Bond, C.E. and T. T. Kan. 1973.

Lampetra (_Entosphenus_) _minima_ n. sp., a dwarfed parasitic lamprey from Oregon. Copeia (3): 568-574.

- Endemic to Miller L. (disrupted trib. Klamath L.) now extinct.

Jan. 8, 1968

Don,

Have been checking around. Several people have suggested you contact:

Dr. Carl Bond
Dept. Fisheries & Wildlife
315 Extension Hall
Oregon State University
Corvallis, Oregon 97331

– could probably provide you with more information than anyone else.

The following areas near Bend are known to contain pure-strain cutthroat trout:

1.) Hackleman Creek and Fish lake which parallels Hwy. #20 just west of Cascades summit in the Blue River - MacKenzie Ranger District of Willamette N.F.

2.) The headwater streams of Blue River & Lookout Creek in the H. J. Andrews Experimental Forest.

3.) Upper Tumalo Creek near Bend.
(possible)

4.) Dolly Varden Trout in Metolious River.

5.) There are still some pure rainbow in the Deschutes but the fisheries biologist here thinks it would be impossible to separate or classify them.

East of the Cascades & in the Silver Lake area particularly, all streams & lakes have been stocked in recent years. No one I've talked to knows of any areas where you might still find pure strains.

Following is a list of people you might contact for help or information:

Jim Griggs - DISTRICT Fisheries Biol.
Oregon GAME Commission
BEND, Oregon

JAY GASHWILER
Bureau Fisheries & Wildlife
c/o Silviculture LAB - U.S.F.S.
BEND, OREGON

DON LECKENBY - GAME Biologist
OREGON GAME Commission
Silver LAKE, OREGON

Bill OLSON - GAME Biologist
Summer LAKE, OREGON.

Dave Koehler

[Oregon]

March 19, 1969

Dr. Donald W. Seegrist
Northeastern Forest Experiment Station
6816 Market Street
Upper Darby, Pennsylvania 19082

Dear Don:

Enclosed are some summary sheets on specimens from the Klamath, Fort Rock, Warner Lakes, Chewaucan, Catlow Valley, and Malheur basins. We are up to the Goose Lake specimens now, but I'll be busy on other projects for the next few weeks. It seems likely that all of the populations we collected last year are contaminated to some degree with hatchery rainbows, but except for Honey Creek of the Warner basin, the contamination is slight. The Klamath data suggest that besides the steelhead rainbow probably originally in the basin, there have been two distinct forms of native trout. The holotype of newberryi does not agree with the two recent samples from Trout Creek, Oregon and Butte Creek, California. The latter two samples do agree closely with each other although they are geographically remote.

I see from notes you sent me last year that there are three collection numbers at the USNM of Salmo gairdneri from the Williamson River collected by Captain Bendire. I'll arrange to borrow these as they were collected about 100 years ago or more.

Yes, I do retain all the bits of information you gather here and there and file it away for possible future use as the above example illustrates.

There is no indication in the meristic data that Buck and Bridge Creek trout have hybridized, but note the basibranchial teeth. This character is most sensitive to rainbow introgression.

It seems amazing that the Elder Creek specimens are so similar to the Chewaucan River trout Snyder collected. The Chewaucan River system must have received massive amounts of stocking--those trout must be highly adapted to the conditions of the individual environments.

The Malheur basin samples may indicate diverse groups of native trout there also. I will request a loan from Carl Bond for his collections.

Note the low gillraker number of the Chino Creek, Nevada sample. This population may be close to the primitive rainbow-like ancestor which invaded the now desiccating basins from the Columbia and mixed with a more primitive cutthroat-like trout native to those basins subsequent lacustrine environments selected for higher gillraker numbers. It is very significant that the most cutthroat-like population in Sheephaven Creek above the McCloud River falls has the lowest gillraker number suggesting little or no lacustrine influence in their evolutionary and zoogeographic history. For example, Lahontan cutthroat trout in isolated tributaries in the Carson, Walker and Truckee rivers have been removed from a lacustrine environment for at least 8,000 years yet have identical gillraker numbers as the recent lacustrine populations from Pyramid Lake, Lake Tahoe and Independence Lake.

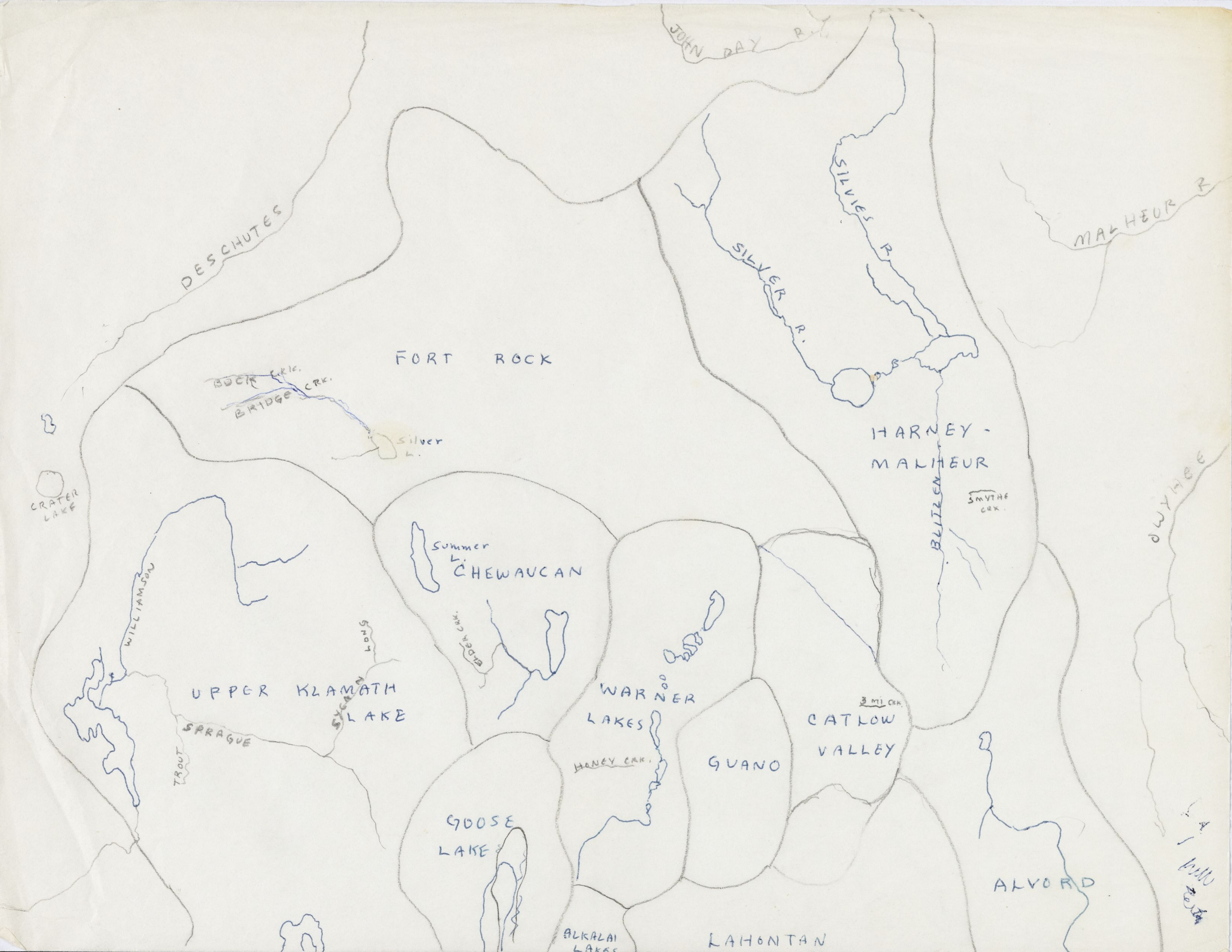
Thanks for all the information in your correspondence of March 7. The article you have reference to by Eigenmann on Tahoe trouts published in the San Francisco Chronicle was also published in the California Biennial Report (1890). He only discussed Tahoe trouts, but had some quite modern views on systematics. I quoted his report in my M. S. thesis.

Carl Schreck's thesis is now in the final typing stage and copies should be ready in about two weeks.

Sincerely,

Robert J. Behnke
Assistant Unit Leader

RJB/slm


JOHN DAY R.
DESCHUTES
SILVIES R.
MALHEUR R
SILVER R.
FORT ROCK
BUCK CRK.
BRIDGE CRK.
Silver L.
HARNEY-MALHEUR
CRATER LAKE
BLITZEN
SMYTHE CRK.
OWYHEE
Summer L.
CHEWAUCAN
WILLIAMSON
LONG
ELDER CRK.
UPPER KLAMATH LAKE
SYCAN
SPRAGUE
TROUT
WARNER LAKES
3 MI CRK.
CATLOW VALLEY
HONEY CRK.
GUANO
GOOSE LAKE
ALVORD
ALKALAI LAKES
LAHONTAN

* - Kosk Crk. →

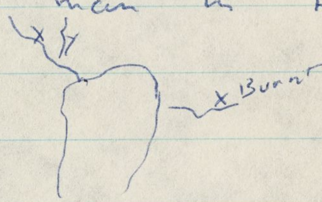
(Carl Bond has specimens)

Dick Wilmot ; collections 1969

<u>Goose L. Basin</u>: Cottonwood Crk., Thomas Crk.

(heard about Dolly Varden in Goose L. system (?) fm. Ore. Game Comm. man in Lakeview.

· Burnt Crk.



Warner L. basin: other fork (~~Sou~~ Main) Honey Crk. in large canyon (larger stream than BS coll.)
- several other tribs to Honey Crk. + 12 mi. Crk. (10 mi 15 mi. s. Adel),

Chewacan - Deadhorse.

Alvord Basin - Whitehorse Crk. (almost no water - trout only in very headwaters

Catlow - Home Crk. -

(Many collections in Goose L. - Warner Lks. basins

p. 388 1935 Fish. Comm. Rept.

9,770 non migratory trout from Kosk Crk. (P.T.) stocked in Klamath R.

Phibos [illegible] arrived

Dear Bob,

Enclosed is part of Miller's article. I don't think it would be of any value to collect in Clark Valley since the stream ~~was~~ a tributary to Parsnip Creek?? I can check this out.

I saw a map of Pluvial Lake Madeline and ~~they~~ there was a very low divide between it and Eagle Lake. The Eagle Lake trout could have gotten into Eagle Lake via Lake Madeline.

Miller says (also Snyder) that the fish fauna of Eagle Lake is typical of Lake Lahontan. However, almost all of the same species are also found in the Pit and Goose Lake. Miller give some fossil (Chasmistes)? fishes from Grasshopper Valley also Chamsthes fossils have been found near Alturas. See his paper in the "Quarternary History of United States" by Frey

Are the species found ~~in~~ Eagle Lake really so different from the Pit River fauna so as to say positively that the fauna is a Lahontan fauna??

Maybe if one did a detailed study of Eagle Lake and the surrounding streams. one would find the Eagle lake fauna to be a Pit River fauna. Almost all of the same species are found in Goose Lake and the Pit.

See you soon. We should plan to come down to Reno. on Thursday after the meeting. We could wash clothes etc on Friday and drive down to Maryland Friday evening. and return to Reno. either Saturday or Sunday. which ever you would like. If Sally wants to come down it takes about 3 hours all together to get to Springfield - (2½ hours N.Y. to Philadelphia) + ½ hour Phila. to Springfield (on commuter train).

The country side is beautiful this time of year and the temperatures have been ~~cool~~ (so far) - I have an air conditioned house now).

Let me know.

Best.

Don

CAC CA

The Eagle Lake Fish could also have come from a "stream capture" of the headwaters of Pine Creek. It is cut off from "Lost Creek" by the lava flow which took place 2000 years ago.

Dept. of Fisheries & Wildlife
Oregon State University
Corvallis, Oregon 97331
June 15, 1971

Dr. Robert Behnke
Colorado State University
Fort Collins, Colorado

Dear Dr. Behnke:

I thought you might like to know the results of my latest chromosome analysis on the trout from eastern Oregon. I have gotten some excellent chromosome spreads on fish from Bridge and Buck Creeks near Silver Lake and Three Mile Creek from the west face of the Steens Mountains. This fish has without a doubt a diploid number of 2n=58 with 46 metacentrics and 12 acrocentrics for 104 arms. I had leaned toward the assumption that this fish was related to the golden trout which you know has 2n=58 but with 48 metacentrics and 10 acrocentrics for 106 arms. I now tend to think the eastern Oregon trout is related to the rainbow in some way. I'm of the feeling that the rainbow invaded these basins, became isolated and evolved into the present day eastern Oregon trout. My reason for feeling this way is the higher number of metacentrics in this fish.

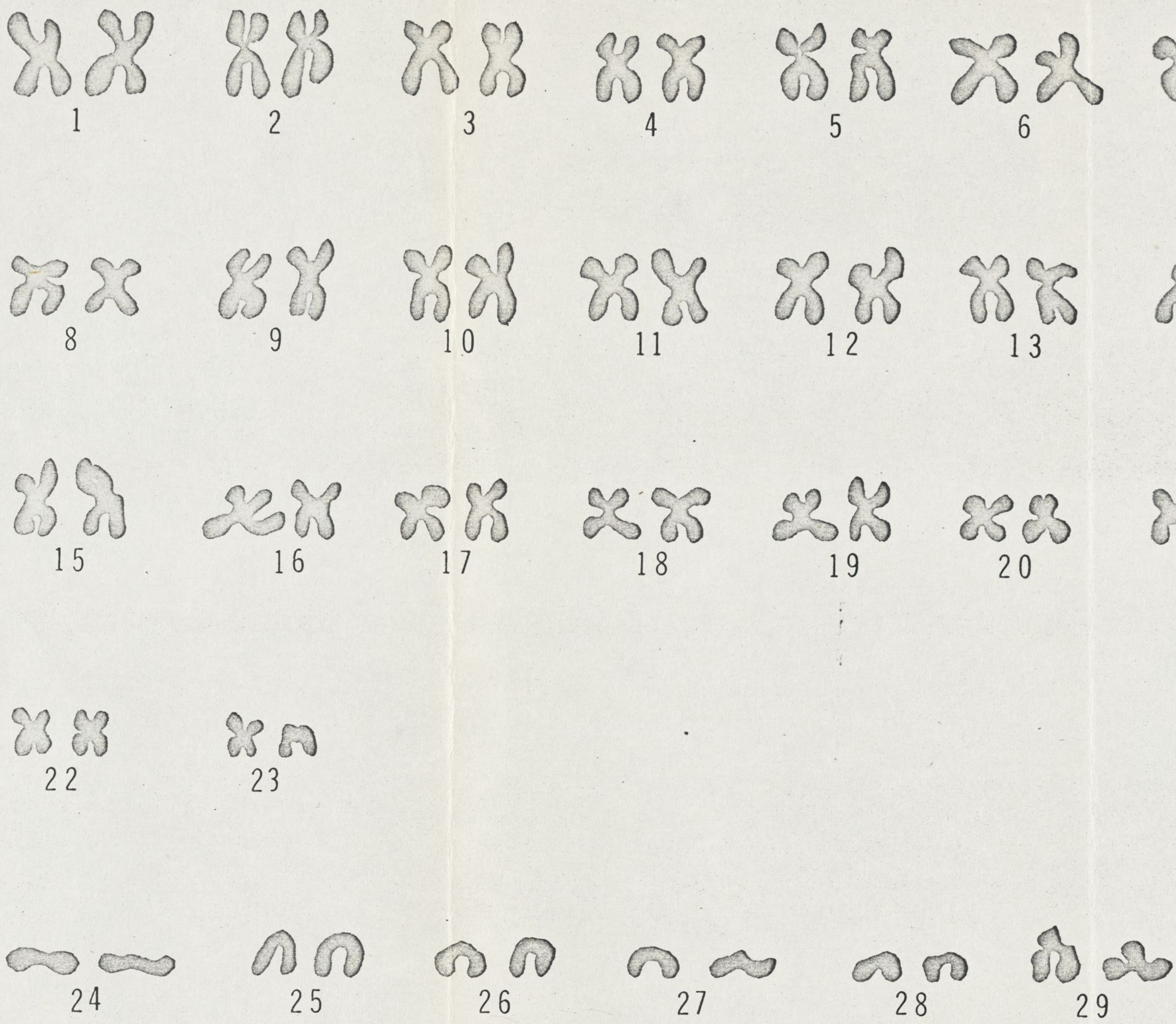
Today I came acrossed something very interesting. Dr. Bond and I collected fish from Rattlesnake Creek north and east of Burns last week and this fish has an identical chromosome compliment as those from Bridge, Buck and Three Mile Creeks. I think this shows there must have been a connection between Catlow and Harney Basins at some time; possibly through the low pass just south of Frenchglen. I'm sending along a karyogram of a fish from Bridge Creek. I would be interested in your comments on these findings.

Well I hope Dr. Post and I have come to an agreement on my thesis and that it will be all out of the way this summer. Everything else is going well. I'm going to start some enzyme electrophoresis on my fish soon and I'm hoping for some variability. I hope everything is well with you and that I will be seeing you before long.

Yours truly,

Richard Wilmot

Richard Wilmot



Somatic Chromosomes from Kidney of <u>Salmo</u> <u>sp.</u>

Bridge Creek, Lake County, Oregon

Wilmot's chromosomes
– red-banded.

other. in [illegible] access code to U.S.A.

(155-5555)

— 011

Lahontan [1985]

- Map: Perry ÷
- Salmonid genetic
- reviews

which work says
phenotypes - organisms

genotype - molecular evolution

- morphology life history ecology
reflects enormous greater part of genome than DNA allozymes.

neutral: mtDNA transitions no change functional [illegible]

[illegible] with paper

OREGON
Fish & Wildlife

Oregon Department of Fish and Wildlife
FISH DIVISION
2501 SW FIRST AVENUE
PO BOX 59
PORTLAND, OREGON 97207

Lahontan Subbasin Fish Management Plan

TO

Dr. Bob Behnke
Dept. of Fisheries & Wildlife
Colorado State University
Fort Collins, Colorado
80253

Don P@ Meeker. cfnr. colostate. EDU

UPS SHIPPER NO
OR 997-343
PKG ID #1101/23

OREGON
Fish & Wildlife

Kathryn E. Kostow
Genetics Program Leader
Natural Production Program

STATE OF OREGON
1859

Oregon

DEPARTMENT OF
FISH AND WILDLIFE

Fish Division
2501 SW First Ave., PO Box 59
Portland, Oregon 97207
(503) 229-5410 Ext. 383
FAX (503) 229-5602
TDD (503) 229-5459
kostowk@dfw.or.gov

Oregon

DEPARTMENT OF FISH AND WILDLIFE

Dr. Bob Behnke
Department of Fisheries and Wildlife
Colorado State University
Fort Collins, Colorado 80253

November 1, 1995

Dear Dr. Behnke,

I enjoyed our phone conversation this morning. I would be glad to receive comments from you about our trout systematics sections in our Biennial Report. Unfortunately, the current version of our Biennial Report is about to go to press so we do not have much time. I apologize for this and I do not wish to hurry you. We also are to put these reports out every two years and can amend previous information when new insights come available.

I would also be glad to receive any additional papers and insights that you have on trout (and other species!) biodiversity. I find the biodiversity of fish in closed systems to be extremely interesting; but also, a description of our fish biodiversity is a major action item in our conservation management program.

I will keep you informed about the potential field trip with Dr. Ruth Phillips in March. Bob Hooton also expressed interest in this trip, and we generally get our district staff, forest service staff, BLM staff and others involved. So far, similar trips have been very helpful to me. My goal is to put together a research project to address fish biodiversity and evolution in this part of Oregon. It is a very fragile area ecologically, with obviously isolated groups of fish and many interesting evolutionary questions. Since many of the species are considered to "common" and "wide-spread" the specialness of the area is not always evident to management agencies or to

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TDD (503) 229-5459

land owners. Conservation and recovery is difficult to promote and achieve without the results of such research. Any input you may offer in this effort would be very welcomed.

I have also enclosed my card. You do not, by chance, participate in email communication? If so, my address is on my card.

Thanks again for your input.

Sincerely,

Kathryn

Kathryn Kostow
Genetics Program Leader

c Hooton

LAHONTAN SUBBASINS

Fish Management Plan

Oregon Department of Fish & Wildlife

Lahontan Subbasins Fish Management Plan

Prepared by

Mary L. Hanson
Wayne Bowers
Raymond Perkins

Oregon Department of Fish and Wildlife

December 1993

CONTENTS

EXECUTIVE SUMMARY

The Lahontan subbasins are situated in southeastern Oregon and encompass portions of southeastern Harney and southwestern Malheur counties. They consist of a series of closed basins with no connection to the Columbia River. The planning area is bordered on the west by the Steens and Pueblo mountain escarpments and on the east and north by the Owyhee River drainage divide. The Nevada state line is the southern border.

The scope of the plan includes streams that drain the east side of the Steens and Pueblo mountains and the Trout Creek Mountains (which includes Oregon Canyon Mountain), as well as other streams in Oregon that drain into the Quinn River in Nevada, and lakes and reservoirs managed for fishery resources. The planning area is divided into the Coyote Lake subbasin, which includes the Willow and Whitehorse drainages; the Alvord Lake subbasin, which includes the Trout Creek drainage and streams draining the east side of the Pueblo and Steens mountains; and the Quinn River subbasin, which includes Oregon Canyon, McDermitt, and Tenmile drainages (*Refer* to Figure 1, page 16).

Natural habitat in the subbasins has been altered by historic livestock grazing, irrigation practices, mining, and associated road building. The cumulative effects of these activities on riparian vegetation, and water quality and quantity aggravated by recent severe climatic factors (e.g., flood and drought) have limited fish production in the subbasins and seriously compromised some fish populations.

Thirteen fish species or stocks are found in the planning area, eight are indigenous, and five of those have special status. The indigenous fish evolved from stocks that inhabited two Pleistocene lakes, Lake Alvord and Lake Lahontan.

The primary species of concern is the Lahontan cutthroat trout, a state and federally threatened species. It is currently present in streams in the Coyote Lake subbasin; in Sage, Indian, and Line Canyon creeks in the Quinn River subbasin; and in Denio, Van Horn, Pike, Cottonwood, and Little McCoy creeks, and possibly other streams in the Alvord subbasin that have not been checked recently. Lahontan cutthroat trout populations in streams in the Alvord subbasin are the result of outplants of fish from Willow and Whitehorse creeks between 1970 and 1981. Lahontan cutthroat trout in Indian Creek were transplanted from Sage Creek in 1980 and 1981.

The impacts to Lahontan cutthroat trout populations throughout their historic range have resulted from loss of habitat and introgression with introduced rainbow trout and competition with other introduced species of trout, such as brook and brown trout. An observed, major decline in abundance of Lahontan cutthroat trout in Willow and Whitehorse creeks has been attributed to a prolonged drought and severe winter icing in addition to habitat loss. These streams and Sage Creek have been closed to angling to protect Lahontan cutthroat trout populations.

Another species of concern is the Borax Lake chub, a state and federally listed endangered species. Its distribution is limited to Borax Lake, a hot, spring-fed lake in the Alvord Lake subbasin. Concern exists that potential geothermal development near the lake may alter the habitat to the detriment of the chubs.

Other species with special status include the Alvord chub in the Alvord Lake subbasin and the Tahoe sucker and Lahontan redside in the Quinn River subbasin. The Alvord chub is a federal Category II and state sensitive species because of its limited distribution in Oregon. The Tahoe sucker and Lahontan redside are state sensitive because of their limited distribution in Oregon. However, they are widespread and common in Nevada. More information on life history, population dynamics, habitat requirements, and limiting factors needs to be collected on these species.

Other species covered by the plan include introgressed populations of rainbow/cutthroat trout and introduced populations of brook and brown trout. These species provide consumptive fisheries where they occur and are popular with fishermen who use the area. Their continued status may be affected by efforts to recover the Lahontan cutthroat trout where it existed historically.

Mann Lake cutthroat trout, a strain composed of several stocks (primarily Lahontan cutthroat trout), provide the basis for a hatchery program whereby eggs are spawned from Mann Lake fish and reared in the Klamath Hatchery. The progeny are used to restock Mann Lake and several other nearby lakes. They provide a quality fishery that is popular statewide. Current drought conditions have raised concerns about the continued viability of this cutthroat trout stock in the event Mann Lake should dry up.

Hatchery rainbow trout are stocked in four, small reservoirs in the Oregon Canyon drainage in the Quinn River subbasin. All four reservoirs have no direct connection to Oregon Canyon Creek, and spilling during high water events is not considered a serious threat to the wild fish in Oregon Canyon Creek. These reservoirs provide a consumptive fishery in an area were angling opportunities are otherwise very limited.

Speckled dace, tui chub, and mountain sucker are other nongame species that occur in McDermitt Creek. The lack of information on life history, population dynamics, habitat requirements, and limiting factors is the principal management concern regarding these nongame species.

Existing policies provide guidance for habitat. Objectives for habitat in the subbasins include (1) influence land management decisions in ways that benefit fish habitat; (2) improve riparian habitat to provide food and cover for fish, maintain late season flows, prevent erosion, and ameliorate temperature extremes; and (3) improve water quantity and water quality to meet the biological needs of fish by providing adequate instream flows, reducing fish losses at diversions, and reducing nonpoint source pollution.

Specific policies were drafted for fish species and angler access in the planning area. Streams in the Coyote Lake and Quinn River subbasins will be managed for natural production of Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan. No hatchery trout will be stocked in streams in the subbasins except as consistent with a Lahontan cutthroat trout recovery plan under the Endangered Species Act, or except as part of a special rehabilitation program under existing state policy. Outplanting of resident rainbow/cutthroat, brook, and brown trout in the Quinn River subbasin outside their current distribution is prohibited.

Streams on the east side of Pueblo and Steens mountains that currently have populations of Lahontan cutthroat trout will continue to be managed for natural production of Lahontan cutthroat trout consistent with the Endangered Species Act and the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan. No attempt will be made to establish Lahontan cutthroat trout populations in those streams that were not stocked with Lahontan cutthroat trout in the past. In the event populations of Lahontan cutthroat trout are lost in streams stocked in the past, attempts would be made to establish populations of Lahontan cutthroat trout or other trout of the Lahontan complex (e.g., Trout Creek rainbow/cutthroat trout, Mann Lake cutthroat trout) in those streams where sufficient habitat exists.

Streams in the Trout Creek drainage (Alvord Lake subbasin) will be managed for natural production of resident rainbow/cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan. No hatchery trout will be stocked into the Trout Creek drainage, except as part of a special rehabilitation program under existing state policy.

Objectives for trout management in streams are (1) maintain and enhance genetic diversity, adaptiveness, and abundance of indigenous Lahontan cutthroat trout and resident rainbow/cutthroat trout in the Lahontan subbasins, and (2) provide diverse angling opportunities for wild trout in the Lahontan subbasins.

Additional policies address fish management in standing waters. Mann, Juniper, Wildhorse, Tudor, and Tencent lakes will be managed for hatchery fish consistent with the Featured Species Management Alternative for trout as described in Oregon's Trout Plan. Only the Mann Lake hatchery strain of cutthroat trout will be used for stocking and Mann Lake will continue to serve as the brood lake for this hatchery program. Bureau of Land Management (BLM) stock reservoirs with fisheries will continue to be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Alternative for trout as described in Oregon's Trout Plan.

Objectives that address fish management in standing waters are (1) provide brood stock at Mann Lake for the Oregon Department of Fish and Wildlife's (ODFW) cutthroat trout hatchery program, (2) provide a quality consumptive fishery on the Mann

Lake strain of cutthroat trout in Mann, Juniper, Wildhorse, Tudor, and Tencent lakes consistent with the department's brood stock program, and (3) provide a consumptive fishery on hatchery rainbow trout in selected BLM stock reservoirs.

Nongame species will be managed to maintain self-sustaining populations of Borax Lake chub in Borax Lake; Alvord chubs in the Alvord Lake Subbasin, except for Borax Lake; and Lahontan redside, Tahoe sucker, mountain sucker, and speckled dace in the Quinn River Subbasin. The objective for nongame fish management is to improve and maintain population health (e.g., abundance, multiple age classes, and genetic fitness) of all indigenous nongame species in the Alvord Lake and Quinn River subbasins.

The policy for angler access will give full consideration to sensitive and special status species and their habitat. Objectives for angler access are (1) maintain limited access to areas where special status species or their habitat may be affected, (2) define a strategy for public access in the Wildhorse Creek drainage, and (3) maintain road access at BLM reservoirs with fisheries in the plan area.

No major shifts in management direction are identified in the plan. Emphasis will continue to focus on the Lahontan cutthroat trout and habitat issues crucial to its continued existence. Some additional emphasis will be directed toward improving knowledge of distribution and abundance of indigenous nongame species, particularly those with special status. Maintaining consumptive fisheries will also be a focus.

The highest plan priorities in the Lahontan subbasins are as follows.

1. Improve data gathering and assessment of fisheries and fish habitat in the Lahontan subbasins.

2. Improve populations of indigenous fishes with special status so that special listing is not necessary to insure their continued existence.

3. Provide consumptive fisheries in the Lahontan subbasins where appropriate.

Staff identified the following highest priority actions for habitat, fish, and angler access in the Lahontan subbasins.

1. Develop a priority list to gather baseline habitat information on streams in the plan area, and coordinate fish population and habitat inventories with grazing allotment evaluations.

2. Coordinate with land management entities (public and private) to identify specific areas of concern and develop cooperative projects to improve riparian habitats.

3. Identify opportunities to improve instream flows.

4. Implement the U.S. Fish and Wildlife Service's Lahontan cutthroat trout recovery plan.

5. Develop a strategy to deal with illegal introductions of fish into the subbasins and draft a contingency plan for Lahontan cutthroat trout if exotic species are introduced.

6. Develop guidelines for maintaining a healthy, genetically fit brood stock in Mann Lake.

7. Collect more information on the distribution, abundance, and population health of nongame species.

8. Request close coordination with the BLM on any recreational development in the plan area.

9. Maintain and enhance public access opportunities to consumptive fisheries.

INTRODUCTION

The Fish Management Policy of the Oregon Department of Fish and Wildlife (ODFW) requires that management plans be prepared for each basin or management unit. The Lahontan Subbasins Fish Management Plan (hereafter referred to as the Lahontan Subbasins Plan) was developed to direct management of fish resources of the Alvord Lake, Coyote Lake, and Quinn River subbasins. The scope of the plan includes streams that drain the east side of the Steens and Pueblo mountains and the Trout Creek Mountains (which includes Oregon Canyon Mountain), as well as other streams in Oregon that drain into the Quinn River in Nevada, and lakes and reservoirs managed for fishery resources.

ODFW is committed to the planning process as an integral part of all current and future management by the agency. The Lahontan Subbasins Plan is one element in the department's planning efforts. Species plans for chinook and coho salmon, steelhead, trout, and warmwater game fish have been adopted. These statewide plans guide the development of more localized plans for individual river basins and subbasins.

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

The Lahontan Subbasins Plan was jointly developed by ODFW staff and a public advisory task force made of up of individuals from the Burns-Hines area, Ontario, McDermitt, Fields, Denio, and Bend, who represented a range of interests. Resource professionals from the Vale and Burns districts of the U.S. Bureau of Land Management (BLM) provided expertise on habitat issues. Public meetings were held in Burns and McDermitt to generate input from the public at large. Members of the task force were:

Member	Affiliation
Grant Baugh	Malheur Anglers, Ontario
Rob Burns	District BLM
Art Cherry	Rancher, Fields
Pat Coffin	U.S. Fish & Wildlife Service
Gary Defenbaugh	Rancher, Fields
Dave Elordi	General angler, McDermitt
Rick Hall	General angler, Burns
Britt and Alice Lay	Ranchers, Fields
Steve Maher	Rancher, McDermitt
Rick Miller	Oregon Trout

Bill Moser	Rancher, Denio
Eric Schulz	Trout Unlimited, Bend
Jack Wenderoth	Vale District BLM
Fred Wilkinson	Rancher, McDermitt
Richard and Jeanette Yturriondobeitia	Ranchers, Fields

The area covered by the Lahontan Subbasins Plan consists of a series of closed basins with no connection to the Columbia River. The indigenous[1] fish in these basins evolved from stocks that inhabited two Pleistocene lakes, Lake Alvord and Lake Lahontan. **APPENDIX A** contains a list of species found in the planning area.

The Plan is divided into four sections: habitat, trout, nongame fish, and access. First, the habitat section provides habitat objectives that are appropriate to management throughout the subbasins. The next two sections describe fishery resources in the subbasins. Objectives for trout and nongame fish management were developed for each of these areas. Finally, the access section details objectives for angler access in the subbasins.

Each section begins with background material pertaining to recommended objectives and actions. Each section concludes with the following.

1. Policies: mandatory operating principles developed specifically for management activities in the basin or area related to that species or topics.

2. Objectives: what is intended to be accomplished.

3. Assumptions and Rationale: support and justification for objectives.

4. Recommended Actions: individual tasks and activities needed to be carried out to progress toward attainment of objectives.

---

[1] *As defined by OAR 635-07-501 (26) indigenous means descended from a population that is believed to have been present in the same geographical area prior to the year 1800 or that resulted from a natural colonization from another indigenous population.*

GENERAL CONSTRAINTS

Besides the statewide Trout Plan, the Lahontan Subbasins Plan must also conform to other established constraints, such as federal acts (e.g., Wilderness, Endangered Species), state statutes, administrative rules, memoranda of understanding, and other policies.

ODFW interacts with other agencies primarily in dealing with fish habitat issues. Although the BLM is the major public land manager in the planning area, several federal and state entities have jurisdictions over activities that affect fish habitat. These include the U.S. Fish and Wildlife Service (USFWS), Oregon State Police (OSP), U.S. Soil Conservation Service (SCS), U.S. Army Corps of Engineers (COE), Oregon Division of State Lands (DSL), the Department of Environmental Quality (DEQ), the Water Resources Department (WRD), and the Department of Geology and Mineral Industries (DOGAMI).

Procedures developed by ODFW are incorporated in the Manual for Fish Management (1977) and A Department Guide for Introductions and Transfers of Finfish into Oregon Waters (1982), and Habitat Protection Policies and Standards (1991).

Legal Considerations

Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OARs) set goals and policies for commercial and sport fishing regulations, fish management, and hatchery operation. Pertinent rules include the Natural Production and Wild Fish Management Policies (OAR 635-07-521 through 529) and the Nongame Wildlife Management Plan (OAR 635-100-001 through 030).

ODFW's role in habitat management is primarily advisory to land management agencies and private land managers. However, the agency can influence habitat directly through its statutory authority to require screens on water diversions from streams and lakes (ORS 498.248-254, ORS 509.615), fishways at dams or obstructions (ORS 498.268, ORS 509.605), permits for use of explosives harmful to fish (ORS 509.140), certification of fish habitat improvement projects (ORS 496.260), and authority to apply for instream water rights (ORS 537.336).

Broad oversight for fish habitat management is provided by a variety of federal laws, most notably the Federal Land Policy and Management Act of 1976, which mandates that public lands be managed to provide food and habitat for fish and wildlife, and that public land resources be inventoried. The act also provides funding for the protection, maintenance, rehabilitation, improvement, and management of wildlife habitat. Other policy direction for fish and wildlife habitat is provided by the BLM Riparian Area Management Policy and the Fish and Wildlife 2000 plan, both adopted in 1987. Both of these documents set specific goals and objectives for riparian habitat management. The

1991 BLM Riparian-Wetland Initiative for the 1990's identified as goals to (1) restore and maintain riparian-wetland areas so that 75% or more are in proper functioning condition by 1997, (2) protect riparian-wetland areas and associated uplands through proper land management, (3) ensure an aggressive riparian-wetland information/outreach program, and (4) improve partnerships and cooperative restoration and management processes in implementing the initiative.

Federal policy direction is incorporated into programs at the state and district level through management framework and resource management plans. The Oregon State BLM office produced the "Oregon/Washington Riparian Enhancement Plan" in 1987. It sets forth specific goals and objectives for priority stream and lake shore miles in each BLM district in Oregon and Washington.

