery reared brown trout from Wickiup Reservoir are stocked in Lake of the Woods and Miller Lake.

Brook trout: ***Salvelinus fontinalis***

Brook trout were introduced into most drainages in the basin by 1935. They have become naturalized in the Williamson and Wood river drainages and in most of the small streams flowing from the east side of the Cascades. In these streams, they are typically found in the colder headwaters and spring-fed areas. Brook trout spawn in the fall of the year and so may compete with brown trout and native bull trout for spawning and rearing habitat. Where the distribution of brook and bull trout coincides, those species may hybridize, resulting in infertile offspring that diminish the productivity of both species.

Brook trout have also become naturalized in Fourmile Lake and Lake of the Woods. They are the major species utilized in the regular stocking of the high lakes. No brook trout are currently stocked in streams. Except for one group released in upper Sycan River in 1975, no streams have been stocked with brook trout since the early 1960's.

Lahontan cutthroat trout: ***Onchorhynchus clarki kenshawi***

Lahontan cutthroat trout are native to the Great Basin area of SE Oregon. Fish of this species are spawned at Mann Lake to support limited hatchery production. In the late 1970's, hatchery reared Lahontan cutthroat fingerlings were stocked in East Fork Lost River; subsequently, some surplus brood stock has been released in Willow Valley Reservoir. Between the stream and the reservoir, they have habitat to sustain natural production. However, since the recent period of drought, during the late 1980's and early 1990's, the status of that population is undocumented.

Kokanee salmon: ***Onchorhynchus nerka kennerlyi***

Kokanee salmon are a land-locked form of sockeye salmon that have been introduced to Lake of the Woods, Fourmile, Miller and Heart lakes. Natural reproduction sustains their populations in Fourmile and Miller lakes. Hatchery reared kokanee salmon are stocked to supplement inadequate natural production in Lake of the Woods and Heart Lake.

Kokanee salmon rear to maturity in a lake environment with good water quality and summer water temperatures in the 50-60F range. They feed primarily on zooplankton. Typically, they mature at 3+ year of age and spawn in gravel substrate of tributary streams or lake shoals and spring areas. Being members of the Pacific salmon group, they die after maturity and spawning.

Lake trout: ***Salvelinus namaycush***

Lake trout are not currently present in the Klamath Basin but are being considered for introduction into Fourmile Lake. As its name implies, it lives its entire life cycle in a lake environment. They require relatively cold water temperatures, in the 40-50's F and good water quality. They feed primarily on other fish but also utilize insects and crustaceans, especially in their younger years. Lake trout are a long lived species and do not mature until 6-7 years of age. They spawn by releasing their eggs and sperm over gravel or cobble substrate in the fall of the year. Lake trout may grow to large size; with fish up to 40 pounds documented in Oregon's Odell Lake.

White sturgeon: ***Acipenser transmontanus***

White sturgeon, native to coastal tributaries, were introduced to the Upper Klamath Basin in 1956 when a truck-load of only 221 fish, ranging in length from 12-41 inches, was released into lower Williamson River. Those fish were from the Columbia River and are the only sturgeon ever stocked into the upper Klamath Basin. Those long-lived fish survived and

grew to large size in Upper Klamath Lake; recently documented sturgeon from the basin have been 6-9 feet in length. There has apparently been no natural reproduction from these fish. Over the years, a few sturgeon have been caught by anglers near the mouth of Williamson River. Recently, BOR staff biologists have found at least two sturgeon remaining in that area. Otherwise, the few fish that have been recovered in the past few years were entrained and stranded down the system of irrigation canals from Upper Klamath Lake. There are no plans to stock more sturgeon into the upper Klamath Basin so this species will eventually die out.

Warmwater Game Fish

All of the species in this category are exotic to the upper Klamath Basin.

Largemouth bass: *Micropterus salmoides*

White crappie: *Pomoxis annularis*

Black crappie: *Pomoxis nigromaculatus*

Sacramento perch: *Archoplites interuptes*

Bluegill: *Lepomis machrochirus*

Pumpkinseed: *Lepomis gibbosis*

Green sunfish: *Lepomis cyanellus*

These species are all members of the family Centrarchidae that have been introduced into various waters within the basin, either by past management actions, by accident, or by illegal acts of individuals. See Table 1 for their general distribution within the basin. Sacramento perch apparently gained access to the basin when they were stocked in Clear Lake, California, head of Lost River. They have spread down through Lost and Klamath rivers.

These species reside in standing waters or slow moving streams and are most productive in warm water. These fish all spawn in the spring or early summer when water temperatures rise sufficiently. They dig shallow nests in shoal areas where they lay and fertilize their eggs. These fish feed on a wide variety of prey species including zooplankton, insects, amphibians and fish. Growth rates of these species are limited by the short length of the "growing season" in the upper Klamath Basin.

Only the pumpkinseed sunfish has been marginally successful in Upper Klamath and Agency lakes. For the other species, the areas of these lakes that get warm enough for their spawning experience low DO and high pH levels that preclude their successful reproduction. The pumpkinseed is able to get oxygen from the water surface layer, has a higher tolerance for pH, and survives in small numbers, (Ziller, 1991).

Yellow perch: *Perca flavescens*

Yellow perch were probably first stocked into the basin by the Oregon State Game Commission (OSGC) in the 1930's when loads of fish were hauled from Sauvies Island on the

Columbia River. Since then, they have been further distributed by the illegal actions of private parties. See Table 1 for their current distribution.

Yellow perch are included with "warmwater" fish but could probably best be referred to as a "cool-water" species since they don't require warm water for reproduction. They spawn in the spring when females extrude strings of gelatinous egg masses over vegetation. They have a high reproductive capacity and tend to over-populate and stunt if they are not in a productive water body and there is no predator to reduce their numbers, which is often the case. Yellow perch feed on all kinds of active prey species.

Brown bullhead: *Ictalurus nebulosis*

Brown bullheads, "catfish", were probably also introduced into the basin by the OSGC in the 1930's when loads of warmwater fish were stocked in Upper Klamath Lake, Lake of the Woods and Lost River. Private parties have easily, but illegally, transferred these hardy fish to many other waters. See Table 1 for their current distribution.

Brown bullheads reproduce by depositing their eggs in shallow nests dug in shoal areas in late spring or early summer. They are efficient forager and predators but, in unproductive waters, may over-populate and become stunted.

Table 1 . General distribution of warmwater gamefish within the Klamath River Basin, P=Present.

	Species*								
Sub-basin/water body	LB	WC	BC	SP	BG	PK	GS	YP	BrB
Klamath R.	P	P	P	P	P	P	P	P	P
Spencer Cr.									P
Lk. Ewauna	P	P	P	P	P	P	P	P	P
Link R.	P					P		P	P
Upper Klamath Lake	P					P		P	P
Agency Lake	P					P		P	P
Williamson R. below falls	P							P	P
Sprague R.	P							P	P
S. Fk. Sprague R., lower	P								P
N. Fk. Sprague R.									P
Crystal Cr.								P	
Recreation Cr.								P	
Thomason Cr.								P	P
Williamson R. above falls									P
Jenny Cr.									P
Lost R.	P	P	P	P	P	P	P	P	P
Lake of the Woods	P		P					P	P
C. Boyle Res.	P	P	P	P		P		P	P
erber Res.	P	P	P			P		P	P
Willow Valley Res.	P				P				
Campbell Res.	P								
Devil Lk.	P							P	P
Bumpheads Res.	P	P							
Upper Midway Res.	P								
Antelope Res.	P								
Dog Hollow Res.	P								
Howard Prairie Res.	P					P			P
Hyatt Lk.	P		P		P				P
Little Hyatt Lk.	P		P		P				P
Keene Creek Res.	P		P		P	P			P
Big Swamp Res.									P
All other waters	No warmwater gamefish present								

* LB: Largemouth bass
WC: White crappie
BC: Black Crappie
SP: Sacramento perch
BG: Bluegill sunfish
PK: Pumpkinseed sunfish
S: Green sunfish
: Yellow perch
rB: Brown bullhead

Non-game Fish, Native

Upper Klamath Basin is the home of a rather rich fauna of native non-game fish, 14 species. Until recently, none of these species have received much attention from fish managers. Even now, only sucker species are being studied and monitored intensively. Table 2 displays the known distribution of these species.

Lost River sucker: *Deltistes luxatus*

Shortnose sucker: *Chasmistes brevirostris*

These large, lake-dwelling suckers were once very abundant in upper and lower Klamath lakes and in the Lost River drainage. They have historically been important sources of food to the indigenous people of the area. Though they are included as non-game fish, they supported a popular "snag" fishery for many years; in fact, the Lost River sucker is classified as a game fish by Oregon statute under the name "mullet". These fish may live for more than 40 years so it wasn't until the late 1980's that fish managers began documenting drastic declines in abundance of these fish. This occurred when the older fish began dying out of the population and there were very few younger fish being recruited into the spawning populations. In 1988, both species were listed as Endangered under the Endangered Species Act.

The recovery plan for these species cites the reduction and degradation of lake and stream habitats as the factors in the decline of both species. A shift toward hypereutrophication of Upper Klamath and Agency lakes is thought to be the major cause of sucker mortality. The *Recovery Plan for Lost River Sucker and Shortnose Sucker* (Stubbs and White, 1993) provides a thorough summary of the identification, biology, status and distribution of these species.

Lost River suckers grow to large size with fish over 36 inches not unusual. Shortnose suckers are smaller; typical adults are 16-18 inches in length. Both species live in lakes or reservoirs but make migrations to tributary streams or springs to spawn. Soon after hatching, larval suckers move to the lake where they rear to maturity.

Lost River suckers are now present in Upper Klamath and Agency lakes; major associated spawning areas are lower Williamson River, Sprague River, and Sucker Springs. They are also present in Klamath River down to Copco Reservoir, in California, including J. C. Boyle Reservoir, and in Lost River downstream of Anderson-Rose Dam, near Merrill. Shortnose suckers share those habitats plus they are present in Gerber Reservoir.

Although both species may utilize the same rearing waters and spawning streams, they often occupy different habitats within those waters.

Klamath largescale sucker: *Catastomus snyderi*

The Klamath largescale sucker is the common, stream dwelling sucker of the Klamath Basin, mainly above Klamath Falls. It may also live in lakes and reservoirs but generally lives entirely in a stream environment where it spawns on a gravel substrate in the spring of the year. They feed primarily on benthic organisms and may grow up to two feet in length.

Klamath smallscale sucker: *Catastomus rimiculus*

In the Klamath Basin, the Klamath smallscale sucker is native only to Klamath River and Spencer Creek. They rear in these streams and in J. C. Boyle Reservoir but spawn only on gravel bars in the spring of the year. Typical adults range in length between 12-16 inches.

Jenny Creek sucker: *Catastomus rimiclus subsp.*

The Jenny Creek sucker is a dwarf form of the Klamath smallscale sucker; a typical adult is only 6-8 inches long. This species is confined to the Jenny Creek drainage above the falls where it has been isolated for 1,000's of years. It rears and spawns in a stream environment, sharing habitat with redband trout. This fish is also classified as a Sensitive species, mainly because of its very limited distribution.

Klamath speckled dace: *Rhynichthys osculus klamathensis*

Blue chub: *Gila bicolor*

Tui chub: *Siphateles bicolor bicolor*

These three species are native cyprinids of the Klamath Basin. They all may be present in mainstem streams and lakes. Blue and Tui chubs are most abundant in Upper Klamath and Agency lakes. Klamath speckled dace populations are generally less dense but also occupy very small streams where they may be the only fish species present. Blue chubs are the largest fish in this group; individuals up to 12-14 inches in length are not unusual in Klamath Lake. Ten inches is large for a Tui chub and a big dace may be four inches long.

Marbled sculpin: *Cottus klamathensis*

Slender sculpin: *Cottus tenuis*

Klamath Lake sculpin: *Cottus princeps*

All of these sculpin species are unique to the Klamath Basin. Marbled sculpins have the widest distribution and may be found throughout the basin. Slender sculpins reside in Klamath and Agency lakes and some of their tributaries while the Klamath Lake sculpin is confined to Klamath and Agency lakes. Slender sculpins are being considered for classification as a sensitive species because of their limited distribution and perception that their numbers are diminishing.

Pacific lamprey: *Lampetra tridentata*

Klamath lamprey: *Lampetra similis*

Klamath-Pit brook lamprey: *Lampetra lethophaga*

The Pacific lamprey in upper Klamath Basin is a land-locked form of the widely distributed anadromous fish. While its sea-going cousin may reach 2-3 feet long, Klamath specimens typically mature at about a foot in length. They are found in Klamath River, Klamath and Agency lakes and in the lower ends of their major tributaries where they migrate to spawn. Juveniles, ammocetes, remain in the stream substrate for 2-3 years before growing

into the parasitic adult, when it emigrates from its natal habitat. They rear in lakes or rivers, parasitizing other fish, including trout and suckers, until maturing and spawning, after which they die.

Klamath lamprey have been recently identified and split out from Pacific lamprey. Klamath lamprey are known to inhabit Klamath River and Spencer Creek. They have also been recovered from Upper Klamath Lake. Their life history is thought to be similar to that of the Pacific lamprey.

A small, parasitic lamprey was recently found in Miller Creek, outlet of Miller Lake. Tentative identification finds it to be not a Miller Lake lamprey, *Enospheus minimus*, but similar to species found in tributaries of Upper Klamath Lake (Personal communication, Dr. Margaret Docker, private consultant to ODFW, 1997).

The Klamath-Pit brook lamprey is a non-parasitic form that is found generally throughout the Klamath Basin.

Non-game fish, exotic

These three species are not native to the upper Klamath Basin.

Fathead minnow: *Pimephales promelas*

This small minnow was first noted in upper Klamath Basin in an isolated report of regarding fish sampled from J. C. Boyle Reservoir in 1964. Nothing further was documented until 1979 when they were found to be well established in Klamath River and upper Klamath Lake. In terms of numbers, fathead minnows are now the most abundant fish in the basin. The original source of this species is not known but it was not a legal introduction.

Golden shiner: *Notemigonus crysoleucus*

The know distribution of golden shiners in the upper Klamath Basin is limited to Howard Prairie Reservoir, Little Hyatt Lake, Keene Creek Reservoir, and Jenny Creek. This species was illegally stocked in the reservoir and some of these fish have gone down into Jenny Creek. The stream environment probably does not provide good spawning habitat for these shiners so they have not become abundant in the creek.

Mosquito fish: *Gambusia affinis*

This species has been distributed into selected waters near Klamath Falls by the Klamath Vector Control District for control of mosquitos. This small fish cannot tolerate normal winter conditions in the upper Klamath Basin and so is found only in a few isolated ponds having the influence of hot springs.

Table 2. General distribution of non-game fish species with the Klamath R. basin, P=present, U= potential but undetermined.

	Species*															
Sub-basin/water body	LRS	SNS	KLS	KSS	JCS	KSD	BC	TC	MS	SS	KLS	PL	KL	KPL	FM	GS
Klamath River	P	P	P	P		P	P	P	P	U		P	P	U	P	
Spencer Cr.				P		P			P	U		U	P	P	P	
Lake Ewauna	P	P	P			P	P	P	P	U	U	P	U		P	
Link River	P	P	P			P	P	P	P	U	U	P	U	U	P	
Upper Klamath and Agency lakes	P	P	P			P	P	P	P	P	P	P	P	U	P	
Williamson R. below the falls	P #	P #	P			P	P	P	P	P	U	P	P	U	P	
Sprague River	P	P	P			P	P	P	P	U		P	P	U		
Sycan R. below Sycan Marsh	U	U	P			P	P	P	P	U		P	U	P		
N. Fk. Sprague R. , lower	U	U	P			P			P	U		P	U	P		
S. Fk. Sprague R. , lower	U	U	P			P	P	P	P	U		P	U	P		
Wood River	P	P	U			U	U	U	U	U		U	U	U	U	
Sevenmile and Fourmile creeks	U	U	U			U	U	U	U	U		U	U	U		
Crystal, Recreation and Thomanson creeks	P	P	U			U	P	P	P	P	P	P	U	U	U	
Harriman, Odessa, and Short creeks	P	P	U			U	P	P	P	U	U	U	U	U	U	
Sycan R. above outlet of Sycan Marsh						P	P	P				P		P		
N. Fk. Sprague R., upper						P										
S. Fk. Sprague R. , upper						P										
Jenny Creek					P	P										P
Fall, Scotch, Cottonwood, Grouse, Long John, and Cow creeks						U			U			U	U	U		
Lost River	P	P	U			P	P	P		U				U	P	
Lake of the Woods						P	P									
J. C. Boyle Res.	P	P	U	P		P	P	P	P	U		P	P	U	P	
Gerber Res.		P						P						U	P	
Willow Valley Res.						P		P								
Howard Prairie Res.																P
Little Hyatt LK.																P

								Species*								
Sub-basin/water body	LRS	SNS	KLS	KSS	JCS	KSD	BC	TC	MS	SS	KLS	PL	KL	KPL	FM	GS
Keene Creek Res.																P
Deadhorse Lk.						U										
Lofton Res.								P								
Holbrook Res.								P								
All other waters	No non-game fish species present															

* LRS: Lost River sucker; SNS: shortnose sucker; KLS: Klamath largescale sucker; KSS: Klamath smallscale sucker; JCS: Jenny Cr. sucke
KSD: Klamath speckled dace; BC: blue chub; TC: Tui chub; MS: marbled sculpin; SS: slender sculpin; KLS: Klamath Lake sculpin;
PL: Pacific lamprey; KL: Klamath lamprey; KPL: Klamath-Pit brook lamprey; FM: fathead minnow; GS: golden shiner.
#: Only downstream of confluence with Sprague River.

Non-fish Species

Crayfish and bull frogs are classified by Oregon statute as shellfish and game fish, respectively, and are managed via angling regulations.

Crayfish: *Asticus klamathensis*

These native crustaceans are common in all larger streams and lakes in the basin. They are most abundant in Klamath and lower Williamson rivers where they support active recreational harvest.

Osconectes transfuga

A non-native species present in Little Hyatt Lake. This species has displaced native crayfish in much of the Rogue River Basin (Personal communications, David Haight, ODFW, January 1997).

Bull frog: *Rana catesbeiana*

Bull frogs are an introduced species in the Klamath Basin where they mainly inhabit the lower elevation waters of Klamath and Lost rivers and Upper Klamath Lake. They are also present in Lake of the Woods. The only documented introduction was in the late 1930's when OSGC brought a variety of warmwater fish, including several thousand bull frogs, from the Columbia River area and released them in Lost River. Similar "loads of warmwater fish" were stocked into upper Klamath Lake and Lake of the Woods and were also likely sources of these large frogs.

Bull frogs are highly competitive, voracious predators and are detrimental to native fauna. They support a modest "fishery" in the basin, primarily on Lost River

Management Considerations

This plan has been developed with the intent of optimizing recreational use of the Klamath River Basin's fish resources for present and future generations while conserving the integrity of the native fish fauna.

The paramount consideration in developing this management plan has been compliance with the Department's Wild Fish Management Policy, Trout Plan, and Warmwater Game Fish Management Plan. These policies guide management toward sustaining diversity and abundance of native fishes. They further provide guidance in addressing diversity in angling opportunities within the constraints of species biology, distribution and abundance. The Klamath River Basin contains a wide spectrum and distribution of fish stocks, particularly in the redband trout complex. This native diversity, on one hand, restricts consumptive management alternatives, but at the same time, provides for a natural variety of angling opportunities not available in many parts of the state.

Fish management direction in this plan is organized by sub-basin groups or individual water bodies. Sub-basin groupings are based on differences in the genetics, life history and distribution of redband trout in the Klamath River Basin. These groupings may be further divided by the need for separate management strategies addressing diversity of fish stocks

and angling opportunities. Within each sub-basin or sub-basin grouping, management of all game fish species is addressed.

Distribution and abundance of the various fish species is constrained by their habitat requirements. Management alternatives are, therefore, limited by the capacity of existing habitats to produce fish. This plan identifies habitat conditions constraining fish distribution and abundance and proposes objectives and actions for improvement of those conditions. Expansion of suitable habitats will result in healthier fish populations and opportunities for future liberalization of management strategies.

Re-introduction of Salmon and Steelhead

A study completed in 1966 considered the feasibility of re-introducing salmon and steelhead to the upper Klamath Basin within their former distribution, (Fortune, et al, 1966). After evaluating the assembled information, the inter-agency steering committee overseeing that study did not recommend a program to re-establish those runs. That conclusion was based on the following considerations quoted from the steering committee's report:
1. "Problems related to downstream passage of fry and juvenile fish at impoundments and lakes are serious. In the judgment of the Committee, losses due to residualism, predation, diversions and failure of downstream migrants to negotiate the impoundment would prevent the establishment and maintenance of adequate runs.

2. "Losses of upstream-migrating adults at fishways and in forebays or lakes would also be inevitable.

3. "The re-establishment of anadromous fish would depend on obtaining stocks of fish whose migrating, spawning, and incubation requirements fit within the very narrow limits afforded by conditions in the Upper Klamath Basin. There are insufficient stocks of fish in the Klamath to implement and effective transplant and no assurance that present Klamath stocks would adapt to the narrow requirements of the Upper Basin. Experience elsewhere has demonstrated it is very unlikely that suitable stocks outside the basin could be found.

4. "While perhaps no single factor in itself precludes the possibility of establishing anadromous fish in the Upper Klamath Basin, the interaction of all factors would prevent establishment of self-sustaining runs capable of perpetuating themselves at a useful level."

At least two additional factors were not considered in the 1966 study but would be risks to current, remaining native trout populations. Viral fish diseases have not been diagnosed within the upper Klamath Basin but are present in the lower basin of California. Introduction of Klamath River salmon or steelhead from California, the logical choices, would risk importation of viral diseases that could cause harm to existing native trout. Further, successful re-introduction of salmon or steelhead would present direct competition for food and habitat with existing native fish fauna.

In a spin-off of the earlier study, a cooperative program was undertaken in 1970-74 by Pacific Power and Light Co.(PC), California Department of Fish and Game (CDFG), and the OSGC where surplus fall run steelhead from Irongate Hatchery were stocked into Klamath River in Oregon. The intent was to provide a steelhead fishery in Oregon. A total of nearly 2,300 steelhead were trucked and released in Oregon's portion of Klamath River at various locations from Keno Dam downstream. Accompanying creel censuses and volunteer reports

accounted for a catch of 92 of these fish. An evaluation of this program (Hanel and Stout, 1974) drew the following conclusions:

- The catch of steelhead was mostly incidental to the ongoing trout fishery; very few anglers were specifically fishing for steelhead despite extensive publicity about the program.
- Winter conditions on upper Klamath River were cold and poor for steelhead fishing.
- Quality of the fishery was poor, being essentially a "put and take" program in a few popular locations.
- Many of the steelhead moved downstream and out of the Oregon fishery area.
- By spring, the steelhead were reaching maturity and were in poor condition for a sport fishery.
- Many resident trout caught in Klamath River are larger than the steelhead released in this experiment.
- The steelhead spawned at the same time and areas as resident trout.

The steelhead stocking program was not continued beyond 1974.

ODFW generally supports the re-establishment of sustainable populations of indigenous species; however, because of existing habitat problems, loss of the native stocks, risk of disease introduction and potential competition with remaining native redband trout, it does not appear feasible, or prudent, to attempt re-establishment of anadromous salmon or steelhead to the upper Klamath Basin in Oregon, now or in the near future. However, ODFW will support such re-introductions if and when the biological and physical questions are addressed and show that such actions are feasible and prudent. Further, ODFW would support future studies addressing that feasibility and the habitat restoration that would be conducive to successful re-introductions. Still, the welfare of remaining native fish stocks in the upper Klamath River Basin ecosystem should be the paramount deciding factor in any future deliberations.

FISH MANAGEMENT DIRECTION

Klamath River Basin, all waters

MANAGEMENT DIRECTION
Klamath Basin, all waters

Summary

Management direction for bull trout, Lost River and shortnose suckers, non-game fish, warmwater gamefish, crayfish and bull frogs is addressed basin wide.

Bull trout shall be managed for natural production under the Wild Fish Management Option (ODFW, 1987a) with guidance of the conservation plan developed by the Klamath Basin Bull Trout Working Group. Angling regulations would continue to prohibit the take of bull trout, a state sensitive species.

Endangered Lost River and shortnose suckers shall be managed under the direction of the USFWS Recovery Plan for those species; they shall remain as protected species.

Non-game fish shall be managed for natural production within their native habitats consistent with the Wild Fish Management Policy, (ODFW, 1992). Management actions directed at other species shall avoid impacting native non-game fish within their native habitats.

Except where there are more specific policies, warmwater gamefish shall be managed for natural production and with stocked fish under the Basic Yield Management Option, (ODFW, 1987b).

Native crayfish and introduced bull frogs shall be managed for natural production under the Basic Yield Management Option, (ODFW, 1987b). Conservation of crayfish while providing for a consumptive fishery is the objective. Exotic bull frogs are harmful to the native ecosystem; therefore, the objective is to reduce their density by providing a liberal consumptive fishery on that species.

Management Direction: for bull trout, Lost River and shortnose suckers, non-game fish, warmwater game fish, crayfish and bull frogs.

Policies

Policy 1. Bull trout, within the Klamath Basin, shall be managed for natural production consistent with the Wild Fish Management Option; angling regulations shall prohibit the take of bull trout within the Klamath Basin.

Policy 2. Lost River and shortnose suckers, classified as Endangered, shall be managed according to the adopted Recovery Plan for those species; angling regulations shall identify them as protected species.

Policy 3. Non-game fish species, within their native habitats, shall be managed exclusively for natural production.

Policy 4. Except where there are policies specific to individual sub-basins or waters, warmwater game fish shall be managed for natural production and stocked fish under the Basic Yield Management Option (ODFW, 1987b).

Policy 5. Crayfish and introduced bull frogs shall be managed for natural production only.

Objectives

Objective 1. Maximize protection of genetic diversity, adaptiveness and abundance of bull trout in the Klamath Basin.

Assumptions and Rationale

1.1 Bull trout of the Klamath Basin are an indigenous stock unique to that area.

1.2 Remaining bull trout in the Klamath Basin are confined to small, isolated populations that are probably not in compliance for minimum number of spawners (300) as required by Wild Fish Policy.

1.3 Actions to protect, conserve and improve bull trout habitat and populations are required to restore Klamath Basin bull trout populations and keep them from threatened or endangered status.