The U.S. Fish and Wildlife Service administers the Threatened and Endangered Species Act of 1973 (Public Law 93-205). Once a species is listed as threatened or endangered, protective measures provided for in the Endangered Species Act apply to it. There are two federally listed species in the Lahontan subbasins--the Borax Lake chub *Gila boraxobius*, listed as endangered, and the Lahontan cutthroat trout *Oncorhynchus clarki henshawi*, listed as threatened. Once a species is listed, specific measures to protect habitat are outlined in a species recovery plan, drafted by the USFWS in consultation with appropriate state wildlife and federal land management resource professionals. The recovery plan for the Borax Lake chub was adopted in 1987. A recovery plan for the Lahontan cutthroat trout is currently being drafted. In addition, activities that may affect habitat of a listed species require consultation with the USFWS. The Alvord Chub *Gila alvordensis* is a Category II candidate species. This designation applies to a species for which additional information is needed to determine whether to propose as threatened or endangered under the Endangered Species Act.

Activities in the planning area that involve the U.S. Army Corps of Engineers are primarily fill-and-removal projects associated with streambank stabilization, irrigation system work, bridge construction and repair, and work on utility installations. An application for a federal permit is required for any fill and removal activity in United States waters or adjacent wetlands. The COE will make a determination if a federal permit is required when more than 10 cubic yards of fill or removal material is involved. Fill-and-removal activities are also regulated by the Division of State Lands, which administers Oregon's fill-and-removal law (ORS 541.605-541.695 and 541.990). An application for a permit is required if placement or removal of 50 cubic yards or more of material is involved.

The Department of Geology and Mineral Industries regulates mineral activities and collects and distributes geologic information in Oregon. A permit from DOGAMI is required prior to surface mining activity that disturbs more than 1 acre of land or extracts more than 5,000 cu yds of minerals within a period of 12 consecutive months (ORS 517.750). Compliance with the permit is monitored by DOGAMI on an annual and non-scheduled basis.

In 1991, the Oregon Legislature enacted a new law for the regulation of chemical process mining. The law defines the application process and sets performance standards for best available technologies, wildlife protection, and reclamation. ODFW was given authority to condition permits to protect fish and wildlife and to do on-site inspections. Rules for implementing the new law have been finalized by DEQ, DOGAMI, and ODFW.

Federal mining regulations require a "notice of intent" to the appropriate land management agency of mining activity that disturbs 5 acres or less during any calendar year. The submission of a "Plan of Operation" is required when more than 5 acres of public land are disturbed during the calendar year or the activity is located within a designated "wilderness study area" or an "area of critical environmental concern". Measures taken to reclaim the land must be included in the notice and plan of operation (43 CFR 3809).

The Department of Environmental Quality sets standards for water quality and administers Oregon's water quality program. Point source pollution is tracked by issuing permits specifying the level of discharge permitted. The nonpoint source program relies on "best management practices" implemented by land management agencies. Best management practices are practices and techniques that may be used to reduce adverse effects on resources (AFSWD 1982). DEQ meets annually with the agencies to review their monitoring plans.

In 1991, DEQ completed the revision of its Nonpoint Source Management Program. The U.S. Environmental Protection Agency (EPA) has approved the program, which is being implemented as resources are available. The program "describes a strategy for implementing a system of practices which will protect Oregon water quality by preventing or controlling NPS [nonpoint source pollution] pollution." Strategies and objectives are defined by specific issues (e.g., riparian areas, cumulative effects, refinement of water quality criteria, and biological stream classification) and by specific land uses (e.g., recreation, agriculture, and grazing and range management).

The Water Resources Department administers Oregon's water law, which includes issuing water rights for the diversion of water, instream water rights for beneficial uses, and licensing of hydroelectric plants. The district "watermasters" in Vale and Burns are the local representatives of WRD, with jurisdiction in the Owyhee and Malheur Lake basins, respectively.

The Water Resources Commission, the policy-making body for WRD, may establish minimum streamflows, withdraw water from further appropriation, or classify water for certain uses. These designations become administrative rules.

In 1987, passage of Public Instream Water Right Law (ORS 537.332 to 537.360) authorized ODFW, DEQ, and the Department of Parks and Recreation to apply for instream water rights for fish and wildlife, pollution abatement, and recreation, respectively. Contrasted to the minimum streamflow that may be changed or rescinded by the Water Resources Commission, an instream water right would be equivalent to an out-of-stream water right, which is granted in perpetuity. Both the minimum streamflow and instream water right would be lower in seniority to vested and previously granted water rights. Established minimum streamflows were converted to instream water rights under the new law.

The Oregon State Police (OSP) have enforcement authority over angling regulations and violations of state law that affect fish and their habitat (e.g., illegal water diversions, pollution, and fill and removal violations). Under a cooperative enforcement program with ODFW, field staff from both agencies meet annually to identify fish and wildlife enforcement priorities for the Southeast Region.

Comprehensive land-use plans developed by the counties set policy for land-use activities in the county, and place restrictions on types of development through zoning and county ordinances.

The portion of the planning area in Harney County is zoned exclusive farm and range use and includes the rural communities of Fields and Andrews. The standard for both zones requires that buildings be set back a minimum 100 feet from the high water line along streams and lakes. The plan also includes policies for specific lakes and reservoirs, rivers and stream, and natural areas.

The Malheur County Comprehensive Plan goals for fish and wildlife habitat include cooperation with local, state, and federal agencies to identify the location, quality and quantity of fish and wildlife habitat; consideration of the effects of proposed development on fish and wildlife habitat when making land-use decisions; recognition of ODFW's "Fish and Wildlife Habitat Protection Plan" as a guideline for planning decisions; and continued recognition of the contribution that fishing and hunting make to the economy and the total recreation needs of the county. The county's floodplain ordinance requires notification of Division of State Lands prior to any alteration or relocation of a watercourse. Malheur County in the planning area is zoned exclusive range use except for the rural service center of Quinn (part of the town of McDermitt in Oregon).

Agreements with Other Agencies

Memoranda of understanding among ODFW, BLM, and the COE describe cooperative activities for protecting and improving fish habitat on federal lands.

ODFW meets annually with other agencies in the region to review current and future projects affecting fish and wildlife resources. On an ongoing basis, ODFW is asked to review and comment on a wide variety of activities that affect fish and wildlife habitat (e.g., timber sales, grazing allotment management plans, fill and removal permits, and habitat management plans). ODFW cooperates on a variety of habitat improvement projects.

Information and Education

Opportunities for public involvement in ODFW-sponsored activities are provided through participation in habitat enhancement projects and fish and habitat inventories. Volunteer activities may involve organized groups, such as angler clubs, school children, or interested individuals. Many of the projects take place on public land and are coordinated with other agencies, such as the BLM and the USFWS. District personnel are also available to give talks on fishery issues.

ODFW's Salmon Trout Enhancement Program (STEP) coordinates volunteers on a wide variety of fish habitat projects and provides training for teachers and offers guidance in setting up classroom projects through the Aquatic Education Project. The STEP biologist for eastern Oregon coordinates STEP activities in the planning area.

Private land owners can participate in habitat improvement projects on their private lands on an individual basis or through Coordinated Resource Management Planning, which may involve several landowners, both public and private. Federal money is available on a cost share basis for a variety of projects under programs administered by the Agricultural Stabilization and Conservation Service. State grants for watershed improvement projects are available from the Governor's Watershed Enhancement Board.

HABITAT

Background and Status

Basin Description

The Lahontan subbasins are situated in southeastern Oregon and encompass parts of southeastern Harney and southwestern Malheur counties. The planning area is bordered on the west by the Steens and Pueblo mountain escarpments and on the east and north by the Owyhee River drainage divide. The Nevada state line is the Oregon southern border. It covers an area of approximately 2,444 square miles. Land ownership is approximately 83% federal, 2% state, and 15% private (Figure 1).

The Lahontan subbasins are in the basin and range physiographic province characterized by fault-block mountains enclosing basins with internal drainage (Franklin and Dyrness 1984). The major topographic features are the north trending mountains, the Steens, Pueblo, and Trout Creek mountains. The remaining topography consists of rolling hills, buttes, and desert playas. Elevations[2] range from a minimum of 3,910 feet in the Mickey Basin 8 miles north of the Alvord Desert to a maximum of 9,670 feet on Steens Mountain (Harney County 1980). The soils are of volcanic origin with valley deposits of lacustrine and alluvial origin (Franklin and Dyrness 1984).

Climate in the Lahontan subbasins is semiarid with low precipitation, warm-to-hot summers, and relatively cold winters (Franklin and Dyrness 1984). The mean temperature at Andrews is 48°F. Summer temperatures may exceed 100°F, and winter temperature may drop below 0°F. Average annual precipitation at Andrews is 7 inches and 18 inches or more on Steens Mountain (Harney County 1980). Evaporation rates measured at the Malheur National Wildlife Refuge from April through October from 1961 through 1990 were highest during July, averaging 11.40 inches, and lowest during October, averaging 3.13 inches (information provided by the Oregon Climate Service, Oregon State University, 6 August 1992).

Most of the precipitation occurs in the winter, usually as snow. Mountain snowpack is the principal source of stream flow, although rain and thunderstorms occur in the spring and summer (Harney County 1980). Large variations in precipitation can be expected on an annual and on a seasonal basis. Recent dry periods noted by district biologists occurred in 1966, 1968, 1977, and 1986-1992. Years with heavy snowpack and subsequent flooding occurred in 1965 and 1985.

The dominant vegetation type found in the subbasins is shrub-steppe, characterized by native bunchgrasses (e.g., *Agropyron spicatum, Festuca idahoensis, Stipa thurberiana,*

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[2] *All elevations are expressed in feet above sea level.*

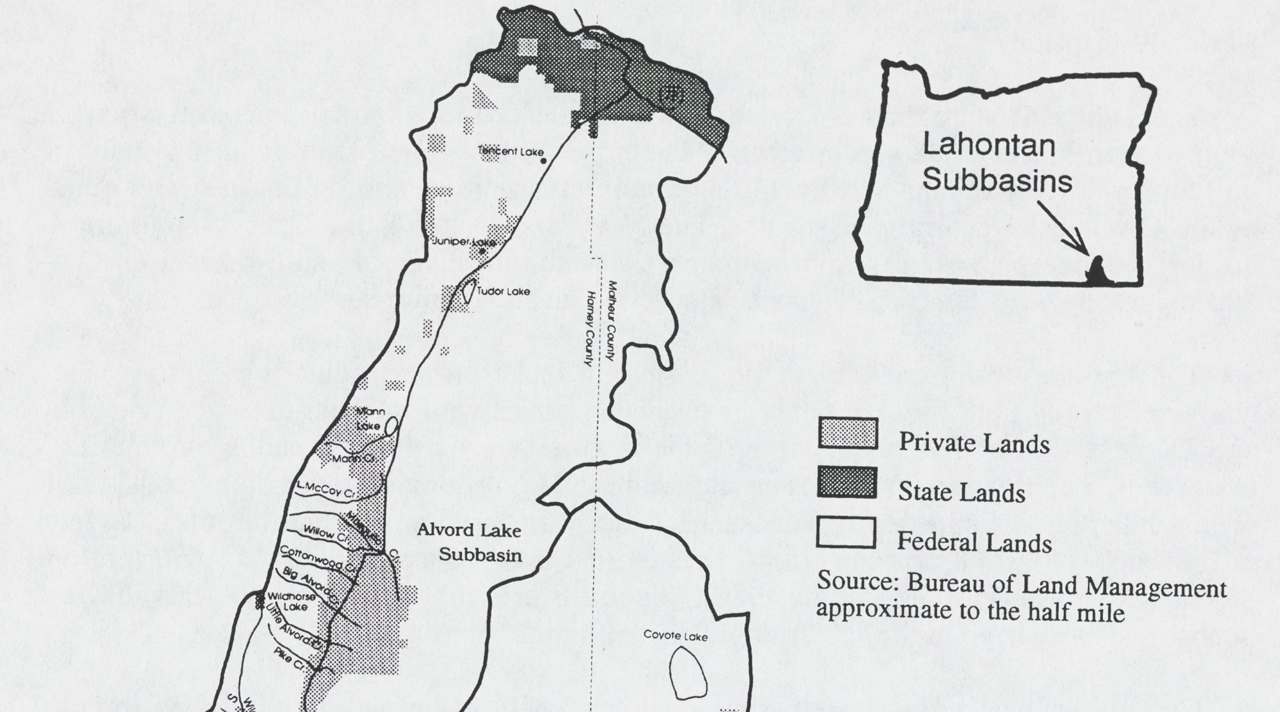

Figure 1. Lahontan subbasins planning area.

Sitanion hystrix, and *Poa sandbergii*) and sagebrush *Artemisia* spp. Salt desert shrub communities *Atriplex* spp. occur on saline soils associated with interior drainage and old lakebeds (Franklin and Dyrness 1984) and on sites too dry for *Artemisia* spp. to grow (Billings 1949). Curlleaf mountain-mahogany *Cercocarpus ledifolius* stands occur at higher elevations in the Trout Creek Mountains. Riparian vegetation is dominated by willow *Salix* spp., sedges *Carex* spp., and wildrye *Elymus* spp. with aspen *Populus tremuloides* becoming a major component at higher elevations.

Major subbasins in the planning area include Alvord Lake, Coyote Lake, and Quinn River (*Refer* to Figure 1). Alvord Lake drains the east face of Steens Mountain and the northeast face of the Pueblo Mountains. Trout Creek enters from the south and drains part of the west slope of the Trout Creek Mountains. Most of the streams in the southern portion of the Pueblo and southwestern Trout Creek Mountains in Oregon flow north into Pueblo Slough, thence to Tum Tum Lake. Denio Creek flows southeast toward Pueblo Slough. During the Pleistocene, the Alvord Lake subbasin was part of pluvial Lake Alvord (Snyder et al. 1964) which extended south into Nevada. It is believed to have connected with Summit Lake, which in turn was connected at one time to Lake Lahontan (Behnke 1979). Willow Creek originates on the eastern slopes of Trout Creek Mountain and flows into Coyote Lake, a desert playa. Other streams in the Coyote Lake subbasin, such as Whitehorse, Antelope, and Twelvemile creeks, originate on the western slopes of Oregon Canyon Mountain. Streams in the Quinn River subbasin include Oregon Canyon Creek, which originates on the east face of Oregon Canyon Mountain, and McDermitt Creek, which originates on the southern slopes of Oregon Canyon Mountain and the southeastern slopes of Trout Creek Mountain. The Quinn River drainage, a closed basin in Nevada, was part of pluvial Lake Lahontan during the Pleistocene.

Streams in the Trout Creek and Oregon Canyon mountains originate in broad, open meadows at elevations of 6,500 feet or higher. Below this elevation, the streams flow through deep, narrow canyons to about 5,000 feet, where they flow out of the canyons and through more gentle topography of rimrock mesas and broad floodplains. Most streams of the Steens and Pueblo mountains originate in steep terrain at elevations from 5,742 to 9,023 feet. The transition to floodplain is rather abrupt because of the steep escarpments, particularly on Steens Mountain.

The lower reaches of most streams, where gradient and velocities are reduced, are less productive habitat for trout because of higher water temperatures and increased siltation. Several nongame species are able to survive in these habitats. The lower portions of many streams are diverted for hay production.

Several natural lakes of either pluvial or glacial origin, as well as stock water reservoirs, provide fishery opportunities in the subbasins. Mann, Juniper, Tudor, and Tencent lakes are of pluvial origin with Mann Lake the largest (Harney County 1980). It was approximately 275 acres with an average depth of 9 feet when surveyed in 1959.

Tudor Lake fills when Juniper Lake overflows, and both lakes dry up periodically, as does Tencent Lake. Mann Lake was dry in 1955 and almost dry in 1968. Wildhorse Lake, located at an elevation of 8,320 feet, was formed from a glacier at the head of Wildhorse canyon on Steens Mountain. It has an average depth of 19 feet and is approximately 16 surface acres in size. Four BLM reservoirs in the Quinn River subbasin, Dawson, Mules Ear #1, Schoolhouse Pit, and Blue Mountain #4, are managed for trout.

Descriptions of Whitehorse and Willow creeks present the typical flow pattern of perennial streams in the Lahontan subbasins. Baseflow is from seeps and springs recharged by snowmelt. Intense rainstorms and snowmelt can cause high runoff in the spring. Spring flow diminishes and reaches baseflow levels in the summer and fall (WRD 1992). Many other streams have intermittent flows fed by spring runoff and summer thunderstorms.

The only gaging station located in the Lahontan subbasins is on Trout Creek; records exist since 1932. The gaging station is located below several diversions. The drainage area is approximately 88 square miles. Average discharge for the period of record was 16.4 cubic feet per second (cfs). A maximum discharge of 470 cfs occurred on 1 Aug 1933 and a minimum discharge 0.01 cfs occurred on 4 August 1930 and on 1 August, 12 and 18 September 1934 (USGS 1991). A gaging station on McDermitt Creek in Nevada is located approximately five miles downstream from the state line. Discharge at both gaging stations has exhibited a wide range of flows over the last 10 years that reflects the general climatic change from above-average precipitation in the first half of the decade to drought conditions in the last half. Mean monthly and annual discharge from 1980 to 1991 for both gaging stations is shown in **APPENDIX B**.

Periodic flow measurements on other streams in the Lahontan subbasins have been taken by BLM and ODFW staff. These flow measurements will be used to support ODFW requests for instream water rights on streams that have significant fishery values or species of concern. Minimum perennial streamflows granted on Trout Creek (5 cfs) and Willow Creek (3 cfs) in 1983 were converted to instream water rights 9 June 1989. **APPENDIX C** contains information on the status of instream water right applications in the subbasins.

Although many of the water rights in the Lahontan subbasins are vested, i.e., diversions predate the 1909 Water Code, not all have been adjudicated (the legal process by which pre-1909 diversions are certificated). Diversions on Trout Creek and Whitehorse Creek have been adjudicated, and diversions on some streams on the east face of Steens Mountain are in the process of being adjudicated (personal communication with Bill Beale, Harney County Watermaster on 1 May 1992, Burns, Oregon). Streams in the portion of the subbasins in Malheur County have not been adjudicated, although some on Tenmile Creek have certificates and several are vested (telephone conversation with Larry Powers, Malheur County Watermaster on 5 May

1992, Ontario, Oregon).

On 31 January 1992, Whitehorse and Willow creeks were withdrawn from further appropriation, except instream uses and limited off-stream stock watering uses that are clearly a part of and/or consistent with the USFWS recovery plan for Lahontan cutthroat trout. The BLM petitioned the WRD to amend the order in light of the fact that a final recovery plan has not been adopted and the order needed language to apply in the interim. The final rule adopted 24 April 1992, requires that any excepted uses applied for prior to adoption of the recovery plan be in compliance with the Endangered Species Act and recommended by ODFW.

Other water rights are pending for, or need to be filed on, approximately 340 stock water ponds on BLM land in the Lahontan subbasins. Most of the ponds were constructed without a water right, and the BLM is in the process of applying for those on a watershed basis. ODFW will have an opportunity to comment on all applications and will make recommendations where necessary to protect fish and wildlife habitat.

The 1988 assessment of water quality problems in Oregon (as required by Section 319 of the federal Clean Water Act) ranked water bodies as to the severity and types of water quality problems identified. Water bodies in the subbasins with segments that were ranked serious include McDermitt Creek, Sage Creek, Trout Creek, East Fork Trout Creek, Wildhorse Creek, Denio Creek, Van Horn Creek, Willow Creek, Whitehorse Creek, Little Whitehorse Creek, and Twelvemile Creek. The most common types of water quality problems identified included turbidity, low dissolved oxygen, sedimentation, erosion, and low flow. Conditions ranged from moderate to severe and varied depending on the stream segment referred to (rankings were based on responses to a questionnaire sent to resource managers and other interests and much of the information has not been verified by DEQ; DEQ 1988).

Land Use

Livestock production is the historic and primary land use in the Lahontan subbasins. The Whitehorse Ranch, the first permanent private ranch in Harney County, has operated continuously since 1869 (Harney County 1980). Hay for winter feed is produced on privately owned, irrigated pastures at the lower elevations along most of the streams. Cattle are moved onto public land grazing allotments in the spring where they graze until the fall, generally. Considerable winter grazing occurs in the Alvord Lake subbasin at lower elevations.

Grazing on public land is managed by three BLM districts. Vale BLM manages allotments in the Coyote Lake and the Quinn River subbasins. Winnemucca BLM manages the allotments in Denio and Kings River drainages and Burns BLM manages the rest of the allotments in the Alvord Lake subbasin.

The Oregon Division of State Lands manages grazing on state-owned land within its jurisdiction in the planning area, although the total acreage is small compared to private and federally owned acreage. Grazing in these state-owned parcels are leased to adjacent land owners for periods of 5 to 10 years.

Historic mining for mercury and picture jasper have occurred in the Quinn River subbasin. The Bretz (Little Cottonwood drainage) and Opalite (Mine Creek drainage) mines in the McDermitt drainage date from 1927, and were worked on an intermittent basis until 1968. Uranium prospecting took place in the Oregon Canyon Creek and McDermitt Creek drainages until 1983, when the market for uranium dropped as a result of the accident at the Three Mile Island nuclear plant (telephone conversation with Bill Holsheimer, Vale District BLM Geologist, on 25 October 1991). Many of those claims have lapsed. Historic mining for mercury and precious metals has occurred along the east face of Pueblo Mountain and the south end of Steens Mountain (telephone conversation with Terri Geisler, Burns District BLM geologist, on 25 October 1991). Total production has been estimated to be less than 500 pounds of mercury and less than 25 ounces of gold.

The Pueblo Mountains have been identified as an area of high potential for gold, silver, molybdenum, mercury, uranium, copper, and zinc, although no actual production takes place. Lead, zeolites, bentonite, perlite, and diatomite are other locatable minerals that occur in the Lahontan subbasins (Information provided by Terri Geisler, Burns District BLM geologist, 3 June 1993).

Renewed interest in gold exploration, which is occurring throughout southeastern Oregon, has resulted in approximately 200 claims being filed in the Vale BLM District portion of the planning area. Most of the mining claims in the Burns BLM District are located on the east side of the Pueblos, particularly Denio and Van Horn drainages, although claims also occur on the eastside of Steens Mountain, along Big Trout Creek, and around Flagstaff Butte. If developed, the mines may use the cyanide heap leach method to extract the gold. The excavated ore is heaped on a plastic liner and a weak solution of cyanide applied to leach out the gold. The leachate is collected and the gold precipitated out.

Geothermal exploration is continuing on public land around Borax Lake. The lake is in an Area of Critical Environmental Concern as designated by the BLM because of the presence of the Borax Lake chub. One geothermal test well was drilled near the lake, but outside the Area of Critical Environmental Concern, in 1989 by Anadarko Petroleum Corporation. Further exploratory well drilling in the area has been proposed by Anadarko, and the BLM decision to allow the action was upheld by the Interior Board of Land Use Appeals.

Recreation use is a potential major land-use factor. More people seeking the outdoor recreation experience can be expected to visit the area, one of the most remote in the state, as Oregon's population increases. Local residents report an increase in traffic and visitor use of public lands over the past several years.

Eighteen wilderness study areas are located in the Steens, Pueblo, and Trout Creek mountains. Designation as "wilderness" of one or all of the wilderness study areas could affect recreation use in the Lahontan subbasins. Until wilderness designations are made, BLM management direction is to insure that the cumulative effects of existing and proposed uses in wilderness study areas do not impair their suitability as wilderness (BLM 1987a).

There are no major urban areas in the Lahontan subbasins. The small communities of McDermitt, Denio, Fields, and Andrews service the area.

Management Considerations

Land-use factors that affect instream and riparian habitat are major concerns to fishery management. Natural habitat in the subbasins has been altered by agricultural practices, mining, and associated activities, such as road building. Of particular concern, with regard to fish habitat, are the ways these activities affect the riparian zone and the cumulative effects of management activities in a given watershed on riparian habitat (e.g., loss of cover and woody species), and water quantity and water quality, specifically water temperature, sedimentation, and turbidity. The habitat parameters in the following discussion are considered the most limiting to fish production in the planning area. Because fish habitat in the subbasins is not directly managed by ODFW, coordination of habitat management activities is also a major concern.

Riparian Habitat

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

The effects of water temperature extremes in streams (too hot in summer and too cold in winter) are lessened by the presence of healthy riparian vegetation. Summer water temperature should not exceed 70°F. However, it is not uncommon for indigenous trout to tolerate water temperature of 80°F for a short period during the day and diurnal temperature fluctuations of 30° to 35°F (Bowers et al. 1979). Trout growth and migration can cease in water temperature over 68°F (Platts 1983). Water temperatures in excess of state water quality standards (above 68°F) have been recorded in Trout; Cottonwood (Trout Creek Mountain); McDermitt; Whitehorse; including Fifteenmile, Cottonwood, and Little Whitehorse tributaries; and Willow creeks during summer months. Water temperatures recorded[3] in Willow Creek at RM 3.2 from 24 May through 15 August 1992, met or exceeded 26°C (approximately 79°F) on 48 of the 84 days during the period. (The thermograph only recorded up to 26°C.) The water temperature model of Theurer et al. (1984), using climatological and hydrological variables averaged for the month of July, showed that at an average stream discharge of 2.6 cfs during that month a lethal thermal barrier (27°C) could be expected downstream of RM 5. In fact, several dead trout were observed below a beaver dam in lower Willow Creek by survey crew members in June. Their demise was attributed to the high water temperature. Nongame species can generally tolerate water temperatures higher than that preferred by trout. An extreme example is the Borax Lake Chub, which exists only in a hot spring lake where temperatures vary from less than 63° to more than 97°F (USFWS 1987, Burns District BLM comments, 3 Jun 1993).

Dissolved oxygen concentration decreases as water temperature rises. Problems occur because the oxygen requirements of cold blooded animals, such as fish, increase along with the metabolic rate as water temperature rises. The dissolved oxygen requirement for trout egg survival in the gravel (8 ppm) is higher than for fish after hatching (5 ppm; ODFW 1977).

Streams lacking adequate riparian vegetation are susceptible to formation of 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). Winter fish kills are not uncommon in streams in the Lahontan subbasins. In recent years drought conditions (lack of snow cover) coupled with extremely low temperatures have caused several stream segments to freeze completely. In 1971 frost action on the soil along cut banks on Willow Creek was believed to cause the breaking away of large sections of the bank in the spring (ODFW, unpublished report).

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). Removal of riparian vegetation affects diet of fish by reducing terrestrial and aquatic insect production (Chapman and Demory 1963).

Cover is another component of fish habitat that is affected by the presence or absence of riparian vegetation. Large woody material provides pool habitat and streambank stability. Riparian vegetation is crucial to building and maintaining stream

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[3] *A Ryan J-90 thermograph was used.*

structure conducive to productive aquatic habitat (Platts 1983). Binns (1979) found cover was highly significant in determining fish biomass in Wyoming streams; as cover increased, fish increased.

There is no specific information on riparian vegetation conditions in the plan area prior to settlement. However, early day fur trappers were quick to note those streams with abundant willow growth because it indicated potential beaver activity (Williams 1971). Griffiths (1902) evaluated forage conditions at sites in the Trout Creek Mountains and Steens Mountains in 1901, at a time when considerable degradation of the rangelands had already occurred. He noted profuse growths of willow, abundant aspen, as well as alder in moister areas in gulches. A few remnant areas undisturbed by livestock grazing were sampled by Evendon (1988) in the Trout Creek Mountains. Plant community types found included quaking aspen/Scouler's willow in areas of steep terrain and Rocky Mountain sedge in boggy areas. Wooly sedge had reestablished on stream banks in an exclosure where cattle had been excluded for 13 years (Evenden 1988).

ODFW attributes the loss of riparian vegetation in the Lahontan subbasins to the cumulative effects of removal of the large woody component by beaver, historic season-long grazing and trampling by domestic livestock and wild horses, which prevented reestablishment of the vegetation, combined with natural events such as wildfires and flooding. The loss of riparian vegetation leaves the streams vulnerable to erosion during spring runoff and other high intensity storm events that occur in the region. In some streams on the eastside of Steens Mountain, the lower reaches were dredged historically to control the flow of water to irrigated fields downstream.

Beaver may not have been present in the planning area historically. Peter Skene Ogden noted their absence in the Quinn River, but found them in high number in the adjacent Humboldt River drainage. Although, it is believed he crossed over the Trout Creek Mountains from McDermitt to Trout Creek on his return trip in 1828, he makes no mention of beaver or beaver dams in this area (Williams 1971). Beaver were transplanted into the McDermitt Creek drainage by the Oregon Game Commission in the 1930s (personal communication, Cecil Langdon, retired ODFW wildlife biologist, 7 May 1992, Ontario, Oregon; and Joseph Urbanek, retired BLM employee, 6 October 1992, Prineville, Oregon.)

Some dramatic changes in the habitat of Willow and Whitehorse creeks may have occurred over a relatively short period of time. When flying over the area in 1961, Roy Naftzger, owner of the Whitehorse ranch, described Whitehorse, Little Whitehorse, Willow, and Fifteenmile creeks as looking like "closely-strung strings of pearls, the 300 or so beaver ponds, often connected, one above the other, from the desert nearly to the top of the watershed" (letter from Roy E. Naftzger, Jr. of the Whitehorse Ranch, to Mary Hanson, ODFW, on 21 May 1992). By 1970, when Willow and Whitehorse creeks were surveyed, Larry Bisbee, district fish biologist with ODFW, provided the following description of Willow Creek:

Much of Willow Creek is lacking good or even fair quality pools or any type of holding or resting water for trout. The lack of pool areas is particularly noticeable in the lower sections of the stream. Since almost the entire stream is fast water there are few well defined pool areas. Holding water for trout consist of deep depressions in the stream bottom formed by tree roots, rocks or under cut banks. No active beaver dams were observed. Only one or two inactive beaver dams which were silted full remained intact.

Although some beaver activity was recorded during the survey on Whitehorse and Little Whitehorse creeks, the pools were described as small and poor to fair for trout habitat. Evidence of large, old beaver dams, long since silted in, was noted in both creeks, as well as Willow Creek.

The presence of beaver is a mixed blessing. Beaver dams provide valuable pool habitat for fish and increase surface wetlands beneficial to all wildlife. Beaver also remove mature riparian vegetation and will denude an area of streamside cover if their numbers are allowed to increase unchecked. Their success depends on the condition of the riparian community and the site potential (personal communication, Wayne Elmore, BLM Riparian Specialist, Prineville BLM District, 24 August 1992). The presence of both beaver and livestock produces a situation where beaver remove mature riparian vegetation and the livestock remove any young regrowth. Careful management of both is necessary to insure the sustainability of the riparian vegetation.

Events in nature can also result in the temporary loss of riparian vegetation. Lightning caused fire burned approximately two miles of streambank on Whitehorse Creek below Doolittle Creek and the lower two miles of Fifteenmile Creek in 1974. Evidence of previous burns was noted frequently during the 1970 physical and biological survey of Willow and Whitehorse creeks. Extremely high runoff in 1984 damaged 6-7 miles of riparian habitat along Whitehorse Creek and a portion along Cottonwood Creek. Streams can usually rebound from the effects of such events and riparian vegetation will reestablish if left undisturbed. Willow were observed resprouting from the base of burned plants after the fire in 1974. Reestablishment of willow in scour areas along Whitehorse Creek was observed three years after the 1984 flood.

Whereas most of the emphasis and information collected has focused on public land in the Willow, Whitehorse, and Trout creek systems, most of the streams in the subbasins have been affected to one degree or another. Observations of the impacts to riparian vegetation from livestock use are common in all stream survey reports.

Efforts to improve riparian vegetation in the Lahontan subbasins have been ongoing since the 1970s, particularly in the Whitehorse and Willow creek drainages (BLM 1990a; ODFW, unpublished report). A variety of BLM planning documents set out objectives for riparian areas (*see* **APPENDIX D** for a summary). Initial efforts focused on structural solutions, (e.g., as willow planting, sediment traps, and riparian fencing), although control of grazing on willows and beaver populations had been recommended in the 1970 physical and biological survey. Between 1971 and 1973, approximately 40,000 willow cuttings were planted on 20 miles of stream in the Whitehorse Creek drainage, 49 trash catcher dams installed, and rim and gap fences were built to prevent livestock access to several miles of stream on Little Whitehorse and Whitehorse creeks in a cooperative effort by BLM, ODFW, and Whitehorse Ranch employees. Although 75% of the willow plantings were successful after 1 year, by 1980 they had been overwhelmed by natural revegetation or completely eliminated by cattle grazing. Three years after their placement, 60% of the trash catcher dams had washed out. By 1980, some were still operational, but less than half were providing suitable pool habitat for trout. Fencing proved the most successful by allowing for the regrowth of shrubs and forbs which provided cover for fish shade to the stream (BLM 1980). Range managers now recognize the importance of controlling the timing and degree of grazing on riparian vegetation (Platts in press, BLM 1992, Kovalchick and Elmore 1992, Elmore 1992, and Cheney et al 1990). Grazing systems being implemented under new and revised allotment management plans, e.g., the Whitehorse Butte and Trout Creek Mountain allotment management plans, address the needs of riparian vegetation and the role it plays in fish habitat and general watershed health (streambank stability, maintenance of late season flows, and water temperature amelioration). Grazing strategies being implemented in these allotments include corridor fencing, livestock removal prior to the critical growing period, livestock removal by a certain date to allow adequate regrowth of herbaceous and woody vegetation, livestock removal when utilization criteria are met, and rest from grazing (BLM 1989, BLM 1990a). Strategies are tailored to meet the objectives in each pasture of the allotments.

The Whitehorse Butte Allotment Management Plan is in the first year of implementation of a four-year grazing system designed to improve riparian habitat in Willow and Whitehorse creeks. A combination of exclosures with water gaps and a rest rotation grazing system using early-season grazing is being used in riparian pastures. A recent challenge to resumption of grazing this year resulted in a no-jeopardy decision being issued in May 1992 by the USFWS, allowing the implementation to proceed. Careful monitoring of livestock use will be necessary to insure the success of this grazing system.

BLM stock reservoirs managed for fisheries can be fenced and water piped to a trough nearby for livestock use. This permits the establishment of riparian vegetation around the reservoir and prevents turbidity caused by livestock entering the water. The troughs are equipped with floats to prevent the water in the troughs from overflowing. The fences and overflow devices must be checked periodically and maintained if fish habitat objectives are to be met. The four BLM stock reservoirs in the Lahontan subbasins managed for fisheries need to be assessed for adequacy of the riparian habitat.

The loss of riparian vegetation with resulting temperature extremes, lack of cover, and increased erosion limits fish production and water quality in the subbasins.

Water Quantity and Water Quality

Instream habitat components affecting fish production in the Lahontan subbasins are water quantity and water quality. Out-of-stream diversions limit fish production by reducing the amount of water in the stream. Some stream segments are completely dewatered immediately below the diversions. Not all diversions have headgates, few have monitoring or measuring devices, and none are screened. Once water is diverted, loss occurs in unlined or leaky canals and ditches. Most diversions pre-date the few established instream water rights in the subbasins.

The Oregon Fish and Wildlife Commission has established by policy the long-term goal of obtaining an instream water right on every waterway exhibiting fish and wildlife values. Current emphasis in the Southeast Region is on stream segments on public land that have sensitive, threatened, or endangered species; significant fishery value; or are threatened by development (*see* **APPENDIX C** for a list of instream flows requested).

Unscreened diversions channel fish into irrigation ditches where they become stranded and die. In 1953, 24 diversion ditches on Trout Creek were evaluated for possibility of screening, but none were screened. State statutes (ORS 498.248 and 509.615) require screens on all diversions that affect movement of game fish. A two-year moratorium on requirements for screens on non-hydro, gravity flow diversions under 30 cfs was passed by the 1989 Oregon Legislature, and ODFW was directed to prepare a statewide screening needs assessment. The Legislature also instituted an income tax credit to cover up to 50% of the costs to install screens and fishways up to a maximum of $5,000.

In 1991, the state Legislature directed ODFW to develop and implement a cost sharing program for the installation of a limited number of fish screens for priority water diversions under 30 cfs in the next two bienniums (specifically, no less than 60, or more than 175 by July 1995). It also required ODFW to develop a comprehensive 10-year program for the installation of 3,000 fish screens for the biennium beginning in July 1995, but extended the moratorium to require screens on diversions under 30 cfs for another two years, unless covered by the new program. (Total diversions identified in the assessment numbered 55,645 with 15,597 occurring in eastern Oregon.)

ODFW will finalize its priority list of water diversions needing fish screening that were identified, evaluated, and ranked by the district biologists (Nichols 1991). The department will then select diversions to be screened from the priority list, but not necessarily from the top of the list. The department will attempt to solicit program volunteers and then select diversions that protect the greatest number of fish at the same time protecting the greatest number of threatened and endangered species. There are 74 diversions listed in the WRD data base that occur in Lahontan subbasins, all less than 30 cfs. This list is conservative since diversions on several streams, e.g., McDermitt, Whitehorse, Willow, and Denio, have not been entered into the data base and do not appear on the list. About 40% of the listed diversions have been ranked by ODFW. Information on the listed diversions is available on request from the WRD and ODFW.

Diverters may design, construct and install their own screens, adequate to prevent fish from leaving the body of water, or may request ODFW to design and construct the screen. Installation costs of screens constructed under this cost-sharing program are paid one-third by the diverter and two thirds by the state using General Fund dollars, regardless of who constructs and installs the screen. The diverter can receive a 50% tax credit for his share of the costs up to $5,000, if the screen is built to Department specifications. The bill requires ODFW to clean and maintain all screens built under this program. The Legislature passed an angling license surcharge to fund ODFW's administrative costs of the program.

Dams built to divert water may create barriers to fish movement. An example is the dam on Whitehorse Creek that serves as the main diversion for the Whitehorse Ranch irrigation system. Once the splash boards are in place to divert water into the ditch, fish that were swept over the dam in the spring or that move downstream in the winter cannot get back above the dam because there is no fish passage. Habitat surveys will identify other diversions in the plan area that are barriers to fish passage. Solutions to fish passage problems and structural design recommendations will be discussed with affected land owners.

Water diversions on Sage Creek may have preserved the Lahontan cutthroat trout in that stream. The complex of irrigated hay meadows may have prevented rainbow trout from ascending the stream system and introgressing with the Lahontan cutthroat trout which occur above the diversions.

Other water developments in the subbasins include numerous small reservoirs and spring developments that provide livestock water and improve distribution of livestock. The cumulative impact of these developments on instream flows is unknown. ODFW has advised the BLM of its concerns regarding this issue (Letter dated 12 Nov 1992 from Wayne Bowers, ODFW District Fish Biologist, to James May, BLM District Manager).

Water quality determines, to a large extent, the species of fish a given stream segment can support. The distribution of trout is a reflection of water quality, primarily temperature, sedimentation, and turbidity. Sedimentation and turbidity in the Lahontan subbasins are associated with nonpoint source pollution.

Sedimentation reduces available spawning habitat, reduces egg survival, impedes spawning and egg incubation, and limits production of aquatic organisms by covering up the substrate and interfering with oxygen exchange. Sediment accumulating in pool areas also reduces available instream habitat. Turbid water generally causes greater damage to fish habitat than to fish themselves, primarily from the siltation of food-producing and spawning areas. Turbidity limits plankton production by preventing the penetration of sunlight and reducing the population of sight feeders, e.g., trout, shiners, and chubs, because they cannot see to feed. Heavy silt loads can result in injury to the gills and other delicate structures, resulting in mortality to fish.

Sediment in Lahontan subbasins 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; and from surface runoff originating from improperly placed roads and poorly vegetated uplands. The lack of streamside vegetation also prevents the trapping of sediments and rebuilding of the streambank (Platts 1983).

Sedimentation and turbidity are believed to limit fish production in the Lahontan subbasins, based on observations during stream surveys. Very little quantitative water quality data exists for waters in the subbasins, except for ongoing studies at Borax Lake. Limited data on water and air temperatures are available in most of the surveys, and some water chemistry data (alkalinity, conductivity, and sulphate level) exists for McDermitt Creek in 1989 and Van Horn Creek collected from 1982 to 1986. Data are not sufficient to quantify the magnitude of problems that may exist, as suggested by the 1988 water quality assessment. Streams with a history of past mining activity should be evaluated for any resulting water quality problems, e.g., Mine and Payne creeks. Factors that could be considered in establishing priorities for data collection include presence of special status species and the DEQ assessment rating.

Monitoring at Borax Lake consists of a remote automated weather station that collects weather information and water quality data within the lake in a joint effort by the USFWS, BLM, ODFW, and The Nature Conservancy to evaluate ecological influences on the Borax Lake chub.

Increased mining activity and the resulting surface disturbance may increase sediments to the streams and increase turbidity. Disturbance of surface soils could result in the leaching of naturally occurring elements, such as mercury, into surface waters. Potential point source pollution may occur from leaks or spills of toxic substances used in the cyanide heap leach process.

Concerns with geothermal development are the potential alteration of the temperature, flow regime, and water quality in Borax Lake, the only habitat of the Borax Lake chub.

Current information on other instream habitat parameters (e.g., cover, pools, substrate, large woody material) is not available for all streams in the Lahontan subbasins. Instream habitat data collected on McDermitt Creek in 1988 and 1989 and on Kings River in 1989 included percent pool measure (pool/riffle ratios), percent pool structure, and percent stream bottom (substrate material). For McDermitt Creek (including 5.20 miles in Nevada), the overall ratings for each category are as follows:

percent pool measure, fair; percent pool structure, good; and percent stream bottom, good (NDOW 1989a). The Kings River reach in Oregon was rated fair for percent pool measure, good for percent pool structure, and good for percent stream bottom (NDOW 1989b).

ODFW stream habitat survey data collected in 1992 for Willow Creek was divided into four reaches for analysis. Pool habitat in Reach 1 (the lower 9 miles where water temperature is a limiting factor) averaged 45% (good) of the wetted area and ranged from 15-26% (poor) in the upper 8 miles of the stream (Reaches 2-4). In Willow Creek overall the wetted area composed of fine sediments (silt, sand, and organics) averaged approximately 46% (poor), while wetted area composed of gravel averaged approximately 43% (good). Willow Creek is considered deficient in woody debris (pieces 15 centimeters diameter by 3 meters in length or larger) with only 300 pieces of wood (total volume of 40 cubic meters) in 17 miles of stream. Shade along the creek averaged 33% (poor) in Reach 1 and averaged 50-63% (fair to good) in reaches upstream.

Little Whitehorse Creek was also surveyed in 1992. Approximately 14 miles of habitat were surveyed and divided into six reaches for analysis. Pool habitat in Little Whitehorse Creek was 29% of the wetted area, and most of that occurred as beaver dams in the lowest reach (Reach 1), downstream of the exclosure (Reach 2). Fast water units (glides, riffles, and rapids) made up 48% of the wetted area, while dry channel accounted for 23% of the wetted area. The wetted area composed of fine sediments (silt, sand, and organics) averaged approximately 55% (poor), while wetted area composed of gravel averaged approximately 31% (good). Woody debris is in very low abundance in Little Whitehorse Creek (603 pieces) providing no habitat complexity or cover. Most of the wood (75%) occurred in the uppermost reach (Reach 6). Shade averaged 44-55% (poor) in all reaches except Reach 2 where shade averaged 70% (good).

The BLM surveyed Denio and Van Horn creeks on BLM land in 1992, and ODFW surveyed Big Whitehorse Creek and tributaries in 1993. Analysis of these data is not completed.

Coordination

Habitat information is collected by state and federal agencies with oversight in either wildlife or habitat management. The BLM, ODFW, and Nevada Department of Wildlife (NDOW) have all collected fish habitat and population data in the planning area. **APPENDIX E** contains a summary of inventory information collected for the Lahontan subbasins.

ODFW and BLM biologists have coordinated on several physical and biological surveys to collect baseline information useful to both agencies and to share manpower and equipment. The stream is walked and evaluated at specific intervals, usually 0.25 mile. Observations include fish present (species, size, and abundance), average stream width, turbidity, percent of stream area shaded, streamside cover type, air and water temperatures, streamflow, substrate (gravel, pool, rubble area), percent of section in pools, gradient, and limiting factors (e.g., barriers). In surveys conducted in the late 1970s, the BLM also evaluated stream channel habitat stability, quality of riparian vegetation, instream aquatic habitat, and bank erosion. Both the BLM and ODFW used this method (the data forms are almost identical) until the mid-1980s when methods that would allow biologists to better quantify change in habitat and fish populations were developed. The newer methods generally involve a more intensive level of inventory than previous methods. None of the original physical and biological surveys conducted by ODFW have been repeated and the information is not directly comparable, but provides some baseline information.

Beginning in 1985, permanent sample sites, representative of the various types of habitat, were established in the Whitehorse, Willow, and Trout creek drainages. Measurements and estimates of habitat characteristics were made based on the methodology developed by Binns and Eiscrman (1979) for quantifying fluvial trout habitat in Wyoming. ODFW estimated trout abundance for each drainage based on the sample population and then compared the population with the habitat characteristics for that drainage (Buckman 1989). The BLM and ODFW used this methodology in 1989 with the addition of several new sample sites, a riparian vegetation composition survey, and inclusion of the Oregon Canyon Creek drainage (Perkins et al. 1991). Figure 2 shows the location of sample sites.

The latest methodologies currently being used include the General Aquatic Wildlife Systems used by NDOW on McDermitt Creek in 1988 and 1989, and BLM's Aquatic Habitat Inventory used on streams in the Whitehorse Butte Allotment in 1988. ODFW's inventory methodologies were updated under the Aquatic Inventory Project, funded by the Restoration and Enhancement Board, and were used in the Willow and Whitehorse drainages in 1992. Burns BLM also used ODFW's method to inventory Denio and Van Horns creeks in 1992. These methodologies were developed to provide biologists with up-to-date, accurate information on the distribution and relative abundance of fish populations, and the quality and quantity of fish habitat. All three inventory methods share common ancestors and provide different levels of survey intensity depending on the inventory needs identified (needs are generally issue driven). They can be used to establish trends over time.

The Vale BLM also samples riparian habitat using low-level aerial, color infrared photography on Whitehorse, Little Whitehorse, Fifteenmile, Doolittle, Willow, upper and lower McDermitt, Cottonwood (tributary of McDermitt), Indian, Sage, and Oregon Canyon creeks, approximately 68 miles total. Initial flights began in 1981 and 1982, with subsequent flights in 1987. These photographs are very useful for showing change over time in channel morphology and riparian vegetation. Analysis of photos taken in 1981,

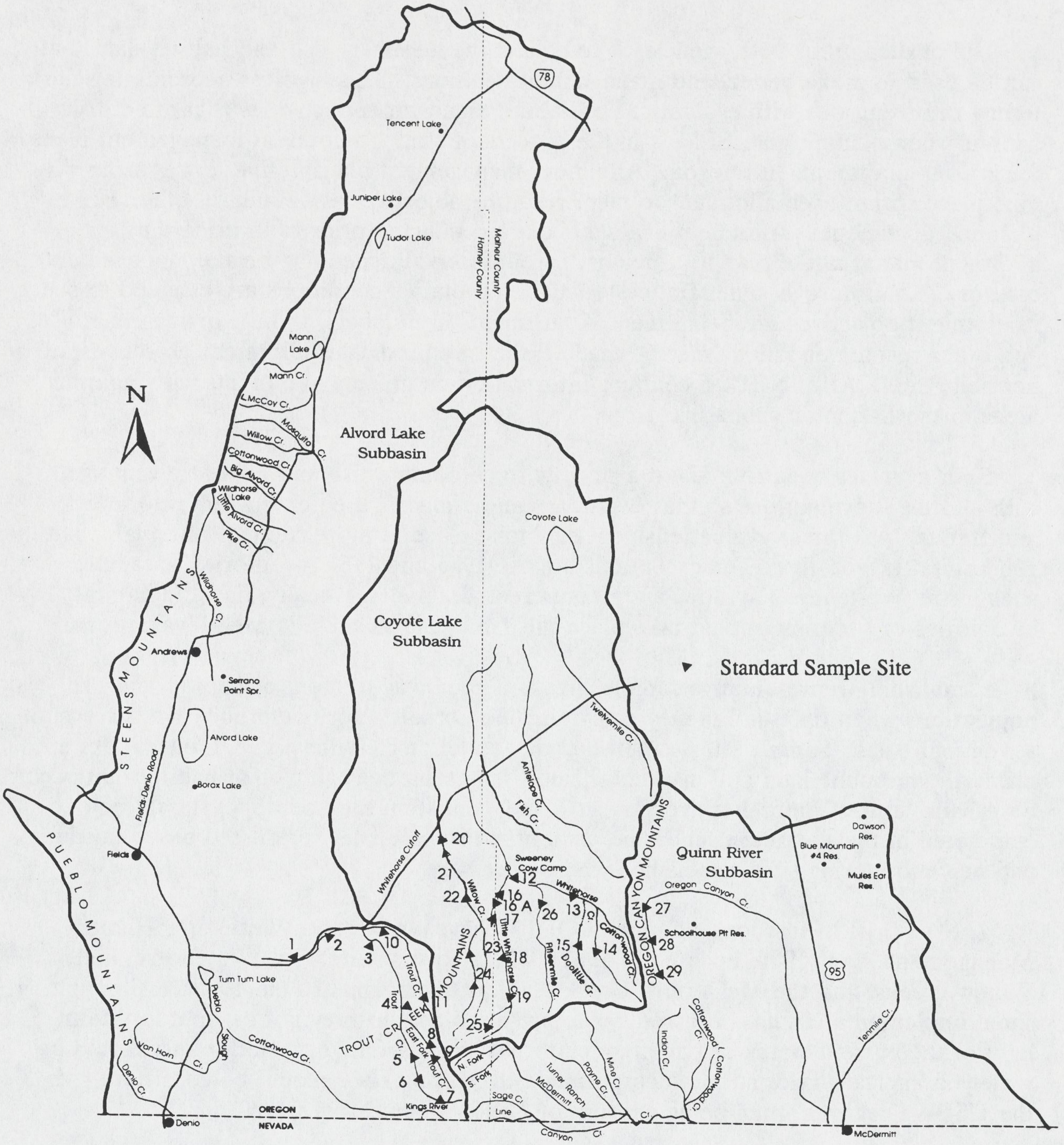

Figure 2. Sample site locations in the Lahontan subbasins in 1985 and 1989.

1982, and 1987 of sites on Willow, Whitehorse, Little Whitehorse, Fifteenmile, and Doolittle creeks showed a downward trend in the most of the sites as evidenced by declines in stream sinuosity and riparian vegetation (Vale BLM, unpublished data).

The challenge for both agencies is to collect the necessary fish and habitat data that can be used to make better land management decisions. This involves coordinating the timing of inventories with evaluations of habitat management activities that affect fish habitat. For example, the BLM is in the process of writing allotment management plans for grazing allotments in Oregon. Allotment management plans define how grazing will take place within each allotment to meet resource objectives as defined in other BLM planning documents. Allotment evaluations are conducted prior to drafting the allotment management plan at a five or 10-year interval depending on the management category (e.g., improve, maintain, custodial)[4]. Vegetative conditions are assessed to see if allotment objectives are being met. Adjustments in numbers, timing, or season of use, and other recommendations may be made if the trend indicates allotment objectives are not being met. **APPENDIX F** contains information on grazing allotments with riparian areas in the Lahontan subbasins.

Both agencies need to make it a priority to coordinate fish and habitat inventories with allotment evaluations so that decisions can be made based on current information and trends. Allotment evaluations generally take place at more frequent intervals than fish habitat inventories. The exceptions are the 1985 and 1989 inventories at sample sites in the Whitehorse, Willow, and Trout creek drainages. Ideally, fish and habitat inventories or sampling should take place the same year as the allotment evaluations.

Establishing representative sample sites is a good way to monitor habitat and fish populations when time and money constraints do not allow for comprehensive surveys on a frequent basis. Sample sites established on Whitehorse, Willow, and Trout creeks are primarily on public land and may not include representative samples of habitat that occur on private land. Comprehensive surveys (using consistent methodology) should be completed in the Lahontan subbasins, established sample sites reassessed based on them, and new monitoring sites established where necessary.

The Vale BLM in cooperation with ODFW have written the Whitehorse Habitat Management Plan (1980, updated in 1981), which covers Antelope, Whitehorse, and Willow creeks, and the McDermitt Creek Habitat Management Plan(1985). Although some implementation has occurred, some proposed actions may not be appropriate in light of the current status of Lahontan cutthroat trout in Oregon. Both plans should be reviewed and new information incorporated into them. They should be consistent with the USFWS recovery plan being written for Lahontan cutthroat trout.

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[4] *"Improve" current unsatisfactory resource condition; "maintain" current satisfactory resource condition; and manage "custodially" while protecting existing resource values (BLM 1984). These BLM categories are used to set priorities for allocating funds and time.*

Policies

Existing statewide policy directs the department to "strongly advocate and support habitat protection and restoration on private and public land" (OAR 635-07-523). As such, it applies to fish habitat in the planning area. The following objectives address specific areas of concern in the Lahontan subbasins.

Objectives

Objective 1. Influence land management decisions in ways that benefit fish habitat.

Assumptions and Rationale

1. Coordination of fish population and habitat inventories with allotment evaluations will provide current information for making better management decisions that benefit fish habitat.

2. Stream surveys need to be updated and monitoring established on many streams in the Lahontan subbasins.

3. The Whitehorse Habitat Management Plans and the McDermitt Creek Habitat Management Plan need to be reviewed and updated.

Actions

1.1 Coordinate fish population and habitat inventories with grazing allotment evaluations. Integrate inventory findings and recommendations into evaluations.

1.2 Develop a priority list and use the ODFW Aquatic Inventory methodology, or other suitable method, to gather baseline habitat information on streams in the planning area.

   a. Work with the Burns, Vale, and Winnemucca BLM districts and NDOW to standardize habitat inventory methodologies.

   b. Combine resources and manpower with BLM and NDOW to accomplish habitat inventory needs.

   c. Identify opportunities for public involvement in habitat inventories through volunteers or classroom projects.

1.3 Provide up-to-date fish population and habitat information to land managers.

1.4 Evaluate inventory data with regard to land management and make recommendations to land managers. Request data be used in consideration of management decisions.

1.5 Cooperate with BLM and private land managers on measures to protect and enhance fish habitat. Identify opportunities for public involvement in fish habitat enhancement through volunteers or classroom projects.

1.6 Request Vale BLM review and update pertinent habitat management plans.

1.7 Recommend riparian protection and instream flow protection or restoration in review of other agencies' permit applications and plans.

Objective 2. Improve riparian habitat to provide food and cover for fish, maintain late season flows, prevent erosion, and ameliorate temperature extremes.

Assumptions and Rationale

1. Loss of riparian vegetation, such as reduction in seral stage, diversity, and quantity, affects fish habitat.

2. Restoration and maintenance of riparian vegetation in the subbasins would benefit fish populations.

3. ODFW supports grazing strategies that when properly implemented improve riparian areas and benefit fish habitat.

Actions

2.1 In cooperation with land managers use allotment management plans, coordinated resource management plans, and other opportunities to institute grazing practices and range improvements that benefit the riparian habitat and associated uplands and protect fish habitat.

2.2 Request the BLM to restrict mining activities in the riparian zone to protect fish to protect fish habitat.

2.3 Encourage land managers to consider the impacts on habitat when designing roads and making recreation plans, such as trails.

2.4 Coordinate with land management entities (public and private) to identify specific areas of concern and develop cooperative projects to improve riparian habitats.

2.5 Provide information to private landowners on the benefits of healthy riparian conditions and methods to achieve them.

2.6 Manage beaver populations in conjunction with grazing practices to benefit riparian and aquatic habitat.

a. Monitor beaver populations and evaluate their adverse effects on fish habitat.

b. Take appropriate action to control beaver where necessary.

2.7 Evaluate riparian habitat conditions at BLM reservoirs managed for fisheries. Make recommendations to BLM as required to improve riparian habitat conditions at BLM reservoirs.

Objective 3. Improve water quantity and water quality to meet the biological needs of fish by providing adequate instream flows, reducing fish losses at diversions, and reducing nonpoint source pollution.

Assumptions and Rationale

1. Improved supervision of water diversions would benefit fish by ensuring that water in excess of legal rights remained in the stream and certificated water rights are enforced.

2. Obtaining instream water rights will protect fish habitat from further out-of-stream diversion.

3. ODFW will continue to apply for instream water rights.

4. Natural recovery of the riparian habitat will result in improvement of the structural components of instream habitat and water quality.

5. Quantitative water quality data has not been collected for most streams in the Lahontan subbasins.

6. Further instream habitat restoration will rely on vegetative recovery and not placement of instream structures.

Actions

3.1 Identify screen needs. If a problem exists, identify a solution and screen strategy.

   a. Draft a list of high priority screening needs in the planning area.

   b. Work with the screen task force to identify screen projects.

   c. Provide information to the Water Resources Department on diversions not in its data base.

   d. Identify opportunities where volunteers could help construct and maintain fish screens.

3.2 Identify fish passage problems and recommend corrective action.

3.3 Identify opportunities to improve instream flows.

   a. Identify streams/reaches where flows are most needed and collect necessary flow data needed for instream water right application.

   b. Work cooperatively with the WRD to monitor instream flows, identify areas to focus water right permit reviews, and identify other areas to participate (e.g., basin planning) where fish habitat can benefit.

   c. Explore cooperative opportunities with senior water right holders.

   e. Identify opportunities where volunteers can help gather instream flow information.

3.4 Work with WRD, BLM, and other interested agencies to study the effects of water developments, e.g., reservoirs, spring developments, on instream flows.

3.5 Request on-the-ground water quality assessment studies from EPA, DEQ, or land management agencies, to evaluate the extent of nonpoint source pollution and trend.

3.6 Monitor mining activities; identify existing and potential problems (e.g., Denio Creek).

3.7 Coordinate with public and private land managers to identify specific areas of concern.

a. Identify priorities for OSP's Cooperative Enforcement Program.

b. Coordinate enforcement with appropriate state and federal agencies.

c. Develop cooperative projects to improve water quality and water quantity.

TROUT

Background and Status

The only indigenous trout in the planning area are members of the Lahontan cutthroat complex (*Oncorhynchus clarki* subspp.). This complex includes up to five related, undescribed subspecies, depending on author. Behnke (1992) proposes five subspecies, three of which are in Oregon, including the Humboldt cutthroat in the Quinn River system, the Whitehorse cutthroat in the Coyote Lake system, and the Alvord cutthroat in the Alvord Lake system. The Alvord cutthroat is thought to be extinct by Behnke, although an introgressed cutthroat/rainbow *O. clarki/O. mykiss* population that includes the Alvord lineage is still present in Trout Creek. A mixed Lahontan/rainbow hatchery trout is maintained in Mann Lake. Natural spawning populations of brook trout *Salvelinus fontinalis* and brown trout *Salmo trutta* are also present in the planning area. Hatchery rainbow *O. mykiss* trout are stocked in four reservoirs in the Quinn River subbasin. The three Lahontan complex subspecies and the three non-native trout are each discussed separately.

Lahontan Cutthroat Trout

Lahontan cutthroat trout evolved from fish inhabiting pluvial Lake Lahontan and remained in tributary streams as desiccation of the pluvial lakes took place during the Pleistocene.

Lahontan cutthroat trout in Nevada were listed as endangered under the federal Endangered Species Act in 1970 and as a subspecies reclassified as threatened in 1975. Their recognition as such in Oregon did not take place until Williams (1991) classified the cutthroat trout of Willow and Whitehorse creeks as Lahontan, based on genetic studies and the existence of pure populations in Sage and Line Canyon creeks was confirmed. The USFWS officially listed the trout in Willow and Whitehorse drainages as Lahontan cutthroat on 4 November 1991. The Oregon Fish and Wildlife Commission subsequently listed them as threatened under state statute.

Hatchery Program: In 1954, when a region wide management plan for trout was formulated, emphasis was on the establishment of cutthroat trout fisheries in the southern and western parts of the region. Cutthroat trout of the Trout Creek Mountains (Willow and Whitehorse creeks) were considered best suited for the area, as were Walker Lake (Nevada) Lahontan cutthroat trout. Adult trout were taken from Willow Creek for brood stock to Wallowa Hatchery in 1955. Cutthroat trout were also raised at Wizard Falls Hatchery. Some of the hatchery-reared cutthroat trout were released in Guano Creek on Hart Mountain in 1957. The hatchery program was cancelled because of disease problems at the hatcheries. Attempts to establish brood ponds in the region, at Roaring Springs (west slope of Steens Mountain) in 1955 and at a pond on Mosquito

Creek (east slope of Steens) in 1970, also failed.

Fish Distribution: Lahontan cutthroat trout are currently present in Antelope, Willow, and Whitehorse creeks and the Whitehorse tributaries of Little Whitehorse and Doolittle creeks in the Coyote Lake subbasin; in Sage, Indian, and Line Canyon creeks in the Quinn River subbasin; and in Denio, Van Horn, Pike, Cottonwood, and Little McCoy creeks in the Alvord Lake subbasin.

Recent genetic research on cutthroat of the Coyote Lake subbasin has shown them to be genetically indistinguishable from Lahontan cutthroat trout of the Quinn River subbasin, yet they show some divergence consistent with their geographic isolation (Williams 1991). Although no direct connection between the Quinn River and Coyote Lake subbasins exists, the presence of Lahontan cutthroat in the Coyote Lake subbasin may be explained by headwater transfer and subsequent divergence of the isolated population (Behnke 1979, 1992). Another theory suggests that ancestral cutthroat trout moved up the Owyhee River into the ancient lake that formerly occupied the Coyote Lake subbasin at generally the same prepluvial time the Lahontan basin was being colonized. These cutthroat would have evolved isolated from other cutthroat when lake levels dropped and access to the Owyhee River was cut off (Trotter 1978). Correspondence in ODFW files indicates that indigenous cutthroat in the Coyote Lake subbasin were present in Willow, Whitehorse, Fish, and Antelope creeks in 1955. (None of these streams have a direct connection with each other at present, but Fish Creek may have flowed into Whitehorse Creek at one time). Cutthroat trout from Whitehorse Creek were transplanted above barriers in Fifteenmile Creek and in Cottonwood Creek, tributaries of Whitehorse Creek, in 1971, and into Antelope Creek in 1972, which was believed barren at that time. Cutthroat trout from Willow Creek were also transplanted into Cottonwood Creek in 1980. *See* **APPENDIX G** for a summary of stocking in the Lahontan subbasins.

The Lahontan cutthroat trout present in streams on the eastside of Pueblo and Steens mountains are progeny of fish transplanted from Willow and Whitehorse creeks between 1970 and 1980 by ODFW. Streams had previously been evaluated for fish potential and were found to be barren. Fish may have inhabited these streams pre-history via Lake Alvord, but no fossil or anecdotal evidence has been found to support this theory. In 1983, ODFW biologists observed Lahontan cutthroat trout in Big Alvord, Little Alvord, and Cottonwood creeks, in addition to the creeks where they currently exist. Willow and Mosquito creeks may contain Lahontan cutthroat trout, but their presence has not been confirmed. Additional sampling is needed to resolve the status of Lahontan cutthroat trout in these streams.

Another subgroup of Lahontan cutthroat trout, the Alvord cutthroat trout, is believed to have existed in pluvial Lake Alvord (Behnke 1988). There are no known pure populations of this subgroup remaining in the Alvord Lake subbasin. The cutthroat parents of introgressed populations of rainbow/cutthroat trout now present in the Trout

Creek drainage may have been Alvord cutthroat trout (Behnke 1979). A relict population of Alvord cutthroat trout was reported to exist in Virgin Creek, a stream in the Alvord subbasin in Nevada, but following electrophoretic analysis they were found to be introgressed with rainbow trout (Tol and French 1988). There have been no genetic studies of Trout Creek trout to determine their relationship to Virgin Creek trout or other Lahontan cutthroat stocks.

Lahontan cutthroat trout from Sage Creek were transplanted above a barrier into Indian Creek in 1980 and 1981. The populations in Sage and Line Canyon creeks are remnants of populations of Lahontan cutthroat trout that historically inhabited the entire drainage. Introductions of rainbow trout and subsequent introgression with this species and interspecific competition with other introduced trout species (brook and brown trout) have resulted in the current mix of trout species in the subbasin.

Life History: Life history information on Lahontan cutthroat trout in the planning area is limited. Some information is available from studies of Lahontan cutthroat trout in the Great Basin. Characteristic of indigenous trout in the West, Lahontan cutthroat trout spawn in the spring when water temperatures reach 5.5 - 9.0°C (about 42 - 46°F; Behnke and Zarn 1976). They mature at 2 - 4 years of age. Scales from a 4-year-old fish from Whitehorse Creek indicated it had spawned twice, although there was no evidence of spawning in eight 4-year-olds from Willow Creek. This could be due to conditions unsuitable to spawning rather than the sexual immaturity at that age.

Limited scale data from fish taken in Whitehorse, Fifteenmile, and Willow creeks in 1967 and 1970 showed growth rates of 1.6 - 3.0 inches the first year, 0.6 - 3.1 inches the second year, 1.4 - 2.4 inches the third year, and 1.8 - 3.7 inches the fourth year. Yearling Lahontan cutthroat trout in Nevada exhibited wide variability in growth rates, averaging between .01 inches and .25 inches per month during the summer and fall months (French and Curran 1992). Average life expectancy may not exceed 3 to 4 years (French and Curran 1992).

Lahontan cutthroat trout in the planning area mature at 6 - 10 inches long. The largest Lahontan sampled during inventory was a 13-inch fish from Whitehorse Creek taken in 1989. Size depends in part on the type of habitat. In general, fish in streams with large pools (beaver ponds) will grow larger than fish in streams without this habitat component. Population density and climatic factors that influence food production are other factors that influence trout size. Length frequency distribution data were gathered on most of the streams with Lahontan cutthroat trout between 1983 and 1991 (Figures 3 - 7). Peaks in the histograms indicate different age classes in the sample, and their presence indicates that recruitment is occurring in the population. Recruitment is evident even in the small population in Sage Creek and in out planted populations in Denio, Van Horn, and Indian creeks.

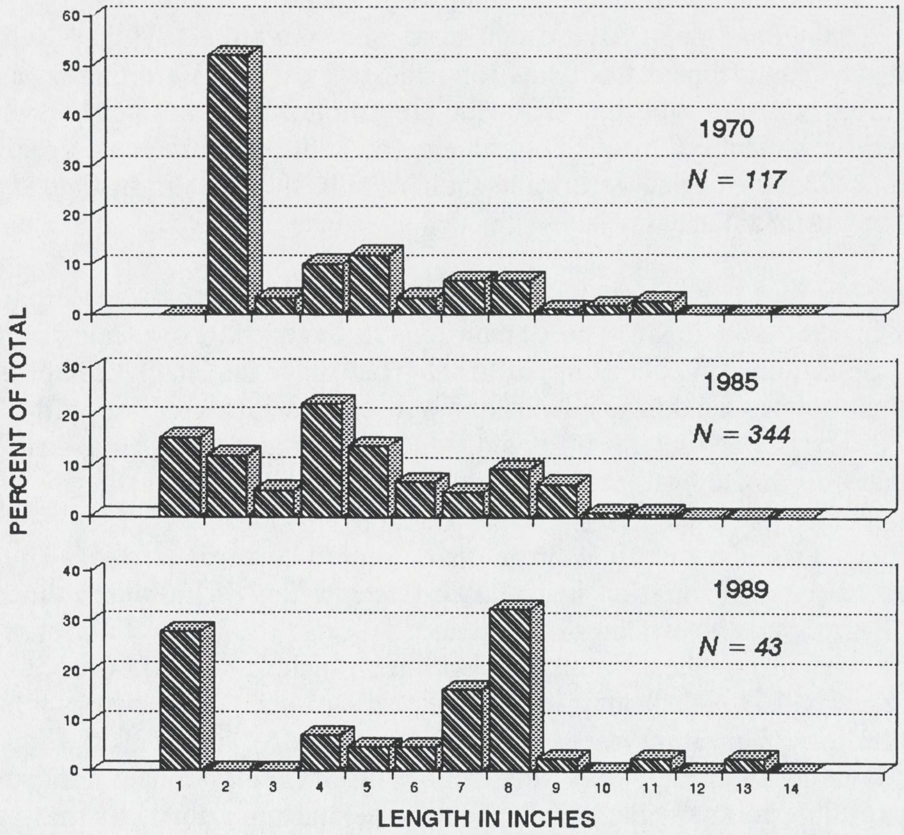

Figure 3. Length-frequency distribution of Lahontan cutthroat trout electrofished in Whitehorse Creek in 1970, 1985, and 1989. In 1970, creosol was used in combination with electrofishing.

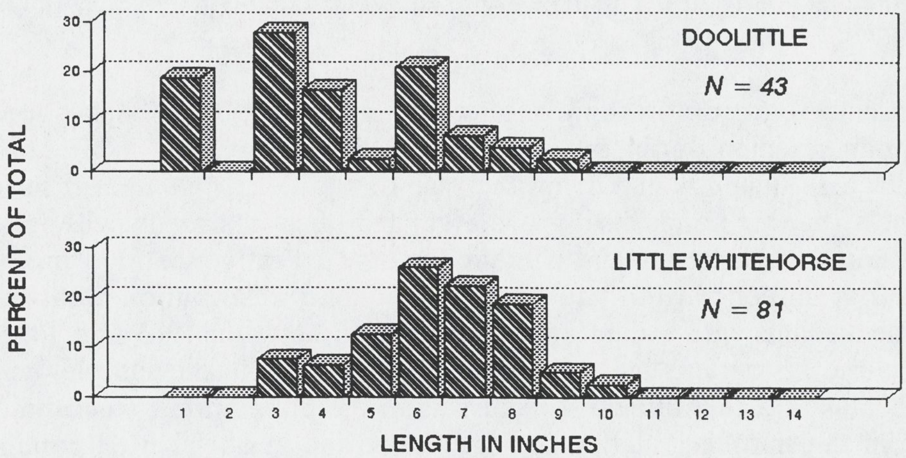

Figure 4. Length-frequency distribution of Lahontan cutthroat trout electrofished in Little Whitehorse and Doolittle creeks in 1985.

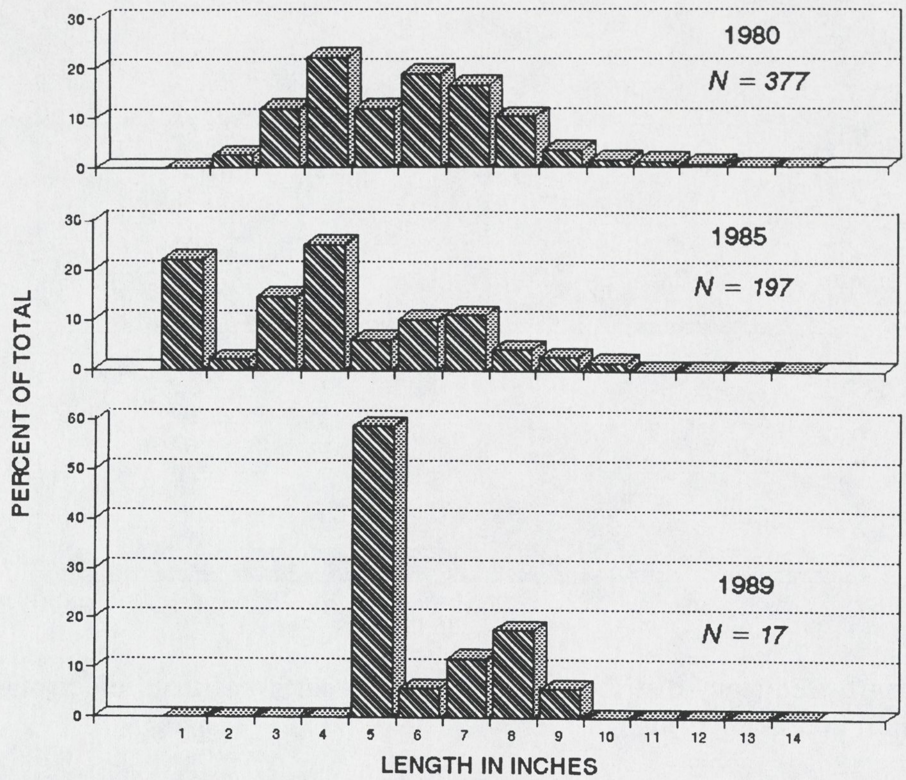

Figure 5. Length-frequency distribution of Lahontan cutthroat trout electrofished in Willow Creek in 1980, 1985, and 1989. Fry were sampled in 1989 (33% of the total), but none was measured.