Actions

1.1 Management of bull trout shall be directed by the conservation plan developed by the Klamath Basin Bull Trout Working Group, (Light, et al, 1996):

Phase 1. Secure existing populations.
Phase 2. Expand the range of bull trout within headwater streams.
Monitoring. Evaluate outcomes from Phases 1 and 2.

Objective 2. Maximize protection of genetic diversity, adaptiveness and abundance of Lost River and shortnose suckers in the Klamath Basin.

Assumptions and Rationale

2.1 Lost River and shortnose suckers are classified as Endangered Species.

Actions

2.1 Management of Lost River and shortnose suckers shall be directed by the Recovery Plan for those species (Stubbs and White, 1993).

Objective 3. Maintain protection of genetic diversity, adaptiveness, and abundance of native non-game fish species within their native habitats within the Klamath Basin.

Assumptions and Rationale

3.1 Non-game fish species are generally not actively managed within their native ranges.

3.2 Management actions aimed at game fish could affect the welfare of native non-game fish species.

Actions

3.1 When planning management actions for game fish, consider and avoid such actions that may be detrimental to the diversity and susceptibility of non-game fish within their native habitats.

3.2 When it is perceived that a native non-game fish species may not be in compliance with Natural Production Policy, actions should be taken to define the status of that species and, if necessary, implement protection and restoration of that species.

Objective 4. Provide consumptive angling opportunities for basic yield fisheries on naturally produced and stocked warmwater game fish.

Assumptions and Rationale

4.1 With adequate habitat, warmwater game fish are capable of sustaining their populations by natural production.

4.2 Some reservoirs may be dried up from water withdrawals for irrigation of agricultural lands, thereby eliminating populations of warmwater game fish.

Actions

4.1 Warmwater game fish may be re-introduced to reservoirs after they have been adequately refilled subsequent to being dry. The source of fish may be from hatcheries or from other naturally producing populations.

Objective 5. Maintain genetic diversity, adaptiveness and abundance of native crayfish while providing for consumptive harvest of this species.

Assumptions and Rationale

5.1 Crayfish are maintaining healthy populations within the Klamath Basin under current regulations and rate of exploitation.

5.2 An exotic species of crayfish, *Osconectes transfuga,* inhabits Little Hyatt Lake; it could potentially invade other waters of the basin and replace native crayfish.

Actions

5.1 Where populations of crayfish are perceived to be in decline, the status of those populations should be determined, and if necessary, action taken to protect and restore those populations.

5.2 Investigate feasibility of eliminating the exotic crayfish species, *Osconectes transfuga*, from Little Hyatt Lake.

Objective 6. Reduce the density of introduced bull frogs within the Klamath Basin.

Assumptions and Rationale

6.1 Introduced bull frogs are detrimental to the native ecosystem by preying upon and competing with indigenous species.

Actions

6.1 Retain unlimited bag limits and seasons for the take of bull frogs.

Klamath River: State line to Upper Klamath Lake, including Spencer Creek, Lake Ewauna and Link River (Figure 2)

Management Considerations

Redband trout in Klamath River are of a unique stock indigenous to the river and its tributaries. Historically, redband trout rearing in Klamath River in Oregon spawned mainly in Spencer Creek. From 1913 to 1955, a fish trap and egg taking station was maintained near the mouth of Spencer Creek where, annually, hundreds of trout, averaging 16 inches in length, were spawned for culture and distribution to Spencer Creek and other waters. The egg taking station was discontinued with the construction of J. C. Boyle Dam in 1958 when 3.5 miles of Klamath River and the mouth of Spencer Creek were inundated by the resulting reservoir. The dam presented an obstacle to migration of trout but had a fish ladder to provide for their passage. Trapping in the fish ladder done in 1959 documented and estimated upstream passage of 5,529 redband trout (Hanel and Gerlach, 1964). Research done in 1988-1991 showed that by 1991 passage of redband trout over the dam had fallen to less than 2% of the 1959 estimate (Hemmingsen, et al, 1992). Good numbers of redband trout continue to spawn in Spencer Creek but they are mostly from fish rearing in the Keno reach, between Keno Dam and J. C. Boyle Reservoir. Researchers monitored downstream fish movement below Boyle Dam to measure possible recruitment from Spencer Creek but concluded that the low numbers of juvenile redbands they saw were not adequate to maintain the population in the river between Boyle Dam and the state line (Hemmingsen et al, 1992). Never the less, based on informal assessment of angler catches, the trout population in that area appears to be sustaining a fishery. Biologists from PC snorkeling in the Boyle Reach in August 1996 observed many young-of-the-year (less than 3 inches in length) redband trout. In the same area, they identified patches of potential, available spawning gravel (Personal communication, Frank Shrier, PacificCorp, January 1997). Though both the trout and spawning habitat were seen in the same area, they were not positively linked.

Monitoring of fish passage was also done at fish ladders on Keno and Link River dams in 1991 (Buchanan, et al, 1991). Numbers of trout passing over those facilities were small but it did document movement of trout from below Keno Dam, generally considered to be Spencer Creek spawners, up into the river above Keno. Further, a few trout passed from Link River up into Upper Klamath Lake; one of those fish was found spawning in Williamson River. A spawned-out trout tagged on the spawning grounds of Williamson River was recovered on the trash racks at Link River Dam. It is not clear what, if any, relationship there is between the "Klamath River redband stock" and those spawning in the lower Williamson River drainage. Perhaps, some of the Williamson River fish simply drop down through the lake and into Link and Klamath rivers where they rear before returning to spawn in their natal streams.

In response to concerns over lack of recruitment and excessive harvest, angling regulations on Klamath River have become more conservative. As of 1997, the bag limit for trout is one per day on all of Klamath River. For many years, all of Klamath River was closed to angling from June 15 through September 30 because trout during that period of warm water were considered unpalatable. The river from Boyle Dam to the state line is now open during that summer period to catch and release angling only, since relatively cool spring waters from the Boyle diversion reach ameliorate stream temperatures there. The Keno reach remains closed during the summer because its high water temperatures would cause excessive mortality in a catch and release fishery. The whole river is restricted to the use of flies and lures only.

Hatchery reared trout were stocked in Klamath River between Keno Dam and "Frain Ranch" in the years 1950-1978. These were mainly "legals" from exotic stocks of rainbow trout. Those fish that weren't caught soon after stocking probably died from the effects of *C. shasta*. A proportion of the "legals" stocked in 1978 were tagged for identification; subsequent creel census and volunteer returns accounted for only 8% of those released. A policy of wild fish only management was adopted and fish stocking was discontinued after 1978.

In the lower river reach, downstream from Boyle Powerhouse, the hydroelectric peaking operation seriously hampers angler use and catch rates. Few anglers attempt to fish during the peaking flow periods because of the added difficulty and poor success they experience under those conditions.

MANAGEMENT DIRECTION
Klamath River

Summary

Management direction for Klamath River, including Spencer Creek, Lake Ewauna and Link River is for natural production only of native redband trout under the Wild Fish Management Option, (ODFW, 1987a), that may provide a limited consumptive fishery within the productivity of that redband trout stock

Management Direction: Natural Production, Wild Fish Option

Policies

Policy 1. Redband trout in Klamath River, including Spencer Creek, Lake Ewauna and Link River shall be managed for natural production only consistent with the Wild Fish Management Option (ODFW, 1987a).

Policy 2. No hatchery trout shall be stocked in Klamath River, including Spencer Creek, Lake Ewauna and Link River.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of redband trout in these waters.

Assumptions and Rationale

1.1 Redband trout in Klamath River are a separate stock unique to that stream and its tributaries.

1.2 J. C. Boyle Dam and Reservoir have caused significant changes in the behavior of redband trout rearing downstream of that project. They no longer make the migration to Spencer Creek for spawning.

1.3 The source of recruitment of trout to the river below Boyle Dam has not been determined; spawning habitat in that reach has not been identified, appears to be very limited, at best.

1.4 Restrictive angling regulations are needed to conserve wild trout in these reaches in order to sustain this population in compliance with the requirements of the Wild Fish Management Policy (ODFW, 1992).

Actions

1.1 Continue conservative angling regulations for Klamath River trout while providing for angling opportunities that can be sustained by natural production.

1.2 Periodically assess the status of the trout populations in Klamath River by creel surveys, electrofishing, migrant traps or other suitable methodologies.

1.3 Determine the source of trout recruitment to Klamath River downstream of Boyle Dam by surveying the river to identify spawning habitat and or radio-tagging and tracking adult trout.

Objective 2. Provide a consumptive fishery for redband trout.

Assumptions and Rationale

2.1 The redband trout population can continue to sustain a conservative consumptive fishery on these waters.

Actions

2.1 Conduct periodic angler creel surveys to assess angler effort, catch, demographics and preferences.

Upper Klamath and Agency lakes including all tributaries, or portions there of, contributing redband trout production to the lakes' rearing population: Williamson River below the falls (RM 23) and tributaries (Spring, Larkin and Sunnybrook creeks); Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries below the outlet of Sycan Marsh, North Fork Sprague River up to RM 12 and tributaries, South Fork Sprague River up to RM 10 and tributaries); Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile Creek, Crystal Creek, Recreation Creek, Thomason Creek, Harriman Creek, Odessa Creek, and Short Creek (Figure 3)

Management Considerations

Upper Klamath and Agency lakes are common rearing areas for migratory redband trout that spawn in their tributaries. Although these fish rear in these lakes commonly, they are from several different stocks. Redband trout from Spring Creek are genetically distinct from those in Wood River. While the redbands from Spring Creek are genetically similar to those in the upper part of Williamson River below the falls (know as the "Kirk Springs area") and Trout Creek (tributary of Sprague River), they have significant differences in life history. Spring Creek redband females averaged 21.4 inches in length compared to 19.8 inches for redband females in the Kirk Springs area of Williamson River. Redband trout spawn in Spring Creek over an extended period between October and August, while those in the Kirk Springs area spawn only in late November through January (Buchanan, et al, 1991). Recently, redband trout have been found spawning in late spring and early summer in Williamson River below Spring Creek; these fish could be called still another stock. The spawning season for redband trout in Trout Creek and other Sprague River tributaries is not well documented but is probably mainly during the spring, based on their spring time passage over Chiloquin Dam. However, there are also redbands moving up Sprague River in the fall (Personal communication, Craig Bienz, TKT, January 1997). The life history and genetics of redband trout in other tributaries has yet to be studied but they may present additional stock diversity.

All of these fish are subject to a common fishery in Klamath and Agency lakes where they rear. This "mixed stock" fishery presents a problem for fish management if one or more of those stocks is less abundant than other stocks. That situation calls for conservative angling regulations in their common rearing area, the lakes, in order to protect the less abundant stocks from excessive exploitation.

Abundance of redband spawners in the Spring Creek and Kirk Springs stocks currently appears to be sufficient to maintain those populations. With enhancement of spawning habitat in Spring Creek since 1974, there has been a general increase in the number of redds counted since the 1981-82 season, Figure 9. Numbers of adults returning to Wood River were monitored in the December 1995-April 1996 spawning season; the peak count of 303 adult redband trout was seen in early January. In Fort Creek, redds were counted from November 1995 through March 1996; 117 redds were tallied during that period with peak activity seen in December. Monitoring in those areas during the 1996-97 season showed similar results. A great majority of the redband trout spawning in Fort Creek takes place upstream of the old Fort Creek dam site where the former reservoir area has reverted to excellent stream habitat.

Presently, restrictive angling regulations limit the daily trout bag limit to one fish on Upper Klamath and Agency lakes (and their spring-fed tributaries), and lower Williamson River to conserve brood stocks returning to those streams. Further protection is provided by catch-and-release regulations on Wood River all season and lower Williamson River, August 1-October 31. Angling with bait (dead minnows and worms) has been a traditional method on Upper Klamath and Agency lakes: the use of bait is still allowed on those waters.

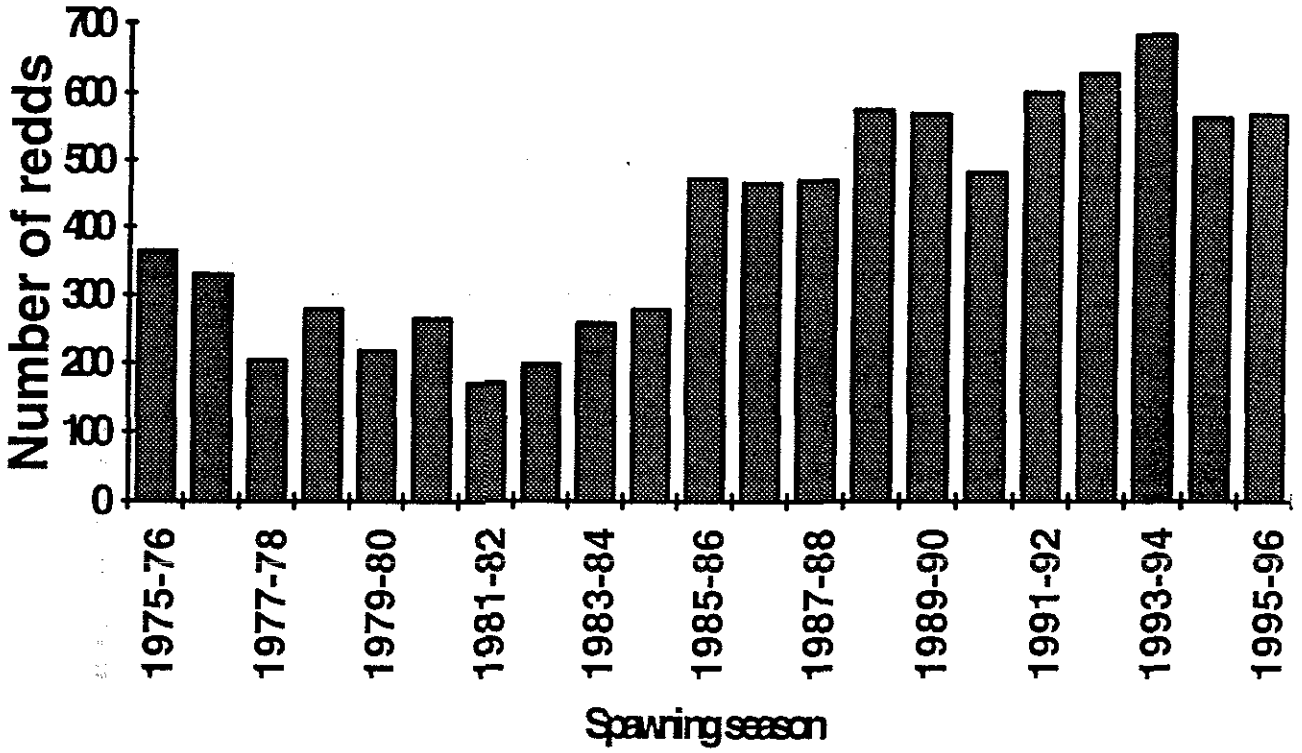
More than 30 million rainbow trout of various stocks and sizes were released into Upper Klamath and Agency lakes (and adjacent spring-fed waters) between 1925 and 1979. Review of past stocking and catch records shows that hatchery reared trout made no substantial contribution to the fishery. In 1962 to 1965, there were 310,000 fin-clipped rainbow trout fingerlings released into Klamath and Agency lakes. Subsequent creel surveys when those fish should have been entering the fishery found they made only a 0.4% contribution. The great majority of those exotic stocks was likely killed by *C. shasta* and, over the years, the fishery for redband and rainbow trout in these lakes and their tributaries has been sustained by natural production of the native redband stocks (ODFW, 1981). The *Fish Management Plan for Upper Klamath and Agency Lakes* adopted by the Oregon Fish and Wildlife Commission in 1981 called for management with wild trout only. No hatchery fish have been stocked since 1979.

Except for Spring Creek, all stocking of streams was discontinued after 1991 when Wood River and Sevenmile Creek were last stocked. Spring Creek still receives an annual allocation of about 16,000 "legal" sized trout of Lot 72, Cape Cod rainbows. That has been the program on Spring Creek for many years to serve the intensive fishery, in Collier State Park in particular. (Appendix 1 is an overview summarizing the trout stocking program on Spring Creek.) An exception was made in 1990-91 when a total of 18,400 Lot 28 redband trout from the Kirk Springs area of Williamson River were released in Spring Creek to replace the Lot 72 fish. There was the expected added benefit that these fish that were not caught in Spring Creek, would emigrate to Klamath Lake where they would contribute to the fishery there and in Williamson River on their return to Spring Creek. At that time it was assumed that the Lot 28 trout were the same stock as the native Spring Creek redbands. The Lot 28 "catchables" proved to be virtually "uncatchable" in the Spring Creek put-and-take fishery because of their secretive, wild behavior. Subsequently, research has shown the trout from Spring Creek and Kirk Springs area of Williamson River to be separate stocks. So, in response to concern about artifical mixing of two separate stocks in Spring Creek and the failure of the Lot 28 trout to support the put-and-take fishery, the program was reverted back to using Lot 72 fish that are catchable and, if not caught in Spring Creek, die from *C. shasta* upon leaving the creek. This current program may have to be reviewed in light of existing Department policy discouraging stocking of susceptible fish into waters with *C. shasta*.

Through this experience, it was discovered that the Lot 28 redbands did emigrate to Klamath Lake and returned to Spring Creek. Of the 294 spawning redband trout sampled there in 1992-93, there were 27 fish (9%) that had adipose fin-clips identifying them as the Lot 28 fish released in 1990-91. Those marked trout at 2 and 3 years, ranged in length from 15.5 to 23.25 inches, averaging 20 inches (Hemmingsen, et al, 1993). So, though they were not compatible with the put-and-take fishery, they grew about 14 inches and were available to the fisheries in Klamath Lake and Williamson River.

The productive waters of Upper Klamath and Agency lakes are capable of growing large sized trout. The 1992-93 sample of 294 redband trout spawners in Spring Creek had fish ranging in length between 15 and 30.7 inches in length, with an average length of 22.4 inches (Hemmingsen, et al, 1993).

Figure 9. Total number of redband trout redds counted in Spring Cr., 1975-96. No count was made in the spring of 1995; counts made in the spring of the previous two years averaged 148, which if added to the 1994-95 count would total to 711 redds.



MANAGEMENT DIRECTION

Upper Klamath and Agency lakes including all tributaries, or portions there of, contributing rainbow trout production to the lakes' rearing population.

Summary

Management direction calls for natural production of all species of trout except it would utilize hatchery-reared, legal-sized rainbow trout to provide a put-and-take fishery in Spring Creek managed under the Intensive Use Management Option, (ODFW, 1987a). No other hatchery reared fish would be stocked. Except in Spring Creek and in Sprague River and its tributaries, redband and brown trout would be managed under the Trophy Fish Management Option, (ODFW, 1987a), while brook trout would be managed consistent with the Basic Yield Management Option, (ODFW, 1987a). Redband and brown trout in Sprague River and tributaries will be managed for natural productiion only under the Wild Trout Manageement Option, (ODFW, 1987a), while brook trout in these waters would be managed under the Basic Yield Option, (ODFW,1987a). This would conserve these stocks of trout while targeting both consumptive and non-consumptive fisheries on fish ranging from large lake-reared redbands to small resident brook trout to hatchery reared trout in an intensive fishery.

Management Direction; Natural and Hatchery Production; Trophy, Basic Yield, and Intensive Use Management Options.

Policies

Policy 1. Redband and introduced brown trout in Upper Klamath and Agency lakes, Williamson River below the falls (RM 23) and tributaries, Wood River and tributaries, Sevenmile Creek and tributaries, and Fourmile (north), Crystal, Recreation, Thomason, Harriman, Odessa, and Short creeks, shall be managed for natural production only consistent with the Trophy Fish Management Option (ODFW, 1987a). Introduced brook trout shall be managed for natural production only consistent with the Basic Yield Management Option (ODFW, 1987a) in these waters.

Policy 2. Redband trout and introduced brown where they occur in Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries up to the outlet of Sycan Marsh, North Fork Sprague River and tributaries up to RM 12, and South Fork Sprague River and tributaries up to RM 10) shall be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a) while brook trout shall be managed under the Basic Yield Management Option (ODFW, 1987a).

Policy 3. Stocking of hatchery fish in Spring Creek shall be limited to yearling rainbow trout of a stock susceptible to *Ceratomyxa shasta* and they will be managed under the Intensive Use Management Option (ODFW, 1987a).

Policy 4. No hatchery trout will be stocked in Upper Klamath and Agency lakes; Williamson River below the falls (RM 23) and Larkin and Sunnybrook creeks; Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile (north), Crystal, Recreation, Thomason, Harriman, Odessa, and Short creeks; and Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries up to the outlet of Sycan Marsh, North Fork Sprague River and tributaries up to RM 12 and South Fork Sprague River and tributaries up to RM 10).

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of redband trout in these waters.

Assumptions and Rationale

1.1 Redband trout rearing in Upper Klamath and Agency lakes are from several different native stocks spawning in the tributaries of these lakes; within any given tributary, it is unclear how many stocks may be present.

1.2 The mixed-stock fishery in these lakes calls for angling regulations that protect the less abundant stocks.

1.3 Except for the redband trout spawning in Spring Creek, the status of spawning stocks has not been adequately assessed.

Actions

1.1 Investigate to determine the life history and status of other redband trout stocks rearing in Upper Klamath and Agency lakes while continuing to monitor the status of the stock in Spring Creek; this work may be accomplished with the use of electrofishing, traps, snorkel surveys, creel surveys, or other appropriate techniques.

1.2 Pursue additional genetic studies to determine the status of redband stocks in Sprague River and tributaries, Sevenmile Creek and other populations as needed.

1.3 Implement angling regulations that are compatible with sustaining all stocks of redband trout.

Objective 2. Provide for diverse angling opportunities by providing for consumptive and nonconsumptive fisheries on redband and hatchery reared rainbow trout and introduced brown and brook trout where they occur in these waters.

Assumptions and Rationale

2.1 Upper Klamath and Agency lakes and their tributaries produce some of the largest trout in the state.

2.2 These waters have a growing reputation, nationally, for yielding trophy-sized redband and brown trout.

2.3 Angling regulations aimed at providing a low exploitation, trophy fishery are compatible with the conservation of mixed stocks.

2.4 Sprague River and its tributaries support lower levels of angler use and a greater proportion of resident trout than other waters in this sub-basin.

2.5 Brook trout do not reach large trophy size in the waters of this sub-basin and are considered as competitors with native redband trout.

2.6 Hatchery-reared legal-sized rainbow trout have supported an intensive put and take fishery in Spring Creek since 1950.

2.7 Hatchery-reared Lot 72 rainbow trout stocked in Spring Creek display different behavior than the redband trout rearing there and they, apparently, do not compete greatly for food or cover. The hatchery rainbows, if not caught, leave the stream after a short period of time and then are susceptible to *C. shasta.*

Actions

2.1 Implement angling regulations to produce fisheries for trophy-sized redband and brown trout on the waters named in Policy 1.

2.2 Maintain general angling regulations on the waters named in Policy 2, Policy 3, and on brook trout throughout the sub-basin.

2.3 Stock 16,000 legal-sized rainbow trout in Spring Creek utilizing frequent stocking rates and stocking locations with good public access to maximize catch rates.

2.4 Investigate further the interaction between the hatchery and wild fish to guide future management decisions.

2.5 Conduct periodic angler creel surveys to document effort, catch, demographics and prefereces.

Williamson River above the falls (RM 23) and tributaries (Figure 4)

Management Considerations

Redband trout are the native, resident trout of the upper Williamson River. They differ from redband trout of the lower river genetically and in life history (Buchanan, et al, 1994). These redbands do not migrate from the stream but may move shorter distances within the system to spawn or seek cooler water during summer.

Brook trout may be found throughout this sub-basin but are concentrated in the headwaters and tributaries. Brown trout are less numerous and are generally confined to the river within or just upstream of Klamath Marsh.

Rainbow trout were stocked near Wickiup Springs in 1930 but there are no records of additional stocking since that time. Many brook trout were stocked in that area between 1926 and 1957, but none since then. There is no record for the introduction of brown trout to this section of Williamson River.

Williamson River above Klamath Marsh supports a popular fishery. This spring-fed stream meanders through high-elevation "stringer meadows" within the forest and provides an attractive setting for the angler. Much of the stream above the marsh lies on private property but is interspersed with WNF lands that provide for public access. Two private ranches at the headwaters are, at least partially, managed for trout fisheries serving their clients.

Within the past two decades, angling bag limits became more restrictive on this stream to conserve the redband trout. Current regulations have a bag limit of two trout over 8 inches in length, with an additional unlimited bag of brook trout of any size.

MANAGEMENT DIRECTION
Williamson River above the falls (RM 23) and tributaries

Summary

Management direction relies only on natural production of all trout species. No hatchery reared trout will be stocked in these waters. Introduced brown and brook trout will be managed under the Basic Yield Management Option, (ODFW, 1987a), providing for consumptive use of these resources. Redband trout will be managed consistent with the Wild Fish Management Option, (ODFW, 1987a), where a limited consumptive fishery may be maintained on this species while meeting the requirements of the Wild Fish Management Policy, (ODFW, 1992).

Management Direction: **Natural production; Wild Fish and Basic Yield Options**

Policies

Policy 1. Redband trout shall be managed for natural production only consistent with the Wild Fish Management Option (ODFW, 1987a) while introduced brook and brown trout shall be managed for natural production only consistent with the Basic Yield Management Option (ODFW, 1987a).

Policy 2. No hatchery fish will be stocked in these waters.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of redband trout in these waters.

Assumptions and Rationale

1.1 Redband trout in upper Williamson River are a separate stock unique to that stream and its tributaries.

Actions

1.1 Continue conservative angling regulations for redband trout while providing for angling opportunities that can be sustained by natural production.

1.2 Continue general angling regulations for brook and brown trout allowing for greater harvest of those species to reduce their competition with redband trout.

1.3 Periodically assess the status of trout populations; these studies may include electrofishing surveys, snorkel surveys, or other appropriate techniques.

Objective 2. Provide a consumptive fishery for redband and introduced brook and brown trout.

Assumptions and Rationale

2.1 The redband trout population can continue to sustain a conservative, consumptive fishery.

2.2 Restrictive angling regulations are necessary for conservation of the redband trout stock.

2.3 Introduced brook and brown trout compete with redband trout to some degree; general angling regulations allowing for greater exploitation of those species will reduce the level of that competition.

Actions

2.1 Maintain conservative, consumptive angling regulations on redband trout, and general angling regulations on introduced brook and brown trout.