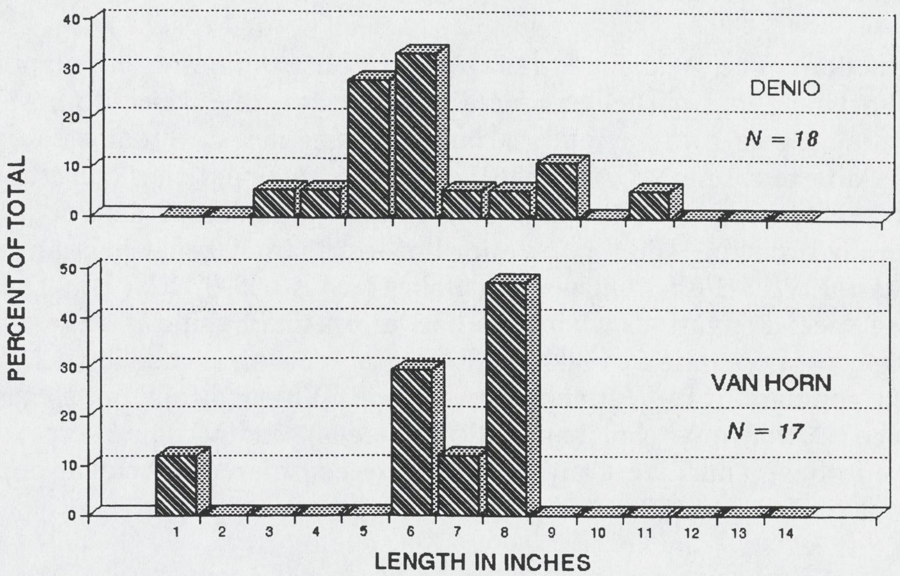

Figure 6. Length-frequency distribution of Lahontan cutthroat trout electrofished in Denio and Van Horn creeks in 1983.

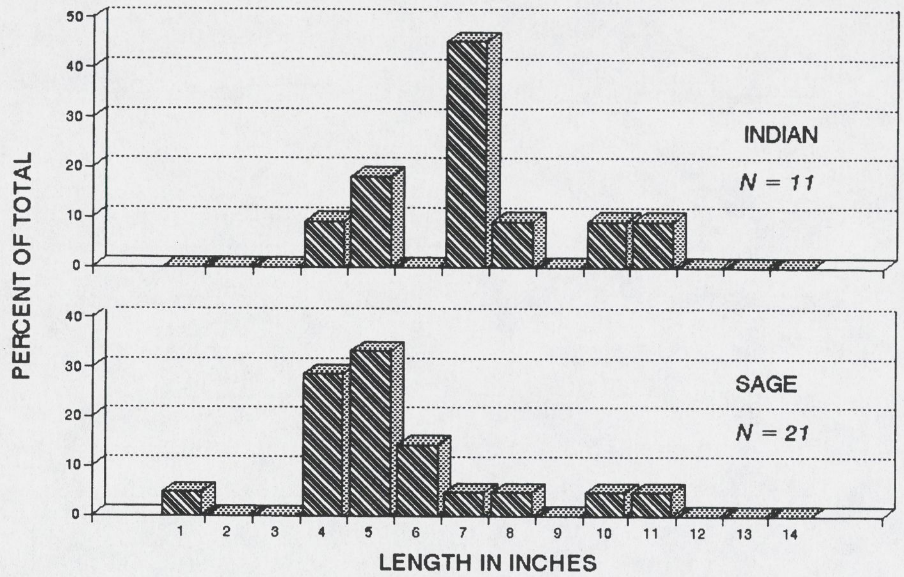

Figure 7. Length-frequency distribution of Lahontan cutthroat trout electrofished in Sage and Indian creeks in 1991.

Condition factor (K) is an index of body condition based on the length to weight ratio. Condition factors for trout in the Coyote Lake subbasin in 1985 ranged from 1.0 to 1.2, and from 1.1 to 1.6 in 1989. A K value of 1.0 is considered fair and 1.2 is considered excellent for Lahontan cutthroat trout, meaning the fish are healthy and food is adequate for growth.

Fish Production: The Wild Fish Management Policy defines a "population" as "a group of fish spawning in a particular area at a particular time which do not interbreed to any substantial degree with any other group spawning in a different area or in the same area at a different time" [OAR 635-07-501(38)]. A population consisting of no less than 300 spawners is considered the minimum size for maintaining genetic health, although naturally occurring small populations of less than 300 spawners are not exempted from the Wild Fish Management Policy [OAR 635-07-527(7)]. Exceptions are made for those special situations where the native, pristine habitat is so restricted that it would not support a population of 300 fish. ODFW recognizes individual Lahontan cutthroat trout populations in Whitehorse, Antelope, Willow, McDermitt, Sage, Denio, Van Horn, Pike, Cottonwood (Steens), Willow (Steens), and Mosquito creeks. Lahontan cutthroat trout in Sage and Line Canyon creeks are considered individual populations by Nevada (French and Curran 1992).

Population estimates generated from data collected in 1989 in the Coyote Lake subbasin are shown in Table 1. The estimated density for the subbasin was 200 trout per mile of habitat. NDOW reported population estimates of 50 fish each for Sage and Line

Canyon creeks (French and Curran 1992). Population estimates for other Lahontan cutthroat streams in the Lahontan subbasins are not available at this time.

Table 1. Estimate of abundance of adult cutthroat trout (> 3 inches long) in the Willow and Whitehorse drainages in 1989 (adapted from Perkins et al. 1991).

Stream	Estimated Number of Fish
Whitehorse Creek	4,200
Little Whitehorse Creek	2,300
Willow Creek	2,100
Total	8,600

Population estimates from data collected in 1985 are not comparable to the 1989 population estimates because different methods were used to collect the data. In 1985 a multiple-pass removal method was used, and in 1989 only one pass was used. In addition, several new sample sites were added in 1989, and representative reaches could not be established with certainty. It was noted, however, that the number of fish sampled on the first pass at each site in 1989 was significantly smaller than those sampled at the same 50 - 200 yard transects in 1985 (Table 2). Regardless of differences in methods used to estimate population, the differences between first passes was so dramatic that we believe they represent a major decline in abundance. The decline in trout numbers is likely attributed to the prolonged drought, severe winter icing, and habitat loss.

Fishery: Angler catch and effort information is collected to measure a variety of factors including return to and success of the angler, liberation effectiveness, angler effort, condition and quality of fish, and effects of regulations on the populations (ODFW 1977). The remoteness of the area and limited road access make frequent sampling difficult. Since 1974, most of the catch data has been collected by game enforcement personnel of the Oregon State Police during their routine patrols. The lack of a systematic creel schedule does not allow for a statistically valid summarization of angler effort or harvest.

The longest record of catch data is for Willow Creek, 1951 - 1990, although the record is not continuous. Catch was sampled on Whitehorse Creek for a five year period between 1958 and 1990, and for three years on Little Whitehorse Creek during the same period. Usually, anglers would be checked only one or two months during the year. No more than four anglers were checked on Whitehorse Creek during any given

Table 2. Number of trout sampled on the first pass in the Willow and Whitehorse drainages in 1985 and 1989 (adapted from Perkins et al. 1991).

Stream	Adult trout 1985	Adult trout 1989	Trout fry 1985	Trout fry 1989
Whitehorse Creek	205	31	96	12
Doolittle Creek	34	0	8	15
Little Whitehorse Creek	72	16	0	6
Willow Creek	127	14	47	35
Total	438	61	151	68

year, and no more than six were checked in a year on Little Whitehorse Creek. The only other Lahontan cutthroat streams with any catch data are Pike and Little Alvord creeks, which were checked in 1988. A total of three anglers were checked. The small sample of anglers checked is not adequate to characterize the fishery for these streams. Hosford (1978) estimated 50 angler days for Whitehorse Creek and 75 angler days for Willow Creek.

Willow Creek data are presented in Table 3. Prior to 1972, the bag limit was 10 fish per day and the catch rates reflect this. The higher catch rates also reflect catches in excess of the bag limit. In 1972, the bag limit was changed to 5 fish per day and a limit of 10 in possession. Angling was closed on Sage Creek on 1 January 1990. Angling on Willow and Whitehorse creeks was closed on 10 May 1990, under an emergency closure to protect the Lahontan cutthroat trout and to be consistent with land-use restrictions. Eastside Steens and Pueblo streams with Lahontan cutthroat trout, Antelope (Coyote Lake subbasin), and Indian Creek (Quinn River subbasin) were subsequently closed to angling during the regular angling regulation process in 1993.

The length-frequency distribution of trout sampled during angler checks on Willow Creek before and after the regulation change is shown in Figure 8. Fish over 12 inches long are rare, as is typical for most small desert streams. This occurs for two reasons: (1) habitat on most streams is limiting for larger fish, and (2) cutthroat trout are easily caught, so a high percentage are caught soon after they become large enough to be legally kept.

Management Concerns: Prior to 1960, trout in Willow Creek were considered to be abundant. In 1955, 650 trout were obtained with little difficulty by seining and angling from upper Willow Creek (RM 15 - RM 16). The fish were transferred to Wallowa Hatchery to develop a brood stock (ODFW, unpublished report). According to

Table 3. Anglers checked on Willow Creek, 1951 - 1990 (record not continuous).

Year	Fish kept	Fish released	Total fish	Total anglers	Total hours	Fish/ angler	Fish/ hour
1951	3	0	3	2	4	1.5	0.8
1952	7	0	7	3	15	2.3	0.5
1953	124	0	124	13	62	9.5	2.0
1954	79	0	79	6	44	13.2	1.8
1955	133	0	133	29	112	4.6	1.2
1956	99	0	99	8	28	12.4	3.5
1957	22	0	22	7	7	3.1	3.1
1958	199	0	199	17	32	11.7	6.2
1959	99	0	99	11	66	9.0	1.5
1960	15	0	15	6	19	2.5	0.8
1966	59	0	59	7	20	8.4	3.0
1967	10	0	10	1	4	10.0	2.5
1968	10	0	10	1	2	10.0	5.0
1969	11	0	11	3	3	3.7	3.7
1973[a]	29	0	29	11	13	2.6	2.2
1975	46	0	46	63	16	7.7	2.9
1976	18	0	18	5	10	3.6	1.8
1977	61	3	64	17	30.5	3.8	2.1
1978	9	0	9	4	1.5	2.3	6.0
1979	0	0	0	3	1	0	0
1980	30	0	30	8	19	3.8	1.6
1982	9	8	17	5	5.5	3.4	3.1
1986	10	0	10	2	1	5.0	10.0
1987	45	0	45	14	7.5	3.2	6
1988	0	4	4	3	3	1.3	1.3
1990[b]	0	0	0	4	4	0	0

[a] *Bag limit changed from 10 to 5 fish per day in 1972.*
[b] *Closed to angling on May 10.*

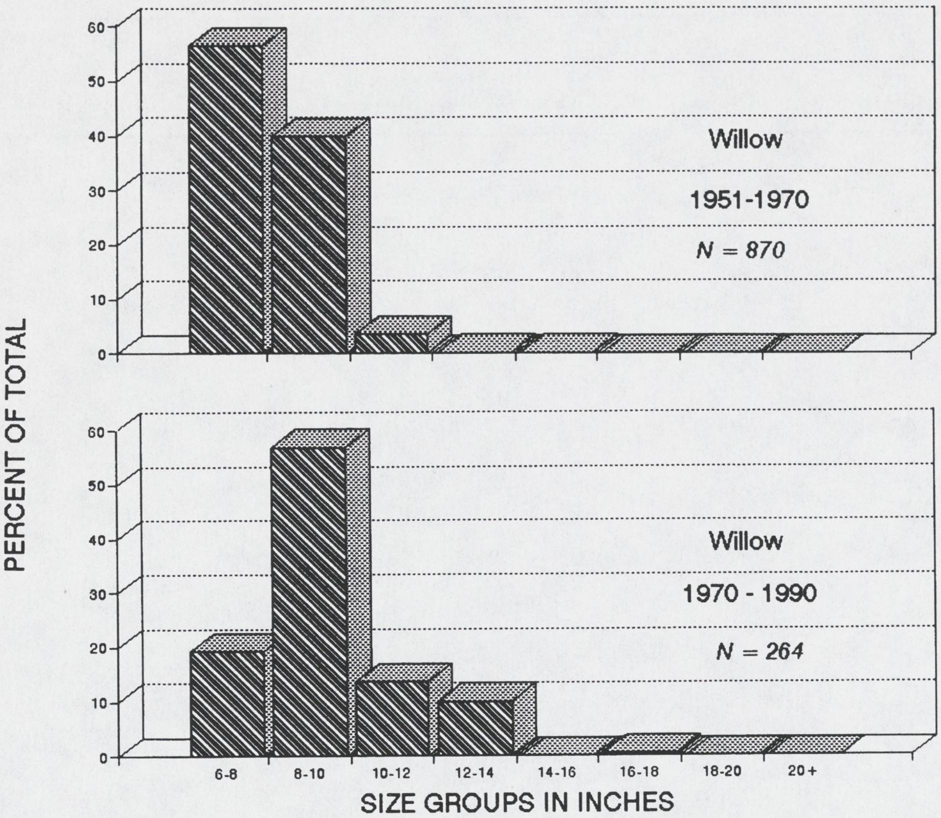

Figure 8. Length-frequency distribution of Lahontan cutthroat trout from anglers checked on Willow Creek.

Larry Bisbee, ODFW district fish biologist in charge of the operation, 200 - 300 fish could be taken from the large ponds behind beaver dams (telephone conversation with L. Bisbee on 29 May 1992). By 1970, stream inventories of Willow and Whitehorse creeks documented a decline in fish populations and habitat. Inventory information from 1985 and 1989 suggests further decline. It is not known whether the current decline in Lahontan cutthroat trout of Willow and Whitehorse creeks is a response to natural stress (drought and flooding) or applied stress (loss of riparian vegetation and pool habitat), or both. Lahontan cutthroat trout in Gance Creek (Nevada) in the Humboldt River basin exhibit extreme annual fluctuations in trout numbers; this is believed to be a natural adaptation to the highly variable stream conditions (Platts and Nelson 1983).

High abundance, as well as multiple age class structure and genetic fitness are indications of population health. The USFWS draft Lahontan cutthroat trout recovery plan recommends multiple age classes for more than 5 years as a guideline for recovery, and Oregon's Wild Fish Policy recommends a minimum of 300 spawners to maintain genetic fitness. Guidelines for Lahontan cutthroat abundance are not available, and consistent inventories will be required to assess the abundance variability in the Willow and Whitehorse trout populations in response to different climatic conditions. Guidelines provided by the USFWS draft Lahontan cutthroat trout recovery plan and Wild Fish Policy should be considered minimums for recovery of Lahontan Cutthroat trout. It is not known if current populations in Willow and Whitehorse creeks can be considered healthy.

Interspecific conflicts exist between Lahontan cutthroat trout and introduced species of rainbow, brown, and brook trout in some streams. Introduced rainbow trout have interbred with Lahontan cutthroat trout in Trout, McDermitt, Oregon Canyon, and Tenmile creeks, altering the genetic makeup of the indigenous trout. Interbreeding (introgression) occurs because rainbow trout and Lahontan cutthroat trout did not evolve together in southeastern Oregon. In other areas of the state where rainbow and cutthroat trouts have evolved occupying the same range, introgression does not occur. Lahontan cutthroat trout in Sage and Line Canyon creeks are vulnerable to introgression with rainbow/cutthroat trout in mainstem McDermitt Creek, but have not interbred because irrigation practices have so far discouraged the upstream movement of rainbow/cutthroat trout into Lahontan cutthroat trout habitat. Brown trout have been introduced in lower McDermitt Creek (legally) and in Van Horn Creek (illegally). Brown trout may outcompete the rainbow/cutthroat in McDermitt Creek and Lahontan cutthroat trout in Van Horn Creek because of their ability to maintain their populations by natural reproduction in spite of heavy fishing pressure (Wydowski and Whitney 1979). Brook trout introduced in upper McDermitt Creek compete with introgressed rainbow/cutthroat trout for food and space. Brook trout may outcompete rainbow/cutthroat trout in the cooler headwater areas because of their preference for cold water and their territorial behavior (Wydowski and Whitney 1979). Introgression between Lahontan cutthroat trout and brook or brown trout does not occur because both are fall spawners and Lahontan cutthroat trout are spring spawners.

Strategies to address the recovery of Lahontan cutthroat trout in the Lahontan subbasins include improvement of existing populations through habitat rehabilitation, isolation of existing populations of Lahontan cutthroat trout (Sage and Line Canyon creeks) from introgression with resident trout, the eventual reintroduction of Lahontan cutthroat trout to streams in its historic range in the Quinn River subbasin, and outplanting of Willow and Whitehorse Lahontan cutthroat trout to suitable habitat in the Alvord Lake subbasin. Improvement in habitat conditions as discussed in the previous chapter should greatly benefit existing populations of Lahontan cutthroat trout.

Barriers could be constructed in Sage and Line Canyon creeks to prevent rainbow/cutthroat trout residing in McDermitt Creek from spawning above them. This would add a measure of protection from introgression for the Lahontan cutthroat trout in the two tributaries. However, barriers are very expensive to construct and would be used only as a last resort. Indian Creek, the other stream with Lahontan cutthroat trout in the McDermitt drainage, has a natural barrier that prevents upstream movement of rainbow/cutthroat trout.

Reintroduction of Lahontan cutthroat trout in the Quinn River subbasin would require elimination of current populations of non-indigenous species from the targeted drainage(s). There would probably also be considerable local opposition to removal of the current fishery and replacement with a threatened species. A proposal in 1991 to eliminate rainbow/cutthroat in Oregon Canyon Creek and rainbow/cutthroat and brook trout from McDermitt Creek and transplant Lahontan cutthroat trout from Sage Creek into these creeks above barriers was vigorously opposed locally. Opponents objected to removal of the existing healthy fishery and feared that reintroduction of the threatened species would curtail or eliminate their grazing operations and the consumptive fishery.

Williams (1991) found the Lahontan cutthroat trout in Willow and Whitehorse creeks to be sufficiently different to warrant maintaining the genetic integrity of each population. Outplants of Willow and Whitehorse Lahontan cutthroat trout to streams on the eastside of Steens and Pueblo mountains have been used in the past with some success (*see* discussion on Page 40). The current populations, although believed to be small, could be maintained where they currently persist with periodic infusions of additional outplants to maintain genetic health. Wildhorse Creek and some barren streams may be considered for establishment of additional populations of Willow or Whitehorse Creek Lahontan cutthroat trout. A population of endangered or threatened species may be designated as an experimental population under the Endangered Species Act when it has been or will be released into suitable habitat "wholly separate geographically from nonexperimental populations of the same species" (50 CFR Sections 17.80 - 17.83). The designation process requires public review to identify specific streams for introductions and allows for specific rules to be written for management of the population, e.g., provisions for angling (50 CFR Sections 17.80-17.83).

Lahontan cutthroat trout are easily caught by hook and line. Angling pressure is believed to have been very light in the past because of the isolation of the Trout Creek Mountains and the sparse local population. Local residents report increased angling pressure since the mid-1960s, when mining activity in the area increased and after a road network in the headwaters of the Trout Creek Mountains was completed. However, increased use by anglers is not reflected in the limited catch data available. Certainly the opportunity to angle for the unique trout of the Willow and Whitehorse creek drainages will be an incentive for many anglers to visit the area if and when the streams are open to angling again. The task force favored continuation of the angling closure at least until a recovery plan is adopted by the USFWS.

Sufficient data is not available to evaluate past angling effort on eastside Steens and Pueblo mountain streams, or its effects on Lahontan cutthroat trout populations.

Enforcement of angling regulations is a concern because of the isolation of the area and the limited enforcement staff. Illegal introductions of exotic fishes are difficult to control for the same reasons. Strategies need to be developed to deal with illegal introductions. The Oregon State Police considers the Trout Creek Mountains a high priority for enforcement effort.

Critical Uncertainties:

- Will pure Lahontan cutthroat trout populations continue to exist in the Quinn River subbasin without construction of artificial barriers?
- What, if any, are the differences in the genetic makeup of the cutthroat stock in rainbow/cutthroat trout in Trout Creek, and Lahontan cutthroat trout in Coyote Lake and Quinn River subbasins?
- What should be the status of populations in streams on the eastside Pueblo and Steens mountains?
- How does ODFW gain public support for rebuilding lost populations?

Mann Lake Cutthroat Trout

Mann Lake cutthroat trout are not pure Lahontans, but contain genetic material from stocks (both cutthroat and rainbow) released into Mann Lake since 1957, when ODFW began managing the lake for trout (Table 4). Rainbow were stocked when cutthroat were not available. The ranch pond at Mann Lake Ranch was reportedly stocked with rainbow in 1942 by ranch owners. Spilling of the ranch pond has allowed fish from there to enter Mann Lake via Mann Creek. In 1971 a barrier was placed in Mann Lake to prevent trout from leaving the lake.

Mature fish are randomly selected from a variety of sites around the lake. No special phenotypic characteristics are selected. The time of trapping may artificially select for fish spawning at that particular time.

Fingerling Mann Lake cutthroat trout are stocked in Mann Lake and Wildhorse Lake, and in Juniper, Tudor, and Tencent lakes when these lakes have water (*see* Table G-2 in **APPENDIX G**). None of the lakes had indigenous populations of fish in historic times. Wildhorse Creek contained no fish historically, but may have had them prehistorically. Cutthroat trout present in Wildhorse Creek are believed to be from fish that were stocked upstream in Wildhorse Lake.

Fish Distribution: The current distribution of Mann Lake cutthroat trout in the Lahontan subbasins is limited to Mann Lake and Wildhorse Lake. Wildhorse Lake has not been stocked since 1986 because helicopter transport has not been available. The

Table 4. Number and species of fish stocked in Mann Lake between 1957 and 1990.

Year stocked	Species	Stock	Number stocked
1957	Cutthroat	Summit Lake (Nevada)	1800
1958	Cutthroat	Summit Lake	11015
1959	Cutthroat	Summit Lake	53360
1960	Cutthroat	Heenan Lake (California)	37300
1961	Cutthroat	Heenan Lake	80000
1965	Rainbow	-	5304
1965	Cutthroat	Heenan Lake	105743
1969	Cutthroat	Utah Strain	61830
1972	Rainbow	Oak Springs	25056
1973	Cutthroat	-	39965
1974	Cutthroat	-	29966
1975	Rainbow	Oak Springs	40070
1976	Cutthroat	Mann Lake	37995
1977	Cutthroat	Mann Lake	32969
1979	Cutthroat	Mann Lake	13430
1979	Cutthroat	Mann Lake	6110
1980	Cutthroat	Mann Lake	20004
1981	Cutthroat	Mann Lake	20299
1982	Cutthroat	Mann Lake	20048
1983	Cutthroat	Mann Lake	15377
1984	Cutthroat	Mann Lake	15206
1985	Cutthroat	Mann Lake	19998
1986	Cutthroat	Mann Lake	15027
1988	Cutthroat	Mann Lake	22035
1990	Cutthroat	Mann Lake	30009
1992	Cutthroat	Mann Lake	23010

current status of cutthroat in Wildhorse Creek is not known. Juniper and Tudor lakes were last stocked in 1986, Tencent Lake in 1985.

Hatchery Program: Since 1976, fish stocked in Mann Lake and several other nearby lakes are from eggs spawned from Mann Lake fish in the spring and reared in the Klamath Hatchery. Table 5 shows the number of adult females and eggs taken since 1984. The number varies with the biologist's requests for eggs. In some years, requests for out-of-basin transfers may be accommodated.

Table 5. Numbers of adult females spawned and eggs taken at Mann Lake from 1984 to 1993.

Year	Number of females	Number of eggs
1984	370	641,000
1985	400	681,000
1987	252	527,000
1989	420	978,000
1991	210	412,000
1993	212	411,747

Fish Production: Inventory data is available for Mann lake for most of the years it has been managed as a trout fishery. Fish in Mann Lake are inventoried during egg taking which occurs every other year. A subsample of cutthroat trout caught in the trap net is measured.

Cutthroat trout length-frequency distribution for 1989, 1991, and 1993 is shown in Figure 9. The condition factor for yearling trout averaged 1.04 in 1989, and averaged 0.96 in 1993. Weights were not taken in 1991 and, therefore, condition factor could not be calculated. Data are not collected regularly on other lakes stocked with Mann Lake cutthroat because their water levels are unpredictable.

Fishery: Mann Lake has been open to year-round angling since 1963. It was originally managed as a consumptive fishery under general statewide regulations, but since the hatchery program began in 1976 and the need to maintain a brood stock was identified, more restrictive regulations have been implemented. Fishing was restricted to "catch and release" in 1979 because of shortages in particular age groups and their effect on the egg-take. Since 1984 the regulation has specified a bag limit of two trout per day with a 16-inch minimum length requirement. Angling is restricted to barbless flies or lures only. This assures both adequate recruitment of brood stock for the hatchery program and a quality fishery for this popular cutthroat stock. Table 6 shows angler catch rates since 1958 and Figure 10 shows the length-frequency distribution of Mann Lake cutthroat trout from the anglers checked. Both reflect the change in regulations.

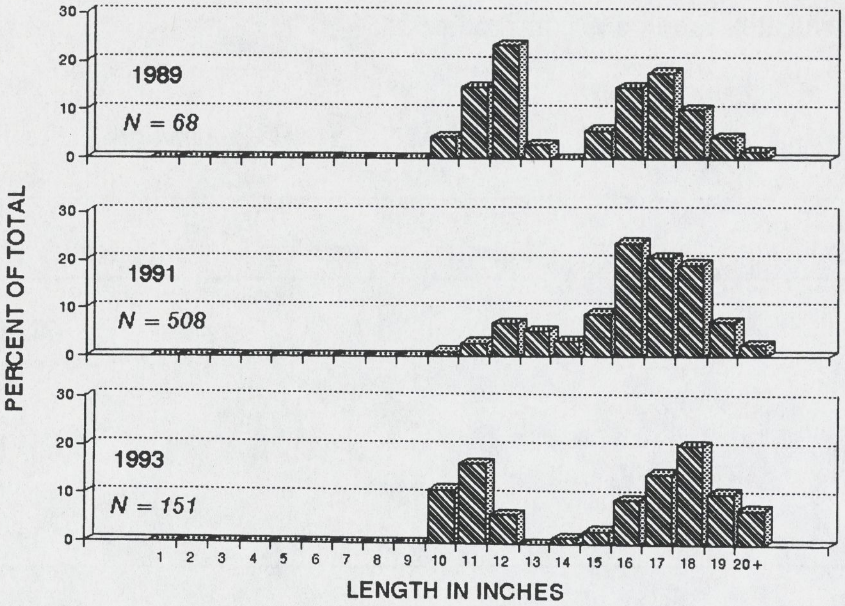

Figure 9. Length-frequency distribution of Mann Lake cutthroat trout in trap nets in Mann Lake, 1989, 1991, and 1993.

Visitor-use data at Mann Lake is collected by the BLM using a traffic counter. Numbers of visitors to Mann Lake from 1975 to present are shown in Table 7. We don't know how visitor use reflects angler use, although the drop in numbers in 1979 may reflect the change in angling regulation. We believe increases in visitor use since 1986 reflect an increase in non-angler visits to the area, rather than an increase in anglers at Mann Lake.

Management Concerns: Objectives for Mann Lake under a management plan approved by the Oregon Fish and Wildlife Commission in 1980 are (1) to provide a brood stock for an annual egg-take until another brood stock has been developed, and (2) provide a landing rate of 0.5 trout per hour with most trout in excess of 12 inches in length. Objective 1 is met on a bi-annual basis and is sufficient to meet current demand. The landing rate indicates that Objective 2 has been met for 5 of the last 10 years. Angling the past three years has been affected by the drought. Net inventory data (*see* Figure 10) show that most fish in the lake are over 12 inches long. No change in the current objectives is recommended.

The current drought conditions present problems for Mann Lake cutthroat fisheries. Juniper, Tudor, and Tencent lakes are currently dry and Mann Lake has been dry in

Table 6. Anglers checked at Mann Lake, 1958 - 1992 (record not continuous).

Year	Fish kept	Fish released	Fish landed	Anglers	Hours fished	Fish/ angler	Fish/ hour
1958	20	0	20	4	25	5.0	0.8
1959	197	0	197	51	320	3.9	0.6
1960[a]	542	0	542	165	924	3.3	0.6
1961	651	0	651	202	1000	3.2	0.7
1962	224	0	224	171	856	1.3	0.3
1963	292	0	292	68	361	4.3	0.8
1964	153	0	153	78	287	2.0	0.5
1966	25	0	25	6	12	4.2	2.1
1967[a]	10	0	10	9	18	1.1	0.6
1968	3	0	3	7	13	0.4	0.2
1970	0	0	0	9	30	0	0
1971	182	0	182	22	86	8.3	2.1
1972[a]	422	0	422	88	240	4.8	1.8
1973	133	0	133	64	184	2.1	0.7
[a]	485	0	485	175	475	2.8	1.0
1975	269	0	269	134	489	2.0	0.6
1976	564	2	566	132	1084	4.3	0.5
1977	213	0	213	68	451.5	3.1	0.5
1978[a]	459	9	459	152	655	3.0	0.7
1979[a]	0	83	83	20	40.5	4.2	2.1
1980[a]	2	327	329	10	53	32.9	6.2
1981	28	0	28	8	18	3.5	1.6
1983	518	57	575	74	25.5	7.8	2.2
1984[b]	51	35	86	24	150	3.6	0.6
1985	35	150	185	22	167	8.4	1.1
1986	25	0	25	24	213	1.0	0.1
1987	47	104	151	63	327	2.4	0.5
1988	41	9	50	70	476	0.7	0.1
1989	28	27	55	74	259	0.7	0.2
1990	61	86	147	207	938	0.7	0.2
1991	37	11	48	57	283.5	0.8	0.2
1992	5	0	5	11	12	0.5	0.4

[a] *Count included cutthroat and rainbow trout.*
[b] *Regulation changed to two fish per day with a 12 inch minimum length.*

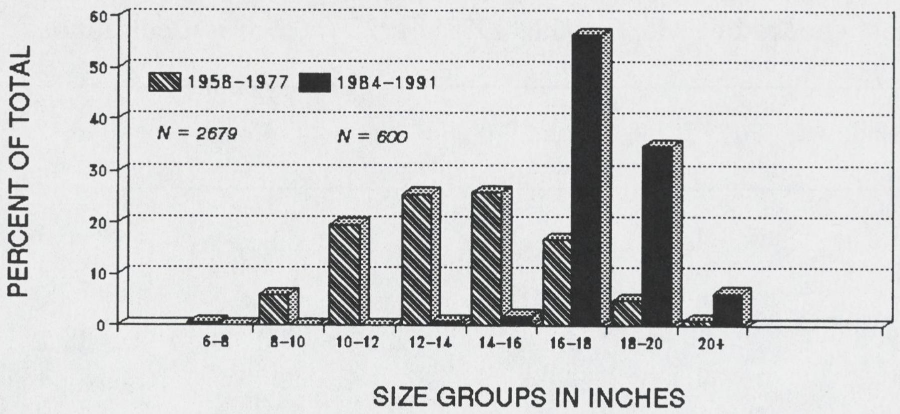

Figure 10. Length-frequency distribution of cutthroat trout from anglers checked at Mann Lake, 1958 - 1991, grouped to show effects after regulation change.

Table 7. Visitor use at Mann Lake based on BLM traffic counter data, 1975 to present.

Year	Number of Visitors
1975	4,800
1976	2,772
1977	2,966
1978	7,051
1979	1,500
1980	2,195
1981	2,274
1982	2,274
1983	No count
1984	No count
1985	Site closed
1986	7,894
1987	9,840
1988	10,200
1989	9,568
1990	10,000[a]
1991	Data missing
1992	7,582[b]

[a] *Counter malfunctioned at 10,000.*
[b] *Counts for the period 4/24 to 10/30.*

years past. Loss of the Mann Lake cutthroat stock, should the lake dry up, is a concern of managers. Several strategies were discussed during the task force meetings. They include (1) purchasing of well water to pump into Mann Lake, (2) using the ranch pond as a temporary holding pond, (3) allowing spawning in the creek on the ranch, and (4) converting ranch ponds to cutthroat production. All of these strategies require consultation with and approval of the ranch owners. Another strategy, in the event the lake goes dry, is to consider other stocks of Lahontan cutthroat (Nevada or California stocks) for stocking (once water conditions are favorable) instead of attempting to rescue and perpetuate the current Mann Lake strain.

The BLM manages most of the land around the Mann lake, but the southern portion is privately owned by the Mann Lake Ranch. The main creek flowing into Mann Lake is on private property. Recent projects to improve recreation facilities at Mann Lake include construction of a gravel road to two boat ramps and installation of two self-contained toilets, one at each boat ramp. A fence to keep livestock from areas of concentrated people use was constructed in 1991. As the lakeshore recedes, the fence will have to be extended if livestock/people conflicts are to be avoided.

Mann Lake is considered a quality fishery with a reputation that extends well outside the local area. Angler dissatisfaction occurs when more restrictive regulations are implemented, as happened in 1979. Some local residents would like to see a return to the more consumptive fishery of the past. This is probably not possible given the current popularity of Mann Lake as a quality trout fishery and the need to maintain a brood stock for the hatchery program. Other lakes in the area provide a more consumptive fishery when water conditions allow for stocking. Their close proximity to Mann Lake makes stocking with Mann Lake cutthroat the most economical strategy.

Concern is increasing over fish stocking in mountain lakes that evolved without fish, specifically the ecological effects of the stocking on indigenous fauna, such as amphibians (Bahls 1992). Wildhorse Lake did not have fish historically, and evaluation of the indigenous fauna was never done. Continued stocking of Wildhorse Lake should be re-evaluated in light of new concerns.

Critical Uncertainties:

- o What will be the strategy for cutthroat brood stock if Mann Lake dries up?
- o Given the concerns about the adverse effects of stocking fish on indigenous fauna, should the Wildhorse Lake program be terminated?

Resident Rainbow/Cutthroat Trout

Fish Distribution: Introgressed populations of rainbow/cutthroat trout in the Alvord Lake and Quinn River subbasins resulted from introductions of rainbow trout over 50 years ago. Dr. Carl Hubbs identified the trout of Trout Creek as rainbow/cutthroat crosses during collections in 1934 (Trotter 1987). Trout observed in Cottonwood Creek and Kings River (Alvord Lake subbasin) during physical and biological surveys of 1973 were either rainbow or rainbow/cutthroat. NDOW found rainbow/cutthroat trout in Kings River in 1989 (NDOW 1989b). Trout samples taken from McDermitt Creek and its tributaries Cottonwood, Indian, Mine, and Payne, and from Oregon Canyon Creek during the 1979 stream survey were examined by Dr. Robert Behnke, Colorado State University, and Dr. Carl Bond, Oregon State University, and determined to be rainbow/cutthroat crosses. Rainbow/cutthroat trout also occur in Tenmile Creek.

Exactly when or by whom most of the streams were stocked is unknown. As early as 1915, hatchery fish of various species were supplied to county fish and game commissioners in northern Nevada by NDOW. Fish were stocked at the discretion of the commissioners without regard for the state line (unpublished information provided by NDOW). Dr. Hubb's field notes indicate that rainbow trout were stocked in Trout Creek about 1929 (Behnke 1992). Oregon has not stocked any streams in the planning area with hatchery fish. Information from NDOW indicates that McDermitt Creek was stocked with rainbow trout in 1959, and anecdotal information indicates rainbow trout were also stocked by Nevada in the mid-1960s. Kings River was stocked by Nevada between 1951 and 1978 (NDOW 1989b).

Life History: Length-frequency distribution of rainbow/cutthroat trout in Trout Creek is shown in Figure 11 and for McDermitt, Oregon Canyon, and Tenmile creeks in Figure 12. They are similar in size and age distribution to Lahontan cutthroat trout in the basin. Fish in East Fork Trout Creek and Little Trout Creek don't get as large as those in the mainstem, but their age distribution is similar.

Fish Production: Estimated abundance of rainbow/cutthroat in the Lahontan subbasins is presented in Table 8. Data from the Trout Creek drainage are available from permanent sample sites established in 1985 and inventoried again in 1989. Only estimated abundance in 1989 is presented because the methods used to estimate abundance were different for the two inventories (*see* discussion on Page 45).

Similar to Willow and Whitehorse creeks in 1985 and 1989, a reduction in the number of fish sampled was also noted for Trout Creek (Table 9). Range of condition factor varied, from 1.2 to 2.6 in 1985 and from 1.1 to 1.3 in 1989. Condition factors for rainbow/cutthroat trout in Oregon Canyon Creek ranged from 1.1 to 1.2.