2.2 Conduct periodic angler creel surveys to assess angler effort, catch, demographics and preferences.

Sycan River above the outlet of Sycan Marsh and tributaries, including Long and Coyote creeks (Figure 5);
North Fork Sprague River (above RM 12) and tributaries (Figure 5);
South Fork Sprague River (above RM 10) and tributaries, including Deming Creek (Figure 5
Cascade Mountain streams: Sink, Cottonwood, Scott, Sand, Threemile, Cherry, Rock, Fourmile (south), Moss, and Denny creeks (Figure 6;
Jenny, Fall, Scotch, Cottonwood, Grouse, Long John, and Cow creeks (Figure 7).

Management Considerations

This array of streams is comprised of the headwaters of the Sprague River watershed; streams flowing from the Cascade Mountains; and streams originating in Oregon but flowing to Klamath River in California. These streams support one or more of the following species: native redband, steelhead and bull trout, introduced brook and brown trout. Though many of these streams have been stocked in the past, no fish have been released in them for more than two decades; their populations have been sustained by natural production. Redband trout in Rock Creek were found to be genetically divergent from other redband populations around Upper Klamath Lake. The most recent surveys, after seven years of drought, were unable to find these fish in Rock Creek (Buchanan, et al, 1994).

Cottonwood Creek, a tributary to Klamath River downstream from Irongate Dam, is the only Klamath Basin stream in Oregon that has anadromous steelhead trout. Though managed for natural production in Oregon, they may be influenced by straying fish from California's hatchery production program.

Except for the prohibition on take of bull trout, these streams are managed under general angling regulations. These streams are more remote from urban populations and generally experience only light to moderate angling pressure. The majority of the stream mileage in this group lies on public lands or on large private holdings that are open to public access.

MANAGEMENT DIRECTION
Sycan River above the outlet of Sycan Marsh
North Fork Sprague River above RM 12
South Fork Sprague River above RM 10
Cascade Mountain streams
Tributaries to Klamath River in California

Summary

Natural production only of all trout species is the direction for this group of streams. Redband trout will be managed under the Wild Trout Management Option and introduced brook and brown trout under the Basic Yield Management Option (ODFW, 1987a). Steelhead will be managed under the Wild Fish Management Option, (ODFW, 1986). Hatchery reared fish will not be stocked. This approach is status quo for these streams which are generally the smaller, headwater tributaries of the basin. Being smaller and somewhat more remote, they have not been subject to intense angler pressure and have sustained populations of these species by natural production.

Management Direction. Natural Production; Wild Trout and Basic Yield Options

Policies

Policy 1. Redband and steelhead trout in these waters shall be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. Introduced brook and brown trout in these waters shall be managed for natural production consistent with the Basic Yield Management Option (ODFW, 1987a).

Policy 3. Steelhead will be managed under the Wild Fish Management Option (ODFW,1986).

Policy 4. No hatchery trout will be stocked in these waters.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of redband and steelhead trout in these waters.

Assumptions and Rationale

1.1 Redband and steelhead trout and introduced, naturalized brook and brown trout have maintained their populations in these streams by natural production for more than two decades.

1.2 Redband trout in Rock Creek may be extinct or out of compliance (less than 300 spawners) with Wild Trout Management Policy, (ODFW, 1992).

Actions

1.1 Implement a thorough biological survey of Rock Creek to determine the status of that unique redband trout stock, and if necessary, take actions to protect and restore that population.

1.2 Make periodic informal assessments of redband trout populations in these streams through spot checks on their distribution and abundance. If the informal work reveals a possible problem with a population, a formal survey should be implemented, and if necessary, actions taken to protect and restore that population.

Objective 2. Provide diverse fisheries for redband and introduced brook and brown trout.

Assumptions and Rationale

2.1 Natural production of redband and introduced brook and brown trout in these waters can sustain a consumptive fishery.

2.2 These streams provide a wide variety of angling opportunities for naturally produced trout in areas ranging from easy to remote access.

Actions

2.1 Provide for diverse angling opportunities that can be sustained by natural production.

2.2 Conduct periodic angler creel surveys to assess angler effort, catch, demographics and preferences.

2.3 Unless required for conservation purposes, angling regulations will be kept simple.

Lost River and tributaries (Figure 8)

Management Considerations

Status and distribution of redband trout in the Lost River watershed is not well documented or understood. There is enough information to conclude that they are not abundant and may exist in only a few isolated locations. The genetics of these fish has not been determined. Intermittent tributaries of Gerber Reservoir may support spawning populations that rear in the reservoir; however, in the past, many thousands of hatchery-reared rainbow trout have been stocked in the reservoir and they may be the source of this population. Miller Creek, downstream from Gerber Reservoir, has supported a population of redband-like trout but that stream was virtually dry during recent drought years. Substantial numbers of trout moved into Miller Creek during spring of 1996 with spill from Gerber Dam providing streamflow; those fish remained in the stream. This suggests trout occur in other areas of Lost River (Personal communications, Mark Beuttner, BOR, January 1997). Anecdotal information from anglers indicates there is some exchange of trout between Klamath River and Lost River via the Lost River Diversion Canal.

Lahontan cutthroat trout have been introduced in East Fork Lost River (Antelope Creek) and into Willow Valley Reservoir. There is potential for their natural reproduction in that stream and reservoir.

The Lost River sub-basin is in an area of low precipitation. Most streams are intermittent or have flows manipulated for storage and delivery of irrigation waters. Fish habitat has been deteriorated by excessive grazing of riparian areas and by channelization of streams. Extensive habitat improvements will be required to achieve greater fish production in this system, including perennial instream flows, appropriate fish passage, and restoration of riparian habitats.

MANAGEMENT DIRECTION
Lost River and tributaries

Summary

Trout in the Lost River drainage are limited to a few small, scattered populations that are largely limited by restricted habitats. Known exploitation of these fish is very low. Proposed management direction for these trout is consistent with the Wild Trout Management Option, (ODFW, 1987a).

Management Direction. Natural Production; Wild Trout Option

Policies

Policy 1. Redband trout in Lost River and tributaries shall be managed for natural production only consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. Hatchery trout will not be stocked in Lost River and tributaries.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of redband trout in Lost River and tributaries.

Assumptions and Rationale

1.1 There are only a few locations within the Lost River sub-basin with known trout populations.

1.2 It has not been determined whether, or not, these fish are wild, native stocks.

1.3 Habitat constraints will limit trout populations in this sub-basin to a few small groups.

1.4 Except for a few trout caught in Gerber Reservoir and Miller Creek, documented exploitation of trout in the Lost River sub-basin is very low.

Actions

1.1 Sample trout populations within the Lost River sub-basin for genetic analysis to determine whether, or not, they are wild, native stocks.

1.2 If genetic analysis confirms the presence of native redband trout, implement appropriate conservation measures (habitat restoration, angling regulations, etc.).

Objective 2. Provide consumptive fisheries for redband trout in these waters.

Assumptions and Rationale

1.1 Natural production of redband trout in these waters can sustain a consumptive fishery.

Actions

1.1 Provide for angling opportunities that can be sustained by natural production.

1.2 Conduct periodic angler creel surveys to assess angler effort, catch, demographics and preferences.

LAKES AND RESERVOIRS

Fourmile Lake

Management Considerations

Fish Stocking History

There is no record of an indigenous fish population in Fourmile Lake even though Fourmile Creek was a direct historical link between Fourmile Lake and Upper Klamath Lake.

Stocking records show that rainbow trout were first released there in 1936 when 50,000 fingerlings were liberated in the lake. In 1946, another 174,000 fingerlings were stocked. Up to 200,000 rainbow fingerlings were released in several years through 1961. Yearling rainbows were stocked in 1954, 1972, and 1973. An annual allocation of 10,000 Oak Springs stock rainbow fingerlings was released in the years 1978-1990. In 1991-1995, annual releases were made of 5,000-20,000 large fingerlings of Lot 28, "Klamath" redbands from Williamson River.

With the exception of only three years, brook trout were stocked annually between 1950 and 1965. Within that span, an average of 100,000 fingerling brook trout were stocked each year. In addition, from 1950 to 1956, a range of 2,800 to 8,000 legal-sized brook trout was released annually. No brook trout have been stocked since 1965.

Kokanee salmon fingerlings of Flathead Lake, Montana stock were released in Fourmile Lake in 1963 and 1964. A release of British Columbia stock kokanee salmon was made in 1965. No kokanee salmon have been stocked since that time. Although there are no records of kokanee salmon being stocked before 1963, they had been introduced some time earlier. Angler catch surveys starting in 1952 showed catches of kokanee salmon from Fourmile Lake. Kokanee salmon were stocked in some Oregon lakes in the 1930's.

Records do show 66,400 and 75,000 "silver" fingerlings being stocked in Fourmile Lake in 1932 and 1936, respectively. These "silvers" are thought to be coho salmon that were also being stocked around the state at that time. Coho salmon were also stocked in 1965 and 1966; 37,000 and 50,000 fingerlings were released in those years.

Angling Regulations

In 1981, the minimum size was 6 inches. The bag limit was 10 per day, but not more than 5 over 12 inches nor more than 2 over 20 inches. The regulations remained the same until 1984 when a special bag limit of 15 kokanee salmon was added. The special kokanee salmon limit was raised to 25 fish in 1988 and those rules have been in effect since that time. In 1997, the trout bag was changed to 5 fish per day, 8 inch minimum, not more than one over 20 inches.

Fish Management

There are no indigenous fish species in Fourmile Lake. Brook trout and kokanee salmon maintain their populations by natural production. Redband trout are stocked annually.

Brook trout

Brook trout have maintained a substantial population by natural production since they were last stocked in 1965. There are no known significant spawning streams entering Fourmile Lake, particularly for fall spawning brook trout. The specific spawning sites for this species are unknown but they are likely upwelling springs and or shoreline gravel areas.

Inventory has shown brook trout lengths up to 14.5 inches. Within the period 1988-94, the condition factor on 102 brook trout averaged 1.18 which is relatively slim for that species. Average length for those fish was 9.2 inches within a range of 5.9 to 14.1 inches.

Redband (rainbow) trout

The limited number of hatchery reared redband trout stocked in Fourmile Lake are successful in providing variety to the fishery and the largest individual fish in the angler's catch. In recent years, redbands up to 18 inches in length have been captured during inventory activities. Thirty-five rainbow and redband trout sampled between 1988 and 1993 had an average condition factor of 1.24, which is considered good. The average length of the sampled fish was 8.5 inches within a range of 4.1 to 17.6 inches.

Fourmile Lake and its watershed provides virtually no know spawning habitat for redband trout. There is no significant natural reproduction of that species.

Kokanee salmon

Fourmile Lake has had a naturally producing kokanee salmon population for many years. Spawning habitat for kokanee salmon has not been identified. As with the brook trout, there are no streams available to them. There are several areas of gravel substrate along the shoreline that may be providing their spawning habitat.

The time of their introduction is unknown. Creel census reports from 1952 show anglers taking good numbers of kokanee salmon in the 8-13 inch length range. In the years spanning 1959-1994, the average length of maturing female kokanee salmon has been 8.5 inches, within the range of 6.4 to 11.0 inches. The smallest lengths at maturity were seen in the years following stocking of hatchery reared kokanee salmon. Apparently, the additional competition resulted in the smaller fish. Maturing female kokanee salmon have averaged 8.8 inches in length over the past 10 years.

Angling regulations were liberalized in 1984 to allow for greater harvest of the small, abundant kokanee salmon. One objective of that strategy was to reduce the competition, thereby allowing the remaining fish to attain larger size. Success for that goal has been marginal at best. Since the great majority of kokanee salmon enter the angler catch as maturing fish, the additional harvest does nothing to address abundance of succeeding year-classes. To achieve large size in maturing kokanee salmon, the abundance of juvenile fish would have to be reduced. Logical options would either reduce the potential for reproduction by reducing the number of spawners or amount of spawning area, or introduce a predator that would thin out the juveniles and, therefore, reduce intraspecific competition.

Research on Odell Lake showed that spawning escapement of kokanee salmon was always adequate because of the self-regulating nature of the kokanee salmon fishery; when the catch rate falls because of small population size, anglers loose interest thereby allowing for adequate spawning escapement (Lindsay and Lewis, 1978). The small size of maturing kokanee salmon at Fourmile Lake does not attract enough angler interest to significantly reduce the population, even with the liberalized bag limit. Reduction of kokanee salmon spawning habitat is not practical since they apparently spawn within the lake.

Introduction of a predator fish species may be feasible and have merit for controlling kokanee salmon numbers while providing an additional species to the Fourmile Lake fishery. Habitat qualities in the lake appear to be ideal for lake trout; the lake's waters are deep and cold for rearing and the substrate is rocky for spawning. Lake trout juveniles would likely compete with brook and redband trout to some degree. Larger lake trout would probably prey on the other trout species. The condition of Fourmile Lake brook trout indicates they also could benefit from a reduction in their population size. At Summit Lake, rainbow and brook

trout, co-existing with lake trout, have very good condition factors. Numbers and condition of redband trout could be controlled by adjustment of stocking rates.

Management Issues

1. Drawdown of the lake level for irrigation use reduces important fish rearing area.

2. Small size of maturing kokanee salmon does not attract angler interest.

3. Mean condition factor for brook trout is below average for that species.

4. Successful introduction of lake trout could reduce population size in kokanee salmon and brook trout resulting in larger, better conditioned fish while providing variety and a trophy fish to the Fourmile Lake fishery.

MANAGEMENT DIRECTION

Fourmile Lake

Summary

Since there are no fish indigenous to Fourmile Lake, management with natural production of introduced species and stocking with hatchery reared fish is in compliance with the Wild Fish Management Policy.

Management of Fourmile Lake is for natural production of introduced brook trout and kokanee salmon and stocking of hatchery reared redband trout; these species will be managed under the Basic Yield Management Option in the Trout Plan (1987). No new special regulations will be needed. Additionally, management direction calls for the introduction and subsequent natural production of lake trout to provide biological control of kokanee salmon populations and add diversity to angler opportunities. Lake trout would be managed under the Trophy Fish Management Option in the Trout Plan (1987); a special minimum length limit will be required.

Management Direction: Natural and hatchery production; Basic Yield and Trophy Fish Options

Policies

Policy 1. Fourmile Lake shall be managed for natural production of brook trout and kokanee salmon and for hatchery reared redband trout under the Basic Yield Management Option in the Trout Plan (ODFW, 1987a).

Policy 2. Lake trout shall be introduced to Fourmile Lake and managed for natural production under the Trophy Fish Management Option in the Trout Plan (ODFW, 1987a).

Objectives

Objective 1. Provide consumptive fisheries for introduced, naturally producing brook and lake trout and kokanee salmon and for stocked, hatchery redband trout.

Assumptions and Rationale

1.1 There are no fish species indigenous to Fourmile Lake.

1.2 Introduced brook trout and kokanee salmon have maintained populations by natural production for many years and will continue to do so.

1.3 There is no spawning habitat for redband trout and, therefore, no opportunity for natural reproduction.

1.4 Rainbow and redband trout have been stocked in Fourmile Lake since 1936 and are also established in the drainage downstream from the lake.

1.5 Lot 28 redband trout originating from the Klamath Basin (Williamson River) will be used to stock Fourmile Lake.

1.6 The introduction of lake trout would provide diversity to angler opportunities by adding an additional species that will grow to large, trophy size.

1.7 Lake trout would prey on kokanee salmon, thereby, reducing kokanee salmon population numbers and allow them to attain larger size at maturity that would be more attractive to anglers.

1.8 Lake trout would, likely, also prey on brook and redband trout to a lesser extent. Reduction in brook trout population numbers should result in larger, better conditioned fish. Redband trout numbers can be controlled by adjusting stocking rates.

1.9 Oregon has no hatchery stock of lake trout; purchase of disease free certified lake trout eggs or fish from another source would have to be made for rearing and introduction into Fourmile Lake.

1.10 Lake trout are exotic to the Klamath and Rogue river basins; however, the introduction of certified lake trout to Fourmile Lake would cause no risk to native species in those systems. Should lake trout exit the lake:

a. There is no direct connection between the irrigation diversion (Cascade Canal) and the Rogue River drainage; diverted water is "strained" through lava beds before it reaches Fish Lake.

b. There is no appropriate habitat for establishment of lake trout in the Klamath River Basin downstream from Fourmile Lake.

1.11 After their introduction, Fourmile Lake would provide excellent habitat for natural reproduction of lake trout. It has cold, deep water of pristine quality and abundant rocky substrate for spawning.

Actions

1.1 Continue stocking Lot 28 "Klamath" redband trout annually.

1.2 Purchase certified disease free lake trout eggs or fish for rearing and introduction into Fourmile Lake.

1.3 Implement a special angling regulation for lake trout providing a minimum length limit of 30 inches to protect spawning fish and provide for trophy fish management.

1.4 Monitor abundance, size, age-class structure and distribution of brook, redband, and lake trout and kokanee salmon through annual inventory activities.

Objective 2. Prevent loss of fish at the Fourmile Lake irrigation diversion outlet structure.

Assumptions and Rationale

2.1 Losses of fish out of Fourmile Lake through the irrigation diversion outlet structure reduces the number of fish available to anglers on the lake.

2.2 Appropriate screening and maintenance of the outlet structure will prevent losses of fish from the lake.

Actions

2.1 Coordinate with the irrigation districts and or the Bureau of Reclamation to assure the outlet structure has appropriate screening and that the screens are inspected, repaired and cleaned as needed to prevent loss of fish.

Objective 3. Protect native trout in Fourmile Creek and tributaries downstream of Fourmile Lake from hatchery fish that move down out of the lake.

Assumptions and Rationale

3.1 Hatchery fish stocked in Fourmile Lake could, potentially, have detrimental impacts on native trout in Fourmile Creek should they move out of the lake.

3.2 Fourmile Lake rarely spills into Fourmile Creek, minimizing movement of hatchery fish from the lake to the creek.

3.3 Fourmile Creek is dry or is intermittent throughout its length and; therefore, it does not provide good habitat for any trout.

3.4 There are no know native trout populations in Fourmile Creek and its tributaries that would be subject to impacts from hatchery fish.

3.5 Lot 28 redband trout from Williamson River are stocked in Fourmile Lake to minimize the effects the hatchery fish might have on wild stocks downstream.

Actions

3.1 Inventory Fourmile Creek and tributaries to determine whether, or not, there are any native trout that could be impacted by hatchery fish straying from Fourmile Lake.

3.2 Continue using Lot 28 redband trout to stock Fourmile Lake.

Management Considerations

Fish Stocking History

The earliest report of fish stocking in Lake of the Woods was in 1913 when a private party introduced rainbow trout from Spencer Creek (Klamath River stock); the fish were from the Spencer Creek hatchery and were provided by the State Fish and Game Commission. In 1922, responding to requests from Lake of the Woods homeowners, the OSGC released a load of fish that had been seined from waters on Sauvies Island (on the Columbia River near Portland). That load included largemouth bass, warmouth bass, black crappie, bluegill and pumpkinseed sunfish, brown bullheads, yellow perch and carp, and perhaps suckers. Between 1925 and 1935, there were also many silver salmon (coho) and steelhead released in the lake; additionally, plants of more largemouth bass, Montana westslope cutthrout trout and chinook salmon were made (Bond, 1948). The history of subsequent fish stocking is detailed below by species.

Rainbow and Redband Trout

In the years 1926-1954, nearly a million rainbow trout fingerlings were stocked in Lake of the Woods. About 80,000 legal-sized rainbows were released between 1949 and 1954. The period 1956-1961 saw another 1.25 million fingerling and legal-sized rainbows released in the lake. From 1962-1966, rainbow fingerlings were stocked at a rate of 50,000 per year. More than 670,000 rainbow fingerlings of Oak Springs (Lot 58) and Roaring River (Lot 72) stocks were released between 1970 and 1986. Rainbow trout from the Eagle Lake, California stock were released in 1974-1988; within those years, 16,330 brood fish (2-4 pounds/fish) were stocked. In 1985 and 1986, there were 75,000 Eagle Lake rainbow fingerlings planted each year. Lot 72 legal-sized rainbows, 55,000, were released between 1988 and 1991. Beginning in 1988, "Klamath" redband trout, Lot 28, have been stocked; 83,000 fingerlings and brood fish were released between 1988 and 1994. The current allocation is for 15,500 Lot 28 redbands at 6 per pound and 20,000 "gradeouts" at 60 per pound.

Brook Trout

Brook trout were introduced to the lake in 1925; between then and 1933, there were 188,000 fingerlings released there. Nearly 600,000 fingerlings were stocked in the period 1958-1969. Between 1978 and 1993, brook trout fingerlings were stocked at a rate of 30,000 per year. Stocking of brook trout was discontinued after 1993 and there is no allocation for them at Lake of the Woods.

Kokanee Salmon

Kokanee salmon were first stocked in Lake of the Woods in 1958; from that year though 1976, they were released at a rate averaging 54,000 fingerlings per year. Those kokanee salmon were from various origins including early and late spawning stocks. Beginning in 1986, kokanee salmon at 100 per pound from Paulina Lake egg-takes have been released in Lake of the Woods at a rate of 25,000 per year; that is the current allocation.

Brown Trout

The current program of stocking brown trout (Wickiup Reservoir stock) in Lake of the Woods was initiated in 1986. Between then and 1990, there were 52,000 fingerlings (70-100/lb.) released there. Since 1991, when the program was changed to stocking yearlings,

another 70,000 brown trout have been liberated in the lake. The present allocation for brown trout is 5,000 per year at 6 per pound and 10,000 "gradeouts" at 30 per pound.

Angling Regulations

In 1981 the open season for all species was the entire year. The bag limit for trout, 6 inches and over, was 10 per day but not more than 5 over 12 inches nor more than 2 over 20 inches. The limit for possession or in 7 consecutive days was two times the daily limit. The bag limit for bass was 5 per day but not more than 3 over 15 inches. There were no bag limits on other warm-water game fish. In 1988, the trout and warm-water game fish seasons and bag limits were the same as in 1981 except the limit on bass was changed to incorporate a 12-inch minimum length limit. In 1994-1995, the seasons and limits for trout and warm-water species still remained the same, but the bass limit was changed to 5 per day, no minimum length limit but no more than one bass over 15 inches. The regulations for 1997 reduced the trout bag to 5 fish, 8 inch minimum length, not more than one over 20 inches; an additional 25 kokanee of any size was authorized.

Fish Management

Information from records indicate there were three types of fish that may have been indigenous to Lake of the Woods: redband (rainbow) trout, Tui chubs and suckers. A study in 1947 by Bond (1948) reported that rainbow trout were known to be present in the lake in the late 1800's, before the first known stocking in 1916. He also stated that there were reports of chubs and suckers in the lake before artificial plants were made. Tui chubs, two species of *Chasmistes* suckers (known as Klamath Lake suckers), and Klamath "coarse-scale" suckers were present in 1947. There was also a fourth sucker, *Catostomus occidentalis,* that was thought to be introduced or a hybrid.

After analyzing the physical parameters of Lake of the Woods and Seldom Creek, Dr. R. R. Miller, Professor of Biological Science, Curator of Fishes, University of Michigan, (personal communication, 1980) concluded that in its pristine condition, the lake was a "trout lake". He thought that the redband trout may have been the only original species but speculated that there may also have been Klamath speckled dace and sculpins, although the later two species were not documented in the earlier studies. Miller also concluded that there were probably no suckers native to Lake of the Woods (especially no *Chasmistes*, since such lake suckers "do not ascend small, steep tributaries anywhere in their range".

As described in the Fish Stocking History section, there were thousands of salmonids of several species stocked in Lake of the Woods. A variety of spiny-rays, catfish, perch and carp were introduced to the lake in 1922. Those warmwater fish subsequently proliferated and, despite intensive control efforts, made management impractical. The lake was treated with rotenone in 1955, eliminating all fish. After treatment, rainbow and brook trout, and kokanee salmon were stocked in the lake. Brown bullheads appeared in 1961 from illegal release as did chubs in 1973. Largemouth bass had been illegally stocked and established by 1984. Since then, black crappie and yellow perch have appeared from more illegal actions. The most recent official introduction was of brown trout, begun in 1986.

Currently, the known species list for Lake of the Woods and tributaries is: redband, brown and brook trout; largemouth bass; black crappie; yellow perch, brown bullheads; Tui and blue chubs. Klamath speckled dace were present in the 1970's and early 1980's but have not been seen in trap-net catches since 1981.

Rainbow and redband trout

Five different stocks of rainbow and redband trout have been released in Lake of the Woods since the 1955 treatment project. Those stocks were Oak Springs, Roaring River, Cape Cod, Eagle Lake and Klamath. There has been no evidence of significant natural production by any of these stocks.

Angler success for rainbow and redband trout has been poor since the late 1970's, apparently because of poor survival of stocked rainbows, both fingerlings and yearlings. In the 1980's, circumstantial evidence indicated that *Ceratomyxa shasta* might be present and responsible for the poor survival of the non-resistant rainbows that were being stocked. But, livebox tests with subsequent pathological examination found no evidence of the suspected disease. Never the less, resistant stocks were released after the late 1980's, but that change didn't seem to improve survival either.

Larger brood fish appeared to make relatively greater returns to the angler. This suggested that predators may have been impacting the small fingerlings and led to more use of yearling ("legal") sized redbands for stocking the lake. Unfortunately, that strategy has not led to great improvement. A creel survey during May and June, 1994 estimated a catch of 154 redband trout; up to 30% of that catch was likely from larger brood fish.

Data from annual inventory with gill-nets appears to reflect the influence of illegally introduced species that compete with and prey on trout. The number of rainbow trout caught per net can be compared over the period 1957 through the present. Those catches have been weighted relative to the number of fish stocked in order to make them comparable. In the period 1957-1961, soon after the lake was treated, the catch of rainbows per net averaged 3.48. By 1962, brown bullheads had been established in the lake. From 1962-1967, the catch of rainbows averaged 1.11 fish per net. Chubs made their appearance in 1975. Between 1975 and 1981, the average catch of rainbows rose to 1.92 fish per net. Largemouth bass were probably present as early as 1982, certainly by 1984. During the period 1982-1986, the catch per net of rainbows fell to 0.17. A few black crappies appeared by 1988. The use of larger, yearling sized trout was begun in 1988 and has continued through the present in an effort to minimize losses to predation. The catch per net of redbands from 1988-1995 has averaged 0.57, somewhat better than that seen most recently with fingerling redbands but not nearly as good as the pre-introduction catches. Yellow perch appeared in the lake in 1994 and have potential for great success and, therefore, adding to the competition with trout.

Another species was introduced to the lake in 1986 when brown trout were stocked. The brown trout have been of comparable sizes to the "Klamath" redbands and are also competing with the redbands. However, net catch data indicate the browns have enjoyed a much better rate of survival. In the years 1992-1995, the average catch of brown trout was 3.67 per net compared to 0.57 per net for the yearling redband.

Potentially, one other factor could be influencing the apparent survival of the "Klamath" redband yearlings. That stock originates from the Williamson River where their life history has them emigrating to Klamath Lake after up to a year of rearing in the river. If the hatchery-reared yearlings retain that behavior, they might be leaving the lake via Seldom Creek during the spring run-off. Whether, or not, these redbands are leaving the lake needs to be determined. If they are leaving the lake in meaningful numbers, screening of the outlet may be a feasible solution. If it is found that the "Klamath" redbands are not leaving the lake or if screening is not feasible, then discontinuing stocking of redband trout may be in order.

Brown trout

As mentioned above, brown trout stocking was initiated in 1986. Results of these releases have been relatively successful. The catch of brown trout in spring gill-net sets have

averaged 3.67 fish per net compared to 0.57 for the "Klamath" redbands. Anglers have reported catching browns up to 7 pounds and interest is growing among anglers targeting on this species. During the May-June, 1994 creel survey, an estimated 160 brown trout were caught by anglers. The percent of length frequencies observed in that creel census was found to be as follows:

Inches	6-8	8-10	10-12	12-14	14-16	16-18
Percent	3	20	48	16	10	3

Brook trout

Many brook trout were stocked in Lake of the Woods between 1957 and 1993. They were known to spawn in Rainbow Creek but natural reproduction was not enough to support a significant fishery. Even with stocking, brook trout did not appear often in the angler catch. The estimated catch of brook trout during the May-June, 1994 creel survey was 6, based on one fish observed. Brook trout that have been caught during inventory were usually in good condition. Stocking of brook trout was discontinued after 1993 because of their low level of contribution to the angler and budgetary restrictions. During the years 1982-1986, their appearance in gill-net inventories averaged 1.8 brook trout per net compared to 0.47 rainbow trout for that same period. Brook trout are still present in Rainbow and Billie creeks where their natural production may contribute minimal numbers to the lake population.

Kokanee salmon

Kokanee salmon of both early and late spawning races were stocked in Lake of the Woods between 1958 and 1977. They became the most popular species with anglers; in 1977, 80% of the angler pressure was in pursuit of kokanee salmon. There was a very successful ice fishery in 1967-1973 that yielded mainly mature kokanee salmon; although many kokanee salmon were caught in this fishery, most of them were spawned out and in very poor condition.

Kokanee salmon were also spawning naturally so that both hatchery and natural production were contributing to the population. During that period, in 1975-1979, fall trap-net catches averaged 700 kokanee salmon per set. Because of the apparent success of natural production, stocking of hatchery-reared kokanee salmon was discontinued in the years 1978-1985. This period of natural production only still yielded average trap-net catches of 600 kokanee salmon per set but angling success was poor. In response to angler requests and seeking a solution to the poor angler success, stocking of 25,000 early-spawning kokanee salmon fingerlings per year was resumed in 1986. When these hatchery fish began to mature, evaluation found that they made up 66% of the maturing fish in 1991. The average trap-net catch of kokanee salmon has since been more than 2000 kokanee salmon per net. The average length of maturing female kokanee salmon has been 9.6 inches, fork length since 1988, larger than the 8.9 inches averaged during the prior period of natural production only. Angler success has been better in recent years. The May-June, 1994 creel survey estimated an angler catch of 527 kokanee salmon.

Largemouth bass

Largemouth bass support a popular fishery but the elevation of the lake makes it marginal for this species. Bass growth is fairly slow compared to other Eastern Oregon populations. It takes seven years for a bass to reach 12 inches in Lake of the Woods. This slow growth is probably limited by temperature and not forage or some density dependent factor. The slow growth to harvestable size subjects fish to many years of natural mortality; as a result, this population is very limited in size. Suitable spawning habitat is abundant, but

cover is limited to downed timber along the margins of the lake and submerged aquatic vegetation which grows at the ends of the lake. Conditions in this natural lake are suitable for successful spawning so the bass population sustains a fairly even recruitment and does not suffer from wide swings in year-class strength.

Management of bass in Lake of the Woods is limited by their slow growth and subsequent cumulative natural mortality Present management is predicated on the assumption that the greatest recreational benefit would be realized by maintenance of large fish for bass anglers. A very low level of exploitation on large bass, however, could effectively eliminate that portion of the population.

Periodic inventories of the bass population will be critical for maintenance of a quality fishery. Sampling indices based on the length frequency distribution (Proportional Stock Density [PSD] and Relative Stock Density [RSD]) and population density (electrofishing catch per unit of effort [CPUE]) of bass should provide the needed measures of the structural characteristics of the population.

Brown bullheads

The first appearance of brown bullheads, after the 1955 treatment, was in 1961. Their natural production was very successful, resulting in an abundance of small "catfish". Through the 1970's, their average length was no more than 5 inches. By the mid-1980's, they averaged nearly 7 inches in length. In the early 1990's, they began to show significant growth and averaged 11.7 inches in the fall of 1994. In recent years, there has been no evidence of reproduction, only one year-class is present. Anglers were targeting these larger bullheads in 1993 and 1994. The 1994 creel survey in May and June estimated a catch of 284 bullheads. In spring of 1995, bullheads appeared to be scarce and few were caught by anglers.

Black crappie

Black crappie were first discovered in Lake of the Woods in 1988. A few more have been seen since then but their numbers are apparently not increasing greatly although habitat conditions should be suitable for their natural reproduction. Predation by bass may be controlling their numbers. There is no other feasible way to control them. Time will tell how black crappie fit into the mixed species population.

Yellow perch

Unsubstantiated reports of "large" yellow perch were heard in 1993. Schools of small perch were seen by snorkelers in 1994 and the first perch "in hand" was seen that year. In spring of 1995, many small perch were being caught off docks and electrofishing revealed small numbers of this species. It was mainly because of numerous, stunted yellow perch that Lake of the Woods was treated in 1955, so there is no question that they can be successful; the numbers seen already are evidence of that. Since there is probably no feasible way of controlling their numbers, the only hope is that competition and predation from other species may keep them in reasonable check, but it is more likely they will become abundant.

Blue and Tui chubs

Chubs were back in Lake of the Woods by 1973 from illegal introduction. Spring gill-net catches averaged 2.9 chubs per net in the years 1975-1984. From 1985 to 1994, the same sets caught 5.4 chubs per net. Over the same span of years, the number of chubs caught in the fall trap-net peaked in 1983 when 427 were captured. After 1984, chubs practically disappeared from the trap-net catches although they were still present in the lake, as the gill-net catches show. The numbers of chubs taken in the trap net fell off dramatically

soon after largemouth bass were established. The chubs that are seen lately are all larger, older specimens, indicating that the younger year-classes are being cropped off by predators.

Klamath speckled dace

Dace had been re-established in Lake of the Woods by the late 1970's and were usually present in the fall trap-net catches; between 1975 and 1981, the average catch was 10 dace per set. No dace have been caught in the trap net since 1981 which is likely the time largemouth bass were introduced. Dace may still be present but, if so, are rare.

Management Issues

1. Stocked rainbow and redband trout of the Klamath stock currently being released, both fingerling and yearling sized fish, have made poor returns to the angler.

MANAGEMENT DIRECTION
Lake of the Woods

Summary

Since all indigenous fish species were extirpated with the rotenone treatment in 1955, only introduced species are now present in Lake of the Woods. The recommended direction is for management for natural production and stocking with hatchery-reared fish; this direction would be in compliance with the Wild Fish Policy.

Kokanee salmon, brown and redband trout would be managed for natural production but would also be augmented with hatchery fish; they would be managed under the Basic Yield Management Option (ODFW, 1987a).

Brook trout would be managed for natural production under the Basic Yield Management Option (ODFW, 1987a).

Black crappie, brown bullheads, and yellow perch would be managed for natural production under the Basic Yield Management Option (ODFW, 1987b).

Largemouth bass would be managed for natural production under the Quality Management Option (ODFW, 1987b). The current special regulation limiting the take of bass over 15 inches would be continued.

Management Direction: Natural and hatchery production; Basic Yield and Quality Options

Policies

Policy 1. Lake of the Woods shall be managed for natural and hatchery production of kokanee salmon, and redband and brown trout under the Basic Yield Management Option, (ODFW, 1987a).

Policy 2. Lake of the Woods shall be managed for natural production of brook trout, black crappie, yellow perch and brown bullheads under the Basic Yield Management Option, (ODFW, 1987a,b).

Policy 3. Lake of the Woods shall be managed for natural production of largemouth bass under the Quality Management Option, (ODFW, 1987b).

Objectives

Objective 1. Provide for consumptive fisheries on introduced and hatchery produced kokanee salmon, redband and brown trout; and on naturally produced brook trout.

Assumptions and Rationale

1.1. There are no indigenous fish stocks in Lake of the Woods or its tributaries.

1.2. Introduced kokanee salmon reproduce naturally but not in numbers adequate to support an attractive fishery.

1.3. An allocation of 25,000 hatchery kokanee salmon is adequate to augment natural production and provide an attractive fishery on this species.

1.4. Small numbers of redband and brown trout may be produced naturally in Rainbow and Billie creeks but that would be incidental to the numbers of trout necessary to support a viable fishery for these species.

1.5. The current allocation of hatchery brown trout (Lot 68, Wickiup Reservoir) is building a population that is supporting a fishery targeting this species.

1.6. Returns to the angler of hatchery, Lot 28 (Klamath) redband trout have been poor and are not attracting a fishery specific to this species.

1.7. Because of their natural life history, Lot 28 (Klamath) redband trout may be emigrating from the lake during the spring run-off, thereby depleting the in-lake population.

1.8. Brook trout will maintain naturally-producing populations in Rainbow and Billie creeks that will make minor contributions to the lake which will add angling diversity.

Actions

1.1 Continue stocking hatchery kokanee salmon (Paulina Lake egg-take) at the current rate of 25,000 per year at 100 per pound.

1.2 Continue stocking hatchery brown trout (Lot 68, Wickiup stock) at the current rate of 5,000 per year at 6 per pound, and 10,000 "grade-outs" per year at 30 per pound.

1.3 Continue stocking hatchery redband trout (Lot 28, Klamath stock) at the current rate of 15,500 per year at 6 per pound and 20,000 "grade-outs" per year at 60 per pound. Continue to release surplus Lot 28 rainbow brood stock as needed for brood stock maintenance.

1.4. Determine whether, Lot 28, Klamath redband trout are emigrating from the lake during spring run-off.

1.4.1 If they are emigrating from the lake, work with the Forest Service to assess the current feasibility of screening the outlet; and if considered feasible, coordinate with the Forest Service to implement such screening.

1.4.2 If they are not emigrating and it is determined to be not feasible to screen the outlet, discontinue stocking Lot 28, Klamath redband trout and replace them with "legal sized" Cape Cod (Lot 72) rainbow trout.

1.4.3 If the outlet screening is successfully implemented but there is no significant improvement in the survival and return to the angler by Lot 28, Klamath redband trout, stocking of fingerlings and yearlings of that Lot should be discontinued and be replaced with "legal sized" Cape Cod (Lot 72) rainbow trout.

1.5 Monitor abundance, size, age-class structure and distribution of trout and kokanee salmon by conducting periodic creel surveys and through annual net and elecrofishing inventories

Objective 2. Provide a basic yield, consumptive fishery on naturally produced black crappie, yellow perch and brown bullheads.

Assumptions and Rational

2.1. Black crappie, yellow perch, and brown bullhead populations have the potential to "overpopulate", become stunted, and compete with other species, but not provide an attractive fishery because of their small size.

2.2. Feasible controls on crappie, perch and bullhead populations are limited to encouraging predator species (bass and brown trout); and to facilitating and encouraging a consumptive, basic yield fishery on these species (increasing angling mortality).

2.3. These species, especially the perch and crappie, are likely to support a larger proportion of the "family-oriented" fishery from docks and shore.

Actions

2.1 Encourage the unlimited take by anglers of yellow perch, black crappie and brown bullheads to help reduce their population size and; therefore, tend to increase the size of individual fish.

2.2 Publicize the potential of a successful ice-fishery for yellow perch and black crappie at Lake of the Woods given appropriate ice conditions providing for the safety of anglers.

2.3 Monitor abundance, size, age-class structure and distribution of crappie, perch and bullheads by conducting periodic creel surveys and through annual net and electrofishing inventories.

Objective 3. Provide a quality fishery for naturally produced largemouth bass as measured by the Proportional Stock Density (PSD) and the Relative Stock Density (RSD), and the electrofishing catch-per-unit-of-effort (CPUE).

Assumptions and Rationale

3.1. Largemouth bass support a dedicated fishery from anglers interested in large bass, but they are also an important species contributing to the "family-oriented", basic-yield type of fishery from docks and shore.

3.2. Management for larger bass has strong support from bass anglers.

3.3. Although largemouth bass in Lake of the Woods exhibit a slow rate of growth, they are capable of attaining lengths in excess of 15 inches.

3.4. Because of their slow growth rate, largemouth bass in Lake of the Woods have a relatively high rate of natural mortality before attaining large size; therefore, protection of small fish by regulation has little effect on the number of fish reaching "trophy" length. Their slow growth and high mortality rate results in a small number of large bass in the population, so any harvest of large bass can significantly reduce the numbers available to the fishery.

3.5. Largemouth bass are one of the "top predators" in the overall fish population in Lake of the Woods and; therefore, they are important for control of crappie, perch, bullhead and chub populations. Conserving the bass population would help control their forage populations.

3.6. Catch and release angling on all sizes of bass would benefit their population structure; but social and recreational benefits make catch and release regulations impractical.

Actions

3.1 Retain special regulations on largemouth bass at Lake of the Woods limiting the bag to 5 bass per day but no more than one over 15 inches in length.

3.2 Encourage catch and release angling for all sizes of largemouth bass.

3.3 Monitor abundance, size, age-class structure and distribution of largemouth bass by conducting periodic electro-fishing inventories to determine the following objectives over a 3-year average: PSD=25; RSD=8; electrofishing CPUE for fish over 200 mm at least 10 fish/1000 seconds.

Objective 4. Protect native trout in Seldom and Fourmile creeks downstream of Lake of the Woods from hatchery fish that may move out of the lake.

Assumptions and Rationale

4.1 Hatchery redband trout emigrating from the lake could, potentially, have detrimental impacts native trout in Seldom Creed, the outlet stream, and Fourmile Creek; however, there is

no known population of native trout in Seldom or Fourmile creeks, both being dry much of each year.

4.2 Lot 28 redband trout, from Williamson River, are used for stocking Lake of the Woods to minimize the risk of hatchery fish impacting native trout.

4.3 In the event that management reverts to the use of Lot 72, Cape Cod rainbow trout, the risk to native trout would remain low since they are less likely to emigrate and would be susceptible to *C. shasta* if they reached Klamath Lake.

Actions

4.1 Inventory Seldom and Fourmile creeks to determine whether, or not, there are native trout present that could be impacted by hatchery fish straying from Lake of the Woods.

Management Considerations

Fish Stocking History

According to ODFW records, brook trout were first stocked in 1930. Between 1930 and 1934, there were 275,000 brook trout released in the lake. The last stocking was made in 1957 when 5,000 were liberated. Brook trout were stocked in Miller Creek as early as 1925; between 1925 and 1932, an average of 18,000 was released annually. Fifty thousand brook trout fry were stocked in Miller Creek in 1949.

The first record of rainbow trout being stocked in Miller Lake was in 1931 when 29,000 were released there. Between 1935 and 1946, a total of 273,000 fingerling rainbows were stocked in the lake. In the years 1964-68, an average of 137,000 fingerlings was stocked annually. Allocations were reduced beginning in 1969; from then through 1991, 10,000-30,000 rainbow fingerlings (mainly Oak Springs stock) were released into the lake each year. Beginning in 1992, and presently, the annual allocation is for 10,000 yearlings of Lot 28 "Klamath" redband stock. Miller Creek received 20,000 small fingerlings and 500 legals in 1965 and 1966, respectively.

Brown trout were stocked in Miller Creek in 1964 and 1965 when 20,000 fingerlings were released each year. Stocking of brown trout in Miller Lake was begun in 1981; from then through 1990, about 5,000 fingerlings were released in most years. The allocation was changed to yearling brown trout in 1991 and is currently for 7,000 fish per year. All brown trout released in the lake have been from Wickiup Reservoir stock.

About 50,000 fry or fingerling kokanee salmon were stocked in the lake each year from 1964 to 1971. These fish were from various stocks including early-spawning British Columbia kokanee salmon and later-spawning fish from Montana.

Angling Regulations

In 1981, the angling season at Miller Lake was open for the entire year. The daily bag limit for trout 6 inches and over was ten per day, but not more than 5 over 12 inches nor more than 2 over 20 inches. In Miller Creek, the open season was April 25 - October 30 and the daily bag limit for trout 6 inches and over was five per day but not more than 1 over 20 inches. In 1983, regulations remained the same except a special bag limit of 15 kokanee salmon per day was added. In 1988, the special kokanee salmon bag limit was increased to 25 fish per day. In 1997, the trout bag was reduced to 5 fish, 8 inch minimum length, not more than one over 20 inches

Fish Management

Composition of indigenous fish fauna of Miller Lake is unclear. It is certain that a "landlocked" lamprey, *Enosphenus minimus*, was one of those native species. As part of the Klamath Basin, Miller Lake could have had redband trout, Tui chubs and, possibly, bull trout, but no documentation has been found to support the natural presence of any of those species. Since the lamprey was parasitic on fish, it is conclusive that there was another fish species present.

Rainbow trout stocking was initiated in the early 1930's which clouded subsequent determination of their natural presence. The earliest available reports addressing Miller Lake (OSGC, 1951), described the lampreys parasitizing rainbow trout and Tui chubs to the point where the trout fishery was virtually eliminated. There was no mention of bull trout (Dolly Varden). Although the chub could have been native, given the relatively poor habitat for chubs

and the history of unauthorized introductions of chubs in Cascade lakes, it is at least equally probable that the Tui chub was not an indigenous species in Miller Lake. By process of elimination, the redband trout was most likely the other indigenous species.

One possible scenario could be that, after Miller Lake was cut off from the remainder of the Klamath Basin, lampreys and redbands coexisted until artificial stocking provided a greatly increased food source for the lampreys. That situation caused an explosion in the lamprey population that subsequently impacted the trout population and fishery.

Relative to present and future management, all of this previous history is moot. "Miller Lake, located twelve miles west of Chemult, was poisoned September 16, 1958, to remove a population of a landlocked form of Pacific lamprey and the Klamath roach," (OSGC, unpublished monthly report, 1958). In 1964, after the toxaphene, used for the treatment, was no longer toxic, stocking was reinitiated. Subsequent fish management is described below.

Rainbow trout

As detailed in the Fish Stocking History section, rainbow and redband trout have been stocked in Miller Lake annually since 1964. Current management calls for stocking of "Klamath" redband trout, Lot 28. This species contributes to diversity in the fishery and may also feed on small kokanee salmon, thereby helping to control that population.

Miller Creek was also restocked with rainbow trout in 1965 and 1966 but not since then. Redbands from the lake may emigrate down the creek, but there is no where for them to go since the creek dries up near Beaver Marsh.

Kokanee salmon

Kokanee salmon were introduced to Miller Lake for several years after the treatment project. They were successful in natural reproduction and stocking was discontinued after 1971. Highly successful natural production in the face of low productivity resulted in a population of "stunted" kokanee salmon. An effort was made to reduce kokanee salmon spawning by constructing a barrier-weir on Evening Creek. The kokanee salmon subsequently spawned within the lake and there was no significant gain in their size. The brown trout population was bolstered with increased stocking with the objective of providing more predators on the kokanee salmon. Special, more liberal, bag limits were adopted allowing for increased harvest by anglers.

Length of maturing kokanee salmon has averaged 7.9 inches since 1974. In the past four years, the kokanee salmon length at maturity has also been 7.9 inches. That figure indicated that measures taken to reduce kokanee salmon numbers and increase their size has been ineffective although the fish maturing in 1994 averaged 8.8 inches which is the third largest size seen in Miller Lake.

Brown trout

Brown trout were re-introduced to Miller Creek in 1964 and 1965. Some of those fish apparently moved upstream into the lake because there were brown trout present, in small numbers, prior to 1981. In 1981, stocking of brown trout was initiated in the lake to: 1. Act as a biological control on the kokanee salmon population, and, 2. Increase the numbers of this popular, trophy species and add to the diversity in the fishery. They do feed on kokanee salmon. One 20.5 inch brown trout sampled in 1994 had three 7.5 inch kokanee salmon in its stomach. They do grow to "trophy" size; a number of over-20 inch fish have been seen in the net catches and at least one 10-pound brown was caught by an angler.

There may be a minor bit of natural production by brown trout but not enough to sustain the fishery and act as a control on kokanee salmon. The current management calls for stocking of 7,000 yearling brown trout (Wickiup stock), annually.

Management Issues

1. Small size of kokanee salmon detracts from attracting angler interest in that fishery.

2. The life history of "Klamath" (Williamson River) redband trout may result in a tendency for them to emigrate from the lake down Miller Creek, therefore reducing the number of fish available to anglers in the lake.

MANAGEMENT DIRECTION
Miller Lake and Miller Creek

Summary

Since all indigenous fish stocks were extirpated with treatment of the system in 1958, only introduced species are now present in Miller Lake and Miller Creek. Recommended management direction is for continuation of current management which is in compliance with the Wild Fish Management Policy. In Miller Lake, kokanee salmon will be managed for natural production under the Basic Yield Management Option (ODFW 1987a). Redband and brown trout will be stocked annually and also managed under the Basic Yield Management Alternative. Redband (rainbow) and brown trout in Miller Creek will be managed for natural production under the Basic Yield Management Option. No new special regulations would be necessary.

<u>Management Direction:</u> Natural and hatchery production; Basic Yield Option

Policies

Policy 1. Miller Lake shall be managed for natural production of kokanee salmon and for hatchery reared redband and brown trout under the Basic Yield Management Option (ODFW, 1987a).

Policy 2. Miller Creek shall be managed for natural production of redband (rainbow) and brown trout under the Basic Yield Management Option (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for introduced, naturally producing kokanee salmon and stocked, hatchery-reared redband and brown trout.

Assumptions and Rationale

1.1 There are no indigenous fish species in Miller Lake.

1.2 Introduced kokanee salmon have maintained their population by natural production for more that 20 years and will continue to do so.

1.3 The amount of appropriate spawning habitat for trout is negligible and; therefore, there is little opportunity for their natural production.

1.4 There is very limited potential for improving spawning habitat for trout. Any such effort would likely also enhance kokanee salmon production which is already excessive.

1.5 There are no wild fish populations in Miller Creek that could be impacted by redband or brown trout stocked in Miller Lake.

1.6 Lot 28 redband trout originating from the Klamath Basin (Williamson River) will be used to stock Miller Lake.

1.7 Lot 68 brown trout, Wickiup stock, will be used to stock Miller Lake.

Actions

1.1 Continue stocking Lot 28 "Klamath" redband trout and Lot 68 "Wickiup" stock brown trout, annually.

1.2 Monitor abundance, size, age-class structure and distribution of rainbow and brown trout and kokanee salmon through annual inventory activities.

1.3 Monitor fish movement out of Miller Lake, down Miller Creek, to determine the numbers of "Klamath' rainbow trout (and others) that may be leaving the lake.

1.4 Monitor size and species composition of anglers catch through periodic creel surveys.

Objective 2. Provide a consumptive fishery for introduced, naturally producing redband (rainbow) and brown trout in Miller Creek.

Assumptions and Rationale

2.1 Rainbow (redband) and brown trout have maintained populations by natural production in Miller Creek since their introduction 30 years ago and will continue to do so.

Actions

2.1 Monitor abundance, size, age-class structure and distribution of redband (rainbow) and brown trout through periodic inventory activities such as electrofishing, snorkeling and angler creel checks.

Management Considerations

Because there were no indigenous fish in these lakes, application of the Wild Fish Management Policy (ODFW 1992) for these lakes is much more limited. A "wild only" alternative is not required in this case; however, movement of hatchery fish out of the lakes and into wild populations downstream is a concern and will be addressed in this plan. Historically, these lakes were barren of fish likely because they are geologically young and have not been connected with other water bodies. In cooperation with the USFS, ODFW has stocked a variety of trout species since the 1910's. The Cascade Mountain lakes were first stocked utilizing packhorses by USFS and ODFW personnel. From the early 1950's through early 1980's, each lake was stocked by fixed-wing aircraft. Since then each lake has been stocked annually or biennially using a helicopter.

At the inception of the stocking program, limnological information was gathered at each lake to determine if it would support fish life. One or more trout species were stocked if the lake appeared to be suitable. Fish stocked in the past include several races of rainbow trout, brook trout, and cutthroat trout. Presently, fish stocking decisions are guided by periodic lake surveys, creel surveys, historical records, and anecdotal information from fishermen. Within the area covered in this plan, the Department has determined that 33 of the more than 200 Cascade Mountain lakes and ponds and one on Gearhart Mountain are capable of sustaining trout throughout the year.

The Department currently stocks brook trout (original brood unknown, possibly from New Jersey) or Klamath rainbow trout (Lot 28 stock from Williamson River) in Cascade Mountain lakes; Cape Cod stock rainbow trout are released in Blue Lake. Brook trout stocked are fall spawners while the rainbows are winter spawners. Inventories show no natural reproduction.

ODFW currently manages Cascade and Gearhart Mountain lakes under the Basic Yield Management Option in the Trout Plan (ODFW, 1987a). Fisheries under this alternative are of a general consumptive nature and production is based on fingerling stocking and the water's natural rearing capability. One objective of this program is to provide a diversity of fisheries to anglers. This diversity may be measured in difficulty of access, or uniqueness of species or the combination of species available at each lake. The Department has found brook and rainbow trout best suited to provide a legal-size fish within one to two years. Lakes have been stocked on an annual basis in past years but due to current budget limitations stocking is now conducted biennially.

The stocking rate in each lake depends on size, productivity, catch rate, survey information, and past experience. Target size at stocking is 150 to 200 fish per pound. Survival and catch rates vary annually and for each lake and the number subsequently stocked is adjusted accordingly.