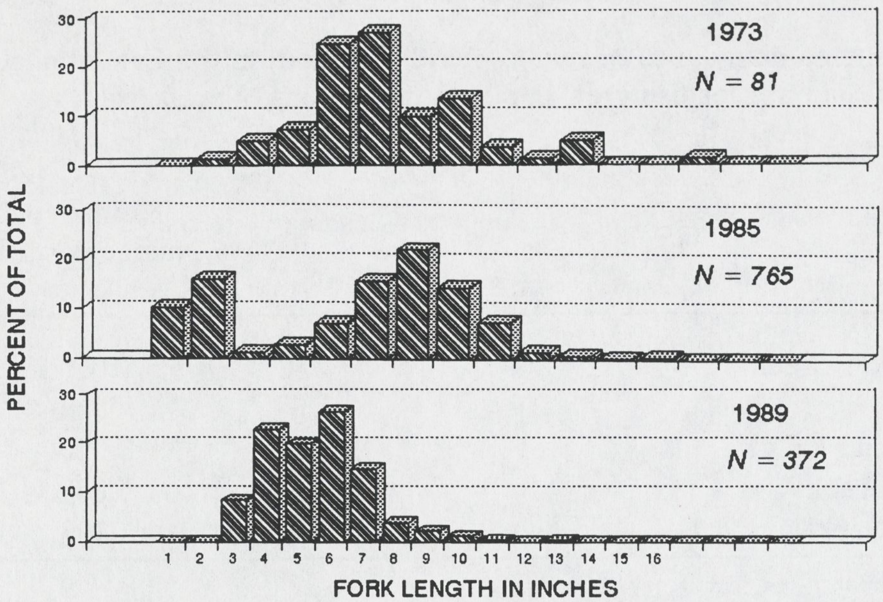

Figure 11. Length-frequency distribution of rainbow/cutthroat trout electrofished in Trout Creek 1973, 1985, and 1989.

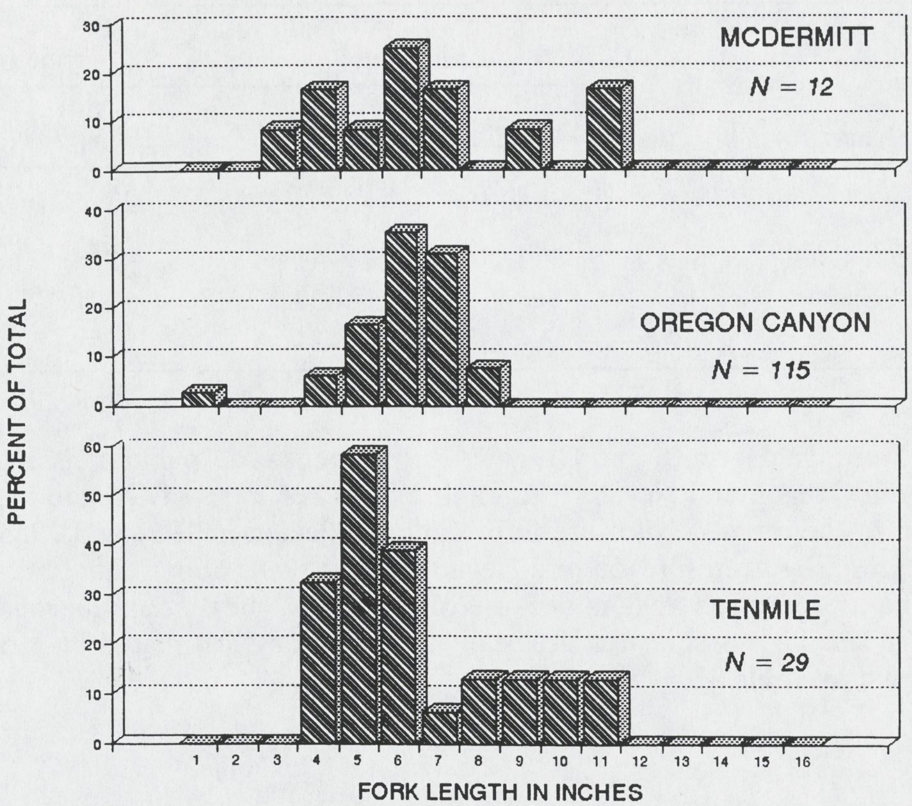

Figure 12. Length-frequency distribution of rainbow/cutthroat trout electrofished in McDermitt and Oregon Canyon creeks in 1989 and in Tenmile Creek in 1990.

Table 8. Estimated abundance of rainbow/cutthroat trout in the Lahontan subbasins in 1989. Oregon data are for fish greater than 3 inches long; Nevada data are for all fish.

Stream	Estimated Number of fish
Oregon Canyon Creek	7,000
Trout Creek	36,000
East Fork Trout Creek	3,000
Little Trout Creek	5,000
McDermitt Creek[a]	1,199

[a] *NDOW general aquatic inventory method.*

Table 9. Number of fish sampled on the first pass in the Trout Creek subbasin in 1985 and 1989.

	Adult trout		Trout fry	
Stream	1985	1989	1985	1989
Trout Creek	449	355	129	162
East Fork Trout Creek	105	41	98	54
Little Trout Creek	49	38	127	34
Total	603	434	354	250

Fishery: Trout, McDermitt, and Oregon Canyon creeks are popular fishing areas for local residents in Oregon and Nevada. Anglers from other parts of Oregon and Nevada are also drawn to the area. Visitor-use information collected in 1964 and 1965 showed anglers came primarily from Oregon and Nevada and use was about equal between the two states. The area attracts anglers because of the remote beauty and because fishing opportunities in this high desert area are scarce. Angler days estimated by Hosford (1978) are shown in Table 10.

Table 10. Angler days for Trout Creek estimated in 1978 (Hosford 1978).

Stream	Angler Days
Trout Creek	300
Cottonwood Creek	10
Kings River	10
McDermitt Creek	300
Oregon Canyon Creek	50
Tenmile Creek	20

Limited angler catch data are available for rainbow/cutthroat trout from Trout Creek and McDermitt Creek from 1954 to 1990. The McDermitt Creek data includes eastern brook trout. The length-frequency distribution of rainbow/cutthroat trout from anglers checked on Trout Creek after 1972 is shown in Figure 13. Most fish are in the 8 - 10 inch size group, as is typical of similar streams in the area.

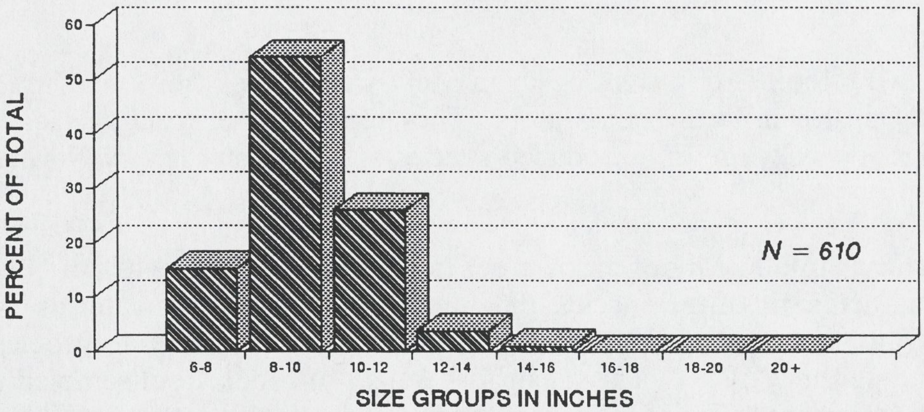

Figure 13. Length-frequency distribution of rainbow/cutthroat trout from anglers checked on Trout Creek, 1972 - 1990.

Management Concerns: Rainbow/cutthroat trout in the Lahontan subbasins are managed as a consumptive fishery, without hatchery supplementation. Although the indigenous cutthroat trout genes have been diluted by interbreeding with hatchery rainbow, the result is a fish that appears healthy and genetically fit. Still they occupy historical habitat of the threatened Lahontan cutthroat trout. Reintroduction of Lahontan cutthroat trout into McDermitt and Oregon Canyon creeks from available sources elsewhere in the Quinn River subbasin is an option for recovery of the Quinn River population. This would entail elimination of portions or all of the rainbow/cutthroat trout populations. Reintroduction plans will have to consider how to preserve a fishery in an area where fishing opportunities are very limited.

The rainbow/cutthroat trout of the Trout Creek drainage may be progeny of the Alvord strain of Lahontan cutthroat trout. Pending further genetic analysis, it is not clear if Alvord cutthroat are (were) a distinct subgroup of the Lahontan cutthroat complex and if the level of introgression with introduced rainbow is "unrepairable." The potential exists that Alvord cutthroat represent a more endangered group of fish than Lahontan cutthroat in the Coyote Lake and Quinn River subbasins. This drainage would not be considered for reintroduction of Lahontan cutthroat trout at this time, as a "pure" source of the Alvord strain is not currently known to exist. On the other hand, stocking with other trout species would not be an option because of the desire to conserve the remaining Lahontan cutthroat genetic material.

Critical Uncertainty:

- The genetic identity of the cutthroat component of rainbow/cutthroat trout in Trout Creek in the Alvord subbasin needs to be determined.

Brook Trout

Fish Distribution: Brook trout occur in McDermitt Creek from the Turner Ranch (*see* Figure 1) upstream to the headwaters. They replace other trout species in the headwater areas. They are an introduced species and were stocked by Nevada from 1915 to 1923.

Life History: Life history of brook trout in McDermitt Creek has not been studied. However, characteristic of the species, they prefer the colder, headwater areas of the drainage. Water temperature higher than 77.5°F is considered fatal to brook trout (Wydoski and Whitney 1979). The mean fork length of brook trout sampled in 1989 by NDOW was 6.2 inches. Their length-frequency distribution is shown in Figure 14.

Fish Production: NDOW (1989a) estimated the population of brook trout in McDermitt Creek to be 1,255 fish. They were the most numerous salmonid sampled in McDermitt Creek in 1989, averaging 189 fish per mile.

Fishery: Brook trout are generally smaller than resident rainbow/cutthroat trout in McDermitt Creek, but are popular with anglers. They are usually fished around the July 4th holiday and during the fall hunting season.

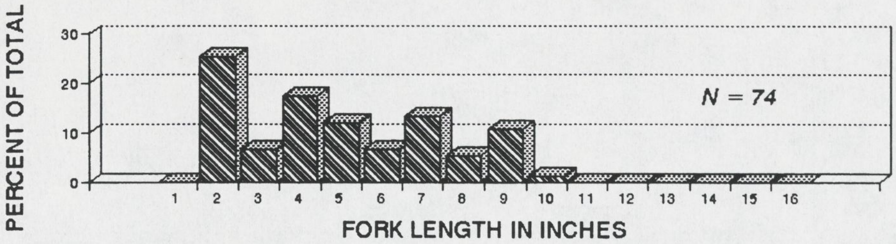

Figure 14. Length-frequency distribution of brook trout electrofished in McDermitt Creek in 1989.

Management Concerns: The brook trout population has maintained itself without additional supplementation since 1923. In this respect, it does not present a major concern to fishery managers. However, it does compete with resident rainbow/cutthroat trout for food and space (*see* discussion of interspecific competition on Page 49) and occupies historical habitat of the Lahontan cutthroat trout. If Lahontan cutthroat trout were reintroduced into McDermitt Creek, brook trout might need to be eliminated.

Critical Uncertainty:

- o As fish habitat improves in McDermitt Creek, brook trout may expand their range farther downstream into historical Lahontan cutthroat trout habitat.

Brown Trout

Fish Distribution: Brown trout are currently found in McDermitt Creek in the Quinn River subbasin and in Van Horn Creek in the Alvord Lake subbasin. They were stocked in McDermitt Creek by Nevada between 1959 and 1970 (NDOW 1989a). ODFW sampled brown trout in lower McDermitt Creek (below the mouth of Mine Creek) in 1979. NDOW found one brown trout at a sample site in lower McDermitt Creek near the state line in 1989. Brown trout were first observed by biologists in Van Horn Creek in 1983, the result of an illegal introduction. They were observed there again in 1991.

Life History: The life history of brown trout in McDermitt and Van Horn creeks has not been studied. Length-frequency distribution of brown trout in Van Horn Creek is shown in Figure 15. The brown trout sampled in McDermitt Creek in 1989 by NDOW was 19.2 inches in fork length.

Fish Production: Abundance of brown trout in Van Horn Creek has not been estimated. NDOW (1989a) estimated the population in McDermitt Creek to be 106 fish.

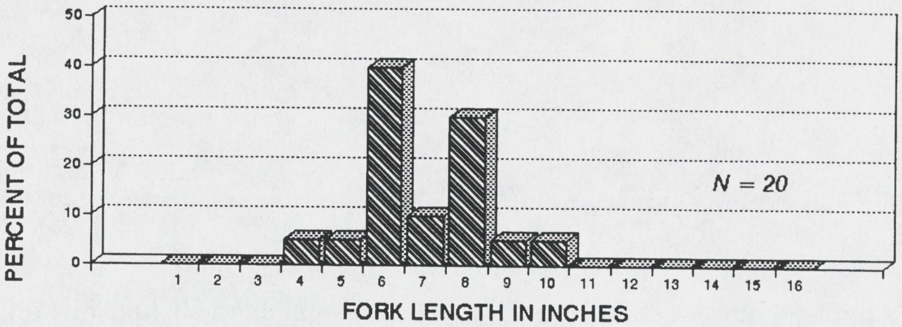

Figure 15. Length-frequency distribution of brown trout electrofished in Van Horn Creek in 1991.

Fishery: There are no angler catch data on brown trout for Van Horn Creek. Anglers checked on McDermitt Creek did not catch any brown trout.

Management Concerns: The management concerns regarding brown trout are similar to those for brook trout discussed above. Management of brown trout in McDermitt Creek will need to be coordinated with NDOW because brown trout habitat continues downstream into Nevada and NDOW may manage that area as a brown trout fishery (NDOW 1989a). In Van Horn Creek, brown trout represent a threat to Lahontan cutthroat trout.

Critical Uncertainty:

- Strategies for removal of brown trout in Van Horn Creek and for dealing with potential illegal introductions need to be developed.

Hatchery Rainbow Trout

Hatchery Program: There are four small BLM stock reservoirs in the Oregon Canyon Creek drainage that are stocked in the spring with fingerling rainbow trout (Table 11). Fingerling trout are used because of the increased expense of raising fish to legal size and transporting them long distances. The trout are raised at Wizard Falls Hatchery near Sisters, Oregon, and trucked to reservoir release sites. The reservoirs were not stocked between 1989 and 1993 because of low water conditions.

Life History: The hatchery stock used is the Oak Springs domestic rainbow trout. The original trout came from Utah in 1923. In 1971, sperm from another rainbow trout brood source in Tacoma, Washington, was added (Kinunen and Moring 1976). Oak Springs stock are fall spawners, but under natural conditions, their progeny may revert to spring spawning (ODFW 1988).

Table 11. BLM reservoirs in the Quinn River subbasin managed for fisheries.

Reservoir	Location[a] T R S	Approximate surface acres	Years stocked[b]	Average number stocked
Blue Mt. #4	38S 43E NWNE 7	2.1	1969 - 1993	689
Dawson	37S 43E NESW 33	1.0	1972 - 1993	570
Mules Ear #1	38S 43E NENW 21	0.5	1983 - 1993	435
Schoolhouse Pit	39S 41E NENE 7	1.4	1980 - 1989	317

[a] *T - township, R - range, S - section.*
[b] *Not stocked every year during the period.*

Fish Production: Fish performance depends on the habitat into which the fish are released (ODFW 1988). The number of fish released depends on the size of the reservoir. No inventory information is gathered on the reservoirs because they are managed as consumptive fisheries and are expected to be fished out every year.

Fishery: Task force members from the area reported that most of the reservoirs are fished out the year after stocking, some early in the season. Sampling of small BLM reservoirs in the McDermitt area in 1974 revealed that angling pressure in all reservoirs was high and rainbow trout stocked in 1973 had been cropped quite closely (ODFW, unpublished report). Data on angler catch rates is available on Blue Mountain #4, Dawson, Mules Ear #1, and Schoolhouse Pit reservoirs between 1979 and 1987 (Figure 16). However, the data are limited because of the small number of anglers checked. Catch data show that some fish live more than one season before they are fished out.

Management Concerns: Hatchery rainbow trout stocked in BLM reservoirs in the Oregon Canyon Creek drainage do not pose an immediate threat to the wild fish population because of their isolation from mainstem Oregon Canyon Creek. None of the reservoirs has a direct connection to live water. Under extremely rare high flow situations, they might overflow, but the water would most likely soak into the ground before it reached an active channel. The probability of hatchery rainbow trout reaching Oregon Canyon Creek from the reservoirs spilling is remote.

The reservoirs are stocked on the same trip as a number of other small reservoirs outside the planning area. Still the transportation costs are high. They are reduced somewhat by volunteers who meet the stocking truck and transport the fish in non-departmental vehicles. Increasing the number of fish stocked or stocking with legal-sized fish is probably not feasible because of costs and the limited habitat available. The

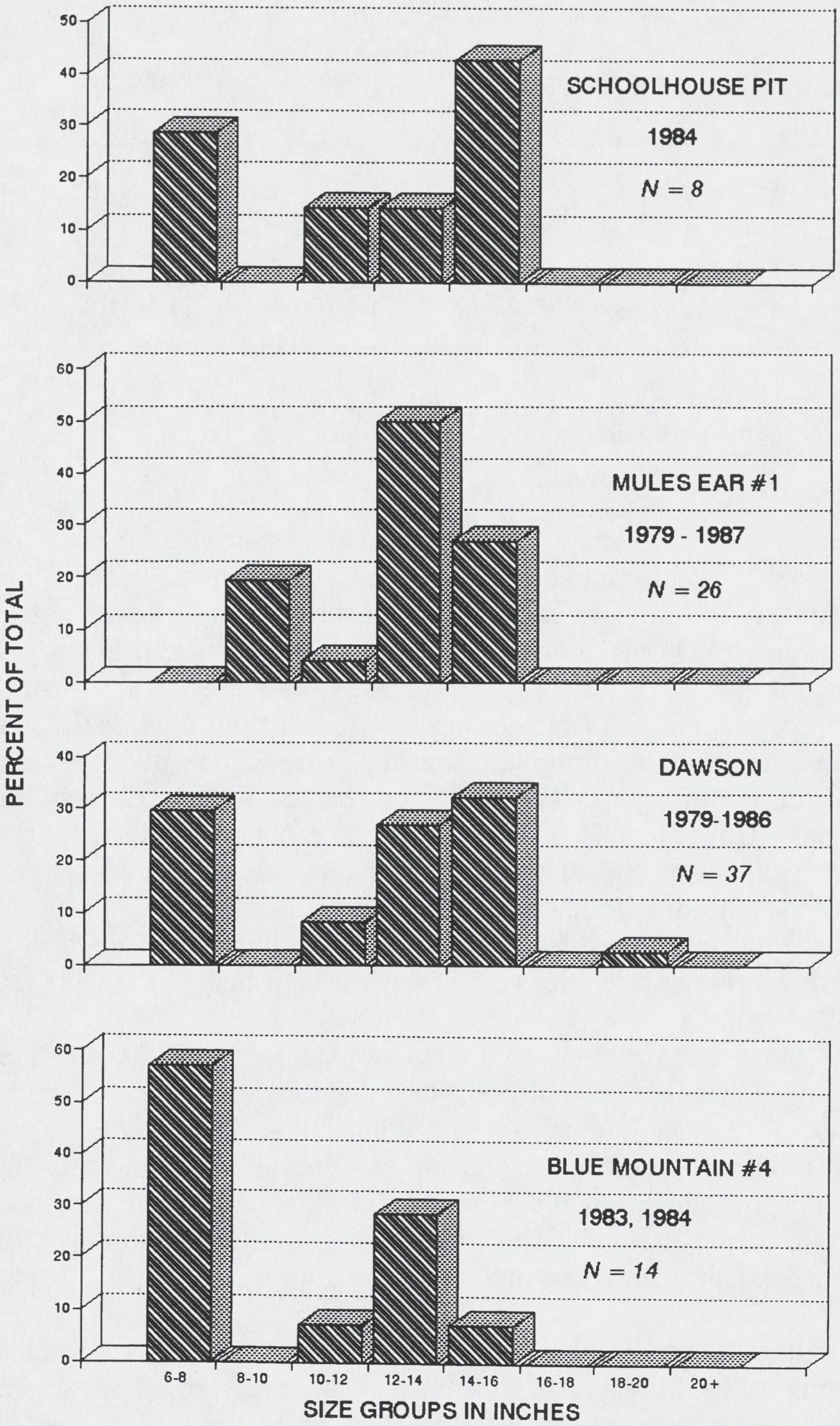

Figure 16. Length-frequency distribution of hatchery rainbow trout from anglers checked at BLM reservoirs managed for fisheries.

fishery is lost when the reservoirs do not fill. Nevertheless, the social benefit of the hatchery program is high because it provides a consumptive fishery in the McDermitt area where fishing opportunity of any kind is scarce.

Policies

Policy 1. **Streams in the Coyote Lake subbasin shall be managed for natural production of Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(1)]. No fish except for progeny of Willow and Whitehorse cutthroat trout shall be stocked into the Coyote Lake subbasin except as consistent with the Lahontan Cutthroat trout recovery plan under the Endangered Species Act or as identified in OAR 635-07-527(3).**

Policy 2. **Streams in the Quinn River subbasin shall be managed for natural production of indigenous Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(1)]. Resident rainbow/cutthroat, brook, and brown trout in the Quinn River subbasin shall not be outplanted outside their current distribution, nor supplemented with hatchery or naturally produced fish. No hatchery trout shall be stocked into streams in the Quinn River subbasin except as consistent with the Lahontan Cutthroat trout recovery plan under the Endangered Species Act or as identified in OAR 635-07-527(3).**

Policy 3. **Streams on the east side of Pueblo and Steens mountains shall be managed for natural production of Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(1)]. No attempt shall be made to establish populations in those streams that were not stocked with Lahontan cutthroat trout in the past. In the event trout populations are lost in streams identified in this policy, attempts will be made to establish populations of Lahontan cutthroat trout or other trout of the Lahontan complex (e.g., Trout Creek rainbow/cutthroat trout, Mann Lake cutthroat trout) in those streams where sufficient habitat exists.**

Policy 4. **Streams in the Trout Creek drainage (Alvord Lake subbasin) shall be managed for natural production of resident rainbow/cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(1)]. No hatchery trout shall be stocked into the Trout Creek drainage.**

Policy 5. **Mann, Juniper, Tudor, Tencent, and Wildhorse lakes shall be managed for hatchery fish consistent with the Featured Species Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(2)]. Only the Mann Lake hatchery strain of cutthroat trout shall be stocked in these lakes. Mann Lake will continue to serve as the brood lake for this hatchery program.**

Policy 6. **BLM stock reservoirs in the Lahontan subbasins shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Alternative for trout as described in Oregon's Trout Plan [OAR 635-500-115(4)].**

Objectives

Objective 1. **Maintain and enhance genetic diversity, adaptiveness and abundance of indigenous Lahontan cutthroat trout and resident rainbow/cutthroat trout in the Lahontan subbasins.**

Assumptions and Rationale

1. Monitoring the distribution and abundance of populations of Lahontan cutthroat trout and resident rainbow/cutthroat trout will provide an indication of their health and adaptiveness.

2. Lahontan cutthroat trout in the Lahontan subbasins have been listed as threatened under the federal and state endangered species acts.

3. ODFW will provide input to the USFWS in development of the Lahontan Cutthroat trout recovery plan.

4. Lack of suitable trout habitat as a result of land and water management practices and climatic factors limits the ability of Lahontan cutthroat trout in the Lahontan subbasins to maintain their distribution and abundance.

5. Hatchery rainbow, brook, and brown trout have been stocked into mainstem McDermitt Creek in past years. Hatchery rainbow trout have been stocked into Trout, Oregon Canyon, and Tenmile creeks in past years.

6. Trout did not inhabit streams on the east side of Pueblo and Steens mountains historically, but they may have occurred there in prehistoric times. Lahontan cutthroat trout populations currently present there were introduced from Willow and Whitehorse creeks in the 1970s and 1980s.

7. Mann, Wildhorse, Tudor, Juniper, and Tencent lakes and BLM stock reservoirs did not historically contain trout, but trout may have occurred in the lakes in prehistoric times. Earliest trout stocking in these water bodies dates from 1957.

8. Basinwide habitat objectives listed in the Habitat section of this plan (pages 31-35) will be achieved.

9. Streams with Lahontan cutthroat trout will remain closed to angling until healthy population levels of Lahontan cutthroat trout are attained.

10. Restoration of Lahontan cutthroat populations on public land will require appropriate National Environmental Policy Act documents.

11. USFWS guidelines in the Lahontan Cutthroat trout recovery plan for multiple age classes for more than 5 years and Wild Fish Policy guidelines for 300 minimum spawners are considered the minimums for population structure and genetic fitness.

Actions

1.1 Periodically monitor Lahontan cutthroat trout distribution and abundance in selective stream reaches in the Lahontan subbasins.

1.2 Coordinate fish inventories with habitat inventories.

a. Combine resources and manpower with BLM and NDOW to accomplish fish and habitat inventories.

b. Identify opportunities for public involvement in fish inventories through volunteers or classroom projects.

1.3 Determine healthy population levels for Lahontan cutthroat trout based on abundance, population structure, and genetic fitness.

1.4 Schedule additional fish and habitat inventories in Willow and Whitehorse creek drainages using Restoration and Enhancement Program crews. Coordinate future inventories with evaluations of adjacent BLM allotments.

1.5 Schedule fish and habitat inventories for Oregon Canyon and McDermitt drainages in the Quinn River subbasin and for Trout Creek drainage in the Alvord Lake subbasin using Restoration and Enhancement Program crews. Coordinate these inventories with evaluations of adjacent BLM grazing allotments.

1.6 Schedule fish and habitat inventories for Cottonwood Creek, tributary to Pueblo Slough in the Alvord Lake subbasin, using Restoration and Enhancement Program crews. Coordinate these inventories with evaluations of adjacent BLM grazing allotments.

1.7 Establish baseline data sets of genetic characteristics of Lahontan cutthroat trout and resident rainbow/cutthroat trout in streams of the Lahontan subbasins not previously surveyed, with the use of biochemical and phenotypic parameters.

1.8 Implement the USFWS Lahontan cutthroat trout recovery plan. Coordinate recovery of Lahontan cutthroat trout with USFWS, BLM, and NDOW.

1.9 Coordinate with Oregon State Police on implementation of their enforcement action plan for Lahontan cutthroat trout in Willow and Whitehorse drainages.

1.10 Coordinate with Oregon State Police to develop a strategy to curtail illegal angling in the Lahontan subbasins.

1.11 Develop a sampling strategy to detect illegal introductions.

1.12 Coordinate with Oregon State Police to develop a strategy to deal with illegal introductions of fish into the Lahontan subbasins. Draft a contingency plan for Lahontan cutthroat trout if exotic species are introduced.

1.13 Evaluate potential to install barriers or some other isolating mechanism on Sage and Line Canyon creeks to prevent resident rainbow/cutthroat trout in mainstem McDermitt Creek from spawning and interbreeding with Lahontan cutthroat trout in Sage and Line Canyon creeks.

1.14 Develop genetic guidelines for introductions and transplants of Lahontan cutthroat trout in coordination with NDOW and the USFWS.

1.15 Evaluate potential to restore Lahontan cutthroat trout to its historic range in the Quinn River drainage with NDOW and the USFWS.

a. Consider strategies to remove resident rainbow/cutthroat, brown, and brook trout in Oregon Canyon, Tenmile, Indian, mainstem McDermitt, and other tributaries in the Quinn River subbasin using available technology as appropriate.

b. On streams in the Quinn River subbasin were Lahontan cutthroat trout are reintroduced, evaluate the need for an angling closure until populations are established.

1.16 Determine if the cutthroat strain in resident rainbow/cutthroat trout in Trout Creek differs from Lahontan cutthroat trout in Coyote Lake and Quinn River subbasins using mitochondrial DNA analysis.

1.17 Regularly check for presence or absence of fish in all streams on the east side of Steens and Pueblo mountains where fish have been stocked in the past.

a. Notify BLM and affected private landowners of the results of these investigations.

b. If the decision is made to introduce a trout species, follow these steps:

1) Explore possible trout brood stocks for introduction based on availability of brood stock and observed genetic differences between Alvord cutthroat trout and possible brood stock trout.

2) Develop genetic guidelines for transplanting trout brood stocks into the Alvord Lake subbasin.

3) Introduce trout into barren streams where sufficient habitat exists and adverse effects to indigenous fauna will not occur.

c. On streams where trout are introduced, evaluate the need for an angling closure until populations are established.

Objective 2: Provide diverse angling opportunities for wild trout in the Lahontan subbasins.

Assumptions and Rationale

1. Management under this objective seeks to provide a diversity of angling opportunities including non-consumptive as well as consumptive use of wild trout.

2. Special regulations may be necessary to protect stock fitness and life history characteristics and to maintain healthy, wild trout populations with multiple age classes.

3. Angling for Lahontan cutthroat trout in the Lahontan subbasins was closed to protect depressed populations and will remain closed as long as necessary.

4. Evaluating angling pressure and catch by creel surveys is not economical in this remote area.

Actions

2.1 Determine the need for additional or modified angling regulations to protect populations of wild trout by monitoring the production, health, and abundance of wild trout. In the absence of creel surveys, the department will propose conservative angling regulations.

2.2 Evaluate the fishery potential in Cottonwood (Trout Creek Mountain).

2.3 Develop strategies to improve public awareness and appreciation of wild trout in the Lahontan subbasins.

Objective 3. Provide brood stock at Mann Lake for the department's cutthroat trout hatchery program.

Assumptions and Rationale

1. The Mann Lake strain of cutthroat trout is a unique composite of several cutthroat stocks from Nevada, Utah, California, and Oregon, as well as rainbow trout.

2. Mann Lake is the only Oregon source of cutthroat trout reliable enough for a hatchery program.

Actions

3.1 Develop guidelines for maintaining a healthy, genetically fit brood stock in Mann Lake consistent with the Gene Resource Conservation Policy (OAR 635-07-540).

3.2 Draft a contingency plan for drought conditions.

Objective 4. Provide a quality consumptive fishery on the Mann Lake strain of cutthroat trout in Mann, Juniper, Tudor, Tencent, and Wildhorse lakes consistent with the department's brood stock program.

Assumptions and Rationale

1. ODFW will continue to use Mann Lake as a source for cutthroat trout brood stock.

2. A catch rate of 0.5 fish per hour with most fish over 12 inches in length for Mann Lake will satisfy this objective.

3. Stocking of these lakes will always be contingent upon availability of water.

4. The proximity of Juniper, Tudor, Tencent, and Wildhorse lakes to Mann Lake makes stocking of them with Mann Lake cutthroat trout the most economic strategy.

Actions

4.1 Continue to biennially stock Mann, Juniper, Tudor, and Tencent lakes with Mann Lake cutthroat trout when water conditions allow.

4.2 Evaluate the effects of the stocking program on the indigenous fauna of Wildhorse Lake. If no adverse effects are identified, stock Wildhorse Lake with Mann Lake cutthroat trout when economical transport can be arranged.

4.3 Continue to rely on limited angler interviews and biennial net sampling at these lakes. Use the combined information to adjust stocking rates as water levels and angler catch rate fluctuate. Manage for a body condition (K) of 1.2.

Objective 5. Provide a consumptive fishery on hatchery rainbow trout in selected BLM stock reservoirs.

Assumptions and Rationale

1. Fish populations in BLM stock reservoirs managed for fisheries cannot reproduce themselves and must be periodically supplemented with hatchery rainbow trout.

2. Enough hatchery fish can be produced to meet this objective.

Actions

5.1 Annually stock BLM stock reservoirs with hatchery fingerling rainbow trout when water is available.

5.2 Evaluate current stocking levels at BLM stock reservoirs managed for fisheries by periodic biological sampling and adjust as necessary to meet fishery objectives. Sample for growth and condition factors to evaluate survival to determine if objective is being met. Manage for a body condition (K) of 1.2 or better.

5.3 Evaluate fish habitat potential of other existing and potential new reservoirs in consultation with BLM.

NONGAME SPECIES

Background and Status

Nongame classification refers to fish that are not statutorily designated as game fish. They have received little attention historically from fishery managers because fish management is traditionally funded by angling license proceeds and directed toward game species. Nongame species remained of interest primarily to the scientific community. In recent years, public attention has been directed toward nongame species, both fish and wildlife, and recognition of their place in the ecosystem. The Nongame Wildlife Management Plan (OAR 635-100-001 to 040) provides guidance for management of nongame species. Its goal is to "maintain populations of naturally occurring Oregon Nongame wildlife at self-sustaining levels within natural geographic ranges in a manner which provides for optimum recreational, aesthetic, economic, ecological, educational, scientific and cultural benefits and where possible is consistent with primary uses of land and waters of the state." "Self-sustaining" means that wildlife species are naturally reproducing throughout their ranges with no dependency on artificial propagation to sustain natural production over time [OAR 635-100-001(3)].

Many nongame fish species have special status because very little information exists about their life history, abundance, and limiting habitat factors, or their distribution may be limited. There are seven nongame fish species inhabiting the Lahontan subbasins; all but three have special status.

Borax Lake Chub

The Borax Lake chub was listed as endangered in 1980 under the federal Endangered Species Act because of its very limited distribution and the potential threats to its habitat. It is a state listed endangered species as well. The private land on which the lake is situated was leased to The Nature Conservancy in 1983. The public land surrounding the private parcel is managed by the BLM and designated an Area of Critical Environmental Concern. A recovery plan written by the USFWS was released in 1987. The same year the BLM Burns District prepared the Borax Lake Chub Habitat Management Plan that was signed by the BLM, ODFW, The Nature Conservancy, and the USFWS. The Harney County Land Use Plan (1980) provides protection "from all conflicting uses in accordance with its 3A [preserve the site] designation."

Fish Distribution: The Borax Lake chub is the only fish species inhabiting Borax Lake and its overflow areas. The chub occurs nowhere else. Its habitat is a hot, spring-fed lake in the Alvord Lake subbasin. Borax Lake resulted from the build-up of precipitates that left the lake above the surrounding valley and isolated the chub from other chub populations as Lake Alvord dried up (USFWS 1987). The chubs may also be found in Lower Borax Lake, a nearby small reservoir, when it has water and in the marshy areas adjacent to Borax Lake. The chub lives in an environment that would be lethal to most fish species because of the high water temperatures (*see* Page 22) and possibly other natural water quality conditions.

Life History: Sampling at Borax Lake in 1991 produced chubs that averaged approximately 2.5 inches in fork-length. The largest sampled was approximately 4 inches and the smallest was approximately 1.4 inches (USFWS 1991). Spring spawning has been observed by researchers, and young-of-the-year are prominent in Borax Lake during May and June (USFWS 1987).

Fish Production: The Nature Conservancy, working cooperatively with the BLM, USFWS, and ODFW, has conducted an annual population census around the perimeter of Borax Lake since 1986. These data show a population that varies from approximately 3,900 in 1988 to a high of approximately 17,000 in 1990 (Figure 17). More recent census efforts have shown that the chub use the entirety of the lake, and are more numerous than previously believed. 1991 census efforts estimated the total lake population as 31,400. Using data from traps around the periphery only--to mimic prior years data--gave an estimate of 15,500 (Salzar 1992). The estimated populations appear to be within the ranges identified in the recovery plan as defining a "naturally-sustaining population" (USFWS 1987).

The relationship between population fluctuation and the temperature regime of Borax Lake is a focus of current research. Stated objectives include (1) develop a model to describe the life history and population dynamics of the Borax Lake chub, (2) determine the influence of temperature on habitat use, reproductive behavior, feeding ecology, and survival of egg, larvae, and adult life states; (3) document the seasonal abundance, distribution and composition of algae and macroinvertebrates in the Borax Lake system; and (4) develop a predictive model of the physical and hydrological attributes of Borax Lake (information provided by The Nature Conservancy, Portland, Oregon, 13 August 1991).

Management Concerns: Management concern is focused on habitat of the Borax Lake chub. Recovery of the chub is really the maintenance of its unique habitat and protection from development that might threaten the integrity of the Borax Lake ecosystem. Although removal of the chub from the endangered list may be accomplished by achieving the recovery plan goals, it is probable that the species will continue to have a special status (e.g., threatened) because its distribution is so limited.

The two most controversial habitat issues involve the geothermal exploration and the future ownership of Borax Lake. Two recovery plan actions include "removal of threats to subsurface waters from geothermal energy exploration or development," and "permanent protection of the 160-acre parcel of land surrounding and including Borax Lake (T37S, R33E, Sec. 14) by The Nature Conservancy or other appropriate Public

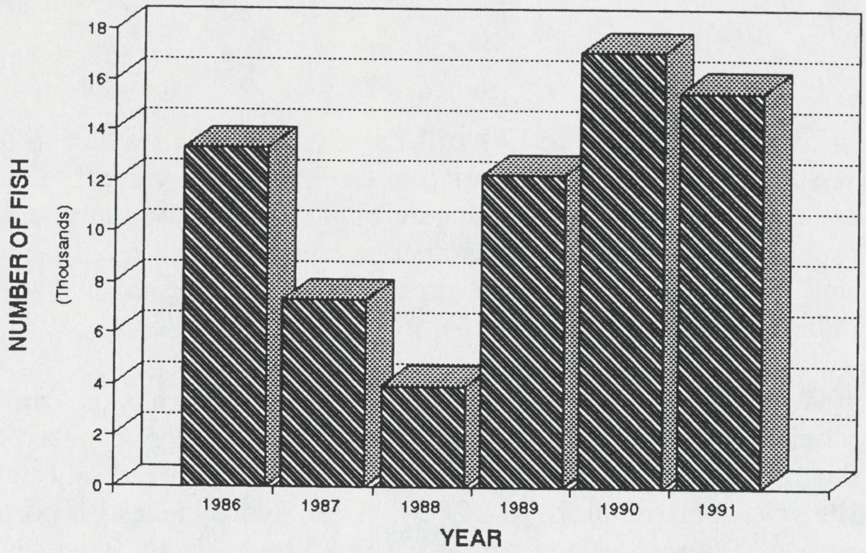

Figure 17. Population estimates for Borax Lake Chub, 1986 - 1991. Data are for perimeter trap sites only.

Resource Agency" (USFWS 1987). Reclassification of the Borax Lake chub from endangered to threatened are conditioned upon completion of these actions, as well as several others (USFWS 1987). Proposed exploratory drilling by Anadarko in 1990 was approved by BLM subject to no drilling during June, July, and August, and was upheld by the Interior Board of Land Appeals. Any future proposed exploration would go through the same environmental analysis process, and if production-level testing or drilling is ever proposed then an environmental impact statement will be prepared. Formal consultation by USFWS in 1980 regarding the chub resulted in geothermal lease stipulation requiring that industry activities be suspended immediately if they may be affecting water quality or quantity at Borax Lake, that monitoring of water quality and quantity must be done before, during, and after drilling and testing, and that no drilling or testing may be done within 2 miles of Borax Lake. A contingency plan was developed by ODFW, USFWS, The Nature Conservancy, and the BLM to move chubs in the event drilling disrupts chub habitat (BLM 1990b) into an old vent filled with water by overland flow from Borax Lake. The Borax Lake Chub Habitat Management Plan (BLM 1987b) has as an objective the use of Lower Borax Lake as a permanent refuge, but this is no longer supported by BLM, ODFW, USFWS, and The Nature Conservancy. The lease under which The Nature Conservancy has been managing the private land surrounding and including Borax Lake is due to expire in 1993 and permanent acquisition of the land by The Nature Conservancy is by no means assured. Strong local support exists for both geothermal development and continued private ownership of Borax Lake.

Critical Uncertainty:

- No reliable refuge for Borax Lake Chub is available.

Alvord Chub

The Alvord chub is indigenous to the Alvord Lake subbasin. In addition to its federal Category II status, it is listed as sensitive in Oregon in the vulnerable category. This means that listing as threatened or endangered is not believed imminent and can be avoided through expanded use of adequate protective measures and monitoring. The Harney County Land Use Plan (1980) directs protection of Serrano Point Pond and Red Point Pond from "identified conflicting uses" to protect the Alvord chub.

Fish Distribution: The Alvord chub is found in the lower reaches of Trout Creek. During the 1973 physical and biological survey, Alvord chubs were encountered up to RM 19. During the 1985 and 1989 inventories, they were encountered at, but not beyond, Sample Site #2 (approximately RM 21.5). The Alvord chub also occurs in Serrano Point Springs and Serrano Pond southeast of Andrews, in the lower portion of Van Horn Creek, and in Red Point Pond and Pueblo Slough near Denio. It may occur in other similar habitats in the Alvord Lake subbasin, such as lower Cottonwood Creek (Trout Creek Mountain), the Alvord Ranch ponds, and small tributaries of Alvord Lake.

Life History: Life history of Alvord chubs has not been studied, although their distribution suggests a tolerance, perhaps a preference, for warmer water. Length-frequency distributions show a range of sizes from 1 to 6 inches fork length, with few chub exceeding 4 inches in fork length.

Fish Production: There are no estimates of Alvord chub abundance. Perkins et al. (1991) noted that during the 1989 Trout Creek inventory, the number of chubs sampled was considerably less than what was sampled in 1985, as was the case with trout.

Management Concerns: The lack of information on life history, population dynamics, habitat requirements, and limiting factors is the principal management concern. The effects of irrigation diversion on the Alvord chub population in Trout Creek are unknown.

Critical Uncertainties:

- What are the distribution, life history, population dynamics, habitat requirements, and limiting factors of Alvord chub?
- What, if any, interaction occurs between Alvord chub and resident rainbow/cutthroat trout?

Nongame Species of the Quinn River Subbasin

Five indigenous species occur in the Quinn River subbasin: Lahontan redside

Richardsonius egregius, Mountain sucker *Catostomus platyrhynchus*, Tahoe Sucker *Catostomus tahoensis*, Speckled Dace *Rhinichthys osculus*, and Tui chub *Gila bicolor*. The Lahontan redside and Tahoe sucker are listed sensitive in Oregon in the peripheral or naturally rare category. Both are considered naturally rare in Oregon and at the edge of their range. They are widespread and abundant in Nevada.

Fish Distribution: Information on distribution of the five nongame species comes from inventories conducted in the McDermitt Creek drainage. They have not been encountered during limited sampling in Oregon Canyon Creek and Tenmile creeks. During the 1979 sampling, the most widely distributed of the five species was the speckled dace, which occurred up to about one mile below the mouth of North Fork McDermitt Creek. Tahoe suckers were sampled above the mouth of Mine Creek. Shiners and suckers were sampled at the Turner Ranch. Tui chubs were sampled at the mouths of Indian Creek and Mine Creek and in lower Indian Creek and lower Cottonwood Creek, its tributary. During the NDOW'S 1989 stream survey, only speckled dace, Lahontan redsides, and mountain suckers were identified, with dace the dominant species. The upstream extent of these species were as follows: Lahontan redsides about 1.75 miles upstream of the state line, mountain suckers about 1.25 miles upstream of the state line, speckled dace about 3 miles below the mouth of North Fork McDermitt Creek.

Life History: The life histories of nongame species in the McDermitt Creek drainage have not been studied, and no inventory data has been collected for them by ODFW. Speckled dace are common to cold water streams in Oregon and Washington, and rarely exceed 4 inches in length (Wydoski and Whitney 1979). The mountain sucker occurs throughout the Great Basin and remains small, not exceeding 8 or so inches in length (Wydoski and Whitney 1979). The tui chub is also found in streams in the Columbia and Klamath basins in Oregon. The maximum length reported for the species is 16.1 inches (Wydoski and Whitney 1979).

Fish Production: Data on abundance for the five species is not available, but biologists observations indicate a general abundance of Lahontan redside, speckled dace, and Mountain suckers. Tui chubs were observed as "common" to "numerous" in lower Indian Creek and McDermitt Creek near the mouth of Indian Creek. Only a "few" Tahoe suckers were observed at one sample site in 1979, suggesting that they have limited distribution and abundance. It is also possible that they were misidentified as mountain suckers during both surveys.

Management Concerns: The lack of information on life history, population dynamics, habitat requirements, and limiting factors is the principal management concern. Although information is available on several of the widespread species, the interactions of the various species and their influence on the trout populations in McDermitt Creek is unknown. Their distribution elsewhere in the Quinn River subbasin in Oregon is likewise unknown.

Critical Uncertainties:

- o What are the distribution, life history, population dynamics, habitat requirements, and limiting factors of nongame species in the Quinn River subbasin?

- o What is the nature of interaction between nongame species and trout in the Quinn River subbasin?

Policy

Policy 1. The following indigenous species and their respective waters shall be managed to maintain self-sustaining populations: Borax Lake chub in Borax Lake; Alvord chub in the Alvord Lake subbasin, except for Borax Lake; and Lahontan redside, Tahoe sucker, mountain sucker, and speckled dace in the Quinn River subbasin.

Objective

Objective 1. Improve and maintain population health (e.g., abundance, multiple age classes, and genetic fitness) of all indigenous nongame species in the Alvord Lake and Quinn River subbasins.

Assumptions and Rationale

1. Borax Lake Chub is listed as an endangered species under the federal and Oregon endangered species acts.

2. The USFWS Borax Lake Chub Recovery Plan will be implemented.

3. The Alvord chub is a federal Category II and state listed sensitive species.

4. The Lahontan redside and Tahoe sucker are state listed sensitive species.

Actions

1.1 Recommend to the USFWS that the Borax Lake Chub Recovery Plan be reviewed and alternatives with and without private land ownership be looked at.

1.2 If Borax Lake remains in private ownership, explore a memorandum of understanding for management of the lake with the landowner.

1.3 Incorporate the Borax Lake Recovery Plan into the Lahontan Subbasins Fish Management Plan.

1.4 Collect more information on the distribution, abundance, life history, and population health of nongame species:

a. Alvord chub in Trout Creek, Serrano Point Springs, and other seeps, springs, and ponds in the Alvord Lake subbasin.

b. Lahontan redside, Tahoe sucker, mountain sucker, tui chub, and speckled dace in the Quinn River subbasin.

1.5 Notify BLM and affected private landowners of the distribution, abundance, and population health of nongame species as new information is obtained.

1.6 Develop a sampling strategy to detect illegal introductions.

1.7 Coordinate with the Oregon State Police to develop a strategy to deal with illegal introductions of fish into the Lahontan subbasins. Draft a contingency plan for indigenous nongame species if exotic species are introduced.

1.8 Consider strategies to improve public awareness and appreciation of indigenous nongame species in the Lahontan subbasins.

ANGLER ACCESS

Background and Status

Access is generally good to popular areas, such as Mann Lake, in the Lahontan subbasins. The BLM reservoirs have adequate access. The improvements completed at Mann Lake in 1991 (*see* discussion on Page 57) were the highest priority for angler access in the Southeast Region. No other ODFW access priorities have been identified in the planning area. Recreational access to newly acquired public land in the Wildhorse drainage will be addressed in the management plan being drafted by the BLM.

Recommendations following the 1970 physical and biological survey in the Whitehorse drainage indicated that access should not be developed or improved to Whitehorse, Little Whitehorse, and Cottonwood creeks, because of the vulnerability of the cutthroat trout to angling pressure. Development of access (roads and trails) along Willow and Trout creeks is discouraged by Harney County land-use policy (Harney County 1980).

No new roads in wilderness study areas will be permitted except for activities considered "grandfathered" or valid existing rights (e.g., certain mineral leases and right-of-way authorizations in effect on October 21, 1976). Details on roading and other activities in wilderness study areas are contained in the interim management policy (BLM 1987a) and Instruction Memo OR-92-241 (BLM 1992a).

The Lahontan subbasins represent one of few remaining areas in the state where anglers and others can enjoy a desert wilderness experience in relative solitude.

Management Considerations

Consideration of the needs of special status species of the Lahontan subbasins should be an overriding factor where access is concerned. The need to keep access limited and manage for primitive fisheries where species need protection should be the major focus of management. However, management consideration should also be given to improving access to consumptive fisheries located in the basin to the extent they do not jeopardize special status species. Close coordination with the BLM is needed to reduce recreational effects to sensitive areas.

Policy

Policy 1. Angler access development will give full consideration to sensitive and special status species and their habitat.

Objectives

Objective 1. Maintain limited access to areas where special status species or their habitat may be affected.

Assumptions and Rationale

1. Limiting access where special status species or their habitat may be affected will reduce adverse effects to these species and their habitat.

Actions

1.1 Request close coordination with BLM on any recreational development in the planning area.

1.2 Explore feasibility of rerouting Willow Creek road away from the stream.

Objective 2. Define a strategy for public access in the Wildhorse Creek drainage.

Assumptions and Rationale

1. Recent BLM acquisition of property in the Wildhorse Creek drainage may provide additional opportunities for angling in the Lahontan subbasins.

Actions

2.1 Coordinate with BLM on its management plan for the Wildhorse Creek property.

Objective 3. Maintain road access to BLM reservoirs with fisheries in the planning area.

Assumptions and Rationale

1. Maintained road access to BLM reservoirs with fisheries will improve the angling experience, visitor use, and economic value of these consumptive fisheries.

Actions

3.1 Work with the BLM and private interest groups to maintain and enhance public access opportunities to consumptive fisheries.

PRIORITIES

The following are considered the highest priorities in the Lahontan subbasins:

-- Improve data gathering and assessment of fisheries and fish habitat in the Lahontan subbasins.

-- Improve populations of indigenous fishes with special status so that special listing is not necessary to ensure their continued existence.

-- Provide consumptive fisheries in the Lahontan subbasins where appropriate.

Management priorities identified by staff and their funding status for habitat, each of the species or species groups, angler access, and general management needs are listed in Table 12. These priorities are ranked on the basis of (1) the importance of the problem or objective, (2) the likelihood that the problem can be solved or substantial progress can be made during the next six years, and (3) availability of funding.

Table 12. Priority actions in the Lahontan subbasins and funding status.

Action	Requires action by other agencies	Currently funded
HABITAT		
Develop a priority list to gather baseline habitat information on streams in the planning area and coordinate fish population and habitat inventories with grazing allotment evaluations (Obj. 1, Act. 1.1 and 1.2).	Yes	Partially
Coordinate with land management entities (public and private) to identify specific areas of concern and develop cooperative projects to improve riparian habitats (Obj. 2, Act. 2.4).	Yes	No
Identify opportunities to improve instream flows (Obj. 3, Act. 3.3).	Yes	No
TROUT		
Implement the USFWS Lahontan cutthroat trout recovery plan (Obj. 1, Act. 1.8).	Yes	No

Table 12. Continued.

Action	Requires action by other agencies	Currently funded
Develop a strategy to deal with illegal introductions of fish into the subbasins and draft a contingency plan for Lahontan cutthroat trout if exotic species are introduced (Obj. 1, Act. 1.11, 1.12).	Yes	No
Develop guidelines for maintaining a healthy, genetically fit brood stock in Mann Lake (Obj. 3, Act. 3.1).	No	Yes
NONGAME		
Collect more information on the distribution, abundance, and population health of nongame species (Obj. 1, Act. 1.4).	No	Yes
Develop a strategy to deal with illegal introductions and draft a contingency plan (Obj. 1, Act. 1.7).	Yes	No
ACCESS		
Request close coordination with BLM on any recreational development in the planning area (Obj. 1, Act. 1.1, Obj. 2, Action 2.1).	Yes	Yes
Maintain and enhance public access opportunities to consumptive fisheries (Obj. 3, Act. 3.1).	Yes	Partially

PLAN IMPLEMENTATION AND REVIEW

This document may be viewed as the basis for development of specific management strategies over time. It is intended to function on a continuum with adjustments made as new information or need suggests they are warranted. Upon adoption by the Oregon Fish and Wildlife Commission, the policies and objectives become Oregon Administrative Rules. Revision of these rules requires action by the Oregon Fish and Wildlife Commission in accordance with the Administrative Procedures Act when needed. Progress on specific actions will be reviewed every two years by staff prior to preparation of the biennial budget recommendations. At that time, priorities will be reexamined and adjustments will be made where necessary, and a progress report prepared.

The plan will be formally reviewed every 10 years. Portions of the plan will be rewritten as needed and presented to a public advisory committee. The final draft will be presented to the Fish and Wildlife Commission for adoption.

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APPENDIX A

Species Information

Appendix Table A-1. Fish species[a] in the Lahontan subbasins and their status.

Common name	Scientific name	Status[b]
	GAMEFISH	
	Trouts--Family Salmonidae	
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	FT, ST, GF
Mann Lake cutthroat trout[c]	*Oncorhynchus clarki*	GF
Rainbow/cutthroat trout[c]	*Oncorhynchus mykiss/O. clarki*	GF
Brook trout[c]	*Salvelinus fontinalis*	GF
Brown trout[c]	*Salmo trutta*	GF
Rainbow trout[c]	*Oncorhynchus mykiss*	GF
	NONGAME FISH	
	Suckers--Family Catostomidae	
Tahoe sucker	*Catostomus tahoensis*	SS
Mountain sucker	*Catostomus platyrhynchus*	U
	Minnows--Family Cyprinidae	
Borax Lake chub	*Gila boraxobius*	FE, SE
Alvord chub	*Gila alvordensis*	C2, SS
Tui chub	*Gila bicolor*	U
Lahontan redside	*Richardsonius egregius*	SS
Speckled dace	*Rhinichthys osculus*	U

[a] *Common and scientific names of fishes based on: Robins, C.R., Chairman. 1991. A list of common and scientific names of fishes from the United States and Canada, 5th edition. American Fisheries Society (Committee on Names of Fishes) Special Publication 12, Bethesda, Maryland.*

[b] *FE - federal endangered; SE - state endangered; FT - federal threatened; ST - state threatened; C2 - federal category II; SS - state sensitive; GF - state game fish; U - state unclassified.*

[c] *Introduced species.*

APPENDIX B

Stream Discharge Summaries

Appendix Table B-1 . Mean monthly and annual discharge (cfs) for Trout Creek for 1980 - 1991. (Some data were rounded to one decimal point.)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
1980	5.5	7.5	6.0	11.8	10.8	18.1	54.6	90.7	36.1	13.5	6.2	6.5	22.3
1981	6.6	4.5	5.7	6.5	8.5	11.5	28.0	30.8	14.9	6.3	2.5	2.2	10.7
1982	5.6	8.1	11.4	7.2	28.5	24.6	70.4	72.4	32.0	18.0	5.6	6.0	24.1
1983	8.1	9.6	8.5	8.1	11.7	39.7	56.6	135.3	109.3	32.7	12.7	11.0	37.0
1984	9.2	9.7	15.8	21.0	18.8	36.9	95.5	204.1	126.8	32.6	12.2	9.8	49.4
1985	12.4	13.8	10.9	9.0	10.4	17.3	64.1	56.5	22.3	8.6	6.2	8.0	20.0
1986	8.9	7.3	7.7	9.7	25.1	54.1	67.2	66.5	32.3	9.4	5.0	6.4	24.9
1987	7.6	7.9	7.0	7.1	8.2	10.4	21.3	16.9	9.33	5.3	3.4	3.5	9.0
1988	4.1	5.5	8.2	6.6	6.1	7.5	11.3	10.1	5.06	2.7	1.5	2.0	5.9
1989	2.9	5.5	4.8	7.8	6.0	33.1	49.7	54.9	23.0	8.8	3.8	4.8	16.9
1990	6.9	5.5	6.1	4.3	3.1	7.3	20.2	13.1	9.04	2.9	2.1	2.7	6.9
1991[a]	4.5	4.4	2.4	.5	4.5	6.7	11.0	48.6	30.1	5.2	3.1	3.5	10.4

[a] *Data are provisional and subject to revision.*

Appendix Table B-2. Mean monthly and annual discharge (cfs) for McDermitt Creek for 1980 - 1991. (Some data have been rounded to one decimal point.)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
1980	3.3	6.3	6.7	43.5	68.7	57.8	110.0	90.7	31.6	11.8	5.0	5.3	36.5
1981	5.8	7.6	8.9	8.8	14.2	11.8	13.6	15.5	7.13	1.6	.0	.1	7.8
1982	.7	9.6	43.4	16.0	237.5	66.5	112.7	116.3	49.6	15.3	1.6	1.6	52.2
1983	7.2	14.1	22.8	47.0	73.7	214.6	216.4	246.4	139.5	34.2	15.4	8.8	86.7
1984	10.0	17.3	45.9	15.2	48.5	201.6	328.2	310.3	133.1	46.5	11.5	10.0	98.2
1985	*	*	*	*	*	65.1	163.7	50.9	18.5	6.2	3.1	1.0	*
1986	8.4	8.9	10.1	22.3	302.3	270.9	144.5	72.3	35.7	6.8	3.5	6.0	72.7
1987	5.6	6.7	7.3	8.0	10.7	20.0	12.5	23.4	9.15	1.4	3.2	3.7	9.3
1988	5.2	8.0	9.2	9.6	17.8	13.9	5.7	6.4	4.3	.5	.1	1.5	6.8
1989	3.0	6.0	7.3	6.7	19.6	252.2	181.4	74.2	21.7	6.3	3.0	4.3	49.0
1990	5.3	6.2	8.7	9.1	10.9	17.0	10.1	12.2	5.4	.7	.1	1.8	7.3
1991	4.9	5.1	4.1	4.4	7.3	9.8	10.1	29.5	22.8	4.5	3.4	2.5	9.1

APPENDIX C

Instream Water Rights Information

Appendix Table C-1. Stream segments in the Lahontan subbasins with applications and certificates for instream water rights.

Stream	Upstream limit	Downstream limit	Application number	Certificate number	Date
Big Trout Creek	Headwaters	Trout Creek Road	070028		08/08/89
Big Trout Creek	Trout Creek Rd	L. Trout Creek	070026		08/08/89
E. Fork Trout Creek	Headwaters	Mouth	070020		08/08/89
Little Trout Creek	Headwaters	Defenbaugh property	070027		08/08/89
Trout Creek	L. Trout Creek	USGS Gage	070029		08/08/89
Trout Creek			MPS[a]	599779	11/03/83
Whitehorse Creek	Headwaters	Whitehorse Ranch property	070023		08/08/89
Little Whitehorse Creek	Headwaters	Whitehorse Ranch property	070022		08/08/89
Willow Creek	Headwaters	Upper BLM Rd	07024		08/08/89
Willow Creek	Upper BLM Rd	County Rd	070025	64741	08/08/89
Willow Creek			MPS	59978	11/03/83
McDermitt Creek	Headwaters	Upper Zimmerman Property	070021		08/08/89
Borax Lake			071814		08/29/91

[a] *Minimum perennial streamflow.*

Appendix Table C-2. Instream flows requested by ODFW for streams in the Lahontan subbasins.

Application number	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
70020	5	5	5	10	10	2	2	2	2	5	5	5
70021	4	4	8	8	6	5	4	3	3	3	3	3
70022	10	10	10	10	10	3	3	3	3	10	10	10
70023	20	20	20	20	20	8	8	8	8	20	20	20
70024	5	5	5	20	20	2	2	2	2	5	5	5
70025	4	5	5	20	20	3	3	3	3	3	4	4
70026	10	10	10	15	15	4	4	4	4	10	10	10
70027	5	5	5	10	10	3	3	3	3	5	5	5
70028	5	5	5	10	10	2	2	2	2	5	5	5
70029	20	20	20	20	20	5	5	5	5	20	20	20

APPENDIX D

A Summary of BLM Planning Documents Relevant to Fish Management in Oregon

The Bureau of Land Management's Oregon/Washington Riparian Enhancement Plan of 1987 identified streams in the Alvord Lake and upper Quinn River hydrologic basins as the highest priority for the Burns and Vale districts, respectively. A Memorandum of Agreement (MOA) between the BLM and the DEQ establishes a framework for the two agencies to cooperate on projects to protect water quality in the state and includes an action plan to implement the MOA. The MOA and action plan provide for (1) opportunity to coordinate and review nonpoint management progress by each agency, (2) joint exchange and dissemination of documented water quality related information, (3) joint coordination on mutual technical assistance needs, and (4) joint identification and prioritization of mutual nonpoint source problem areas. In addition, opportunities for public involvement are also provided for in the MOA.

Vale District documents include the Southern Malheur Management Framework Plan, 1983, and the Southern Malheur Grazing Environmental Impact Statement, 1983, in which general objectives for riparian zones are set. The Southern Malheur Rangeland Program Summary, 1984, identified improvement of riparian values as the primary resource objective in the Trout Creek Mountains. Rangeland Program Summary updates (1986, 1991) detail progress in program implementation and scheduled evaluations. A high priority on management of riparian areas for enhancement of riparian values was emphasized in the latest update. The Whitehorse Basin Habitat Management Plan (1980) and McDermitt Creek Habitat Management Plan (1985) address specific needs for fish and identify objectives for fish habitat, specific actions to accomplish the objectives, and an implementation schedule. These plans are updated as new information becomes available.

Burns District planning documents include the Andrews Resource Area Management Framework Plan (1982), Andrews Grazing Management Program Environmental Impact Statement (1983), and the Andrews Rangeland Summary and Record of Decision (1984). Rangeland Program Summary updates (1984, 1986, 1989, 1990, 1991) detail progress in implementing the rangeland program and include agreements and decisions affecting riparian vegetation and a schedule for allotment evaluations.

The borders of two allotments include land in Oregon and Nevada. Grazing in these allotments is administered by the Winnemucca District BLM in Nevada, whereas the wildlife habitat in Oregon is surveyed and monitored by the Burns District BLM in Oregon. Planning documents, e.g., grazing environmental impact statements, drafted by the Nevada BLM are reviewed by the Burns BLM district. The pertinent planning documents are the Paradise-Denio Management Framework Plan (1975) and the Paradise-Denio Grazing Environmental Impact Statement (1981). Although the riparian objective of the environmental impact statement is to improve and maintain the condition of riparian and streamside habitat, the final environmental impact statement identifies "continued degradation of riparian areas and aspen stands" as an adverse effect of the proposed decision. According to Scott Billings, Resource Area Manager, riparian objectives are incorporated into allotment management plans when allotments with riparian values are evaluated.

APPENDIX E

Lahontan Subbasins Stream Inventory Summary

Appendix Table E-1. Stream inventory summary for the Lahontan subbasins.

Drainage area	Year	Agency	Remarks
Alvord Lake Subbasin, Pueblo Mountain:			
Van Horn, Denio creeks	1975	ODFW	Streams checked for presence of fish.
Denio Creek	1977	BLM	Stream habitat survey.
Van Horn, Denio, Arizona creeks	1979	BLM	Physical and biological stream survey; channel stability survey; riparian habitat quality and potential; instream aquatic habitat.
Van Horn, Denio creeks	1981-1986	BLM	Water quality monitored.
Van Horn Creek	1982	BLM	Stream channel and habitat stability survey.
Denio Creek	1982, 1983	BLM	Macroinvertebrates sampled.
Van Horn, Denio creeks	1983	ODFW	Fish inventory.
Van Horn, Denio creeks	1991	ODFW	Fish inventory.
Van Horn, Denio creeks	1992	BLM	R&E Habitat Inventory
Alvord Lake Subbasin, Steens Mountain:			
Wildhorse Creek	1973	ODFW	Physical and biological stream survey.
Mosquito Creek	1975	ODFW	Fish observations in lower four miles.
Pike, Indian, Big Alvord, Cottonwood, Willow creeks	1979	BLM	Physical and biological stream survey.
Little McCoy Creek (Castle Creek), Willow, Cottonwood, Big Alvord, Little Alvord, Pike creeks	1983	ODFW/BLM	Fish inventoried.
Willow Creek (Steens)	1987	BLM	Water quality and macroinvertebrates sampled.
Pike, Big Alvord, McCoy, Little Alvord, and Mosquito creeks	1991	ODFW	Fish Inventory.

Appendix Table E-1. Continued.

Drainage area	Year	Agency	Remarks
Alvord Lake Subbasin, Trout Creek Mountain:			
Trout Creek	1966	ODFW	Stream flows, turbidity, and temperatures taken.
Trout Creek drainage, Kings River	1973	ODFW	Physical and biological stream survey.
Trout Creek, East Fork Trout Creek	1978	ODFW	Streams checked for species present and upper limits of fish distribution.
Trout Creek drainage	1982	BLM	Fish inventory, water quality sampled.
Trout Creek drainage	1985	ODFW/BLM	Fish and habitat inventory at sample sites; population estimates; habitat quality index (HQI, Binns method); macro-invertebrates sampled.
Trout Creek drainage	1986-1990	BLM	Water quality sampled.
Trout Creek drainage	1986, 1990	BLM	Macroinvertebrates sampled.
Trout Creek	1987	ODFW	Fish abundance and habitat conditions observed.
Trout Creek drainage	1989	ODFW	A repeat of 1985 work.
Kings River	1973	ODFW	Physical and biological stream survey.
Kings River	1976	BLM-NV	Stream habitat survey.
Kings River	1982	BLM-OR	Fish inventory, water quality, discharge data collected.
Kings River	1989	NDOW	General Aquatic Wildlife Systems inventory.
Cottonwood Creek	1973	ODFW	Physical and biological stream survey.
Coyote Lake Subbasin:			
Willow, Whitehorse, Little Whitehorse creeks	1966	ODFW	Stream flows, turbidity, and temperatures taken.
Willow Creek	1968	ODFW	Streamflows measured.

Appendix Table E-1. Continued.

Drainage area	Year	Agency	Remarks
Whitehorse, Little Whitehorse, Willow drainages	1970	ODFW	Physical and biological stream survey.
Whitehorse and Willow creek drainages	1971	ODFW	Min-Max thermometers, thermograph readings, evaluation of problem, stream habitat improvement recommendations.
Willow Creek	1978	ODFW	Stream checked for species present and upper limits of distribution.
Willow Creek	1979,1981	BLM	Physical and biological stream survey.
Whitehorse Creek drainage (Twelve-Mile, Antelope, Little Whitehorse, and Whitehorse Creeks)	1981	BLM	Physical and biological stream survey.
Whitehorse and Willow drainages	1985	ODFW/BLM	Fish and habitat inventory at sample sites; population estimates; habitat quality index (HQI, Binns method); macro-invertebrates sampled.
Whitehorse Creek	1986	ODFW	HQI at Sweeney cow camp.
Whitehorse Creek	1987	ODFW	Fish abundance and habitat conditions observed.
Whitehorse, Little Whitehorse, Willow creeks and tributaries, Antelope, Little Antelope, Twelvemile creeks	1988, 1989	BLM	Riparian condition inventory.
Whitehorse and Willow drainages	1989	ODFW	A repeat of 1985 work.
Little Whitehorse Creek	1990	ODFW	Additional new site sampled; fish and habitat data collected.
Willow and Little Whitehorse creeks	1992	ODFW	R&E Habitat Inventory.
Whitehorse Creek	1992	ODFW	Several areas between Whitehorse ranch diversion and lower sample site on BLM (#12) sampled for presence of fish.

Appendix Table E-1. Continued.

Drainage area	Year	Agency	Remarks
Quinn River Subbasin:			
McDermitt Creek	1974	ODFW	Fish inventory.
McDermitt, Oregon Canyon creeks	1978	ODFW	Streams checked for species Mine, Payne, and Cottonwood present and upper limits of fish distribution.
McDermitt, Sage, and Indian creeks	1979	ODFW/BLM	Physical and biological stream survey.
McDermitt mainstem	1989	NDOW	General Aquatic Wildlife Systems inventory.
Indian Creek	1989	ODFW/BLM	Fish observations.
Oregon Canyon and tributaries, headwaters of McDermitt, North Fork McDermitt creeks	1988, 1989	BLM	Riparian condition inventory.
Indian and Tenmile creeks	1990	ODFW	Visual checks for fish presence.
McDermitt, Sage, and Indian creeks	1991	ODFW	Fish inventory.

APPENDIX F

Grazing Allotments in the Lahontan Subbasins

Appendix Table F-1. Vale District BLM grazing allotments with riparian areas in the Lahontan subbasins.

Allotment name	Number	Riparian areas	Category[a]	Planning document[b]	Allotment evaluation date	Total AUMs	Grazing system (riparian pastures)	Stream trend			Date trend evaluated
								Down	Static	Up	
15 Mile Community	01201	Oregon Canyon, Antelope, Doolittle, Twelvemile, upper Whitehorse, Dry, 15-Mile, Sheepline Canyon creeks	I	AGP[d]	1991	21,146	Rest rotation	19.25	4.75	6.00	1989
McCormick	01202	Indian, Cottonwood Sheepline Canyon, Doolittle, 15-Mile creeks	I	AGP[d]	1990	8,872[c]	Early season annually				1989[e]
Zimmerman	01203	North Fork McDermitt, McDermitt, Payne Mine, Sage creeks	I	Draft EA 1991	1990	9,575[c]	Rest rotation	2.0	1.25	0.75	1989[f]
Whitehorse Butte	01206	Willow, Little Whitehorse, Whitehorse creeks	I	EA 1990	1995	10,978[c]	Rest rotation, exclosures	18.00	6.00	1.25	1989
Sherburn	11303	Tenmile Creek	M	AMP 1984	1991	3,771	Deferred rotation	-	-	-	None

[a] *I - Improve; M - maintain.*
[b] *AGP - annual grazing plan; EA - environmental assessment; AMP - allotment management plan.*
[c] *This figure may include suspended use and non use as well as active.*
[d] *Environmental assessment scheduled for 1992.*
[e] *Information and data not compiled.*
[f] *Information and data on McDermitt, Mine, Sage, and Payne creeks not compiled.*

Appendix Table F-2. Burns District BLM grazing allotments with riparian areas in the Lahontan subbasins.

Allotment name	Number	Riparian areas	Category[a]	Planning document[b]	Allotment evaluation date	AUMs	Grazing system (riparian pastures)	Stream trend			Date trend evaluated
								Down	Static	Up	
Alvord	6012	E. Steens creeks	I	AMP 1984	1989	9,072	Rest rotation	.25	3.00		1992[c]
Wildhorse Canyon	6013	Wildhorse Creek	I	AMP 1991	1991	218	Rest rotation		.5		1992
Trout Creek Mt.	6015	Trout Creek	I	EA/DEC 1990	1992	8,852	Rest rotation, Deferred	0	4.7	14.5	1991, 1992
Tule Springs	6018	Borax Lake complex	I	EA/DEC 1990	1992	5,506	Deferred		.2		1992
Serrano Point	6019	Stonehouse, Deppy, Willow, Willow Springs creeks	I	Draft AMP	1992	500	Rest rotation	-	-	-	None
Pueblo-Lone Mt.	6020	E. Pueblo streams, except Denio	I	None[d]	1989	17,964	Season long		10.7	8.0	1992
South Fork	6024	Cottonwood Creek	M	AMP 1985	1991	40	Early season	-	-	-	None
Mann Lake	6026	Mann Lake	I	AGR 1991	1990	3,670	Early season	-	-	-	None
Carlson Creek	6027	Juniper, Carlson creeks	I	Annual AGR	19	467	Season long		1.3		1991
Miner's Field	6028	Pass, Williams, Bone, Schouver, Burk creeks	I	Draft AMP	1992	1,825	Rest rotation		0.2	0.2	1988

[a] *I - Improve; M - maintain.*
[b] *AMP - allotment management plan; EA - environmental assessment; DEC - decision; AGR - agreement.*
[c] *Selected streams checked after fire in 1992.*
[d] *Environmental Assessment scheduled for 1992.*

Appendix Table F-3. Winnemucca District grazing allotments with riparian areas in the Lahontan subbasins.

Allotment name	Number	Riparian areas	Category[a]	Planning document[b]	Allotment evaluation date	AUMs	Grazing system (riparian pastures)	Stream trend			Date trend evaluated
								Down	Static	Up	
Pueblo Mt.	6021	Denio Creek	I	DEC 1991	1990	1,656	Rest Rotation		3.0	1.6	1993
Kings River	6022	Kings River	M	AMP 1971	1994 tentative	12,192	Rest rotation		16.3[c]		1989

[a] *I - Improve; M - maintain.*
[b] *DEC - decision; AMP - allotment management plan.*
[c] *Includes 15.5 miles in the Kings River Field, which lies in Oregon and Nevada.*

APPENDIX G

Stocking Summaries

Appendix Table G-1. Summary of fish transplants into streams in the Lahontan subbasins.

Water body	Year	Number stocked	Species[a]	Source
Antelope Creek	1972	37	LCT	Whitehorse Creek
Big Alvord Creek	1980	26	LCT	Willow Creek
Cottonwood Creek (Steens)	1980	7	LCT	Willow Creek
Cottonwood Creek (Trout Creek)	1969	Unknown	RB/CT	Unknown
Kings River	1951-1978	41,539	BT, RB	Stocked by Nevada
Cottonwood Creek	1971	40	LCT	Whitehorse Creek
(Whitehorse Creek)	1980	31	LCT	Willow Creek
Denio Creek	1975	21	LCT	Whitehorse Creek
	1980	32	LCT	Willow Creek
Fifteenmile Creek	1971	35	LCT	Whitehorse Creek
Little Alvord Creek	1980	15	LCT	Willow Creek
McCoy Creek	1980	25	LCT	Willow Creek
Mosquito Creek	1971	25	LCT	Whitehorse Creek
Pike Creek	1980	28	LCT	Willow Creek
Twelvemile Creek	1974	36	LCT	Whitehorse Creek
Van Horn Creek	1975	30	LCT	Whitehorse Creek
Willow Creek (Steens)	1980	31	LCT	Willow Creek
Indian Creek	1980	20	LCT	Sage Creek
	1981	37	LCT	Sage Creek
McDermitt Creek	1897-1970	90-15,000	RB, BT, BR	Stocked by Nevada

[a] *LCT - Lahontan cutthroat trout; RB/CT - rainbow/cutthroat trout; BT - brook trout; RB - rainbow trout; BR - brown trout.*

Appendix Table G-2. Stocking summary for standing waters in the Lahontan subbasins.