There is no conclusive data to confirm movements of hatchery fish out of the lakes, but the potential risk to downstream wild populations affects management alternatives. Information on each lake's outlet and inlet has been compiled from periodic lake surveys that began in 1932, from Oregon Water Resources Board maps and United States Geological Survey (USGS) maps, and from field observations of ODFW district personnel; this information is shown in Table 3. These lakes have outlets that are either ephemeral or have no outlet, the water being contained within the lake basin. Status of lake outlets listed in Table 3 is subject to change as future high lake surveys provide more updated information. Outlet status is important because Wild Fish Management Policy (1992) directs the Department to not

authorize introduction of non-indigenous fish in locations where impacts to wild populations might occur from hybridization, competition, disease introduction, or predation. Brook trout interbreeding with bull trout exemplifies such a concern. Dambacher et al. (1992) found negative interactions between introduced brook trout and wild bull trout in CLNP where interbreeding resulted in sterile offspring and, eventually, diminished numbers of bull trout. Stocking of North Puck Lake with brook trout was discontinued in 1993 because of potential risks to Threemile Creek bull trout even though there appears to be no outlet from North Puck Lake.

In recent years, there has been a growing concern about impacts of fish stocking on native lake ecosystems. Herpetologists are concerned that stocking fish into lakes may disrupt amphibian populations. Blaustein (in press, 1993) found mortality in western toad *Bufo boreas* eggs from the fungus *Saprolegnia ferax* in Lost Lake, Todd Lake, and Three Creeks Lake (Deschutes NF). While *Saprolegnia spp.* occurs naturally in these lakes, it is also a common pathogen of hatchery fish. Although *Saprolegnia* appears to be an acute cause of mortality in *B. boreas,* research suggest that their susceptibility may be exacerbated by increased levels of ultraviolet-B radiation measured at these lakes (Blaustein, A. presentation to American Fisheries Society. Sunriver, OR. February 1994). It is unknown at this time if stocking of hatchery fish, changes in the ozone layer, or both are causing these losses.

Liss et al. (1991) found in studies in the Washington Cascades that introduced fish populations can have substantial effects on plankton, aquatic insect, and salamander populations. The Cascade frog *Rana cascadae* is known to occur at high elevations east of the crest of the Cascades. It is listed as a Federal Candidate species and the Department lists it as State Sensitive- Critical. The spotted frog *Rana pretiosa* also occurs in this region and is listed as State Sensitive- Critical and Federal Candidate species. It is difficult to assess impacts of fish stocking since historic and current distribution and abundance of these amphibians in the region of the Cascade Mountains covered in this plan is unknown. Hopefully, further research and additional inventories of native amphibians will help answer these questions.

These issues indicate a need to examine the ODFW stocking program of the Cascade and Gearhart Mountain lakes with regard to its potential ecological impacts to natural ecosystems. ODFW is committed to the conservation of native ecosystems, and will work jointly with the USFS to identify the lakes appropriate for fish management activities. In 1985, through its representative, the International Association of Fish and Game Agencies, ODFW signed a Memorandum of Understanding with the USFS that resolution of recreation management in wilderness areas of Oregon, including fish stocking, would be addressed through cooperative development of Wilderness Management Plans. To date, the format and protocol for addressing these issues in Wilderness Management Plans has yet to be developed. This plan will provide interim direction until amended following concurrence with the USFS of new fish stocking policies for these lakes as part of jointly developed wilderness management plans.

Personnel from WNF have indicated some lakes have recreational use approaching or beyond limits of acceptable change. Recreational fishing is one activity that may be contributing to heavy use. Other factors such as distances to the trailhead, ease of terrain, distance to neighboring lakes, or outstanding scenic beauty also effect levels of use. It may be possible to redistribute anglers through reduction or discontinuation of fish stocking, removal of trail access, or other management actions. Again, these issues will be settled in the future in Wilderness Management Plans.

ODFW has been committed to not stocking any new lakes since 1978 in the Cascade Mountain lakes. Many lakes and ponds in this region of the Cascade Mountains are not stocked. These lakes range in size from small ponds to several acres in surface area.

Currently, Cascade and Gearhart Mountain lakes are open for fishing all year with a 5-trout bag limit, minimum length 8 inches, no more than one over 20 inches.

MANAGEMENT DIRECTION
Cascade and Gearhart Mountain Lakes

Summary

Management direction for the Cascade and Gearhart Mountain lakes within the Klamath River Basin shall be for hatchery production managed under the Basic Yield Management Option, (ODFW, 1987a). None of these lake had indigenous fish species and there is virtually no habitat available for the natural production of trout.

Management Direction: Hatchery Production; Basic Yield Option

Policies

Policy 1. Cascade and Gearhart Mountain lakes within the Klamath River Basin shall be managed for selected species of hatchery reared trout and managed for the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide consumptive fisheries for selected trout species in Cascade and Gearhart Mountain lakes of the Klamath River Basin.

Assumptions and Rationale

1.1 There is a high level of public interest in retaining this fishery.

1.2 Many of these high lakes have been stocked periodically since the 1910's.

1.3 Suitable spawning habitat does not exist in these lakes and periodic stocking is required to maintain a fishery.

1.4 These angling opportunities depend on Winema NF adhering to Standards and Guidelines in the LRMP to maintain the natural productive capacity of each lake.

1.5 There may be opportunities to stock additional trout species in the high lakes.

1.6 Diversity may be measured in difficulty of access or the trout species or combination of species available at each lake.

Actions

1.1 Periodically stock the lakes listed in Table 3 with hatchery rainbow trout and or brook trout.

1.2 Periodically inventory trout populations in stocked lakes for size, growth, condition factor, and species composition.

1.3 Periodically monitor angler effort and catch.

1.4 Continue to adjust the high lakes stocking program to meet the productivity and angler use of each lake.

1.5. Investigate the possibility of introducing new trout species to increase the diversity of the fishery.

1.6 Continue to work with Winema and Fremont NF to document adherence to LRMP Standards and Guidelines.

Objective 2. Minimize the impacts of hatchery trout stocked in Cascade and Gearhart Mountain lakes on the production and genetic integrity of wild trout and native wildlife in the Klamath River Basin.

Assumptions and Rationale

2.1 Some high lakes have outlets that may allow hatchery fish access to waters containing wild fish populations.

2.2 Effects of emigrating hatchery fish on wild fish populations is unknown but poses certain risks.

2.3 Where high lakes have connections to waters containing wild trout and native wildlife, maximizing harvest or eliminating same-species stocking will minimize impacts to wild fish and native wildlife.

2.4 Information on the outlet status of some high lakes needs to be confirmed.

Actions

2.1 Survey high lake outlets that drain into the Klamath River Basin to determine if wild trout, naturalized populations of introduced trout or native wildlife are present. If hatchery trout stocked in the lakes have access to downstream wild trout populations of the same species, electrophoresis or morphometric measurements may be necessary to determine the degree of interaction between wild and hatchery trout.

2.2 Continue to use hatchery stocks that demonstrate a minimum of migratory behavior.

2.3 Determine if elimination of stocking is needed to minimize impacts of hatchery fish on wild fish or native wildlife and act as necessary.

2.4 Determine outlet condition of those lakes listed in Table 3 with unknown status.

Objective 3. Manage Cascade and Gearhart Mountain lakes fisheries consistent with wilderness management plans to be jointly developed with Winema and Fremont National Forest personnel.

Assumptions and Rationale

3.1 Recent research has shown introduced hatchery fish populations may negatively impact native amphibian and macroinvertebrate populations and plankton ecosystems in high lakes. It is unknown at this time if these actions are causing a serious depletion in these ecosystems in Cascade and Gearhart Mountain lakes.

3.2 Some effects of introduced hatchery fish may be irreversible.

3.3 Without a Wilderness Management Plan in place, the Klamath River Basin Plan will provide direction in the interim.

Actions

3.1 Work with the Winema and Fremont NF to determine if stocking of hatchery fish in high lakes has negatively effected native species ecosystems.

3.2 Work with the Winema and Fremont NF to determine the cause of damage to land surrounding high lakes stocked with hatchery fish. Manage the fishery to minimize the problem if the attraction of people to the fishery is the source of the damage.

3.3 Identify jointly with USFS lakes that have intrinsic values that preclude fish stocking and discontinue stocking.

3.4 Develop a monitoring plan with Winema and Fremont NF to assess the impact to Cascade and Gearhart Mountain lakes as a result of fish stocking.

Table 3. Cascade and Gearhart Mountain lakes program

	Lake Name	Map location	Elev.	size	Depth	Species*	No. stocked	Outlet status	Land
			feet	acres	feet	allocated			Management @
1	Badger	T36S R5E S04	5,920	9	11	BT	500	n-bsn	Wilderness
2	Bert	T35S R5E S22	6,050	2	10	BT	500	n-bsn	Wilderness
3	Blue	T35S R16E S17	7,031	20	35	Rb	2,000	n-bsn	Wilderness
4	Clover	T37S R6E S28	6,700	2	8	BT	300	y-i-Clover Creek	Wilderness
5	Como	T37S R6E S21	6,750	7	32	BT, Rb	750/750	y-i-Moss Creek	Wilderness
6	Deep	T34S R5E S14	5,950	4	17	BT	1,000	y-DE	Wilderness
7	Deer	T34S R5E S34	6,075	5	15	BT	1,000	n-bsn	Wilderness
8	Donna	T34S R5E S23	5,960	2	9	BT	500	y-DE	Wilderness
9	Echo	T37S R6E S22	6,680	5	16	BT	500	n-bsn	Wilderness
10	Elizabeth	T34S R5E S35	6,020	3	8	BT	500	n-bsn	Wilderness
11	Fisher	T34S R5E S23	6,050	2	9	BT	300	y-i-Marguette Lake	Wilderness
12	Francis	T35S R6E S17	6,520	3	12	BT	750	y-i-Rock Creek	Semi-primitive Rec.
13	Harriette	T37S R6E S22	6,750	70	63	BT, Rb	1,500/1,500	y-DE	Wilderness
14	Heavenly Twin, Big	T34S R5E S35	5,975	25	13	BT, Rb	1,000/1,000	n-bsn	Wilderness
15	Heavenly Twin, Lit.	T34S R5E S35	5,950	7	17	BT	500	n-bsn	Wilderness
16	Isherwood	T34S R5E S26	5,980	16	17	BT, Rb	1,000/1,000	n-bsn	Wilderness
17	Long	T35S R5E S27	6,080	37	9	BT	1,000	y-i-Horse Cr	Wilderness
18	Marguerette	T34S R5E S14	6,020	15	29	BT, Rb	1,000/1,000	y-DE	Wilderness
19	Mystic	T37S R6E S26	7,240	2	14	BT	300 (1991)	y-i-S. Pass Lk	Wilderness
20	Notasha	T34S R5E S35	6,035	6	27	BT, Rb	300ea(1991)	n-bsn	Wilderness
21	O'Donahue	T34S R5E S23	6,160	3	17	BT	500	n-bsn	Wilderness
22	Paragon	T37S R6E S26	6,980	3	8	BT	300 (1991)	y-i-S. Pass Lake	Wilderness
23	Puck, North	T34S R5E S12	6,450	7	18	Rb	750	n-bsn	Wilderness
24	Puck, South	T34S R5E S12	6,450	24	10	BT	1,500	n-bsn	Wilderness
25	Snow	T34S R5E S14	6,080	3	8	BT	400	n-bsn	Wilderness
26	Sonja	T34S R5E S23	5,875	8	38	BT, Rb	1,000/1,000	n-bsn	Wilderness
27	South Pass	T37S R6E S24	6,525	8	8	BT, Rb	500/1,000	y-DE	Wilderness
28	Squaw	T36S R5E S06	5,745	26	11	BT	1,000	n-bsn	Wilderness

	Lake Name	Map location	Elev.	size	Depth	Species*	No. stocked	Outlet status	Land
			feet	acres	feet	allocated			Management @
29	Tananger	T34S R5E S14	5,840	5	12	BT	750	n-bsn	Wilderness
30	Trapper	T34S R5E S23	5,938	17	11	BT	1,500	y-i-Cherry Creek	Wilderness
31	Weston	T37S R5E S18	6,400	2	16	BT	300 (1993)	n-bsn	Wilderness
32	Wind	T34S R5E S15	6,030	2	8	BT	300	y-DE	Wilderness
33	Wizard	T34S R5E S26	5,910	5	17	BT	1,000	n-bsn	Wilderness
34	Woodpecker	T36S R5E S04	5,910	3	11	BT	500	n-bsn	Wilderness

* refers to BT= brook trout, RB= rainbow trout, @- refers to Winema National Forest Land and Resource Management Plan (1990). n= no, y= yes, bsn= basin lake with no outlet, DE= outlet present and flows to ground water or water body listed, i=intermittent flow to water body listed, unk= unknown status.

Management Considerations

Howard Prairie Reservoir presently contains rainbow trout, redband trout, brown bullheads, pumpkinseed sunfish, golden shiners, and speckled dace. Redband trout and speckled dace are indigenous in tributaries above the reservoir. Redband trout, Jenny Creek suckers and Klamath speckled dace are native to the Jenny Creek system which receives occasional spill from the reservoir. Rainbow trout have been stocked in the reservoir since 1959. The other fish species were probably introduced by anglers. Bullheads were first sampled in 1964 and pumpkinseeds and golden shiners were found in 1972.

In 1986 the OFWC accepted the staff and public's recommendation to manage Howard Prairie Lake for hatchery trout and brown bullheads.

Since 1986, the reservoir has been stocked with between 250,000 and 350,000 fingerling hatchery rainbow trout annually. These trout have been stocked with a planting boat to provide better distribution of fish and reduce mortality from avian predators. Over the years stocking rates have been manipulated to attain "peak production" based upon the following criteria:

1. Fingerling rainbow stocked in late spring should grow to 10 inches by the following spring.

2. Condition factors should average 1.30.

3. The catch rate during late April should average 0.7 fish per hour.

The rainbow trout population is healthy; condition factors on yearlings are well above 1.0. Length at maturity has ranged from 12 to 16 inches. Yearling rainbows average 10 to 12 inches in late April. Stocked fish normally grow rapidly; however, during dry years when the reservoir is drawn down severly by fall, their growth rates drop significantly

Howard Prairie Reservoir is one of the most popular and productive reservoirs in the state, and sustains very high angling pressure. Jackson County Parks estimates about 250,000 angler visits per year. Angling pressure for trout at Howard Prairie Reservoir is heavy, while pressure on the brown bullhead population is light. Through 1973, the early season catch rate on trout was in excess of 1.0 fish per hour and in 1967 it peaked at 1.6 fish per hour. Since that time, catch rates have ranged from 0.1 to 0.9 fish per hour with an average 0.6. The majority of the trout exceed 10 inches by late spring. Since 1974, fish over 10 inches in the creel have ranged from 89 to 99% with an average of 94%.

In 1982, the reservoir opened to year-round angling. The popularity of winter angling increased significantly the first few years but pressure was dependent on weather and ice conditions. During the winter of 1984, peak pressure counts on sunny days averaged 50-100 anglers, and peaked at 170 anglers in early February. Concern over the winter ice fishery was raised by spring and summer trout anglers and by the resort owner. They believed that too many fish were being harvested during the winter, and that reduced spring and summer catch rates. Creel census data showed that anglers averaged 1.03 fish per hour from February 1984 through 1986. However, during April of the two good ice years 1984 and 1985, angling success fell off to 0.37 fish per hour. Regulations were changed and fishing during the winter months was not

allowed after the 1987 winter season. Current angling regulations provide for an open season from late April through October with general bag and length limits.

Oak Springs stock fingerling rainbow trout are currently used in Howard Prairie Reservoir. If they can move upstream or downstream from the reservoir, fish from this stock may compete with and displace native stocks. Oak Springs rainbows generally spawn in the fall and should not interbreed with native spring spawning stocks. Oak Springs rainbows may also compete with and displace the rare Jenny Creek sucker in outlet streams below Howard Prairie Reservoir.

Annual sampling indicates that there may be some competition between trout and other fish species in Howard Prairie Reservoir. A chemical treatment, however, does not appear necessary unless combined warmwater and non-salmonid fish populations increase to 90% of the entire population.

MANAGEMENT DIRECTION
Howard Prairie Reservoir

Summary

Management direction proposed for Howard Prairie Reservoir is essentially status quo. It will be managed for hatchery production of rainbow trout to produce a consumptive fishery under the Basic Yield Management Option, (ODFW, 1987a). Warmwater gamefish will fall under the Basin Wide management direction for natural production consistent with the Basic Yield Management Option, (ODFW, 1987b).

Management Direction: Natural and hatchery production; Basic Yield Option.

Policies

Policy 1. Howard Prairie Reservoir shall be managed primarily for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for hatchery trout.

Assumptions and Rationale

1.1 Howard Prairie Reservoir is capable of rearing hatchery rainbow trout fingerlings up to 10 inches in length in one year.

Actions

1.1 Evaluate trout survival and angler catch with annual creel surveys, net and electrofishing inventories.

1.2 Modify annual stocking rate of 350,000 fingerling rainbow at 75 per pound and angling regulations as needed to meet the following criteria:

a. Fingerling rainbow stocked in late spring should grow to 10 inches by the following spring.

b. Condition factors should average 1.30.

c. The catch rate during late April should average 0.75 fish per hour.

d. Stocking levels should reflect reservoir levels at time of stocking.

Objective 2. Protect unique wild trout in the tributaries to Howard Prairie Reservoir and the wild trout and sucker populations downstream from Howard Prairie Reservoir in Jenny Creek from hatchery fish that may move out of the reservoir.

Assumptions and Rationale

2.1 The Oak Springs stock of rainbow trout is currently used in Howard Prairie Reservoir; if those trout leave the reservoir, they may compete with and displace native fish in streams above and below the reservoir.

2.2 Native trout in the tributaries to Howard Prairie Reservoir are assumed to be of the same unique redband trout stock found in the Jenny Creek system downstream from the reservoir.

Actions

2.1 Determine the classification of native trout living in tributaries to Howard Prairie Reservoir.

2.2 Inventory tributaries to Howard Prairie Reservoir for presence and abundance of Oak Springs stock rainbow trout that may have emigrated from the reservoir.

2.3 Inventory Jenny Creek below Howard Prairie Reservoir for presence and abundance of Oak Springs stock hatchery rainbow trout and other species that may have emigrated from the reservoir.

2.4 If fish are moving downstream through the outlet structure, work with staff from BOR and TID to provide and maintain facilities to prevent movement of fish from Howard Prairie Reservoir to Jenny Creek.

Management Considerations

Water stored in Hyatt Lake is mainly directed downstream and diverted to the Rogue River Basin for irrigation purposes. During periods of spill, those waters flow into Keene and Jenny creeks where native redband trout, Jenny Creek suckers and Klamath speckled dace reside.

Hyatt Lake was stocked with warmwater fish shortly after its formation in 1923 and was managed for those species until 1960. At that time the lake was treated with rotenone by ODFW to remove a population of stunted fish. The lake was then restocked with bass, bluegill, and rainbow trout. Hyatt Lake proved capable of providing an excellent trout fishery, but unauthorized releases of other fish species have required three more chemical treatments. A good trout fishery declined by the mid-1960s because of competition with Tui chubs and brown bullheads. The lake was again treated in 1967 and restocked with rainbow trout. In 1977, the lake was treated a third time to eliminate competition from brown bullheads. After the 1977 treatment, Hyatt was again a productive trout lake until the late 1980s when survival and growth of rainbow fingerlings declined. The adult largemouth bass population provided a fairly popular fishery and fish in excess of 5 pounds were not unusual. However, annual sampling indicated that juvenile bass production was poor, probably because of competition with extremely abundant brown bullheads.

A proposal by ODFW to treat the lake in 1988 was denied by strong public opposition. Opponents attempted to collect surplus brown bullheads with seines and nets, but that effort was abandoned when about 32,000 bullheads were removed from the trapnet the first day. The bullhead population in the lake was estimated at 7.5 million. In 1989 a Hyatt Lake Management Advisory Committee was created. It included landowners, agency personnel, sportsman's club members, legislators, and other interested individuals. The group agreed that the lake should again be chemically treated to eliminate the bullheads in favor of trout, warmwater fishes, or a combination of warmwater gamefish and trout. In the absence of treatment, the committee feared that the only species the reservoir would produce was brown bullheads. Hyatt Lake was again chemically treated in October 1989 after the impoundment had been drawn down to 3,000 acre-feet. In 1990, it was stocked with 15,000 largemouth bass fingerlings.

The lake has been stocked annually with about 200,000 fingerling (3 to 4 inch) Oak Springs rainbow trout. These fish reach about 10-12 inches by the following spring with condition factors averaging over 2.0, which is considered excellent. Since 1983, trout have been stocked with a planting boat to provide better distribution of fish and reduce mortality from avian predators.

Hyatt lake was open year-round for several years but concern that winter harvest was limiting trout catches during the spring and summer precipitated closing of the lake during the winter starting in 1988. Currently, this lake is managed under general angling regulations for the SW Zone.

Oak Springs stock of rainbow trout is currently used in Hyatt Lake. If they can emigrate downstream, the Oak Springs fish may compete with and displace native stocks in outlet streams below Hyatt Lake. Oak Springs rainbows generally spawn in the fall and should not interbreed with native spring spawning stocks. About 40,000 summer and winter steelhead fingerlings were stocked in 1991 and more have been stocked in subsequent years; these stocks are spring spawners and their life history patterns may make them more likely to emigrate down into the stream system below

the lake during periods of spill where they would compete with the native species. However, the majority of flow exiting the reservoir is directed to the Rogue River Basin.

MANAGEMENT DIRECTION
Hyatt Lake

Summary

Direction for Hyatt Lake will be for continued management for hatchery production of rainbow trout under the Basic Yield Management Option, (ODFW, 1987a). Largemouth bass would be managed under the Basic Yield Management Option unless it is determined that the Quality Fish Management Option would be beneficial, (ODFW, 1987b).

Management Direction: Natural and hatchery production; Basic Yield Option.

Policies

Policy 1. Rainbow trout shall be managed for hatchery production consistent with the Basic Yield Management Option, (ODFW 1987a).

Policy 2. Largemouth bass shall be managed for natural production consistent with the Basic Yield Management Option unless it is determined that the Quality Fish Management Option is beneficial, (ODFW 1987b).

Objectives

Objective 1. Provide a consumptive fishery on hatchery rainbow trout.

Assumptions and Rationale

1.1 Hyatt Lake is capable of rearing trout from fingerling to legal-size in less than a year and has been a good producer of large catches of hatchery rainbow trout.

1.2 Criteria for size, condition factor, and catch rate are set to determine need to modify stocking levels for optimum production.

Actions

1.1. Evaluate trout survival, growth, condition factor and catch by creel surveys and annual net and electrofishing inventories.

1.2. Modify annual stocking rate of 250,000 fingerling rainbow at 75 per pound as needed to meet the following criteria:

a. Fingerling rainbow stocked in the late spring should grow to 10 inches by the following spring.

b. Condition factors should average 1.30.

c. If changes in habitat conditions, reservoir level at time of stocking, angler use, or other factors that could change harvest or recreation opportunities occur.

Objective 2. Provide a consumptive fishery for naturally reproducing largemouth bass.

Assumptions and Rationale

2.1. Largemouth bass were stocked in 1990 as part of an established mini-plan to control the brown bullhead population.

2.2 A goal for the future is to produce bass large enough to allow management consistent with the Quality Fish Management Option, (ODFW, 1987b).

Actions

2.1. Monitor bass populations with periodic net or electrofishing inventories.

2.2. Determine if the lake can produce large enough bass to be considered for management consistent with the Quality Fish Management Option (ODFW, 1987b).

2.3. Develop regulations and management strategy to provide as many above average sized largemouth bass as possible.

Objective 3. Protect unique wild trout and sucker populations downstream from Hyatt Lake in Jenny Creek from hatchery fish escaping from the reservoir.

Assumptions and Rationale

3.1. If Oak Springs stock rainbow trout are allowed to move downstream, they may compete with and displace native fish in the outlet streams below Hyatt Lake. This stock generally spawns in the fall and should not interbreed with native spring spawning stocks.

3.2. Summer and winter steelhead have also been released in Hyatt Lake; these stocks are more likely to emigrate and compete with native fish in the streams below the lake if water spills downstream, otherwise flows are directed to the Rogue River Basin for irrigation uses.

Actions

3.1. Determine the potential of hatchery trout escaping and mixing with the unique native fish that inhabit the Keene and Jenny Creek systems downstream from Hyatt Lake.

3.2. Inventory Keene Creek below Hyatt Lake for presence and abundance of exotic fish stocks that may have emigrated from the lake.

3.3. If fish are moving downstream through the outlet structure, work with BOR and TID staff to provide and maintain facilities to prevent movement of fish from Hyatt Lake to Keene Creek.

3.4. Eliminate future stocking of steelhead stocks in Hyatt Lake if they are determined to be impacting native fish in the Jenny Creek system.

Management Considerations

Little Hyatt Lake is stocked annually with 2,500 Oak Springs stock rainbow trout fingerlings at 75 per pound; they survive well the first year but few are seen in their second year. The relatively shallow nature of this reservoir at full pool (14 feet deep) may limit survival of hatchery fish to one season. If they can emigrate downstream, the Oak Springs rainbows may compete with and displace native fishes in outlet streams below Little Hyatt Lake. These hatchery rainbows are generally fall spawners and should not interbreed with native spring spawning stocks. However, Keene Creek below Little Hyatt Lake dam is often dewatered in winter and spring when Hyatt Reservoir is being filled; that condition may preclude survival of any trout through their life history.

MANAGEMENT DIRECTION
Little Hyatt Lake

Summary

Little Hyatt Lake is to be managed for hatchery production of rainbow trout and natural production of brown bullheads under the Basic Yield Management Option, (ODFW, 1987a,b).

Management Direction: Hatchery production; Basic Yield Management Option.

Policies

Policy 1. Little Hyatt Lake shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW 1987a).

Objectives

Objective 1. Provide a consumptive fishery on hatchery rainbow trout.

Assumptions and Rationale

1.1. Fingerling hatchery rainbow trout will be stocked because they are less expensive than catchable trout and rear to acceptable size.

Actions

1.1. Evaluate fish survival, growth and catch with periodic creel surveys and net and electrofishing inventories.

1.2. Modify the stocking rate of 2,500 fingerling rainbow trout at 75 per pound as needed to rear fish to sizes acceptable to the angler.

Objective 2. Protect unique wild trout and sucker populations downstream from Little Hyatt Lake in the Jenny Creek system from hatchery fish escaping from the reservoir.

Assumptions and Rationale

2.1. If Oak Springs stock rainbow trout are allowed to move downstream, they may compete with and displace native fish in streams below Little Hyatt Lake. This stock generally spawns in the fall and should not interbreed with native spring spawning stocks.

2.2. If trout do not survive year around in Keene Creek below Little Hyatt Lake dam, it may be more feasible to control downstream movement at the outlet of Keene Creek Reservoir.