Water body	Period of record[a]	Species	Average number stocked	Minimum number stocked	Maximum number stocked
Borax Lake	1963-1967	RB, CT	2,622	585	4,920
Juniper Lake	1958-1963	RB, CT[d]	23,197	3,830	89,668
Mann Lake	1957-1990	RB, CT[d]	28,052	1,795	105,743
Tencent Lake	1985	CT[d]	20,033	20,033	20,033
Tudor Lake	1984-1986	CT[d]	10,012	4,991	15,027
Wildhorse Lake	1958-1986	CT[d]	4,905	1,475	18,240
Blue Mountain #4	1972-1993	RB, CT[c,d]	624	270	1,000
Mules Ear #1	1983-1993	RB	435	395	496
Dawson Reservoir	1972-1993	RB, CT[c,d]	570	287	750
Schoolhouse Reservoir	1980-1989	RB, CT[c,d]	317	196	450

[a] *Stocking may not have occurred every year within the period of record.*
[b] *RB - rainbow trout; CT - cutthroat trout.*
[c] *Stocked with cutthroat trout in 1980 only.*
[d] *Stocked with Mann Lake cutthroat trout in some years.*

APPENDIX H

Oregon Administrative Rules for Lahontan Subbasins

Lahontan Subbasins
Fish Management Policies and Objectives

Applicability

635-500-1670 OAR 635-500-1670 through 635-500-1730 apply to the Lahontan subbasins. The area covered by the plan consists of a series of closed basins in southeastern Harney and southwestern Malheur counties. It includes streams that drain the eastside of the Steens and Pueblo mountains and the Trout Creek Mountains (which includes Oregon Canyon Mountain), as well as other streams in Oregon that drain into the Quinn River in Nevada, and lakes and reservoirs managed for fishery resources. Thirteen fish species or stocks are found in the basin, of which eight are indigenous and five have special status. **Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.**

Organization of Rules

635-500-1680 Administrative rules for the Lahontan subbasins are organized as follows:

(1) OAR 635-500-1700 covers policies and objectives for habitat management in the Lahontan subbasins.

(2) OAR 635-500-1710 covers policies and objectives for trout management in the Lahontan subbasins.

(3) OAR 635-500-1720 covers policies and objectives for nongame fish management in the Lahontan subbasins.

(4) OAR 635-500-1730 covers policies and objectives for angler access in the Lahontan subbasins. **Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.**

General Priorities

635-500-1690 (1) The following actions are considered the highest plan priorities in the Lahontan subbasins:

(a) Improve and maintain populations of indigenous fishes with special status so that listing is not necessary to insure their continued existence;

(b) Provide consumptive fisheries in the basin where appropriate;

(c) Improve data gathering and assessment of fisheries and fish habitat in the basin.

(2) The following actions are considered the highest priorities for habitat, fish and angler access in the Lahontan subbasins:

(a) Develop a priority list to gather baseline habitat information on streams in the plan areas, and coordinate fish population and habitat inventories with grazing allotment evaluations;

(b) Coordinate with land management entities (public and private) to identify specific areas of concern and develop cooperative projects to improve riparian habitats;

(c) Identify opportunities to improve instream flows;

(d) Implement the U.S. Fish and Wildlife Service's Lahontan cutthroat trout recovery plan;

(e) Develop a strategy to deal with illegal introductions of fish into the subbasins and draft a contingency plan for Lahontan cutthroat trout if exotic species are introduced;

(f) Develop guidelines for maintaining a healthy, genetically fit brood stock in Mann Lake;

(g) Collect information on the distribution, abundance, and population health of nongame species;

(h) Pursue coordination with the BLM on any recreational development in the plan area;

(i) Maintain and enhance public access opportunities to consumptive fisheries.

Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.

Habitat

635-500-1700 (1) Existing statewide policy, applicable to fish habitat in the Lahontan subbasins, directs the department to strongly advocate and support habitat protection and restoration on private and public land. See, OAR 635-07-523.

(2) Management objectives for habitat are:

(a) Influence land management decisions to benefit fish habitat;

(b) Improve fish habitat to provide food and cover for fish, maintain late season flows, prevent erosion, and ameliorate temperature extremes;

(c) Improve water quantity and water quality to meet the biological needs of fish by providing adequate instream flows, reducing fish losses at diversions, and reducing nonpoint source pollution. **Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.**

Trout

635-500-1710

(1) Policies for trout in the Lahontan subbasins:

(a) Streams in the Coyote Lake subbasin shall be managed for natural production of Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(1). No fish except for progeny of Willow and Whitehorse cutthroat trout shall be stocked into the Coyote Lake subbasin except as consistent with the Lahontan Cutthroat trout recovery plan under the Endangered Species Act or as identified in OAR 635-07-527(3);

(b) Streams in the Quinn River subbasin shall be managed for natural production of indigenous Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(1). Resident rainbow/cutthroat, brook, and brown trout in the Quinn River subbasin shall not be outplanted outside their current distribution, nor supplemented with hatchery or naturally produced fish. No hatchery trout shall be stocked into streams in the Quinn River subbasin except as consistent with the Lahontan Cutthroat trout recovery plan under the Endangered Species Act or as identified in OAR 635-07-527(3);

(c) Streams on the east side of Pueblo and Steens mountains shall be managed for natural production of Lahontan cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(1). No attempt shall be made to establish populations in those streams that were not stocked with Lahontan cutthroat trout in the past. In the event trout populations are lost in streams identified in this policy, attempts will be made to establish populations of Lahontan cutthroat trout or other trout of the Lahontan complex (e.g., Trout Creek rainbow/cutthroat trout, Mann Lake cutthroat trout) in those streams where sufficient habitat exists;

(d) Streams in the Trout Creek drainage (Alvord Lake subbasin) shall be managed for natural production of resident rainbow/cutthroat trout consistent with the Wild Fish Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(1). No hatchery trout shall be stocked into the Trout Creek drainage;

(e) Mann, Juniper, Tudor, Tencent, and Wildhorse lakes shall be managed for hatchery fish consistent with the Featured Species Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(2). Only the Mann Lake hatchery strain of cutthroat trout shall be stocked in these lakes. Mann Lake will continue to serve as the brood lake for this hatchery program;

(f) BLM stock reservoirs in the Lahontan subbasins shall be managed for hatchery production of rainbow trout consistent with the Basic Yield Management Alternative for trout as described in Oregon's Trout Plan, OAR 635-500-115(4).

(2) Objectives:

(a) Maintain and enhance genetic diversity, adaptiveness, and abundance of indigenous Lahontan cutthroat trout and resident rainbow/cutthroat trout in the Lahontan subbasins;

(b) Provide diverse angling opportunities for wild trout in the Lahontan subbasins;

(c) Provide brood stock at Mann Lake for the department's cutthroat trout hatchery program;

(d) Provide a quality consumptive fishery on the Mann Lake strain of cutthroat trout in Mann, Juniper, Tudor, Tencent, and Wildhorse lakes consistent with the department's brood stock program;

(e) Provide a consumptive fishery on hatchery rainbow trout in selected BLM stock reservoirs. **Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.**

Nongame Fish

635-500-1720 (1) The policy for nongame fish in the Lahontan subbasins is that the following indigenous species and their respective waters shall be managed to maintain self-sustaining populations: Borax Lake chub in Borax Lake; Alvord chub in the Alvord Lake subbasin, except for Borax Lake; and Lahontan redside, Tahoe sucker, mountain sucker, and speckled dace in the Quinn River subbasin.

(2) The objective for nongame fish in the Lahontan subbasins is to improve and maintain population health (e.g., abundance, multiple age classes, and genetic fitness) of all indigenous nongame species in the Alvord Lake and Quinn River subbasins.
Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.

Angler Access

635-500-1730 (1) The policy for angler access development in the Lahontan subbasins is to give full consideration to sensitive and special status species and their habitat.

(2) The objectives for angler access are:

(a) Maintain limited access to areas where special status species or their habitat may be affected;

(b) Define a strategy for public access in the Wildhorse Creek drainage;

(c) Maintain road access to BLM reservoirs with fisheries in the Lahontan subbasins.
Adopted 12-8-93, ef. 12-20-93. Stat. Auth.: 496.138, 496.146, 496.162, 496.172, 506.109, 506.119, and 506.129.

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The maps were produced by Catherine Roso with final revisions by Milton Hill.

CHAPTER 3: RAINBOW/REDBAND/STEELHEAD TROUT
(*Oncorhynchus mykiss*)

Species Overview

The species *Oncorhynchus mykiss* is one of the most taxonomically complicated groups in Oregon. The species probably consists of multiple subspecies, none of which have been formally recognized. The most recently published treatise on the species is in Behnke (1992), where three subspecies with ranges extending into Oregon are proposed: *O.m. irideus*, or coastal rainbow and steelhead trout; *O.m. gairdneri*, or inland Columbia Basin redband and steelhead trout; and *O.m. newberrii*, or Oregon Basin redband trout.

Some systematists disagree with Behnke's (1992) proposed groups and subspecies names. Generally the subspecies status and range of the group Behnke calls *O.m. irideus* is undisputed. The western boundary of this group in the Columbia Basin is clearly the Cascade Mountains. It has been proposed that during the last glacial epoch, the *O. mykiss* distribution was disrupted by glacial advances and the species split into Asian and North American components. Streams along coastal Oregon and in the lower Columbia Basin were generally unglaciated and were occupied by the North American component. The group currently described as coastal rainbow and steelhead trout may have invaded Oregon streams from the Asian component after the last glacial retreat and the reopening of rivers north of the Columbia. This group replaced or interbred with the historical North American *O. mykiss* occupant, but has only reached inland up the Columbia to the Cascade Mountains. The North American *O. mykiss* still occupies the inland area. The distribution south may also represent an incomplete invasion. A distinct transition zone occurs along the south Oregon coast at approximately Cape Blanco. Interior populations in south coast basins like the Rogue and Klamath possess several distinct characters seen farther south in California *O. mykiss*, but not elsewhere in Oregon or to the north.

The arguments among systematists primarily involve the groups Behnke (1992) calls *O.m. gairdneri* and *O.m. newberrii*. According to some data sets, primarily biochemical data, the geographical range of these two groups appear to actually contain multiple subspecies each. Behnke (1992) described *O.m. gairdneri* as extending in Oregon from the Cascade Mountains inland in the Columbia Basin, including the Snake Basin. Within this group, however, several highly divergent groups have been found isolated by natural barriers. Two such groups are in White River, a tributary of the lower Deschutes River, and in McGraw Creek, a tributary of the Snake River in the Hells Canyon area.

The identity of *O.m. newberrii* is even more complicated. Behnke (1992) describes this subspecies as occupying seven basins in Oregon -- Klamath, Warner, Goose Lake, Chewaucan, Fort Rock, Catlow and Malheur lakes plus several similar groups in northern California. Each of these basins is (or was historically in the case of the Klamath) a closed basin with no outlets to other bodies of water. Some of the basins are known to have historically interconnected to each other or to other drainages. Lake Modoc was connected to Goose Lake Basin during the Pliocene and opened to the Pacific through the Klamath River probably during the late Pleistocene. Fort Rock Lake was connected to the Little Deschutes River until the early Pleistocene, but it is uncertain whether the historical drainage connected to the current Deschutes Basin or flowed south into some ancestral Klamath/Lake Modoc system. Goose Lake still occasionally drains into the Pit River in California when the lake level is high enough for water to spill over an outlet falls at the southern end of the lake. Parts of the Malheur Lakes Basin were connected to the Snake and Columbia basins until the late Pleistocene or more recently. Historical interconnections between other basins are unknown.

Biochemical data indicates that the Malheur Lakes Basin redband trout more properly belong in the inland Columbia subspecies, *O.m. gairdneri* by Behnke's (1992) designation, than to the Great Basin subspecies (Currens 1990). Malheur Lake was connected to the Malheur River until it was closed by a lava flow at the end of the Pleistocene, less than 15,000 years ago. A more recent connection through a stream exchange between the Silvies and John Day rivers may have also occurred, accounting for some of the variation observed within both basins (Bisson and Bond 1971).

The Klamath Basin is also problematic, and may actually contain more than one subspecies. The upper Klamath Basin in Oregon is now artificially isolated by several dams. However, steelhead migrated to Klamath Lake until the construction of Copo Dam in 1917. Behnke (1992) argues that the steelhead were *O.m. irideus* and are completely extinct from the Klamath Lake area. Alternatively, some steelhead lineage may remain in the silvery, migratory Klamath Lake trout. According to meristic measurements and biochemical data collected by Currens (unpublished), the lake trout are more similar to *O.m. irideus* than to *O.m. newberrii*. Isolated trout in Jenny Creek, above a waterfall, and in the upper Williamson and upper Sprague rivers have meristic characteristics more like *O.m. newberrii*, but are quite distinctive from all other trout by biochemical characters.

The "*newberrii*-like" trout in the Klamath; the trout in Warner, Goose Lake, Catlow, Fort Rock, Chewaucan; and the trout in White River and McGraw Creek may each be a separate subspecies founded from an ancient redband ancestor that occupied Oregon prior to *O.m. gairdneri*. Each has been isolated from all other trouts since the physical isolation of their basins. Their special uniqueness is the result of evolutionary changes during the long period of isolation. Other physically isolated *O. mykiss* populations in the Columbia Basin, islanded within the ranges of both *O.m. gairdneri* and *O.m. irideus*, may also be found to be "ancient redbands" when adequate information is compiled.

This report follows Behnke's (1992) subspecies and range designations, in spite of recognized controversy, since it is the most recently published treatment of *O. mykiss* subspecies taxonomy. Readers should expect, however, that subspecies boundaries and names may be modified over the next few years.

COASTAL RAINBOW/STEELHEAD (*Oncorhynchus mykiss irideus*)

Subspecies Overview

Oncorhynchus mykiss irideus occupies North American coastal river basins from the Kuskokwim River in Alaska to the Otay River in California. The subspecies is also in Asia along the Kamchatka Peninsula. In Oregon it occupies most basins in the Columbia Basin west of Hood River, including the Willamette River, and most basins along the coast. The subspecies has been domesticated into one of the most widely used hatchery trout stocks. It has been artificially introduced worldwide and has established many naturalized populations outside of its historical range.

The subspecies includes a resident phenotype, rainbow trout, and an anadromous phenotype, coastal steelhead. The steelhead express a further array of life histories including various freshwater and saltwater rearing strategies and various adult spawning migration strategies. Juvenile steelhead may rear one to four years in fresh water prior to their first migration to salt water. Saltwater residency may last one to three years. Populations in the upper Rogue express a strategy that includes a "half pounder" run where subadults reenter fresh water after spending only three or four months in salt water, rear for about eight months, then return to salt water to continue rearing. Adult steelhead may enter fresh water on spawning migrations year around if habitat is available for them, but generally spawn in the winter and spring. Adults that enter between May and October are called "summer-run" fish. These hold several months in fresh water prior to spawning. Adults that enter between November and April are called "winter-run" fish. These fish are more sexually mature upon freshwater entry and hold for a shorter time prior to spawning. Rainbow trout are thought to spawn at three to five years of age, generally in the winter or spring, although some populations vary from this pattern. Both rainbow and steelhead may spawn more than once. Steelhead return to salt water between spawning runs.

The different *O.m. irideus* adult life history types are rarely sympatric in Oregon. Most coastal steelhead in Oregon are winter-run fish. Rainbow trout are most commonly found in river reaches that are inaccessible to anadromous fish and summer steelhead are present only in a few large basins. Basins in which the different life histories are sympatric include the Chetco, lower Rogue, Willamette and Sandy, which have winter steelhead and rainbow trout; and the upper Rogue, North Umpqua, and the Hood, which have winter and summer steelhead and rainbow trout. The relationship between sympatric life history phenotypes for this subspecies has not been studied in Oregon, but observers have noted that when they are sympatric they appear to form different populations, but do not appear to be completely reproductively isolated from each other (for example, Rivers 1991). Oregon has 295 *O.m. irideus* populations, including six summer steelhead, 113 winter steelhead, and 176 rainbow trout.

Coastal steelhead abundance follows a similar cycle in all populations from Puget Sound in Washington to California, indicating that factors common to all populations influence trends. The most probable factor responsible for this cycle is ocean conditions. Ocean productivity is recognized to undergo long-term cycles that include periods that are relatively favorable or unfavorable to the survival of salmonids. This cycle appears to be a natural process that cannot be affected by management actions. The ocean productivity cycle appears to be unfavorable for steelhead currently and all steelhead population abundance trends are correspondingly low.

Steelhead and rainbow populations have also been affected by freshwater habitat degradation. Most coastal salmonid freshwater habitats were historically conifer temperate rain forest ecosystems. Stream systems were structurally complex with large instream wood, flood plains, beaver ponds, braided channels, and coastal marshes and bogs. Human activities have altered these ecosystems, particularly by reducing their complexity and removing components that were essential to steelhead and rainbow trout production. Logging and road construction in the Coast Range and Cascade Mountains has had the most widespread impact on coastal *O. mykiss*, and has affected most populations. Most other habitat impacts are specific to particular basins and will be discussed in the following status report section.

Coastal steelhead hatchery programs are present on the coast and in the lower Columbia and Willamette basins. These programs historically depended on two broodstocks. The Alsea winter steelhead hatchery stock was founded from wild steelhead in the Alsea River on the mid-coast. This stock has been outplanted into most coastal basins. In spite of this widespread outplanting of a single broodstock, Oregon's wild coastal steelhead populations have not been "homogenized" like those described by Reisenbichler and Phelps (1989) in Puget Sound. This is demonstrated by the high level of genetic variation that is still present among steelhead populations along the Oregon coast (Hatch 1990, Reisenbichler et al. 1992). Alsea steelhead are now being planted in fewer locations and local broodstocks are being developed in many of the basins.

The second broodstock, Big Creek winter steelhead, was founded from wild winter steelhead in Big Creek on the lower Columbia River. This broodstock has been widely outplanted in the Willamette River and other tributaries from Hood River to the Columbia River estuary. In spite of this outplanting, the steelhead above Willamette Falls, at least, are still very distinctive from all other *O.m. irideus* populations. Other lower Columbia River populations still need to be studied. Big Creek steelhead are also being planted in fewer locations now and several local broodstocks are being developed.

Coastal rainbow hatchery programs use several domesticated broodstocks founded nearly 100 years ago from Northern California populations. These hatchery fish are used primarily for "put-and-take" harvest programs in lakes and reservoirs. Most of the rainbow hatchery programs in the range of *O.m. irideus* are in streams and ponds in the Willamette Basin, in many high lakes in the Cascade Mountains, and in a few coastal lakes. Some of the lakes and ponds have outlets and hatchery fish may stray out of them downstream into trout or steelhead populations.

Many of the *O. mykiss* harvest programs in the range of *O.m. irideus* are targeted on hatchery fish and are regulated for the catch-and-release of wild fish.

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Willamette River	**WILLAMETTE RIVER ***		
	Tualatin River	**Winter**	
	Molalla River/ Pudding	**Winter**	
	1. Deadhorse Canyon (above Barrier ?)		**Resident**
	2. Pudding River		**Resident**
	a. Butte Cr. (above Butte Cr. Falls)		**Resident**
	b. Abiqua Creek		**Resident**
	Yamhill River	**Winter**	
	Rickreall Creek	**Winter**	
	Luckiamute River	**Winter**	
	Mary's River	**Winter**	
	Santiam River *		
	1. Rock Cr. above falls		**Resident**
	2. N.Fk Santiam R. (below Detroit Dam) (population 1)	**Winter**	
	3. N.Fk Santiam R. (below Detroit Dam) (population 2)		**Resident**
	4. Little N.Fk Santiam River		**Resident**
	a. Cedar Cr. above falls		**Resident**
	5. N.Fk Santiam R. (above Detroit Dam)		**Resident**
	6. S.Fk Santiam R. (below Foster Dam)	**Winter**	
	7. S.Fk Santiam R. (below Foster Dam)		**Resident**
	8. S.Fk Santiam R. (above Foster Dam)		**Resident**
	a. Wolf Cr. above falls		**Resident**
	b. Above House Rock Falls		**Resident**
	c. M.Fk Santiam R. (above Green Peter Dam)		**Resident**
	Calapooia River	**Winter**	

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Willamette River (continued)	**McKenzie River ***		
	1. Lower McKenzie R. below dams		**Fluvial**
	2. Blue River (above Blue R. Dam)		**Resident**
	3. Upper McKenzie (above Trail Bridge Dam)		**Resident**
	4. S.Fk McKenzie R. (above Cougar Dam)		**Resident**
	a. above falls at RM 28.5		**Resident**
	Coast Fork Willamette River (below Cottage Grove Dam)		**Resident**
	1. Row River (above Dorena Dam)		**Resident**
	2. Fall Creek		**Resident**
	3. N.Fk Willamette R. (above West Fir Dam)		**Resident**
	4. Upr. M.Fk Willamette R. from Dexter to Hills Creek		**Resident**
	5. Upr. M.Fk Willamette R. (above Hills Creek Dam)		**Resident**
Lower Columbia: Hood River to Youngs Bay	**COLUMBIA RIVER ***		
	Youngs Bay *		
	1. Lewis & Clark River	**Winter**	
	2. N.Fk Klaskanine	**Winter**	
	3. S.Fk Klaskanine	**Winter**	
	Bear Creek	**Winter**	
	Big Creek	**Winter**	
	Fertile Valley Creek	**Winter**	
	Gnat Creek	**Winter**	
	Plympton Creek	**Winter**	
	Clatskanie River	**Winter**	
	Nice Creek	**Winter**	
	Fox Creek	**Winter**	
	Goble Creek	**Winter**	
	Tide Creek	**Winter**	
	Milton Creek	**Winter**	
	McBride Creek	**Winter**	
	Scappoose Creek	**Winter**	
	Willamette River below falls *		
	1. Clackamas River (population 1)	**Winter**	
	2. Clackamas River (population 2)		**Resident**
	a. North Fork above Natural Falls 1		**Resident**
	b. North Fork above Natural Falls 2		**Resident**
	i. Fall Cr. above Natural Falls		**Resident**
	ii. Bee Cr. above Natural Falls		**Resident**
	iii. Bedford Cr. above Natural Falls		**Resident**
	iv. Whiskey Cr. above Natural Falls		**Resident**
	v. Boyer Cr. above Natural Falls		**Resident**
	A. Winslow Cr. above Natural Falls		**Resident**
	c. South Fork above Natural Falls		**Resident**
	i. Memaloose Cr. above Natural Falls		**Resident**
	ii. Fish Cr. above Natural Falls		**Resident**
	A. Wash Cr. above Natural Falls		**Resident**
	- Falls Cr. above Natural Falls		**Resident**
	B. Calico Cr. above Natural Falls		**Resident**
	d. Roaring R. above Natural Falls		**Resident**
	i. S.Fk Roaring R. above Natural Falls		**Resident**
	e. Oak Grove Fk. above Natural Falls		**Resident**

** Populations are present only in the tributaries of this water body as listed below it.*
*** Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Lower Columbia: Hood River to Youngs Bay (continued)	i. Shellrock Cr. above Natural Falls		**Resident**
	f. Collowash R. above Natural Falls		**Resident**
	i. Hot Springs Fk. above Natural Falls 1		**Resident**
	ii. Hot Springs Fk. above Natural Falls 2		**Resident**
	A. Dutch Cr. above Natural Falls		**Resident**
	B. Pansy Cr. above Natural Falls		**Resident**
	C. Blister Cr. above Natural Falls		**Resident**
	D. Stroupe Cr. above Natural Falls		**Resident**
	E. Nohorn Cr. above Natural Falls		**Resident**
	F. Skin Cr. above Natural Falls		**Resident**
	G. Hugh Cr. above Natural Falls		**Resident**
	H. Whetstone Cr. above Natural Falls		**Resident**
	iii. Farm Cr. above Natural Falls		**Resident**
	iv. Dicky Cr. above Natural Falls		**Resident**
	v. Happy Cr. above Natural Falls		**Resident**
	vi. Elk Lake Cr. above Natural Falls		**Resident**
	A. Battle Cr. above Natural Falls		**Resident**
	vii. E.Fk Collawash R. above Natural Falls		**Resident**
	viii. Cub Cr. above Natural Falls		**Resident**
	A. Berry Cr. above Natural Falls 1		**Resident**
	B. Berry Cr. above Natural Falls 2		**Resident**
	ix. Squirrel Cr. above Natural Falls		**Resident**
	3. Abernathy Creek	**Winter**	
	Sandy River (population 1)	**Winter**	
	Sandy River (population 2)		**Resident**
	1. Big Cr. above Natural Falls		**Resident**
	2. Gordon Cr. above Natural Falls		**Resident**
	3. Trout Cr. above Natural Falls		**Resident**
	4. Bull Run R. separated by dams 1		**Resident**
	5. Bull Run R. separated by dams 2		**Resident**
	6. Bull Run R. separated by dams 3		**Resident**
	7. Bull Run R. above Natural Falls		**Resident**
	a. Little Sandy R. separated by a dam		**Resident**
	b. Little Sandy R. above Natural Falls 1		**Resident**
	c. Little Sandy R. above Natural Falls 2		**Resident**
	d. Blazed Alder Cr. above Natural Falls		**Resident**
	8. Salmon R. above Natural Falls		**Resident**
	a. Boulder Cr. above Natural Falls		**Resident**
	9. Clear Cr. above Natural Falls		**Resident**
	10. Lost Cr. above Natural Falls		**Resident**
	a. Cast Cr. above Natural Falls		**Resident**
	Tanner Creek	**Winter**	
	Eagle Creek	**Winter**	
	Herman Creek	**Winter**	
	Lindsay Creek	**Winter**	
	Hood River (population 1)	**Winter**	
	Hood River (population 2)	**Summer**	
	1. Indian Cr. above falls		**Resident**
	2. Cedar Cr. above falls		**Resident**
	3. Whiskey Creek		**Resident**
	4. Neal Creek		**Resident**
	a. W.Fk Neal Cr. above falls or grade		**Resident**
	5. Beaver Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*

** *Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Lower Columbia: Hood River to Youngs Bay (continued)	6. Odell Cr. above falls or grade		**Resident**
	7. Ditch Cr. above falls or grade		**Resident**
	8. South Pine Cr. above dam		**Resident**
	9. Collins Cr. above dam		**Resident**
	10. W.Fk Hood above falls or grade		**Resident**
	a. Deadpoint Cr. above falls or grade		**Resident**
	b. Greenpoint Cr. below falls		**Resident**
	i. N.Fk Greenpoint Cr. above falls or grade		**Resident**
	c. Lake Branch Cr. above falls or grade		**Resident**
	i. Tributary A above falls or grade		**Resident**
	ii. Tributary B above falls or grade		**Resident**
	iii. Tributary C above falls or grade		**Resident**
	iv. Mosquito Cr. above falls or grade		**Resident**
	v. Tributary E above falls or grade		**Resident**
	vi. Divers Cr. above falls or grade		**Resident**
	vii. Laural Cr. above falls or grade		**Resident**
	viii. Skipper Cr. above falls or grade		**Resident**
	ix. Indian Cr. above falls or grade		**Resident**
	x. No Name Cr. above falls or grade		**Resident**
	xi. Midget Cr. above falls or grade		**Resident**
	xii. Washout Cr. above falls or grade		**Resident**
	xiii. Buckpoint Cr. above falls or grade		**Resident**
	xiv. Marco Cr. above falls or grade		**Resident**
	d. Tumbledown Cr. above falls or grade		**Resident**
	e. Red Hill Cr. above falls or grade		**Resident**
	f. Ladd Cr. above falls or grade		**Resident**
	g. Jones Creek		**Resident**
	11. M.Fk Hood River		**Resident**
	a. Tony Cr. above falls or grade		**Resident**
	i. Bear Cr. above falls or grade		**Resident**
	b. Clear Branch separated by dam		**Resident**
	c. Clear Branch separated by dam		**Resident**
	12. E.Fk Hood River		**Resident**
	a. Trout Cr. above falls or grade		**Resident**
	b. Cat Cr. above falls or grade		**Resident**
	c. Dog Cr. below falls		**Resident**
	i. Puppy Cr. above falls or grade		**Resident**
	d. Chrystal Springs Cr. above falls or grade		**Resident**
	e. Ash Cr. above falls or grade		**Resident**
	f. Tilly Jane Cr. above falls or grade		**Resident**
	g. Polallie Cr. above falls or grade		**Resident**
	h. Fall Cr. above falls or grade		**Resident**
	i. Cold Springs Cr. above falls or grade		**Resident**
	j. Tumble Cr. above falls or grade		**Resident**
	k. Culvert Cr. above falls or grade		**Resident**
	l. Engineers Cr. above falls or grade		**Resident**
	m. Hell Roaring Cr. above falls or grade		**Resident**
	n. Meadow Cr. above falls or grade		**Resident**
	o. Pocket Cr. above falls or grade		**Resident**
Mid and North Coast	**Necanicum River**	**Winter**	
	Indian Creek	**Winter**	
	Canyon Creek	**Winter**	
	Ecola (Elk) Creek	**Winter**	

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Mid and North Coast (continued)	**Asbury Creek**	**Winter**	
	Arch Cape Creek	**Winter**	
	Short Sands Creek	**Winter**	
	Nehalem River *		
	1. N.Fk Nehalem River	**Winter**	
	2. Lwr. Nehalem R. (below Hwy 26)	**Winter**	
	3. Upr. Nehalem R. (above Hwy 26)	**Winter**	
	4. Salmonberry R. below falls	**Winter**	
	5. Salmonberry R. above falls		**Resident**
	Watseco Creek	**Winter**	
	Tillamook Bay *		
	1. Lagler Creek	**Winter**	
	2. Miami River	**Winter**	
	3. Electric Creek	**Winter**	
	4. Patterson Creek	**Winter**	
	5. Jacoby Creek	**Winter**	
	6. Doty Creek	**Winter**	
	7. Vaughn Creek	**Winter**	
	8. Kilchis River	**Winter**	
	9. Wilson River	**Winter**	
	10. Trask River	**Winter**	
	11. Tillamook River	**Winter**	
	Netarts Bay *		
	1. Whiskey Creek	**Winter**	
	Sand Creek	**Winter**	
	Nestucca Bay *		
	1. Nestucca River	**Winter**	
	2. Little Nestucca River	**Winter**	
	Neskowin Creek	**Winter**	
	Salmon River	**Winter**	
	Rock Creek (Devil's Lake)	**Winter**	
	Siletz Bay *		
	1. Siletz River below falls	**Winter**	
	2. Drift Creek	**Winter**	
	3. Schooner Creek	**Winter**	
	4. Siletz River above falls	**Summer**	
	Yaquina River	**Winter**	
	Thiel Creek	**Winter**	
	Beaver Creek	**Winter**	
	Alsea Bay *		
	1. Alsea River	**Winter**	
	2. Drift Creek	**Winter**	
	Big Creek	**Winter**	
	Yachats River	**Winter**	
	Cummins Creek	**Winter**	
	Bob Creek	**Winter**	
	Tenmile Creek	**Winter**	
	Rock Creek	**Winter**	
	Big Creek	**Winter**	
	Cape Creek	**Winter**	
	Sutton Creek	**Winter**	
	Siuslaw Bay *		
	1. N.Fk Siuslaw River	**Winter**	

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Mid and North Coast (continued)	2. Siuslaw River	**Winter**	
	Siltcoos River	**Winter**	
	Tahkenitch Creek	**Winter**	
	Umpqua Bay *		
	1. Smith River	**Winter**	
	2. Umpqua River (mouth to N.Fk)	**Winter**	
	3. N. Umpqua River (population 1)	**Summer**	
	4. N. Umpqua River (population 2)	**Winter**	
	5. N. Umpqua River (population 3)		**Resident**
	6. Upper N. Umpqua River		**Resident**
	a. Fish Creek		**Resident**
	b. Clearwater River		**Resident**
	7. S. Umpqua River	**Winter**	
	8. S. Umpqua River above falls		**Resident**
	a. Cow Cr. above Galesville Dam		**Resident**
	Tenmile Creek	**Winter**	
	Coos Bay *		
	1. Coos River	**Winter**	
	2. Millicoma River	**Winter**	
	Miner Creek	**Winter**	
	Big Creek	**Winter**	
	Whiskey Run Creek	**Winter**	
	Twomile Cr. above falls		**Resident**
	Cut Creek	**Winter**	
	Coquille Bay *		
	1. Coquille (except S.Fk above confluence of M.Fk)	**Winter**	
	a. M.Fk Coquille River above falls		**Resident**
	2. S.Fk Coquille (above confluence of M.Fk)	**Winter**	
	a. S.Fk Coquille River above barrier		**Resident**
	Crooked Cr. above barrier		**Resident**
	Johnson Creek	**Winter**	
	China Creek	**Winter**	
	Twomile Creek	**Winter**	
	Floras Creek	**Winter**	
	Sixes River	**Winter**	
South Coast: Cape Blanco to Border	**Elk River**	**Winter**	
	1. N.Fk Elk River		**Resident**
	2. S.Fk Elk River		**Resident**
	Brush Creek	**Winter**	
	Euchre Creek	**Winter**	
	Rogue River *		
	1. Lower Rogue (mouth to Illinois River) (population 1)		**Resident**
	2. Lower Rogue (mouth to Illinois River) (population 2)	**Winter**	
	a. Illinois River (population 1)	**Winter**	
	b. Illinois River (population 2)		**Resident**
	Thomas Creek	**Winter**	
	Hunter Creek	**Winter**	
	Pistol River	**Winter**	
	1. Pistol River, upper basin		**Resident**
	Bowman Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 5. Coastal rainbow/steelhead (*Oncorhynchus mykiss irideus*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
South Coast: Cape Blanco to Border (continued)	**Chetco River**	**Winter**	
	Chetco River		**Resident**
	1. Big Emily Creek		**Resident**
	2. Eagle Creek		**Resident**
	a. Mineral Hill Fk., upper basin		**Resident**
	b. N.Fk Eagle Cr., upper basin		**Resident**
	3. Boulder Creek		**Resident**
	a. Tributary C		**Resident**
	b. Tributary D		**Resident**
	4. Tincup Creek		**Resident**
	a. Tributary A		**Resident**
	5. Sluice Creek		**Resident**
	Winchuck River	**Winter**	
	California Smith River		**Resident**
Upper Rogue	**Rogue River ***		
	1. Rogue River above Canyon (Spring)	**Early Summer**	
	2. Rogue River above Canyon (Fall)	**Late Summer**	
	3. Mid-Rogue (Illinois R. to Gold Ray Dam) (population 1)	**Winter**	
	4. Mid-Rogue (Illinois R. to Gold Ray Dam) (population 2)		**Resident**
	5. Stair Creek		**Resident**
	a. Applegate River (population 1)		**Resident**
	b. Applegate River (population 2)	**Winter**	
	c. Applegate River (population 3)	**Summer**	
	6. Basin, above Gold Ray Dam (pop. 1)	**Winter**	
	7. Basin, above Gold Ray Dam (pop. 2)		**Resident**
	a. Big Butte Creek		**Resident**
	i. Skeeter Creek		**Resident**
	8. S.Fk Rogue River		**Resident**
	a. Buck Creek		**Resident**
	9. N.Fk Rogue River		**Resident**
	a. Barr Creek		**Resident**
	b. Mill Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*

** *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

Coastal rainbow and steelhead (*O. mykiss irideus*) occupy coastal drainages from California to Alaska. The range distributions inland in major rivers, such as the Columbia and Fraser, are limited to the Coast Range and lower subbasins. In the Columbia, the subspecies extends to the west side of the Cascade Mountains, including the Hood River in Oregon. The subspecies has the full variety of life history characters present in the species, including both winter- and summer-run anadromous steelhead and resident rainbow trout. In Oregon, winter steelhead and rainbow dominate and populations and different life histories are rarely sympatric.