Actions

2.1. Determine the potential of hatchery trout escaping and mixing with the unique native fishes that inhabit Jenny Creek downstream from Little Hyatt Lake.

2.2. Inventory Keene Creek below Little Hyatt Lake for presence and abundance of exotic fish stocks that may have emigrated from the lake.

2.3. If fish are moving downstream over the spillway, work with BOR and TID staff to provide and maintain facilities to prevent movement of fish from Little Hyatt Lake to Keene Creek either at Little Hyatt Lake dam or the outlet of Keene Creek Reservoir.

Keene Creek Reservoir

Management Considerations

In the past Keene Creek Reservoir has been seeded by trout, bass, and possibly brown bullheads leaving Howard Prairie Reservoir, Hyatt and Little Hyatt lakes. Any hatchery trout that may reach this reservoir could pose a threat to sensitive wild redband and sucker stocks in the Jenny Creek system if they were able to continue downstream. Currently, ODFW has no plans to manage this water to provide a fishery.

MANAGEMENT DIRECTION
Keene Creek Reservoir

Summary

Keene Creek Reservoir is a regulation impoundment for the delivery of irrigation water and is subject to wide fluctuations in water levels that severely limit production of fish. Public access is being prohibited by the BOR. Therefore, management direction for this reservoir is for natural production of redband trout, to whatever extent the limited habitat will allow, with no intent to provide a fishery on this water.

Management Direction: Natural production; Basic Yield Management Option.

Policies

Policy 1. Keene Creek Reservoir shall be managed for natural production of redband trout under the Basic Yield Management Option.

Objectives

Objective 1. Protect unique redband trout and sucker populations downstream from Keene Creek Reservoir in the Jenny Creek system from hatchery fish escaping from the reservoir.

Assumptions and Rationale

1.1 Oak Springs stock rainbow trout are currently released in Little Hyatt Lake and Howard Prairie Reservoir and may escape to Keene Creek Reservoir; if that occurs and these fish are able to continue downstream, they may compete with and displace native fish in the Jenny Creek system below Keene Creek Reservoir.

1.2 If fish are prevented from passing through the outlet structures at Howard Prairie Reservoir and Little Hyatt Lake, there would be no threat to native fishes below those waters or below Keene Creek Reservoir.

Actions

2.1 Determine the potential of hatchery trout escaping from upstream impoundments and mixing with the unique native fishes that inhabit Keene Creek downstream from Keene Creek Reservoir.

2.2 Inventory Keene Creek below Keene Creek Reservoir for presence and abundance of exotic fish stocks that may have emigrated from the lake.

2.3 If fish are moving downstream through the outlet structure, work with BOR and TID staff to provide and maintain facilities to prevent movement of fish from Keene Creek Reservoir.

Management Considerations

An OSGC survey from 1953 documented the presence of speckled dace in Deadhorse Lake; that species could have been indigenous but may also have been introduced. Recently, minnow-like fish have been seen in the lake but have not been positively identified.

Rainbow and brook trout have been stocked in Deadhorse Lake for many years. Current management allocates 4,500 yearling rainbow trout "legals" per year of Cape Cod stock. Additionally, 2,000 brook trout fingerlings are released biennially. Kokanee salmon fingerling were stocked in 1964 and 1965 but that program was abandoned, presumably because of poor growth or competition with trout.

A high percentage of the "legals" are caught by anglers each season; a small number of carry-over rainbows have been caught by anglers but have not been seen in recent inventories. Samples obtained in 1990 found aged 2+ brook trout to average 10 inches in length with a condition factor of K=1.17.

Despite the short season, Deadhorse Lake is a very popular destination for anglers. The intensive fishery harvests a high proportion of the legal-sized rainbows stocked each year. Because of the short growing season and the high catch, the fishery cannot be adequately sustained with a fingerling stocking program; hence, the use of legal-sized rainbow trout.

Until 1994, the Deadhorse Lake fishery was under general regulations. In an effort to apportion the catch to more anglers, a 5-fish bag limit was imposed beginning in 1994.

MANAGEMENT DIRECTION
Deadhorse Lake

Summary

Deadhorse Lake is proposed for management for hatchery production with yearling rainbow trout and fingerling brook trout under the Basic Yield Management Option, (ODFW, 1987a). This direction is a continuation of current management.

Management Direction: Hatchery production; Basic Yield Management Option.

Policies

Policy 1. Deadhorse Lake shall be managed for hatchery production of rainbow and brook trout under the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for stocked rainbow and brook trout.

Assumptions and Rationale

1.1 There are no indigenous trout in Deadhorse Lake.

1.2 Because of the intensive fishery, it cannot be sustained with stocking of fingerling rainbow trout.
1.3 Small numbers of brook trout grow adequately to provide diversity and contribute to the fishery.

Actions

1.1 Stock up to 4,500 rainbow trout "legals" annually and up to 2,000 brook trout fingerlings biennially.

1.2 Monitor fish species compositions, relative abundance and growth with periodic angler creel surveys and net or electrofishing inventories.

Management Considerations

A Cooperative agreement between a private landowner, FNF and ODFW stipulates that ODFW will manage the fishery resources in the reservoir in exchange for public access to the portion of private property on the reservoir.

Holbrook Reservoir has been stocked annually with hatchery trout but illegal introductions of brown bullheads and Tui chubs have caused severe competition to the trout requiring treatment projects in 1983 and 1991 to remove all fish. Without competition from bullheads and chubs, Holbrook Reservoir is capable of producing good trout growth and providing a good trout fishery.

The current program calls for annual release of 8,000-10,000 Oak Springs stock rainbow trout fingerlings at 50-100 per pound. Inventory in the fall of 1995 showed fingerlings stocked that spring had grown to over 9 inches in length and had an average condition of K=1.25; at the same time, rainbows stocked as fingerlings in the spring of the previous year were averaging 15 inches in length with K=1.47.

In 1989, Tui chubs were found illegally introduced into Lofton Reservoir; subsequently, some of those chubs have reached Holbrook Reservoir. Based on past experience, as the chubs proliferate, survival and growth of the trout will fall to unacceptable levels. Then, in order to maintain a fishery, either the chubs must be removed or management would have to shift to use of legal sized rainbow trout. The landowner having the water rights has indicated a willingness to totally drain the reservoir in order to remove the chubs. However, unless Lofton Reservoir is kept free of chubs, such a procedure would have to be undertaken on a regular basis that would result in a cyclic fishery over the years.

Because the spillway on the dam is not screened, presumably the hatchery reared rainbow trout stocked in Holbrook Reservoir could have emigrated down into Fishhole Creek; however, that behavior has not been documented.

Holbrook Reservoir has been managed under general angling regulations; open all year, bag limit 5 trout with minimum length of 8 inches.

MANAGEMENT DIRECTION
Holbrook Reservoir

Summary

Management for hatchery production of stocked fingerling rainbow trout is the direction proposed for management of Holbrook Reservoir. This would be under the Basic Yield Management Option, (ODFW, 1987a). This direction would be a continuation of the status quo.

Management Direction: Hatchery production; Basic Yield Management Option

Policies

Policy 1. Holbrook Reservoir shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for stocked rainbow trout.

Assumptions and Rationale

1.1 There are no indigenous fish in Holbrook Reservoir.

1.2 Without extreme competition from illegally introduced species, Holbrook Reservoir is capable of producing good growth of stocked rainbow trout fingerlings and supporting a consumptive fishery.

1.3 Holbrook Reservoir can be completely drained, if necessary, to eliminate competing fish species.

1.4 Lofton Reservoir must be kept free of competing fish species to avoid their repeated re-introduction to Holbrook Reservoir via the natural drainage.

Actions

1.1 Annually stock up to 10,000 rainbow trout fingerlings at 50-100/lb.

1.2 Monitor fish species composition, relative abundance and growth by periodic creel surveys and net or electrofishing inventories.

1.3 When rainbow trout size and numbers fall to unacceptable levels, work with the water right owner to drain Holbrook Reservoir and eliminate the competing fish species; then re-stock with the regular allocation of rainbow trout.

Objective 2. Protect the genetic integrity of wild redband trout in Fishhole Creek.

Assumptions and Rationale

2.1 Wild redband trout occur in Fishhole Creek downstream from Holbrook Reservoir.

2.2 If stocked hatchery rainbow trout were to emigrate from Holbrook Reservoir, they could compete with, displace or, possibly, interbreed with redband trout in Fishhole Creek.

2.3 During spring run-off, Holbrook Reservoir often fills and spills over an unscreened spillway.

2.3 Hatchery rainbow trout, Oak Springs stock, that have been released into Holbrook Reservoir, spawn in the fall at the hatchery and, therefore, may not interbreed with wild, spring spawning redband trout

Actions

2.1 Assess the potential for stocked hatchery rainbow trout to emigrate from Holbrook Reservoir to Fishhole Creek; if that is likely, inventory Fishhole Creek downstream from Holbrook Reservoir for the presence and abundance of hatchery rainbow trout.

2.2 If hatchery rainbow trout are found in Fishhole Creek downstream from Holbrook Reservoir,

2.2.1 Assess the risk to wild redband trout from the presence of hatchery stocks of rainbow trout; if unacceptable,

2.2.2 Work with the water right owner and FNF to install and maintain screening to prevent fish from moving through the outlet structure; or,

2.2.3 Consider stocking sterile brown or brook trout in place of rainbow trout in Holbrook Reservoir.

Heart Lake

Management Considerations

There are no indigenous fish in Heart Lake, but there are wild redband trout in Fishhole Creek downstream from the lake. This lake was treated with rotenone in 1965 to remove a dense population of brown bullheads and Tui chubs. Since that time, it has been stocked with rainbow trout and kokanee salmon fingerlings at rates of 3,000 per year.

Inventory in the fall of 1994 found that rainbow trout fingerlings stocked in the spring had grown to 8 inches in length with conditions of K=1.3. Kokanee salmon were maturing at 10.5 inches in length. Anglers have reported catching much larger rainbow trout, but they have not been caught in inventory net sets.

Recently, small minnow-like fish have been seen in Heart Lake but they have not yet been positively identified.

Heart Lake has been managed under general angling regulations.

MANAGEMENT DIRECTION
Heart Lake

Summary

Management direction for Heart Lake is for hatchery production of rainbow trout and kokanee salmon under the Basic Yield Management Option, (ODFW, 1987a).

Management Direction: Hatchery production; Basic Yield Management Option.

Policies

Policy 1. Heart Lake shall be managed for hatchery production of rainbow trout and kokanee salmon under the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for stocked rainbow trout and kokanee salmon.

Assumptions and Rationale

1.1 Heart Lake is capable of producing adequate growth of stocked fingerling rainbow trout and kokanee salmon to provide and attractive fishery, assuming there is not substantial competition from other fish species.

Actions

1.1 Annually stock Heart Lake with approximately 3,000 each of rainbow trout and kokanee salmon.

1.2 Identify the unknown fish species in Heart Lake.

1.3 Monitor fish populations for species composition, relative abundance and growth with periodic angler creel surveys and net or electrofishing inventories.

Objective 2. Protect the genetic integrity of wild redband trout in Fishhole Creek.

Assumptions and Rationale

2.1 Wild redband trout are present in Fishhole Creek downstream from Heart Lake.

2.2 If stocked hatchery rainbow trout were to emigrate from Heart Lake, they could compete with, displace or, possibly, interbreed with redband trout in Fishhole Creek.

2.3 Hatchery rainbow trout, Oak Springs stock, that have been released into Heart Lake spawn in the fall at the hatchery and, therefore, may not interbreed with wild, spring spawning redband trout.

Actions

2.1 Assess the potential for stocked hatchery rainbow trout to emigrate from Heart Lake to Fishhole Creek; if that is likely, inventory Fishhole Creek downstream from Heart Lake for the presence and abundance of hatchery rainbow trout.

2.2 If hatchery rainbow trout are found in Fishhole Creek downstream from Heart Lake,

2.2.1 Work with the water right owner and the FNF to install and maintain screening to prevent fish from moving through the outlet structure; or,

2.2.2 Consider stocking sterile brown or brook trout in place of rainbow trout in Heart Lake.

Big Swamp Reservoir

Management Considerations

There are no indigenous fish species know to be present in Big Swamp Reservoir. In the early 1960's, the following species were stocked: rainbow trout, largemouth bass, bluegill sunfish, and channel catfish. All of those introductions were unsuccessful. Subsequently, brown bullheads appeared and are the only species currently present in Big Swamp Reservoir, and they appear to be stunted. Other than bullheads, this reservoir is probably too shallow to sustain gamefish populations through the winter.

MANAGEMENT DIRECTION
Big Swamp Reservoir

Summary

Management direction for Big Swamp Reservoir will be guided by the Basin Wide Management Direction for warmwater gamefish; that is for natural production of brown bullheads under the Basic Yield Management Option, (ODFW, 1987b).

Management Direction: (See Basin Wide management direction for warmwater gamefish)

Management Considerations

There are no indigenous fish in Lofton Reservoir.

The history of the fishery at Lofton Reservoir shows it to be a steady producer of nice trout with the exception of two periods when brown bullheads or chubs were illegally introduced. Prior to 1966, the reservoir was stocked with brook trout; samples found mature brook trout up to 16.5 inches in length. Since 1966, annual releases of about 8,000 fingerling rainbow trout have been made.

The reservoir was treated in 1976 with rotenone to eradicate brown bullheads. That project was successful and the reservoir remained free of competing species until 1989 when small Tui chubs were observed along the shoreline. Fall sampling has been conducted annually since 1978. The average length and weight of yearling rainbow trout from 1978-1990 was 9 inches and 152 grams, respectively. Since 1991 when chubs were first captured in the net, they have averaged 6.75 inches and 63 grams. Numbers of surviving trout captured have also dropped dramatically. In the three years prior to the appearance of chubs, the average number of yearlings per net set was 22; in the last three years, that average has dropped to 4.7, with only 2 fish caught in 1995.

Nearly 10,000 sub-yearling brown trout were stocked in Lofton Reservoir in the fall of 1994 with the objective of possibly controlling the chub population or, at least, producing a fishery in spite of the chubs. Those brown trout caught by anglers in the fall of 1995 had reached a length of 10 inches.

Since the drainage from Lofton Reservoir goes to Holbrook Reservoir, the presence of competing species in Lofton provides a source of those fish to Holbrook where their populations have been incompatible with providing a trout fishery with stocked fingerlings.

Lofton Reservoir was treated with rotenone in the fall of 1996 to eliminate the chub population.

MANAGEMENT DIRECTION
Lofton Reservoir

Summary

Management direction for Lofton Reservoir is for hatchery production of rainbow trout under the Basic Yield Management Option (ODFW, 1987a).

Management Direction: Hatchery production; Basic yield Management Option.

Policies

Policy 1. Lofton Reservoir shall be managed for hatchery production of rainbow trout under the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Provide a consumptive fishery for stocked rainbow trout.

Assumptions and Rationale

1.1 There is no potential for natural reproduction of trout in Lofton Reservoir.

1.2 Without competing species, Lofton Reservoir is capable of supporting a good fishery based on releases of hatchery reared fingerling rainbow trout.

1.3 Lofton Reservoir must be kept free of Tui chubs in order to provide a viable fishery based on stocking of hatchery reared fingerling trout and to prevent the continued infestation of Holbrook Reservoir with these competing fish.

Actions

1.1 Restock Lofton Reservoir with fingerling rainbow trout annually.

1.2 Monitor the fish species composition, relative abundance and growth with annual net or electrofishing inventories.

1.3 Conduct periodic angler creel surveys to assess angler effort, catch, demographics and preferences.

J. C. Boyle Reservoir

Management Considerations

J. C. Boyle Reservoir supports a variety of fish species including Klamath River redband trout, endangered suckers, several species of warmwater gamefish (Table 1), and non-game fish (Table 2). These species are either indigenous or have emigrated down Klamath River from the upper basin since construction of J. C. Boyle Dam. There are no records of fish being stocked in this reservoir; all are maintained by natural production, either within the reservoir or in Klamath River and Spencer Creek, tributaries to the reservoir.

This impoundment's high productivity yields good growth rates in all species. Largemouth bass have one of the fastest growth rates among the waters of Eastern Oregon (personal communication, Terry Shrader, ODFW, 1995). Spawning success for species using reservoir shoal areas is likely limited by the daily fluctuations in water level. Adult Klamath River redband trout pass through the reservoir enroute to Spencer Creek spawning areas and on their return to the river. Juvenile redbands, emigrating from Spencer Creek, must also find their way through the reservoir to rearing areas in the river, upstream and downstream; enroute, they likely suffer some degree of loss from predation by spiney-rayed fish that have become resident since the reservoir was formed.

J. C. Boyle Reservoir supports an active fishery, mainly for bass, crappie and sunfish. It is open to angling all year under general regulations.

Management selected for redband trout should correspond to that for Klamath River.

MANAGEMENT DIRECTION
J. C. Boyle Reservoir

Summary

Management direction will be for natural production of redband trout under the Wild Fish Management Option, (ODFW, 1987a), consistent with management in the adjacent sections of Klamath River.

Management Direction: Natural production of redband trout; Wild Fish Option. Natural production of warmwater gamefish; Basic Yield Option.

Policies

Policy 1. Redband trout in J. C. Boyle Reservoir shall be managed for natural production under the Wild Fish Management Option (ODFW, 1987a).

Policy 2. No hatchery reared fish shall be stocked in J. C. Boyle Reservoir.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of wild redband trout.

Assumptions and Rationale

1.1 Redband trout migrate through, and may temporarily rear, in J. C. Boyle Reservoir.

1.2 The management option for redband trout in J. C. Boyle Reservoir should be consistent with the management option for that species in Klamath River.

1.3 The effect of predation by warmwater game fish on redband trout is unknown.

Actions

1.1 Adopt angling regulations on J. C. Boyle Reservoir for redband trout that are consistent with those applied to Klamath River adjacent to the reservoir.

1.2 Monitor size, age and abundance of redband trout in J. C. Boyle Reservoir.

1.3 Monitor adult and juvenile redband trout movement patterns in J. C. Boyle Reservoir; determine the origin of these fish, whether from upstream or downstream of the reservoir.

1.4 Determine the level of predation on redband trout by spiney-rayed fishes in Boyle Reservoir.

1.5 Determine the effectiveness of fish passage and screening facilities on J. C. Boyle Dam.

Objective 2. Provide a consumptive fishery for warmwater gamefish.

Assumptions and Rationale

2.1 The various warmwater gamefish species are capable, by natural production, of sustaining consumptive fisheries.

Actions

2.1 Monitor relative abundance and length frequency distribution through periodic angler creel surveys and net or electrofishing inventories.

Gerber Reservoir

Management Considerations

Gerber Reservoir supports a variety of fish species including several warmwater gamefish (Table 1), non-game fish (Table 2) and rainbow (redband) trout. Available stocking records do not explain how many of these species were introduced. Redband trout, shortnose suckers, Tui chubs and Klamath speckled dace are the only possible native species. Rainbow trout of various hatchery stocks were released in 1968-1990; in the late 1980's and 1990's these fish were hatchery grade-outs surplus to allocated production. Surviving rainbows rear to over 18 inches in length and contribute to the fishery. Coho salmon were stocked in the mid-1970's; they grew well and were caught by anglers but have since died out. All other species were apparently introduced by private actions. The latest illegal introduction was evidenced by the appearance of fathead minnows in 1986. The productivity of Gerber Reservoir is demonstrated by the documentation, over the years, of all major warmwater gamefish capable of exceeding 12 inches in length.

Endangered shortnose suckers are relatively abundant in Gerber Reservoir where they have successful reproduction and rearing resulting in good population structure.

Gerber Reservoir is open year around to angling under general regulations.

MANAGEMENT DIRECTION
Gerber Reservoir

Summary

Management direction for Gerber Reservoir is proposed to be for natural production only for all species of game fish. No fish would be stocked. Redband trout would be managed under the Wild Trout Management Option (ODFW, 1987a) while all other gamefish would be managed under the Basic Yield Management Option (ODFW, 1987b).

Management Direction: Natural production of all gamefish species; Wild Trout and Basic Yield Options.

Policies

Policy 1. Redband trout in Gerber Reservoir shall be managed for natural production consistent with the Wild Trout Management Option (ODFW, 1987a).

Policy 2. All gamefish species other than redband trout in Gerber Reservoir shall be managed for natural production consistent with the Basic Yield Management Option (ODFW, 1987b).

Policy 3. No stocking of fish shall be done in Gerber Reservoir.

Objectives

Objective 1. Maintain protection of genetic diversity, adaptiveness and abundance of all fish species in Gerber Reservoir.

Assumptions and Rationale

1.1 All species of fish in Gerber Reservoir are capable of natural production within the reservoir and its tributaries.

1.2 There may be a residual population of native redband trout residing in Gerber Reservoir; if so, continued stocking of rainbow trout would constitute a risk to that stock.

Actions

1.1 Discontinue stocking of hatchery reared rainbow trout.

1.2 Monitor relative abundance, age and length frequency distribution of fish species with periodic net and electrofishing inventories.

Willow Valley Reservoir

Management Considerations

Of the possible indigenous species, Willow Valley Reservoir may have Tui chubs and Klamath speckled dace. This reservoir has supported a population of warmwater gamefish to some extent for many years. There is no record of early introductions. Typical fish composition has been largemouth bass, white crappie, bluegills and Tui chubs. Following periods of drought, crappie and bass were re-stocked in 1978 and 1981, respectively, and in 1994 with bass and blugills. Lahontan cutthroat were introduced to the system in 1977 when they were stocked in East Fork Lost River and subsequently, into the reservoir between 1982 and 1994. The reservoir's productivity yields good fish growth. Cutthroat trout reach lengths over 20 inches. At times the bluegills have grown to 8 inches in length, the largest seen in the Klamath Basin. Anglers have reported catching largemouth bass weighing over 3 pounds.

The greatest problem for fish management is, of course, the periodic draining of the reservoir during periods of low precipitation. These events require re-stocking and associated periods of re-building the populations to support viable fisheries.

Willow Valley Reservoir is open to angling all year under general regulations. Angler use on this reservoir is generally low, probably because of the fluctuations in fish availability, poor boat access and the reservoir's relatively remote location.

MANAGEMENT DIRECTION
Willow Valley Reservoir

Summary

Management direction provides for the use of surplus hatchery reared Lahontan cutthroat to be stocked in Willow Valley Reservoir to supplement natural production of that species. Warmwater gamefish would fall under the Basin Wide Management Direction for natural production and stocked fish. Both the trout and warmwater gamefish would be managed consistent with the Basic Yield Management Option (ODFW, 1987a,b).

Management Direction. Natural and hatchery production of Lahontan cutthroat trout; Basic Yield Management Option.

Policies

Policy 1. Lahontan cutthroat trout in Willow Valley Reservoir shall be managed for natural and hatchery production under the Basic Yield Management Option, (ODFW, 1987a).

Objectives

Objective 1. Improve angler catch rates for Lahontan cutthroat trout by periodically supplementing their natural production with surplus hatchery fish from Klamath Hatchery.

Assumptions and Rationale

1.1 There will be Lahontan cutthroat trout fingerlings available that are surplus to production allocations.

1.2 Hatchery reared Lahontan cutthroat trout survive and grow well in Willow Valley Reservoir.

1.3 It is more useful to stock surplus Lahontan cutthroat trout in Willow Valley Reservoir and allow them to add to angler opportunity than to destroy them at the hatchery.

1.4 Periodic reservoir drawdown to meet downstream irrigation demands can significantly affect fish production during years of drought.

Actions

1.1 Stock Lahontan cutthroat trout in Willow Valley Reservoir that are surplus to the hatchery production program, when available.

1.2 Monitor fish abundance, size and species composition by periodic net or electrofishing inventories.

Devil Lake

Management Considerations

There are no indigenous fish stocks in Devil Lake but native redband trout are present in Fishhole Creek, directly downstream from Devil Lake. Rainbow trout, both fingerlings and yearlings, were stocked in Devil Lake between 1946 and 1973. The lake was treated in the late 1950's to eliminate carp of unknown origin after which the trout grew well; they averaged 14 inches in 1968. Subsequent, illegal introductions of brown bullheads, yellow perch and largemouth bass made it unfeasible to sustain a trout fishery through stocking of fingerlings. No trout have been stocked since 1973.

Recent inventories found abundant yellow perch up to 9 inches in length but averaging about 6 inches. Largemouth bass had lengths up to 10.6 inches and averaged just over 9 inches. The size of bass in Devil Lake is likely limited by the short period of adequate water temperatures for growth of that species.

Devil Lake is open to angling all year under general regulations.

MANAGEMENT DIRECTION
Devil Lake

Summary

Management direction for Devil Lake calls for hatchery production of rainbow trout that would be stocked from hatchery production surpluses or transfers and managed under the Basin Wide Management Direction.

Management Direction: Hatchery production, Basic Yield Management Option.

Policies

Policy 1. Devil Lake shall be managed for hatchery production of rainbow trout under the Basic Yield Management Option.

Objectives

Objective 1. Provide a consumptive fishery for stocked rainbow trout.

Assumptions and Rationale

1.1 Devil Lake is capable of rearing rainbow trout to sizes attractive to anglers.

1.2 Rainbow trout stocked in Devil Lake would add diversity to the fishery that is now supported by warmwater game fish.

1.3 Hatchery production of rainbow trout sometimes results in numbers of fish that are surplus to the programmed allocations; it is from these surpluses or transfers that fish for Devil Lake would be provided.

Actions

1.1 When available from hatchery production surpluses or transfers, rainbow trout will be stocked in Devil Lake.

1.2 Sample angler catches periodically to evaluate survival, growth and rate of return to the angler by the stocked rainbow trout; make adjustments to the stocking rate as needed.

Objective 2. Protect the wild redband trout population in Fishhole Creek from hatchery fish escaping from Devil Lake.

Assumptions and Rationale

1.1 If hatchery trout were allowed to escape downstream from Devil Lake, they may compete or interbreed with native redband trout.

Actions

1.1 Determine the adequacy of screening on the outlet structure on Devil Lake to prevent passage of trout out of the reservoir.

1.2 If the outlet screening is not adequate, work with the dam owner to provide appropriate screening to prevent emigration of trout from the reservoir.

Campbell Reservoir

Management Considerations

Redband trout reach the reservoir by emigrating down the water diversion from Deming Creek. These trout rear in the reservoir, to lengths up to 20 inches, before maturing and returning up the diversion to spawn in Deming Creek. That life history pattern is unnatural, developing only after construction of the reservoir. Management direction for Deming Creek calls for screening of the water diversion to prevent the redbands from leaving their native stream and, thereby, eliminate the redbands from Campbell Reservoir.

Largemouth bass were apparently released in Campbell Reservoir by private action since there is no record of an official introduction. Inventories in the 1970's found largemouth bass up to 12.8 inches in length.

MANAGEMENT DIRECTION

Summary

Management direction for Campbell Reservoir shall be for natural production of redband trout until such time that Deming Creek Diversion is screened; at that time managemant would shift to stocking of hatchery produced rainbow trout. Under either management scenario, Campbell Reservoir would be managed under the Basic Yield Management Option (ODFW 1987a).

Management of largemouth bass would be guided by the Basin Wide Management Direction for warmwater game fish.

Management Direction: Natural production; Basic Yield Option

Policies

Policy 1. Campbell Reservoir shall be managed for natural production of redband trout until the Deming Creek diversion is screened when management will be changed to hatchery production of rainbow trout; under either management direction, it will be managed under the Basic Yield Management Option (ODFW 1987a).

Objectives

Objective 1. Provide a consumptive fishery for naturally produced redband or hatchery produced rainbow trout.

Assumptions and Rationale

1.1 Campbell Reservoir rears redband trout to sizes attractive to anglers and supports an active fishery targeted on redband trout.

1.2 Campbell Reservoir will continue to be stocked by naturally produced redband trout emigrating from Deming Creek diversion until such time that the diversion is screened.

Actions

1.1 When screens are installed on Deming Creek dirversion, the trout fishery in Campbell Reservoir will be sustained by stocking of hatchery produced rainbow trout.

Objective 2. Protect the wild redband trout population in Deming Creek from hatchery fish escaping from Campbell Reservoir.

Assumptions and Rationale

1.1 If hatchery trout were allowed to escape downstream from Campbell Reservoir, they may compete or interbreed with native redband trout.

Actions

1.1 Determine the adequacy of screening on the outlet structure of Campbell Reservoir to prevent passage of trout out of the reservoir.

1.2 If the outlet screening is not adequate, work with the dam owner to provide approptriate screening to prevent emigration of trout from the reservoir.

Bumpheads Reservoir
Upper Midway Reservoir
Dog Hollow Reservoir
Round Valley Reservoir
Smith Reservoir

Management Considerations

These reservoirs are grouped together because they have similar characteristics. They are all irrigation storage impoundments that are on BLM land. They are all open to angling all year under general regulations. The same management direction will be proposed for all of these waters. Management considerations for the individual waters are described in the following discussions.

Bumpheads Reservoir

There are no fish native to Bumpheads Reservoir but introduced crappie and largemouth bass have been in Bumpheads Reservoir for many years. The source of the original stocking is unknown. Periodically, the fish populations have been diminished by drawdown of the reservoir for irrigation needs. Re-stocking of black and white crappie was done in 1978 and largemouth bass in 1982, but drought conditions in the early 1990's eliminated those populations. Adult crappie were stocked again in 1995.

Upper Midway Reservoir

The only fish species known to have been present in Upper Midway Reservoir has been largemouth bass. Since there is no official record of stocking for this water, the bass were apparently introduced by private actions. Bass have had successful natural production in this small reservoir. Inventories in 1984 and 1986 found bass exceeding 13 inches in length. But, good spawning success coupled with a lack of a forage species led to an abundance of small bass in the mid-1980's. The reservoir was drained in 1994; it was restocked with 600 largemouth bass in 1996.

Dog Hollow Reservoir

There is little fish management experience to report on Dog Hollow Reservoir. There are no fish native to this reservoir. There have been anecdotal angler reports of largemouth bass, of unknown origin, being present, probably before the drought period in the late 1970's. Largemouth bass fingerlings were stocked there in 1989, but no evaluation was done before the reservoir dried up again in 1994. No fish have been stocked since then.

Round Valley Reservoir

Prior to dam construction, it is doubtful that there were any fish living in its watershed. Although there is no record of official stocking, Round Valley Reservoir has supported populations of largemouth bass, yellow perch, pumpkinseed sunfish and brown bullheads. Past inventories have found largemouth bass exceeding 15 inches in length. Yellow perch more than 11 inches long have been seen there but most of them were about 6 inches. Pumpkinseeds were captured that were up to 6.8 inches long, well above average length for that species in the Klamath Basin. Given adequate

sustained water levels, this reservoir is apparently capable of supporting a viable warmwater fishery. But, it was dried up in 1994 and has not been re-stocked.

Smith Reservoir

Though no records of official fish stocking exist, Smith Resevoir has had populations of warm water game fish in the past. After being nearly dry, largemouth bass were stocked in 1996 in addition to the surviving brown bullheads. There is no management history on this reservoir.

MANAGEMENT DIRECTION
Bumpheads Reservoir
Upper Midway Reservoir
Dog Hollow Reservoir
Round Valley Reservoir
Smith Reservoir

Summary

Management of these reservoirs is proposed to be guided by the Basin Wide Management Direction for warmwater gamefish. That prescription is for those species to be managed for natural production and with stocked fish consistent with the Basic Yield Management Option, (ODFW, 1987b).

***Management Direction*: See Basin Wide Management Direction for warmwater gamefish, ie. natural production and stocked fish; Basic Yield Management Option.**

ANGLER ACCESS

Overview

Anglers generally have good access to the waters of the Klamath Basin and their fishery resources. Many of the basin's waters are on public lands or are on large private ownerships where public access is permitted. A substantial number of developments have been provided on these waters by public and private entities to facilitate access for anglers. Still some segments of basin waters are lacking adequate access for anglers. A number of new facilities are needed to optimize public access to all of the basin's streams, lakes and reservoirs. The following sections describe existing and needed angler access.

Existing Angler Access

Klamath River: State line to Upper Klamath Lake, including Spencer Creek, Lake Ewauna and Link River.

Klamath River from state line to Boyle Dam lies on BLM and large private holdings that have been open to the public. This lower section of river is reached by rough, but passable, gravel and earthen roads. The Keno reach, lying in a canyon between Boyle Reservoir and Keno Dam, is paralleled by roads on both sides, Hwy 66 on the south and a private "logging road" on the north.

Between Keno Dam and Link River, including Lake Ewauna, most bordering lands are in private ownership. This segment is essentially a long, narrow reservoir that is best accessed by boat. Three public boat ramps are available at: Veteran's Park (City of Klamath Falls) at the head of Lake Ewauna; Klamath Wildlife Area (ODFW), and Keno Recreation Area (PP) at Keno Dam.

Upper Klamath and Agency lakes including all tributaries, or portions there of, *contributing rainbow trout production to the lakes' rearing population:* Williamson River below the falls (RM 23) and tributaries (Spring, Larkin and Sunnybrook creeks); Sprague River mainstem and tributaries (Trout Creek, Sycan River and tributaries below the outlet of Sycan Marsh, North Fork Sprague River up to RM 12 and tributaries, South Fork Sprague River up to RM 10 and tributaries); Wood River and tributaries; Sevenmile Creek and tributaries; Fourmile Creek (north), Crystal Creek, Recreation Creek, Thomason Creek, Harriman Creek, Odessa Creek, and Short Creek.

Angler access is generally good to upper Klamath and Agency lakes. There are 10 developed public boat ramp facilities and five additional private resort and marinas with boat ramps available to the public. Bank access is provided on the south end by Moore Park and the Link River Trail; on the west by Hwy 140, Shoalwater Bay and Eagle Ridge; and on the east by Hwy 97. Nearly all of the stream banks on the tributaries in this sub-basin are privately owned. Lower Williamson River has one public access area with facilities for boat and bank anglers; it also has two resorts with boating facilities. Upstream from Collier State Park, at the mouth of Spring Creek, the majority of the river is on public property. Collier Park and WNF lands provide access

to Spring Creek. Wood River is all privately held except Kimball State Park, at the headwaters; the Wood River Day Use Area (WNF); an undeveloped, state-owned (ODFW) site on Weed Road that provides access for small boats; and Wood River Ranch (BLM) at the mouth. Petric County Park has a boat ramp leading to lower Wood River. Along all of the mainstem and North and South Forks of Sprague River there are only three rustic, public access sites. National Forest lands provide public access to about 25 miles of Sycan River.

Williamson River above the falls (RM 23) and tributaries

Except for the Klamath Marsh NWR, all of the river up to the head of the marsh is on private land but most of the active fishery takes place above the marsh. Much of the stream above the marsh lies on private property but is interspersed with WNF lands that provide for public access. Two private ranches at the headwaters are, at least partially, managed for trout fisheries serving their clients.

Sycan River above the outlet of Sycan Marsh and tributaries, including Long and Coyote creeks;
North Fork Sprague River (above RM 12) and tributaries;
South Fork Sprague River (above RM 10) and tributaries, including Deming Creek:
Cascade Mountain streams: Sink, Cottonwood, Scott, Sand, Threemile, Cherry, Rock, Fourmile (south), Moss, and Denny creeks;
Jenny, Fall, Scotch, Cottonwood, Grouse, Long John, and Cow creeks.

These streams are more remote from urban populations and generally experience only light to moderate angling pressure. The majority of the stream mileage in this group lies on public lands or on large private holdings that are open to public access.

Lost River and tributaries

Lands bordering Lost River are mainly private under agricultural use. Public access is available at Big Springs Park in Bonanza, an undeveloped ODFW site downstream of Harpold Dam, Stevenson County Park near Olene, around "Wilson Reservoir" on BOR lands and the Crystal Springs Angler Access (ODFW). The only boat ramp is at the Crystal Springs facility.
BLM lands provide public access to a mile of Miller Creek downstream from Gerber Dam.

Fourmile Lake (south)

Fourmile Lake is located near the summit of the Cascades about 3 miles northeast of Mt. McLoughlin in southeastern Klamath County. It is totally within the WNF and all but the southern tip of the lake is bordered by the Sky Lakes Wilderness Area. The Forest maintains a campground at the southwestern end. Boat launching is done off a shallow beach area. Access to the lake is via Forest Road 3661 for six miles

north of Hwy 140. Because of the high elevation, the road is open, generally, from mid-June through October, being blocked by snow the other months.

Lake of the Woods

Lake of the Woods lies near the crest on the east side of the southern Cascade Range in southwestern Klamath County. Road access is via State Highway 140 about 32 miles from Klamath Falls or 42 miles from Medford, or via Dead Indian Memorial Road, 38 miles from Ashland. The lake is totally within the Winema National Forest. There are two large fully developed campgrounds and two day-use areas, including three boat launching facilities; Lake of the Woods Resort; three organization camps; and more than 200 summer homes on the lake. All of these developments are administered by the Klamath Ranger District. Because of the good access and facilities, Lake of the Woods receives a high level of use including angling, swimming, water skiing, canoeing and sailing.

Miller Lake

Miller Lake lies just east of the crest of the Cascade Mountains in northwestern Klamath County. This lake may be accessed via Forest Road 9772 for 13 miles west of Chemult off Hwy 97. The first 1/2 mile of FR 9772 is paved but the remainder is maintained gravel. The road is typically blocked by snow from November though May or later.

Miller Lake is on the WNF. The Forest maintains a full service campground at Digit Point along with a day-use area. One concrete ramp with service dock provides for boat launching. A maintained trail circles the lake.

Cascade and Gearhart Mountain Lakes

Within the Klamath River Basin, fisheries in 33 of the Cascade and Gearhart Mountain lakes are managed for recreational angling. These lakes are located east of the Cascade summit mainly within the Sky Lakes and Mountain Lakes Wilderness Areas on the WNF; Blue Lake is in the Gearhart Mountain Wilderness Area on FNF. These lakes are located within a wilderness or in a roadless area that can only be reached by non-motorized or non-wheeled travel such as by foot or horse. No motorized boats are allowed. Early season access is generally limited by persistence of winter snows on access trails.

Howard Prairie Reservoir

Howard Prairie Reservoir is located 20 miles northeast of Ashland off Dead Indian Memorial Road. Public access is excellent at this popular trout fishing lake. There are five campgrounds, four boat ramps, a store, a marina, and some lodging provided for recreation. The campgrounds are operated by Jackson County Parks Department. Good access is provided at all pool levels. Boat ramps are located at Grizzly Creek, Howard Prairie Lake Resort, Willow Point, and Klum Landing. There is a

5 mph speed limit with no wake at the resort marina and Klum Landing. Moorage permits are required after 48 hours outside designated moorage areas.

Hyatt Lake

Hyatt Lake is located 21 miles east of Ashland off Dead Indian Memorial Road or Hwy 66. Access to the water is good at all reservoir levels with three boat ramps and paved or unimproved roads along the north, west, and south shores of the reservoir. Camping and picnicking are allowed on the west and south sides of the reservoir in established areas. Other than the area adjacent to the summer homes, there is good public access to the east shore as well. Recreational facilities at the lake include Hyatt Lake Lodge, Campers Cove Resort, and 18 summer homes. The BLM currently operates a campground at the southern end of the lake that recorded about 19,000 user days in 1987. Another BLM campground is located on the east shore.

Little Hyatt Lake

Little Hyatt Lake is located 18 miles east of Ashland off Hwy 66. Access to Little Hyatt Reservoir remains somewhat limited but offers a more secluded trout fishing lake for those that desire one.

Keene Creek Reservoir

Keene Creek Reservoir lies adjacent to Hwy 66 near the summit between Ashland and Klamath Falls. Despite being bordered by the highway, access is limited; there is very little parking available, and the reservoir sides slope steeply to the bottom. In addition to the physical access problems, the BOR has instructed TID to post "no trespassing" signs around the pool.

Deadhorse Lake

Deadhorse Lake is in the FNF at the end of the Campbell Lake Road. It may be reached via a series of forest roads, about 32 miles SW from Paisley off Hwy 31 or about 42 miles NE from Bly off Hwy 140. Because of the high elevation, this lake is often snowbound until early July. Developments at the lake include campground facilities and a boat ramp.

Holbrook Reservoir

Holbrook Reservoir is within the Lofton Recreation Area on the FNF and lies about 7 miles south of the summit of Hwy 140 at Quartz Mountain Pass. A cooperative agreement provides for public access to the reservoir on the private land. This reservoir is open to day-use only but a boat ramp and toilet facilities are provided on the public land.

Heart Lake

Heart Lake lies 8 miles south from the summit of Quartz Mountain Pass on Hwy 140. It is within the Lofton Recreation Area on the FNF. A short graveled road reaches the lake within a mile of the main paved access road. Only day use is allowed at Heart Lake but toilet facilities and a concrete boat ramp are provided for public use.

Big Swamp Reservoir

Big Swamp Reservoir lies mainly on the FNF but part of it is on privately owned land. It can be reached by driving south about 10 miles from Hwy 140 at the summit of Quartz Mountain Pass. The final access to the reservoir is on rough dirt road off the main, paved road from Hwy 140. No recreational facilities have been developed at this reservoir.

Lofton Reservoir

Lofton Reservoir is the namesake of the Lofton Recreation Area on the FNF. It is located about 8 miles south, via paved road, off Hwy 140 from the summit of Quartz Mountain Pass. It is about 75 miles from Klamath Falls and 35 miles from Lakeview. A developed campground and concrete boat ramp are provided at the reservoir for recreational use.

J. C. Boyle Reservoir

J. C. Boyle Reservoir is located about 16 miles WSW of Klamath Falls on Klamath River. Hwy 66 crosses the reservoir near its mid-point. Most of the shoreline is accessible from near-by roads. There are four developed access facilities on the reservoir: BLM maintains a full-access campground with boat ramp and fishing dock; PC provides a day-use area and boat launching facility; and Klamath Sportsman's Park borders the east shore along the upper half of the reservoir.

Gerber Reservoir

Gerber Reservoir is about 35 miles east of Klamath Falls. A paved road via Bonanza reaches Gerber Reservoir Guard Station. A good gravel road south from Hwy 140 at Bly also accesses other cinder roads circling the reservoir. Snow and wet conditions may preclude or impair travel on these routes.

BLM provides several recreational developments. There are two full service campgrounds, two rustic camping areas, and one day use area. Three boat ramps are available and serviceable at higher water levels. The boat ramp on Ben Hall arm is also usable at lower levels and is accessible to the disabled. Nearly all of the shoreline of Gerber Reservoir is in public ownership.

Willow Valley Reservoir

Willow Valley Reservoir is about 38 miles SE of Klamath Falls. From East Langell Valley Road., Willow Valley Road., a good gravel surface, passes near this reservoir. There are no developed facilities on the reservoir except a rough, rock boat access that is usable only at higher water levels. The entire shoreline is in public, BLM, ownership.

Campbell Reservoir

Campbell Reservoir lies about 6 miles NE of Bly via Forest Road 34 off Hwy 140. The dam and direct road access to the reservoir is under private ownership. The eastern third of the impoundment is on BLM land. There are no developed facilities on Campbell Reservoir.

Devil Lake

Devil Lake is 10 miles SE of Bly adjacent to Fishhole Creek Road about 8 miles off Hwy 140. The dam and majority of this impoundment is on private land but much of the western shoreline lies on FNF. Despite the private ownership, the public has been allowed access the to lake. There are no developed facilities; small boats are launched off the shore near the dam.

Bumpheads Reservoir

Bumpheads Reservoir is somewhat remotely located near the geologic formations known as the Bumpheads. Under dry conditions, it can be reached via rough dirt roads about 7 miles off Willow Valley Road from East Langell Valley Road or about 20 miles south of Gerber Reservoir via the Round Valley and C. C. C. roads. This reservoir is entirely on BLM land but there are no developed facilities, only a rough, rocky boat access near the dam that is usable at higher water levels.

Upper Midway Reservoir

Upper Midway Reservoir can be reached by following the Round Valley Road for about 10 miles from the Gerber Road (1218) or by following forest roads about 27 miles south from Bly on Hwy 140. It is entirely on BLM land. A small, rustic campground has been provided along with a graveled boat ramp.

Dog Hollow Reservoir

Dog Hollow Reservoir lies about 3 miles south of Gerber Reservoir. It may be reached by traveling SE on the Round Valley Road from the Gerber Road (1218) and then south on a dirt road about 3.5 miles. It is entirely on BLM land but there are no facilities provided.

Round Valley Reservoir

Round Valley Reservoir is adjacent to Round Valley Road about 7 miles SE from the Gerber Road (1218). All of the surrounding lands are administered by BLM. There are no facilities developed at this reservoir. Small boats may be launched off the shore near the dam at higher water levels.

Smith Reservoir

Smith Reservoir is located on Bryant Mountain. Public access is available about 4 miles south of Bonanza off West Langell Valley Road to Bryant Mountain Road, unpaved, for about 7 miles. Nearly all of the shoreline at full pool is on BLM land. There are no recreational improvements at this reservoir.

Table 4. Angler access needs in the Klamath River Basin: water, needed facility, location.

Klamath River
- Boat ramp and parking
  - At Keno adjacent to Hwy 66

Upper Klamath Lake
- Boat ramp and parking
  - Modoc Point
  - Algoma Pond
  - Pelican Cut, upgrade
- Parking, additional
  - Rocky Point

Williamson River, lower
- Boat ramps and parking
  - Modoc Point Road
  - Rapids, Hwy 97 crossing area
  - Pine Ridge-above Chiloquin Bridge reach
  - Collier State Park-Williamson River Campground reach

Wood River
- Boat ramp and parking
  - Weed Road, ODFW property

Sprague River
- Boat ramp and parking
  - Chiloquin Dam "pool"
  - RM 6, "substation"
  - RM 11, lower Williamson River Road
  - RM 15-20 area
  - RM 30 area, S'Ocholis Canyon
  - Lone Pine

Sprague River Hwy crossing
Klamath County sites off Drews Road, upgrade
Godowa Springs Road crossing, RM 72

Willow Valley Reservoir
Boat ramp and parking
Accommodate lower water levels
Table 4. (continued)

Campbell Reservoir
Boat ramp and parking
On public land, accommodate lower water levels

Designation of Navigable Waters

The following stream reaches may meet federal navigability standards to qualify as Navigable Waters of the State but only a 33 mile section of the Klamath River (Oregon/California border to Keno, RM200-233) has been so designated by the State Land Board (SLB). Designation of these waters as navigable would provide major additions to public (angler) access to these waters. Those stream reaches are:

Klamath River, all
Williamson River, downstream from Spring Creek
Wood River, all
Sprague River, downstream from Lone Pine
Crystal and Recreation Creeks

ANGLER ACCESS MANAGEMENT DIRECTION: Provide for diverse angler access opportunities.

Policies
Policy 1. Barrier free access to angling opportunities shall be provided for the angling public where it is appropriate and feasible.

Objectives
Objective 1. As opportunities arise, acquire the angler access sites identified in Table 4.

Assumptions and Rationale

1.1 The sites listed in Table 4 are needed to fully facilitate angler access to current fisheries.

Actions

1.1 When the access sites listed in Table 4 become available, acquire them as funding allows.

Objective 2. Develop and maintain facilities providing appropriate access to a diversity of angling opportunities.Assumptions and Rationale

2.1 Existing access facilities must be maintained and upgraded as necessary to be functional and provide appropriate angler access.

2.2 Landowners or managers of needed access sites and facilities, Table 4, are encouraged to develop, maintain and provide appropriate angler access at those locations.

2.3 ODFW may develop angler access as an agency or in partnership with other landowners and managers.

2.4 Where appropriate and feasible, sites should provide barrier free access to the angling public.

Actions

2.1 Encourage landowners and managers of needed angler access sites, Table 4, to develop and maintain appropriate facilities at those locations; ODFW may work in partnership with those entities.

2.2 Given opportunities and funding, ODFW will develop appropriate facilities where additional angler access is needed, Table 4, either alone or in partnership with other entities.

2.3 Where appropriate and feasible, barrier free angler access facilities will be developed to be fully accessible to the public.

Objective 3. Encourage DSL to pursue navigabitiy claims on rivers where documentation exists that they meet federal navigability standards.

Assumptions and Rationale

3.1 All of Klamath River; Williamson River, downstream from Spring Creek; all of Wood River; Sprague River, downstream from Lone Pine; and Crystal-Recreation creeks may qualify as navigable waters.

3.2 If the waters named in 3.1 were formally adopted by the SLB as Navigable Waters of the State of Oregon, their beds and banks to mean high water would become public property of the State of Oregon and; therefore, accessible to anglers.

3.3 Increased angler use on streams resulting from their adoption as navigable could, potentially, cause increased exploitation of fish populations and damage to habitats.

Actions

3.1 The Oregon Fish and Wildlife Commission supports the adoption as Navigable Waters of the State all waters so qualified within the Klamath River Basin.

3.2 Any potential effects on the fish resources of these streams from increased angler access would be monitored and, if necessary, mitigated by regulation.

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APPENDIX

Appendix 1
SPRING CREEK TROUT STOCKING PROGRAM

Introduction

Spring Creek is a major tributary to Williamson River ar RM 16.5. It is also one of the principal spawning areas for redband trout in the Williamson River system as well as a popular angling stream for local and out-of-state anglers.

Releases of hatchery rainbow trout have been made in Spring Creek since 1925 when fingerlings were first stocked; legal-sized rainbows have been stocked annually since 1949 to augment angling opportunities there. In development of the Klamath Basin Fish Management Plan, ODFW policy requires review of ongoing stocking programs for consistency with Oregon's Wild Fish Management Policy (WFMP) and Oregon's Trout Plan. Specific questions include:

1. Are hatchery rainbow trout in Spring Creek surviving to mature and spawn with redband trout in Spring Creek? If so, what is the ratio of spawning hatchery fish to wild fish?
2. What is the potential for adverse social reactions between rearing hatchery trout and rearing wild redband trout juveniles and spawning adults?
3. Assuming that continued stocking meets WFMP standards, are these trout being stocked in areas with good public access?
4. What indications are there that the public is utilizing these stocked fish and that there is at least 40% minimum catch of numbers released, as required by the Trout Plan, is being attained?
5. Are anglers, drawn by the stocking program, having an impact on spawning and rearing redband trout in Spring Creek?

The following white paper attempts to answer these questions.

Location and Ownership

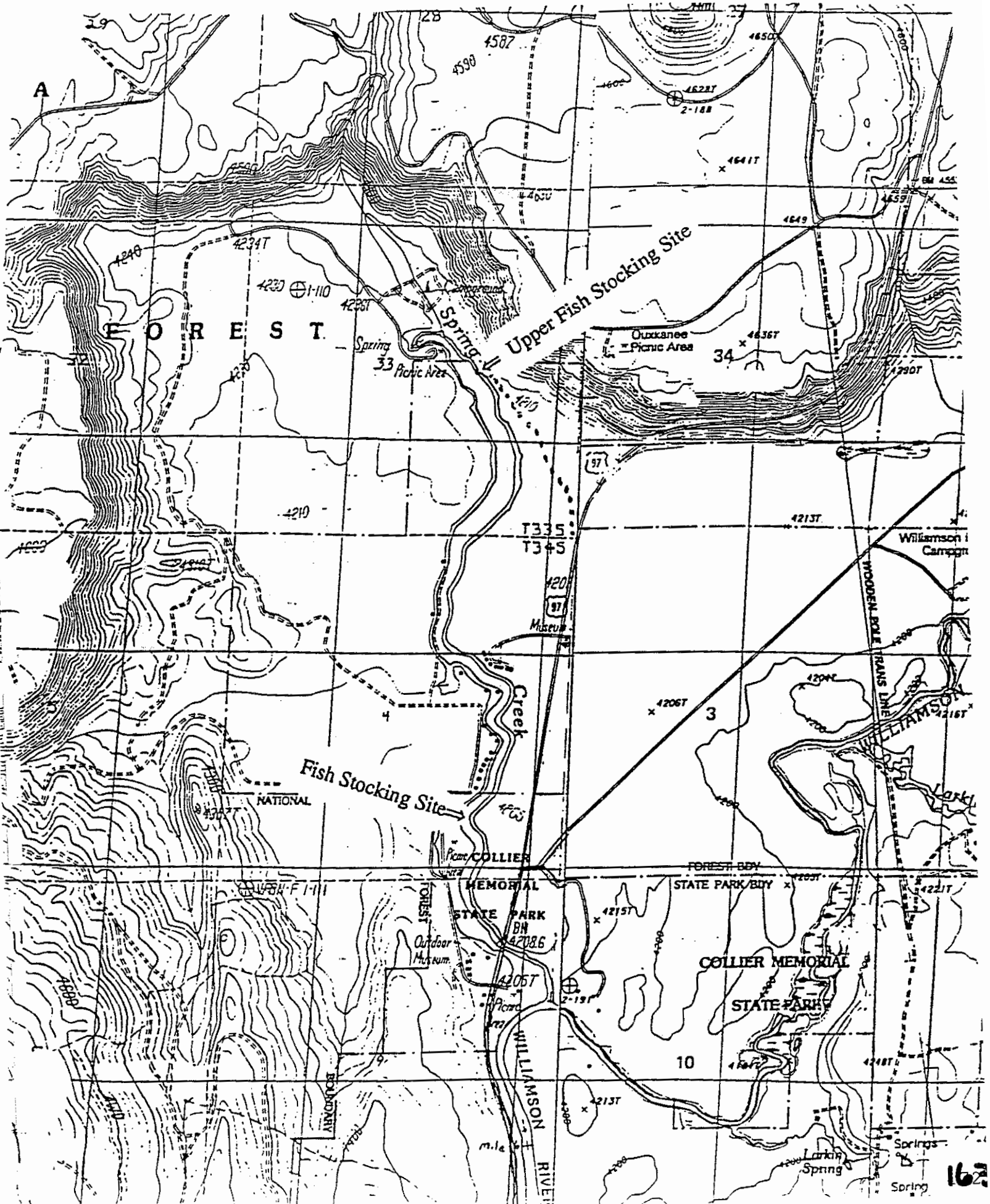
Spring Creek is only two miles long. It rises from large springs at its head to flow approximately 300 cfs near the mouth. Water temperatures are quite stable and rarely vary from the low 40's F. Land ownership along the stream falls into three reaches. The upper 0.58 mile is in the Winema National Forest, the middle 0.75 mile is in smaller private ownerships, and the lower 0.67 mile is within Collier State Park. A map of the Spring Creek vicinity is attached.

Current Stocking Program

"Legal-sized" rainbow trout have been stocked in Spring Creek for many years to support a "put and take" fishery on that stream, particularly within Collier State Park. The current hatchery stock used is Lot 72 "Cape Cod" rainbow trout. This stock has been in the Oregon hatchery system since the early 1970's.

Typically, the fish have been stocked by Klamath Hatchery personnel with a portable tanker twice a week. Stocking rates have been about 1,000 fish per week during the summer trout season. Those fish were released at two locations. The primary stocking site is near the NW boundry of the park. The other, "upper", site is approximately 1/4 mile SE of the head of Spring Creek. Access to the upper site is via an unimproved forest road having an unmarked intersection with Hwy 97 near the base of "Spring Creek Hill"; that road is not shown on any public maps of the area but has been depicted on the accompanying map by a dotted line.

Spring Creek Vicinity



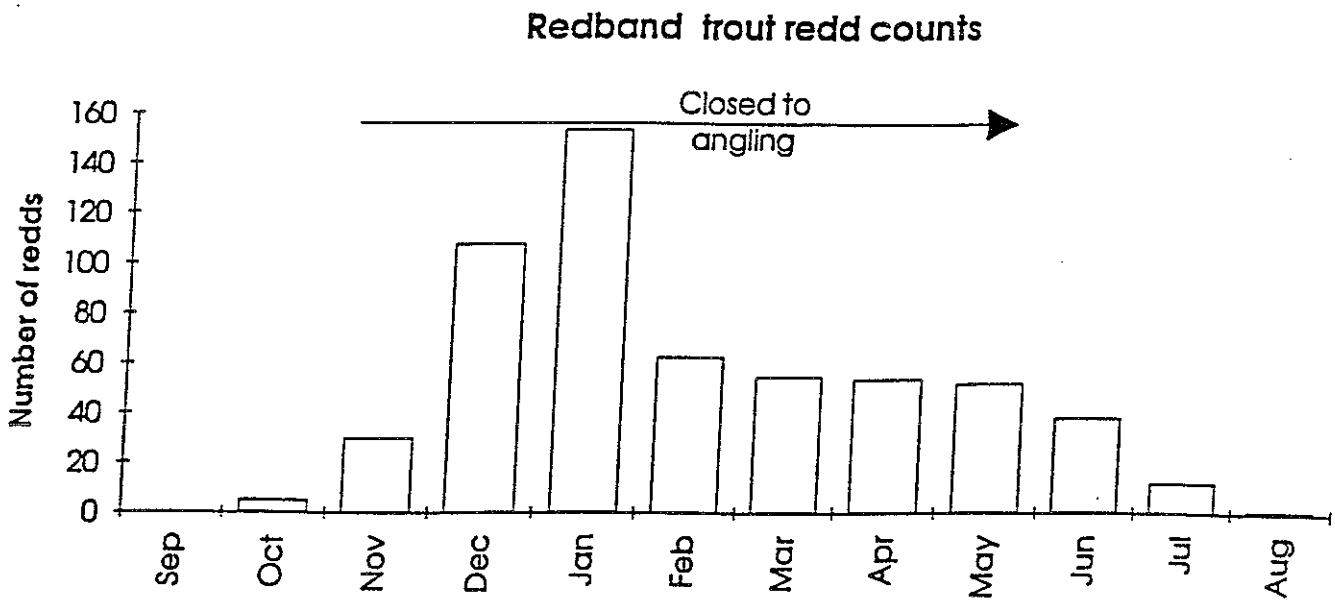


Figure 1. Spawning activity for redband trout on Spring Creek, 1988-90, (Buchanan, D. V., et al, 1990).

Within the past five years, an average of 14,300 rainbow trout at 3/lb. have been stocked in Spring Creek. The distribution between the stocking sites in those years was as follows:

Table 1. Numbers of legal-sized rainbow trout stocked in Spring Creek

	Locations	

Year	Collier Park	Upper site	Totals
1991	8,330	6,410	14,740
1992	10,400	6,200	16,600
1993	6,250	5,000	11,250
1994	8,720	5,350	14,070
1995	12,600	2,250 1/	14,850

1/ Stocking discontinued at upper site after June 26.

Life Histories of Stocked and Wild Trout

Wild redband trout spawn in Spring Creek after rearing to maturity in Upper Klamath Lake. Nearly all spawning by these fish takes place within the boundries of Collier State Park. Spawning habitat has been enhanced with the addition of gravel above a gabion near the mouth and in an area above the old diversion structure. Trout have made extensive use of the improved spawning habitat.

Redband trout have been found to spawn in Spring Creek in every month of the year except September. Redd counts made by French in 1988-90, (ODFW, 1990), showed peak spawning activity in January with the majority taking place between December and May, Figure 1.

After emergence, redband fry seek cover and rear in Spring Creek for a short time, less than a year, before emigrating to Williamson River and Klamath Lake. Few, if any, of the wild redbands grow to legal size in Spring Creek and they exhibit "wild", secretive behavior while rearing in the stream. Contrastingly, the hatchery-reared rainbow trout "catchables" are much less wary, hold in open water and are vulnerable to angling. Even fish from the hatchery-reared Williamson River "wild stock" (Lot 28), released as legals in 1990-91, exhibited drastically different behavior than the domesticated rainbows. Even through those wild-stock hatchery fish were of legal size, they proved to be virtually uncatchable because of their more secretive, wild behavior.

Field observations indicate a substantial proportion of the hatchery rainbows are caught by anglers. If not caught, research by Moring (1976) demonstrates they soon emigrate from the stream. Because of their great difference in habitat preferences and behaviors, it is unlikely the stocked rainbows have a significant effect on wild redband production. In addition, once legal rainbow trout migrate from Spring Creek, they are soon exposed to and die from a local disease *Ceratomyxa shasta* which is present in lower Williamson River. Native redband trout are highly resistent to that disease. As a result, there is little likelyhood hatchery trout could survive to spawn with native trout in these streams.

An exception to the long standing program of stocking domesticated rainbow trout was made in 1990-91 when a total of 18,400 Lot 28 redband trout from the Kirk Springs area of Williamson River were released in Spring Creek to replace the normal Cape Cod hatchery rainbows. There was the expected added benefit that these fish that were not caught in Spring Creek, would emigrate to Klamath Lake where they would contribute to the fishery there and in Williamson River on their return to Spring

Creek. At that time it was assumed that the Lot 28 trout were the same stock as the native Spring Creek redbands.

The Lot 28 "catchables" proved to be virtually "uncatchable" in the Spring Creek put-and-take fishery because of their secretive, wild behavior. Subsequently, research has shown the trout from Spring Creek and Kirk Springs area of Williamson River to be separate stocks. So, in response to concern about artifical mixing of two separate stocks in Spring Creek and the failure of the Lot 28 trout to support the management objective of a high catch rate put-and-take fishery, the program was reverted back to using Lot 72 fish. Through this experience, it was discovered that the Lot 28 redbands did emigrate to Klamath Lake and returned to Spring Creek. Of the 294 spawning redband trout sampled there in 1992-93, there were 27 fish (9%) that had adipose fin-clips identifying them as the Lot 28 fish released in 1990-91. Even this isolated instance was within compliace with the WFMP standard of not more than 10% spawners of a dissimilar stock.

Angler Access to Stocked Trout

Angler access to Spring Creek within Collier Park is excellent along both stream banks. The park provides two large day-use areas and a full facility campground. Nearly all angling within the park is done from the shore.

There are no facilities developed at the upper stocking site. Winema National Forest maintains a small campground/day-use area at the head of Spring Creek, approximately 1/4 mile upstream from the upper stocking site. This Forest Service facility was once a larger development but was closed for a time because of lack of use. It was later re-opened in its current scaled-down form. The upper release site is near the head of a large, lake-like, pool; angling in this area has been almost entirely from boats. The portion of Spring Creek between the upper release site and the Forest Service campground is shallow, with many downed trees and not a good boating area. Forest Service recreation staff "have never seen an angler at the campground".

The headwaters of Spring Creek have been found to be super-saturated with nitrogen that could cause "gas bubble disease" in fish; trout are seldom seen in that area. Trout released at the upper site are probably available to anglers for only a short time at that location before they begin to emigrate downstream where they could support a fishery along the mile of stream down to the stocking site in the park. In 1995, ODFW made spot surveys for anglers in Spring Creek between the upper stocking site and the upper park boundry on 7 days in May, June and July. Those surveys found only four parties all of which were angling from boats well downstream from the upper stocking site. These boat anglers accessed Spring Creek from private lands.

Since July 1995, stocking of rainbow trout has been limited to the site in Collier State Park which affords excellent angler access and maximum utilization of trout released for harvest by anglers.

Spring Creek Fishery

No statistical estimate has been made of the proportion of stocked fish caught by anglers but based on the observed amount of angler use and catch rate that percentage is likely substantial. The only estimate of angler use on Spring Creek was made in1969. Between June 21 and September 12 of that year, an estimated 1,170 anglers spent 2,680 hours to catch 2,077 rainbow trout (97% hatchery fish) and 88 brook trout. The estimates do not discriminate between areas in Spring Creek. Non-residents made up 54% of the anglers in that fishery.

The day-use areas of Collier State Park include a rest area and Logging Museum. Counts of cars using these areas in 1994 and 1995 during the angling season were as follows, (personal communications, James Beauchemin, Manager, Collier State Park):

May	June	July	August	Sept.	Oct.	Total
14,123	17,629	22,315	20,462	14,050	11,000	99,579

Although the proportion of these numbers that were anglers is unknown, even a small percentage would equal a substantial angler use within this area. In addition to the number of cars entering the day-use areas, many anglers park adjacent to the highway to access the stream while still others come from Collier Park Campground at the mouth of Spring Creek.

The open angling season in recent years has been from late May through October with general bag limits and tackle regulations. Based on redd counts made by French, Figure 1, about 90% of the spawning activity is during the time when the stream is closed to angling by state regulation. Observation of angler success indicates that the large spawners are not very succeptible to legal angling methods and relatively few of them are caught by anglers. It is likely that more adult spawners are taken illegally during periods of the year closed to angling, than by legal anglers catching them incidentally in the hatchery trout fishery.

Members of The Klamath Tribes are not subject to the state's regulations on Spring Creek. The Tribes' regulations allow angling all year except from December 25-January 31 with a 10-fish per day bag limit.

References

Buchanan, D. V., A. R. Hemmingsen, D. L. Bottom, R. A. French and K. P. Currens. 1990. Native Trout Project. Oregon Department of Fish and Wildlife, Fish Research Project F-136-R, Annual Progress Report, Portland.

Moring, J. R. 1976. Catchable rainbow trout evaluation. Oregon Departmant of Fish and Wildlife, Job Final Report, Project F-94-R., Portland.

Appendix 2.

Acronyms Used in This Document

Acronym	Title
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CLNP	Crater Lake National Park
FERC	Federal Energy Regulatory Commission
FNF	Fremont National Forest
MID	Medford Irrigation District
NRCS	National Resource Conservation Service
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OFWC	Oregon Fish and Wildlife Commission
OSGC	Oregon State Game Commission
OSHD	Oregon State Highway Department
SLB	State Land Board
PC	PacificCorp
RVID	Rogue Valley Irrigation District
TID	Talent Irrigation District
TKT	The Klamath Tribes
TNC	The Nature Conservancy
USFWS	United States Fish and Wildlife Service
UST	U. S. Timberlands
WNF	Winema National Forest

Appendix 3.
Management Alternatives: Excerpts from *Oregon's Trout Plan* (ODFW 1987a)

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MANAGEMENT ALTERNATIVES

The three broad management options outlined in the 1978 Wild Fish Management Policy have been a useful guide to Oregon fish managers, however more specific criteria and guidelines would help conserve wild trout stocks while providing optimal recreational and aesthetic benefits for present and future Oregonians. Before a management alternative is designated for a water, that water will first be classified under the Wild Fish Policy as Option A, B, or C. This plan defines six management alternatives (under the three options of the Wild Fish Policy) with criteria and guidelines to allow fish managers to classify their trout waters so that wild fish and their habitat can be protected while providing diverse fisheries for consumptive and non-consumptive users. The alternatives are, in priority order: Wild Fish; Featured Species/Waters; Trophy Fish; Basic Yield; Intensive Use; and Private Waters/Reservations. Most waters will fit under more than one alternative, but the guidelines listed in the higher priority will be used to direct a given trout water.

Wild Fish

Management Expectations

Management under the wild fish alternative is exclusively for wild fish Option A (Wild Fish Policy). These fish may have significant genetic value and some populations will be recognized specifically for their uniqueness.

Numerous surveys show that anglers rate among those attributes they seek in angling "sport", water quality, natural beauty, privacy, satisfaction, and solitude (Addis and Erickson 1968; Moeller and Engelken 1972; Lowry 1978[a]; Copes and Knetsch 1981). The Wild Fish Alternative seeks to meet angler diversity and desires for these nonconsumptive

attributes in addition to the consumptive use of wild trout. Management under this alternative recognizes that wild fish can be the best use for a given body of water and that special habitat considerations are necessary to maintain or enhance healthy wild populations of trout. This alternative will preserve genetic variability and fitness for specific wild stocks within the given water body. Some examples of the wild fish alternative might include: Most headwater streams in Oregon, the Deschutes River below Pelton Dam, the Blitzen River above Page Springs, Klamath Lake and Gold Lake.

Guidelines

1. No hatchery-reared trout will be released in these waters.

2. Although ODFW does not have regulatory authority over most activities that affect aquatic habitat, it will actively pursue and promote habitat protection and enhancement. Habitat must be protected or enhanced, using a subbasin wide approach, to maximize the productivity of the stock, conserve stock fitness and life history characteristics, and to maintain healthy trout populations with multipleage classes. Activities that protect and enhance trout habitat will be coordinated with land management agencies and the public.

3. Consumptive and nonconsumptive fisheries are encouraged. However, special regulations may be necessary to protect stock fitness and life history characteristics and to maintain healthy trout populations with multiple age classes.

4. No new introductions of hatchery or wild species will be made unless proposed in a management plan, evaluated to determine impact on wild trout stocks, and approved by the Commission.

5. The productive capacity of waters in this alternative will be maintained or enhanced so no net loss of natural fish production occurs.

6. Unique native populations may require additional recognition for protection.

Featured Species And Waters

Management Expectations

Management under this alternative emphasizes species or stocks that are uncommon or unique, and waters that have historical benefit or potential for unique natural beauty, water quality, aesthetics or recreational capabilities. Species, stocks, or waters under this alternative can be managed as Options A, B, or C (Wild Fish Policy).

Systems managed under this alternative may feature native species such as bull trout and cutthroat trout in eastern Oregon or introduced species such as lake trout and Atlantic salmon. The key to this alternative is the potential uniqueness or rarity of the stocks, species,

or waters featured. Thus, it can satisfy a wide diversity of recreational opportunities for present and future generations of Oregonians. Some examples include: The Metolius River, some wilderness high lakes, Atlantic salmon in Hosmer Lake and lake trout in Odell Lake.

Guidelines

1. Habitat must be protected or enhanced to maintain and preserve the uniqueness of these stocks, species, or waters. Protection or enhancement activities will include a subbasin-wide approach via land management agencies to preserve unique natural beauty, water quality and volume, and aesthetic or recreational capabilities.

2. The productive capacity of waters in this alternative will be maintained or enhanced so that no net loss of natural fish production occurs.

3. Featured species or stocks will be managed to maintain their genetic diversity, stock fitness, and resulting life history characteristics.

4. Special regulations may be necessary to protect the uniqueness of the featured stock, species, or waters. Consumptive and nonconsumptive fisheries are encouraged.

5. No new introduction of hatchery or wild species will be made unless proposed in a management plan, evaluated to determine effects on wild trout stocks, and approved by the Commission.

Trophy Fish

Management Expectations

Certain waters are capable of producing large "bragging-size" trout. This alternative does not include publicizing all trophy trout waters in the state. Many anglers fish secret and favorite waters that produce some trophy trout. Waters that have limited access or the capability to produce large fish without special habitat protection, regulation, or stocking procedures will be placed in other alternatives to preserve angler diversity. Some examples of trophy fish waters include: Segments of the Malheur River, Lower Williamson River, Mann Lake and Davis Lake. Management Options may be A, B, or C (Wild Fish Policy).

Guidelines

1. Habitat must be protected, restored, or enhanced to produce large trout.

2. Species or stocks known to produce large trout will be managed to maintain genetic diversity, stock fitness, and resulting life history characteristics.

3. Nonconsumptive fisheries are encouraged. Special regulations (catch limits, size restrictions, catch and release, and gear restrictions) may be necessary to protect these large fish and insure the population health and size diversity.

4. Releases of fingerling trout will be reduced below carrying capacity in some waters to produce large, naturally-reared trout.

5. The productive capacity of waters in this alternative will be maintained or enhanced so that no net loss of natural fish production occurs.

6. No new introduction of hatchery or wild species will be made unless proposed in a management plan, evaluated to determine impacts on wild trout stocks, and approved by the Commission.

Basic Yield

Management Expectations

These waters are managed under Options A, B or C (Wild Fish Policy) to use their natural productivity and grow trout to a harvestable size with or without the addition of fingerling or yearling hatchery trout. Although trophy trout and unique fish species may be available, the major fisheries are of a general, consumptive nature without special regulations. Most of the trout available to the angler are either from natural production or from releases of hatchery fingerlings. Other species may be present and may have fishery values equal to or greater than trout. Some examples of waters include: East Lake, Crane Prairie Reservoir, Howard Prairie Reservoir, and the Crooked River below Prineville Dam.

Guidelines

1. Habitat must be protected and enhanced to optimize natural production potential of wild stocks and natural rearing capability from fingerling stocking.

2. The productive capacity of waters in this alternative will be maintained or enhanced so that no net loss of natural fish production occurs. Problem waters can be transferred into a higher priority alternative.

3. General regulations will be used to produce consumptive fisheries unless special regulations are needed to enhance trophy-sized fish or unique species or stocks without seriously restricting the major fisheries.

4. Natural reproduction and fingerling stocking will provide the major fish production in this alternative. Stocking of yearling hatchery rainbow trout may also be used in some waters.

5. Other species may have equal or priority status for some waters listed in this alternative.

6. No new introduction of hatchery or wild species will be made unless proposed in a management plan, evaluated to determine effects on wild trout stocks, and approved by the Commission.

Intensive Use

Management Expectations

These waters are managed under Options A, B, or C (Wild Fish Policy). Waters managed for this alternative are apt to be near large population centers, or attract intensive angler use because of easy access or location of other water-oriented recreational facilities. Many of these waters can be used heavily by anglers for short periods (April, May, and June) and afterwards be used for sail boating, water skiing, swimming, and camping. Other waters can support fisheries year-round. Some of these waters are stocked with yearling rainbow trout on a regular basis. Examples include: Dorman Pond, Wirth Pond, Hagg Reservoir, and Detroit Reservoir.

Guidelines

1. Even with a consumptive fishery to large numbers of anglers, natural production supplemented with fingerling hatchery trout is the least expensive management program.

2. Habitat protection and enhancement projects are necessary because of the intensive use and large number of recreation days provided. Year-round protection is necessary in waters with natural rearing or natural production. Waters with marginal water quality and quantity are still critically important to maintain these fisheries even for 2 or 3 month periods.

3. General regulations will be used to produce consumptive fisheries but special regulations may be needed to protect wild trout under Option A or B.

4. ODFW will continue to coordinate with other state and federal agencies to prevent conflicts with other water-related recreational activities.

Appendix 4.
Characteristics of and Guidelines for Management Alternatives: Excerpts from *Warmwater Fish Plan* (ODFW 1987b)

Appendix 4.
Characteristics of and Guidelines for Management Alternatives: Excerpts from *Warmwater Fish Plan* (ODFW 1987b)

Four management categories will be used to manage warmwater game fish fisheries. These categories represent uses of the resource desired by the public. Species in all waters will be classified for basic yield, quality, high yield, or trophy management. "Basic yield" management will be low-key, with minimal regulation and little intervention in natural processes. "Quality" management will promote above-average sizes, attractive catch rates, and moderate regulation. "High yield" will feature harvest for consumption, and moderate-to-high catch rates. "Trophy" management will emphasize high catch rates, low harvest, and maintenance of large fish in the populations. Selection of appropriate alternatives will be consistent with public needs and biological constraints. Alternatives will be chosen on the basis of guidelines applied consistently statewide.

Most waters will be managed for basic yield or quality; exceptional waters will be managed for high yield or trophy. All management will be on a species or species-group basis. Therefore, a waterbody may be managed concurrently for trophy bass and basic yield bluegill, for example.

Growth rate is a critical characteristic of a fish population in determination of management potentials. Growth is also readily measured and generally stable over time in established fish communities. Fast growth means fish reach desirable size sooner, generally with less loss to natural mortality. Slow growth ultimately limits the potential for large fish. As illustrated below, management flexibility increases with fish growth rate.

Fish Growth	Acceptable Warmwater Fish Management Choices
Slow	Basic yield High yield
Moderate	Basic yield High yield Quality
Fast	Basic yield High yield Quality Trophy

There is no one "right" or "best" management scheme that fits all waters and all types of anglers. ODFW must be responsive to the need for diverse opportunities within the constraints of physical and biological potentials.

A. **Basic Yield Management.** Basic yield waters will be managed under general statewide regulations. These waters will feature simple regulations and a broad range of opportunities. From the management standpoint they will require little action unless change to another category is proposed. Anglers will find variety in species and sizes.

Characteristics of basic yield management:

* A wide range of fish sizes may be available.

* Catch and release is an option but not emphasized.

* Catch rates will be highly variable.

Guidelines for Basic Yield Management:

* All waters containing warmwater game fishes qualify.

B. **Quality Fish Management.** One target for populations showing suitable production potential and slow to fast growth is to increase the abundance of desirable, mid- to large-sized fish. The intent is to provide fish which are larger than average without attempting to produce trophy fish.

Characteristics of management for quality angling:

* Provides better than average opportunity to catch mid- to large-sized fish. Size range of fishes produced will vary, depending on the productivity of individual waters.

* Angling mortality may be controlled through regulations more restrictive than those in general use to prevent overharvest of any size group.

* Harvest of fish larger than average is higher than that provided under trophy or high yield management.

* Requires a high investment by ODFW in management and law enforcement.

Guidelines for Quality Management:

* Moderate-to-fast fish growth.

* Forage base not fully used under current management. Forage must be adequate to produce and maintain quality-sized fish.

* Generally acceptable to various user groups (local acceptance).

* Stable long-term environmental conditions.

C. **High Yield Fish Management.** Most warmwater anglers value the opportunity to harvest fish for consumption. Warmwater game fishes generally show strong recruitment and great resilience in responding to exploitation. High yield management will typically be aimed at the sunfishes, yellow perch, and brown bullhead catfish because they are often very abundant. Management will encourage rather than restrict effort and exploitation. Few anglers will be restricted by high yield management.

High yield management can also be applied to basses in those few waters meeting the guidelines. Such management may be complementary to panfish fisheries that reflect an incidental catch of small- to mid-sized bass. Regulations might be used to shift harvest away from large bass and toward mid-sized bass in some cases.

Characteristics of Management for High Yield Angling:

* A consumptive fishery is provided, with catch and release a personal option.

* Catch rates are moderate to high.

* A broad range of fish sizes is available.

* Average fish size in harvest is likely to be small to intermediate.

* Regulations are as liberal as biological constraints allow, consistent with adopted management objectives. Harvest is maximized while recruitment is protected.

* Requires low-to-moderate investment by ODFW in management and law enforcement.

Guidelines for High Yield Management:

* Capable of supporting high fish densities.

* Public acceptance of volume fishery on fish of moderate size.

* Areas of fish concentration or potential for concentration devices.

* Good angler access.

D. Trophy Fish Management. Some segments of the angling public express strong interest in catching larger than average fishes. Often, a catch-and-release or low harvest philosophy accompanies that interest. Trophy angling for bass is probably possible in some waters through restrictions on harvest. Whether trophy sunfish or catfish angling is feasible on any but ponds is doubtful. Trophy angling may offer the opportunity to experience high catch rates but will not satisfy those anglers who value consumptive angling. Care will be needed in selection of trophy waters.

Characteristics of Management for Trophy Angling:

* Provides the opportunity to catch (but not necessarily to keep) a fish of the largest size achievable in Oregon waters.

* Angling mortality is managed with regulations that are much more restrictive than those in general use.

* Catch rates of subtrophy fish may be high, but harvest rates will typically be low. To promote high growth rates, some consumptive harvest may be necessary when recruitment is high.

* A wide range of fish sizes will be available, including very large fish.

* Requires a high investment by ODFW in management and law enforcement.

Guidelines for Trophy Management:

* Fast fish growth without indication of density-dependent decreases in growth rates.

* Strong forage base not fully used under other management procedures.

* Generally acceptable to those wanting trophy angling and those displaced by loss of opportunity for consumptive fishery (local acceptance).

* Stable long-term environmental conditions.