The Hood Basin is on the boundary of the subspecies. It is one of the few basins that contains all three life histories in sympatry. The Hood River winter steelhead have been shown biochemically to be *O.m. irideus* (Schreck et al. 1986). However, the summer steelhead and trout have not been studied and could be either the coastal or inland subspecies, or a natural mix of the two. Fifteenmile Creek, just upriver of the Hood, has a winter steelhead population that has been shown biochemically to be *O.m. gairdneri* (Schreck et al. 1986). This population, along with three others in adjacent streams, are the only winter-run inland steelhead in Oregon, and may also be a mix of the two subspecies.

The systematics of *O.m. irideus* in Oregon are much less studied than they are for the inland subspecies of *O. mykiss*. Therefore, it is not possible to describe gene conservation groups for large portions of the subspecies range. Some major boundaries based on studies of winter steelhead can be described, but each group may include subgroups upon further study. For example, the Siletz summer steelhead appears to be a unique population, although it has not been described as a separate gene conservation group pending further information. It is the only summer steelhead in a basin that drains the coast range and was maintained historically by a partial barrier cascade that selectively passed the population because of its run timing during low summer flows. All other anadromous fish, including winter steelhead, were excluded from above the barrier. Resident rainbow trout are also present above numerous impassable barriers throughout the subspecies' range. None of these isolated trout populations have been previously studied, although several in the Columbia Basin were sampled in 1993. A collection of isolated *O. mykiss* trout populations in subbasins along the west slope of the Cascades, including the Sandy, Clackamas, and other Willamette subbasins, look more redband-like than rainbow-like. Behnke (personal communication) has referred to these fish as "Willamette redsides." Some populations on the south coast, in the Umpqua, in the Hood and above the Columbia Gorge waterfalls, have been described by field staff as "cutthroat-rainbow hybrids" and are also of interest.

Known major groupings in the *O.m. irideus* range, based on current information, are provided below.

Lower Columbia River: This group includes winter steelhead in small lower Columbia River tributaries, and in the Hood, the Sandy and the Clackamas rivers. Rainbow trout are also present in the Hood, Sandy and Clackamas rivers, including populations that are sympatric with the steelhead and others that are isolated above barriers. Summer steelhead are also present in the Hood River. Only a few winter steelhead populations have been genetically studied. This group is distinguished by both meristic and allozyme characters (Schreck et al., 1986). Additional groups, particularly of trout, may be discovered with further investigation.

Willamette River Above Willamette Falls: Willamette Falls was naturally, but selectively, passable by winter steelhead before it was laddered in 1885 and appears to form a gene flow barrier between the populations above and below it. This group includes winter steelhead and rainbow trout. Winter steelhead are present only up to the Calapooia subbasin and rainbow trout are absent from all Coast Range drainages. Winter steelhead in the Coast Range drainages may be naturalized rather than wild populations. The distribution of the subspecies within the Willamette seems to be affected by the distribution of resident coastal cutthroat since cutthroat and rainbow sympatry is rare. Only the winter steelhead have been genetically studied in this system. They are distinguished by unique meristic and allozyme traits (Schreck et al. 1986).

North to Mid-Coast and Umpqua: This group is dominated by winter steelhead populations and is problematic. It is distinct from all other groups, particularly by allozyme characteristics (Hatch 1990, Reisenbichler et al. 1992), but it further contains a considerable amount of variation within it that is poorly understood. It does not appear to have been "homogenized" by the extensive outplantings of Alsea winter steelhead as has been described for the Puget Sound area by Reisenbichler and Phelps (1989) because considerable variation exists from basin to basin. However, no particular geographic pattern to the variation has been determined yet. The most striking pattern, as described by Hatch (1990), is a difference between populations in large and small drainage basins, characterized by a lack of rare alleles in the populations in small drainages. Hatch (1990) proposed that small drainages may contain small populations that have lost rare alleles by genetic drift. This loss may obscure expected north-south clines. Additional groups should be expected in this area with future studies that include an increased sampling density and the addition of new loci. Some groups that may be of particular interest are the isolated Salmonberry rainbow trout in the Nehalem River, the summer steelhead in the Siletz River, and the trout and steelhead in the Umpqua River. None of these groups have ever been studied.

South Coast/Lower Rogue: This group consists of winter steelhead and rainbow trout. With the exception of the Illinois, lower Rogue, and Chetco rivers, all of the trout are restricted to areas above barriers. None of these trout have been studied. The Cape Blanco boundary for steelhead has been demonstrated with allozyme data by Hatch (1990) and Reisenbichler et al. (1992), although the exact assignment of populations right on the boundary, such as those in the Elk and Sixes rivers, is unknown. Busby et al. (1993) focused a study on the south coast and Rogue basins to determine whether the Illinois River winter steelhead comprised an "evolutionarily significant unit" (ESU) under National Marine Fisheries Service (NMFS) policy and the federal Endangered Species Act. They determined that the Illinois River winter steelhead belonged in a group with the south coastal winter steelhead and that the group was bounded in the Rogue Basin in the area of the Rogue River Canyon, just upstream of the Illinois River.

Rogue River above Rogue River Canyon: This group contains winter and summer steelhead and rainbow trout. The group is distinguished by allozyme characters (Busby et al. 1993), by unique life history traits (Rivers 1991, Everest 1973, ODFW 1994), and by unique karyotypes (Thorgaard 1983). While the group shares some of these characteristics with some California populations, including some in the Klamath River, it is the most distinctive *O.m. irideus* found to date in Oregon. The unique life history includes a non-spawning run into the Rogue River called a half-pounder run. This trait is also present in the Klamath River, but is absent in the lower Rogue and Illinois rivers, and other Oregon coastal streams. The upper Rogue River *O. mykiss* also includes individuals with a 60 chromosome karyotype that is unique in Oregon. The natural karyotype present throughout both *irideus* and *gairdneri* populations elsewhere in Oregon is 58 chromosomes. *O. mykiss* with 60 or more chromosomes are found in California.

Status Report

Listing Status

Coastal rainbow and steelhead are not listed in Oregon. A petition to list the Illinois River winter steelhead population under the federal Endangered Species Act was rejected in 1993 because the National Marine Fisheries Service (NMFS) determined that it did not constitute a listable unit (Busby et al. 1993). However, the NMFS has initiated a status review of steelhead in all coastal basins in California, Oregon and Washington. This review should be completed in 1995.

Specific Status Conditions

Lower Columbia: Most of the winter steelhead populations in the lower Columbia Basin are small populations, except for those in the Clackamas, Sandy and Hood rivers. Counting stations in fish ladders on the Clackamas and Sandy rivers show each of the populations to be in excess of 1000 fish. The Sandy River population had a flat trend with moderate variation since the early 1960s (Figure 64). The Clackamas population, as monitored at North Fork Dam, changed from a strong cyclic pattern in the late 1950s, 1960s and mid 1970s, to a flat trend with less varition since the mid 1970s (Figure 65). Status of the other small populations is varied. Observations of sport catch in the Lewis and Clark River, South Fork Klaskanine River and Plympton Creek indicate these populations have more than 300 adults each, however, no comprehensive populations surveys have been done. Hood River summer and winter steelhead populations have been monitored at Powerdale Dam since 1992 and are also above 300 fish.

Water withdrawals have impacted steelhead habitat in the Lewis and Clark, Clackamas, Sandy and Hood rivers. An unscreened 135 cubic feet per second (cfs) diversion on the East Fork of the Hood River causes a significant loss of juveniles annually. Other smaller uncreened diversions are also present. Other habitat imacts include extensive urbanization, particularly in the lower Willamette River, and timber harvest impacts, particularly downriver from the mouth of the Willamette River. Steelhead populations in the eastern portion of the range, including those in Hood River, must pass Bonneville Dam on the mainstem Columbia River. Mainstem dams are also present in the Hood, Clackamas and Sandy basins, including the impassable dams on the Bull Run tributary of the Sandy River. The productive potential of the Hood Basin is thought to be limited by insufficient juvenile and adult holding and rearing areas, a natural low productivity that is typical of the drainage, and poor water quality resulting from glacial runoff. High turbidity levels and heavy silt loads are a common occurrence in the mainstem, Middle and East forks of the Hood River, and in several tributary streams located in the upper headwaters of both the Middle and East forks of Hood River. The perennial streams in the Hood River drainage that are fed by glacial melt are typically low in nutrients.

Most of the lower Columbia Basin steelhead populations have been planted with a winter steelhead broodstock founded from Big Creek in the lower Columbia Basin. Hatchery steelhead smolt releases for 1992 and 1993 are provided in Appendix A. Releases of Big Creek stock have been discontinued in the Lewis and Clark, South Fork Klaskanine and Hood rivers, effective in 1993. New hatchery programs using native winter steelhead broodstocks are being implemented in the Clackamas and Hood rivers. However, smolt releases in the Clackamas River still includes non-indigenous Big Creek winter steelhead, Eagle Creek winter steelhead (a mixed broodstock that includes Big Creek, Clackamas wild, Donaldson rainbow and perhaps Alsea origins), summer steelhead, as well as domestic rainbow trout. Summer steelhead are not indigenous to the Sandy and Clackamas rivers. The introduction of a summer steelhead hatchery stock founded from the Washougal River in Washington may impact the productivity of native winter steelhead in these basins.

Angling regulations in the lower Columbia Basin require the release of wild steelhead. The Hood River winter run also may be impacted by the Columbia River Zone 6 winter gill-net fishery, which primarily targets hatchery and wild summer steelhead.

Rainbow trout populations are present in the Sandy, Clackamas and Hood basins. Some of the populations of rainbow trout in the Bull Run watershed in the Sandy Basin probably originated from juvenile winter steelhead that were blocked and isolated by City of Portland Water Bureau dams. Similarly, the lowest downstream population of rainbow trout in the Little Sandy River was also likely a winter steelhead population prior to dam construction by Portland General Electric. Genetic samples were collected during 1993 on one headwater population above a waterfall in the Little Sandy Basin. These fish look "redband-like." Analysis of these collections should be available in 1995. Rainbow trout in upper Salmon River, Clear and Lost creeks in the Sandy basin are also isolated by natural barriers. They are located on National Forest lands and are limited only by their habitat. Hatchery rainbow and steelhead are released downstream of the natural barriers that isolate these populations and therefore do not affect the populations.

Most Clackamas River rainbow trout populations in headwater streams are also isolated above natural barriers and are therefore unaffected by hatchery rainbow trout and steelhead releases downstream. These populations are located on National Forest lands, and are probably limited primarily by their habitat. Some populations have been affected by competitive interactions with brook trout, which have established naturalized populations downstream of Cascade Mountain lakes, where they have been stocked since the early 1900s.

Little information is available on the current status of rainbow trout populations in the Hood River Basin. Based on the limited information that is available, it is believed that a low density of rainbow trout probably spawn and rear throughout much of the drainage. Some of the population boundaries currently described may be modified with further information, and the species or subspecies taxonomy of some populations is uncertain. A natural hybrid zone between two *O. mykiss* subspecies may exist in this system. A possible natural *O. mykiss/ O. clarki* hybrid zone may also be present. Numerous natural waterfalls and high stream gradients restrict or impede fish movement between the upper reaches of many of the tributary streams in the Hood Basin, therefore many of the trout populations are isolated. Some of these isolated populations are locally abundant, although over a very limited distribution. Samples of trout were collected for genetic analysis in 1993. Preliminary results will be available in 1995 and sampling will continue in 1994-95.

Releases of legal size hatchery rainbow trout have been conducted since 1955 in the Hood River Basin. Current releases include Odell Creek (500), East Fork Hood River (15,000) and releases in some lakes. Hatchery releases for 1992 and 1993 are provided in Appendix A. Genetic consequences of these releases are currently unknown.

Willamette above Willamette Falls: Winter steelhead and rainbow populations are both present above Willamette Falls, but they are naturally distributed through only part of the basin. The Calapooia River is the upper limit of the indigenous winter steelhead in the Willamette Basin. The steelhead populations in Coast Range subbasins may be introduced. Rainbow trout are absent from all Coast Range subbasins but extend through Cascade Mountain subbasins upstream into the McKenzie and Middle Fork Willamette rivers.

Historical records document that Willamette Falls was a partial obstruction to steelhead and salmon. The first crude fish ladder at the falls was constructed in 1885. Wild Willamette steelhead are a late winter run, passing Willamette Falls from February through May. The number of steelhead passing the falls is currently monitored at the fish ladder, however, precise separation of hatchery and wild fish is not feasible with the present camera counter. In Figure 66, winter steelhead that pass the ladder prior to February 15 each year are called "hatchery fish." Typically the later running fish are considered to represent the wild populations. The 1991 and 1993 late runs were the two lowest since record keeping began in 1971. The 1994 late run totaled 4,275 fish compared to the 10-year average of 8,005 fish. The current down cycle in ocean productivity is probably partly responsible for the low abundance.

The Santiam subbasin produces about 60% of the wild steelhead in the basin above Willamette Falls, although production is decreased compared to historical levels. Prior to construction of Foster and Green Peter dams in 1966 on the South Fork Santiam River, an estimated 2,600 native winter steelhead migrated above the dam site. Adult passage was provided, but since closure of the dams, the run above the site has dropped to 256 adults in 1993 and 234 adults in 1994. Poor survival of juvenile outmigrants through the project appears to be the major cause of the decline. The basin below the dams continues to be productive.

The Calapooia River winter steelhead population is estimated to be about 700 adults and probably has the least amount of hatchery influence within this group. Small winter steelhead populations are also present in several other Cascade (Molalla/Pudding) and Coast Range drainages, although the Coast Range populations may be introduced.

High levels of urban and industrial pollution and low summer flows contributed to serious water quality problems in the Willamette Basin until the late 1960s. Conditions have improved since the implementation of water quality standards. However, the Willamette remains the most urbanized basin in the state. Other impacts caused by operational releases from Willamette Basin storage reservoirs and several years of drought conditions have also contributed to reductions in survival of steelhead juveniles in the Willamette River. Passage over small irrigation dams and lack of, or inadequate, screening continues to be a problem for steelhead in the Santiam and Calapooia subbasins. The mainstem Willamette River, historically a highly braided river with complex instream structure and abundant rearing areas, is now very channelized with reduced rearing capacity.

Big Creek Hatchery winter steelhead, which return primarily in December and January, were introduced into the Willamette Basin in the 1960s. The current winter steelhead hatchery program includes 92,500 Big Creek stock for the Tualatin and Molalla rivers and 100,000 native Santiam stock for the Santiam River. Actual hatchery releases for 1992 and 1993 are provided in Appendix A. Summer steelhead were not indigenous to the Willamette basin. The introduction of hatchery summer steelhead into the Molalla, Santiam, McKenzie and Middle Fork Willamette systems may have contributed to declines of native winter steelhead and may be affecting rainbow populations. Small naturalized summer steelhead populations have become established in some parts of the Willamette. Summer steelhead monitoring at Leaburg Dam on the McKenzie has shown that an average of 10% of the summer steelhead passing the dam are unmarked (naturalized) fish. Although unmarked summer steelhead have not been observed at Dexter Dam, natural spawning may be occurring in the Middle Fork Willamette subbasin in Fall Creek. Natural spawning may also be occurring in McDowell and Wiley creeks in the South Santiam subbasin.

Ratios of hatchery to wild steelhead in the Willamette Basin are being monitored at several locations. Trapping of adults in the Mollala and Pudding basins during 1993 collected 99% unmarked winter steelhead and 1% summer steelhead. Most of the fish were captured at a single trap site in Abiqua Creek and additional trap locations are being considered in the subbasin. Traps installed at Stayton in the North Santiam River in 1993 and 1994 caught 82% and 85% respectively unmarked winter steelhead. Hatchery strays from outside of the system represented 2% of the catch in both years, the remainder were North Santiam stock hatchery fish.

Disease resistance tests of steelhead in the mainstem Willamette River were conducted in the 1970s (Buchanan 1975) and in 1993 and 1994. More steelhead contracted infections of *Ceratomyxa shasta* in 1993 and 1994 than previously. Big Creek hatchery fish were particularly susceptible, but the susceptibility of wild fish and of locally founded North Santiam hatchery stock also increased. The reason for this change is unclear. Possibly the population of *C. shasta* has increased; possibly the resistivity of Willamette steelhead has decreased.

Wild steelhead catch-and-release regulations were implemented for the entire Willamette Basin in 1994.

Rainbow trout above Willamette Falls are native to tributaries draining the east side of the valley, with the distribution extending beyond the wild steelhead distribution to the McKenzie River and Middle Fork Willamette River in the upper basin. In lower river tributaries such as the Molalla, Santiam and Calapooia, rainbow trout have a sporadic distribution since winter steelhead dominate in the lower stream reaches and cutthroat trout dominate many areas in the headwaters and above natural barriers. Rainbow trout populations are mostly located on National Forest or private timberlands in stream reaches that are above the release sites for hatchery rainbow trout and steelhead; population abundance is primarily limited by instream habitat quality. Naturalized populations of brook trout limit some rainbow trout distributions in streams immediately below Cascade Mountain lakes where brook trout stocking has occurred since the early 1900s.

In the McKenzie River system, rainbow trout dominate mainstem trout populations above RM 17, including larger spawning tributaries such as Blue River, South Fork McKenzie River, Gate, Marten, Quartz, and Horse creeks. Hatchery releases of legal size rainbow trout (145,000) have been conducted in mainstem McKenzie, South Fork McKenzie, and Blue River since 1948. The genetic consequences of these releases have not been evaluated.

Native rainbow trout also dominate the mainstem Middle Fork Willamette River and major tributaries, Fall Creek , North Fork Willamette River, Salmon, and Hills creeks. Releases of legal size hatchery rainbow trout have been gradually reduced since stocking was initiated in the 1950s. Approximately 55,000 "legals" are distributed at present among Fall, Salmon, Salt, and Hills creeks and the Upper Middle Fork Willamette River. No rainbow trout genetic analysis has been conducted on these streams to date.

North to Mid-Coast/Umpqua River: The life histories of winter steelhead in this group normally include two to three years in fresh water and two to three years in salt water based on steelhead scale collections made by ODFW staff. Population structure is typically 80% "2-salts" (two years in the ocean) and 20% "3-salts" (three years in the ocean). Older age fish tend to enter fresh water before younger age fish. All of the steelhead in streams that drain the Coast Range are winter-run fish, with the exception of one summer-run population in the Siletz River. Summer steelhead are also present in the Umpqua River, which passes through the Coast Range and drains the Cascade Mountains. Rainbow trout populations are rare in this group and are typically above barriers to anadromous fish except in the Umpqua Basin, where some populations are sympatric with steelhead.

For most steelhead populations in this group, the ODFW salmon-steelhead punchcard has been the main method used for following trends in abundance. Juvenile sampling and spawning ground counts have not been effective in tracking status of the populations. Based on these punchcard abundance estimates, the mid-coast populations between the mouth of the Umpqua and the Nestucca appear to be the most depressed on the Oregon coast. Populations in all other coastal streams in this group appear to have experienced a mild decline. The recent down trend observed in all the coastal steelhead populations in this group are probably influenced by the current low ocean productivity. Individual populations are further, but variably, affected by activities that have occurred in the freshwater environment, depending on the extent of the activities in any particular basin. One of the strongest populations on the coast is in the Salmonberry River in the Nehalem Basin. Both spawning ground and juvenile surveys indicate that this population has been relatively abundant over the last 15 years, although it, too, has experienced a mild decline recently. This population has been managed for wild fish only and has had little influence from hatchery programs.

Habitat degradation including stream siltation, loss of structural complexity, and loss of riparian cover from logging and road building in the Coast Range; agricultural practices along the coast; stream channel alterations caused by dredging, past logging practices, and diking and channelization; water withdrawals; and urban and rural development have all impacted freshwater productivity for steelhead along the mid to north Oregon coast. This decrease in freshwater productivity is responsible for long-term declines. All steelhead populations are thought to be smaller than they were historically.

Hatchery winter steelhead smolt releases, using a broodstock developed from the Alsea River, occurred in 14 populations in this group over the last two years. Releases in 1992 and 1993 are provided in Appendix A. Adult populations in streams stocked with these steelhead in recent years have averaged about 65% to 75% hatchery fish, based on scale samples collected during a volunteer scale program or on the ratios of marked to unmarked fish measured in the sports catch. Straying of hatchery steelhead into unstocked streams or into other stocked streams has also been well documented. All unstocked streams that have had measurable steelhead fisheries have been shown to contain as high as 40% stray hatchery steelhead based on volunteer scale program data. Much of this straying is probably due to the management practice of rearing the hatchery fish at a single location (Alsea Hatchery), then transferring them to release locations in other basins where they are released directly into the stream. Acclimation now occurs at six sites in an attempt to reduce straying, but adults are recaptured at only two of those sites. New hatchery programs using winter steelhead broodstocks founded from local populations are now being used in four basins.

Hatchery fish founded from the Siletz River summer steelhead have been introduced into the Kilchis, Wilson, and Nestucca rivers where summer steelhead are not indigenous. The effect of interbreeding or competition between hatchery summer steelhead and wild winter steelhead in these streams is unknown.

The Siletz River summer steelhead are the only summer steelhead originating in Oregon's Coast Range. The historical population is estimated to have been about 750 fish. Siletz Falls blocked passage of winter steelhead and other anadromous species, but summer steelhead were able to negotiate the falls during the summer low flow period. A fish ladder was constructed in 1953 that now allows winter steelhead, coho, spring chinook, fall chinook, and searun cutthroat to pass above the barrier. Releases of hatchery summer steelhead above the barrier, using a broodstock founded from the local population, started in the late 1950s. All of the hatchery steelhead are marked. Partial trapping of Siletz summer steelhead at the ladder indicates that currently only about 3% of the population, or about 50 fish, are wild (unmarked) fish. This result indicates that the naturally spawning summer steelhead are producing very few adult offspring. The new species that are now able to cross the barrier may be out-competing the summer steelhead. The draft Mid Coast Subbasins Fish Management Plan recommends excluding winter steelhead and other anadromous species not native above Siletz Falls in an effort to recover depressed wild summer steelhead.

Angling regulations that require the release of wild steelhead have been implemented in 35 populations in north to mid-coast basins.

Most of the rainbow trout populations in this group are isolated above barriers, including natural waterfalls and man-made barriers. Inventory work on the Middle Fork Coquille Basin in the Camas Valley area has located only cutthroat trout, and no rainbow trout. 1990 surveys in Crooked and Twomile creeks have discovered what appear to be rainbow/cutthroat hybrids. No genetic analysis has been conducted to date on these fish. The rainbow trout that are reported in Twelvemile Creek may actually be juvenile steelhead since survey crews have reported that the barriers previously thought to isolate the population are likely passable to adult steelhead. Further inventory will be conducted above secondary barriers to see if isolated rainbow populations are present farther up the basin. Rainbow trout have been documented on the South Fork Coquille River in the Eden Valley area above a large waterfall. However, surveys by USFS personnel in 1989 and follow-up surveys in 1992 on Wooden Rock and Foggy creeks revealed that rainbow trout made up only 5% of trout present with cutthroat trout dominating.

The resident rainbow trout population in the North Fork Salmonberry River is isolated between two waterfall barriers. Winter steelhead are present downstream and resident cutthroat trout are upstream. This population is located on private timberland and is threatened by future timber harvest activity.

The systematics of the *O. mykiss* populations in the Umpqua River have not yet been studied. The populations are currently grouped with the rest of the mid- to north coast populations, however, it is very likely that the basin will be split from the rest of the coast when further information becomes available. Genetic sampling of several Umpqua Basin rainbow trout populations was completed in 1994, with analysis of results available in 1995.

The one summer steelhead population in the Umpqua Basin is in the North Umpqua River and tributaries. About half of this population spawns and rears in Steamboat Creek. The 1992 creel census study revealed slightly over 50% of the summer steelhead run above Rock Creek is composed of hatchery fish. Rock Creek is the tributary of the North Fork where the hatchery facility in this basin is located. The other steelhead in the Umpqua Basin are winter-run populations. The Winchester Dam counting station enables annual population size estimates for the North Umpqua summer and winter races (Figures 67 and 68). Based on these dam counts and other information from elsewhere in the basin, three of the four Umpqua winter steelhead populations appear to be declining. Only the North Umpqua winter population, which has no hatchery program, is considered to have been stable over the past few decades.

Habitat quality index (HQI) and juvenile survey data indicate that most streams in the Umpqua Basin have enough steelhead to fully seed the available habitat, but production is greatly decreased compared to historical levels. Habitat degradation has had a substantial impact on wild steelhead stocks. Physical and general surveys show most streams to be in poorer condition than historically with overall fish production reduced. Habitat complexity has been lost and many streams have been scoured by historical splash-dam logging practices. Instream water rights have been established on most fish-bearing streams, but since they are junior to established consumptive water rights, water quality and quantity remain a high concern. A major reduction in timber harvest and road construction is needed in Steamboat and Canton creeks for long-term protection and restoration of the North Umpqua summer steelhead population. For example, in Canton Creek, over 600 stream crossings associated with logging have been counted.

The illegal introduction of smallmouth bass in the lower mainstem Umpqua River may have impacted the juvenile steelhead that rear in that area since the bass are predators on juvenile salmonids.

The Smith and South Umpqua rivers have a long history of Alsea hatchery stock smolt releases. Returning Alsea adults spawn in January-February while most Umpqua basin populations spawn in March-May. Adult returns from Alsea Hatchery smolts that are released into the South Umpqua make up about 15% to 25% of the winter steelhead run into the North Umpqua. This straying is probably due to the practice of rearing the hatchery steelhead at Rock Creek Hatchery on the North Fork, then releasing them directly into the South Fork. The hatchery winter steelhead have been observed spawning with wild North Umpqua summer steelhead. Starting in 1994, 30% of the hatchery winter steelhead entering the Winchester ladder on the North Umpqua will be removed. The winter steelhead hatchery program for Smith River has been reduced from 65,000 to 25,000 Alsea smolts. A native summer steelhead broodstock has been used in the North Umpqua since 1958. A south Umpqua River winter steelhead broodstock is currently being developed. Releases of legal-sized hatchery rainbow into the South Fork have been decreased from 8,000 to 4,000 in 1994. Actual releases of both steelhead and

rainbow in 1992 and 1993 are provided in Appendix A.

Angling regulations adopted in 1992 allow anglers to keep one wild summer steelhead in the weekly catch in the North Umpqua. Wild winter steelhead are still legal to harvest in the Mainstem, North and South Umpqua rivers.

Isolated rainbow trout populations in the Umpqua Basin are predominately located on National Forest lands in the North Umpqua above Soda Springs Dam. Historic releases of brown trout and brook trout in the early 1900s in the upper North Umpqua Basin above Soda Springs Dam have resulted in naturalized populations of these exotic species. These species are currently limiting native rainbow trout distribution in this basin due to competitive interactions. Pacificorp has been collecting fish and habitat distribution information on the upper North Umpqua Basin as part of its relicensing of its hydropower projects. This survey information was completed in 1994. The rainbow trout isolated in Cow Creek above Galesville Reservoir were formerly winter steelhead prior to dam construction.

South Coast/Lower Rogue River: South coast winter steelhead populations in the small coastal streams from Cape Blanco to the Oregon/California border appear to have a stable trend over the last few decades, but are currently at lower than 1970s levels, as indicated from punchcard information. The populations appear to vary in size following cycles probably associated with ocean productivity, but show no long-term trend. Land management activities, including logging and road building, have impacted critical steelhead habitat along the southern Oregon coast where watersheds are particularly unstable.

The winter steelhead population in the Illinois River has declined based on catch records. Sports harvest declined from 2,500 fish in the 1970s to less than 200 fish in 1992. Irrigation withdrawals have been a major impact to steelhead production in the Illinois basin, and the impacts were particularly severe during the recent drought. Other land management activities, such as logging and mining, have also reduced productive steelhead habitat in the basin.

There is only one steelhead hatchery program in this group. The program releases 50,000 smolts in the Chetco River using a locally developed broodstock. Between 1969 and 1977 the hatchery program released Alsea stock. Straying of immature upper Rogue River hatchery summer steelhead half-pounders has been documented in several of these populations. However, since these strays are subadults, interbreeding with hatchery fish has not been a problem.

Harvest regulations allow taking wild fish in this group except in the Illinois River, where no trout, salmon or steelhead can be kept.

Most resident rainbow trout populations in this group are isolated above natural or artificial barriers. Only populations in the lower Rogue River, including the Illinois River and in the Chetco River, are sympatric with winter steelhead. Headwater populations in the Smith, Chetco, Pistol, and Elk rivers are all located on National Forest lands. The populations are not monitored, but their abundance is likely limited by habitat constraints. The Illinois River trout population appears to be much smaller than that observed in the 1950s (Rivers 1991).

No hatchery trout are released into these coastal streams. Legal-sized rainbow trout were planted in Illinois tributaries until 1977. Headwater lakes in the Illinois Basin are still planted.

Upper Rogue Basin Above Rogue River Canyon: The steelhead populations in the upper Rogue Basin have 15 different subadult/adult life history patterns and four juvenile/pre-smolt life history patterns (ODFW 1994). Eight life history patterns include a false spawning run (half-pounders). About 95% of the summer-run fish and about 30% of the winter-run fish return to the river as half-pounders. The biological benefits of a steelhead half-pounder life history are unknown. Eight of the adult life history patterns include repeat spawning. The proportion of the adults that are repeat spawners vary from year to year, with about 10% to 25% spawning a second time, 1% to 3% spawning a third time, and rarely a few spawning a fourth time. These proportions, observed by ODFW staff between 1974 and 1984, compare with incidences of repeat spawning documented in the 1940s, 1950s and 1960s by Everest (1969) and Rivers (1991). Most repeat spawners are one or two-year-old smolts. Three and four-year-old smolts are also present in the population.

The summer steelhead adult population appears to be depressed to about 25 percent of its mid-1980s population sizes based on census data collected by seining at Huntley Park in the lower basin. The winter-run adult populations are more abundant, but also show a recent downward trend, based on counts at Gold Ray Dam in the upper basin. Summer and winter steelhead counts at Gold Ray Dam, where one winter steelhead population, and only part of a summer steelhead population are monitored, are provided in Figures 69 and 70. Low stream flows created by irrigation withdrawals, dam construction, urbanization and seasonal changes in runoff due to logging practices have been detrimental to all steelhead populations in this group. Urbanization along important summer steelhead spawning and rearing streams has further degraded habitat for these populations.

Cole Rivers Hatchery produces 520,000 summer and winter steelhead smolts for release in this group. The broodstocks were founded from the upper Rogue Basin

populations, but have not had wild fish included in the broodstock in recent years. Returning hatchery adults that escape the sport harvest are collected at trapping facilities. Hatchery-to-wild ratios have not been monitored, but there is thought to be little interaction between hatchery and wild steelhead on the spawning grounds.

Rainbow trout populations occur sympatrically with steelhead, thus providing an additional life history pattern for this group, and additional populations are isolated above natural and artificial barriers. Lost Creek and Applegate dams created impassable barriers on the upper mainstem Rogue and Applegate rivers. Steelhead have been lost above these areas, but rainbow populations persist. The partially built Elk Creek Dam is also causing a partial barrier to steelhead although studies are under way to improve passage at the site.

Headwater populations of rainbow trout in the Rogue Basin have been affected by historic releases of brook trout and hatchery rainbow trout. Brook trout from introductions that were initiated by the U.S. Bureau of Fisheries in 1918 have replaced rainbow trout in tributaries of the North Fork Rogue above the community of Union due to competitive interactions. Current legal-sized hatchery rainbow trout releases into Upper Rogue Basin streams occur in the North Fork Rogue River, Crater Creek, Mill Creek, Union Creek, and Minihaha Creek. Additional releases occur in standing waters. The genetic consequences of these hatchery releases are unknown at this time. Releases of legal-sized hatchery rainbow in the mainstem Rogue River below Lost Creek Dam and in the mainstem Applegate River above and below Applegate Dam were discontinued after 1993. Release data for 1992-1993 is provided in Appendix A.

Actions Under Way

Lower Columbia Basin: Steelhead population monitoring at fish ladders will continue in the Clackamas, Sandy, Hood, McKenzie, Santiam, Molalla, and mainstem Willamette rivers. Wild broodstock development will continue in the Clackamas, Santiam, and Hood rivers. Spawning ground surveys will continue in the Molalla and Santiam subbasins. A steelhead acclimation facility has been constructed in the Sandy River below Marmot Dam, but is not designed to capture returning adults. Rainbow populations are monitored annually by snorkeling in the North Fork of the Middle Fork Willamette River, and by periodic electrofishing surveys on the lower McKenzie River.

The Clackamas and Willamette basin plans have been approved by the OFW Commission. Basin plans are being written for the Sandy and Hood River systems.

Genetic samples were collected in 1993 from the Hood Basin, in Pocket, Robinhood, North Fork Greenpoint, and Emile creeks; from Fifteenmile Creek; and from the Little Sandy River. Analysis of results should be available in 1995.

Coast: Adult steelhead trapping occurs in Coquille, Siuslaw, Alsea, Yaquina, Siletz, and Trask rivers and tributaries. Information gathered from this sampling gives some indication of run strength and composition of hatchery and wild fish. Adult monitoring at Winchester Dam on the Umpqua River, and at Gold Ray Dam and in spawning streams in the Rogue River will continue. Juvenile steelhead sampling will continue in the Illinois River.

The Coquille, Mid-Coast, Umpqua, Nehalem, South Coast, and Rogue Basin plans are all in draft form.

Research projects are being conducted in the Siuslaw River on a wild steelhead broodstock development/acclimation project, an assessment of hatchery winter steelhead strays in coastal streams, and development of a habitat model for steelhead. Research completion reports on the impact of Lost Creek and Applegate dams for anadromous fish of the Rogue River are under way.

A 1992 statistical creel survey was conducted on the North Umpqua River and provided abundance data, based on catch, for hatchery and wild rainbow. Trout surveys conducted by Pacificorp in the North Umpqua have been completed including genetic sampling of several isolated populations in the upper basin in 1994.

INLAND COLUMBIA BASIN REDBAND/STEELHEAD
(*Oncorhynchus mykiss gairdneri*)

Subspecies Overview

Columbia Basin redband/steelhead trout are present in the Columbia Basin east of the Cascade Mountains starting at Fifteenmile Creek in Oregon. The same subspecies is present in the inland Fraser River in British Columbia, according to Behnke (1992).

The *O.m. gairdneri* subspecies includes sympatric anadromous steelhead and resident redband trout populations and isolated redband trout populations that are above barriers to anadromous fish. Sympatric fish with resident and anadromous life histories form different breeding populations due to assortative mating (they prefer mates with a life history similar to their own), but the populations are not completely reproductively isolated from each other (Currens 1987). Activities within the area of sympatry that affect populations with one life his tory generally will also affect the other. The steelhead populations show further life history variation in juvenile rearing and adult spawning migration behaviors. Juvenile steelhead may rear in fresh water one to three years before smolting, then spend one, two, or, rarely, three years in the ocean before reentering fresh water to spawn. Most inland steelhead are summer-run fish, entering fresh water between March and October then holding for several months prior to spawning. Oregon has only four populations of winter-run *O.m. gairdneri*, all located on the western boundary of the subspecies, in Fifteenmile Creek and adjacent creeks. The summer-run populations in the Columbia Basin are further divided into two groups, "A" and "B," depending on their run timing past Bonneville Dam. The "B" steelhead tend to be larger, older and later running and migrate specifically to certain Snake River subbasins in Idaho. All of Oregon's populations are "A" steelhead. Inland steelhead rarely spawn more than once, but redband trout in the Columbia Basin are repeat spawners.

Inland redband/steelhead have been heavily impacted by dam construction in the Columbia Basin. The Hells Canyon Dam complex on the Snake and the Pelton/Round Butte Dam complex on the Deschutes are impassable to anadromous fish. The steelhead life history is extinct above both complexes, although resident redband trout are still present. The steelhead populations remaining in the Snake River pass eight mainstem Columbia and Snake River hydropower dams during their migrations to and from the ocean, while the Columbia populations in Oregon pass one to four dams. Numerous other hydropower and irrigation dams in various tributaries have fragmented redband trout populations.

Other habitat problems affecting most inland steelhead and redband trout populations include irrigation diversions and cattle grazing. These activities modify river channels; remove riparian vegetation; block migration corridors; decrease summer flows, occasionally to complete dewatering; and increase summer water temperatures. Many populations have retreated to headwater areas as a result of these activities, causing extensive population fragmentation and declines in numbers.

Inland steelhead hatchery programs generally use local broodstocks and there is no history of broadcasting a single broodstock over a wide area, as there is for coastal steelhead. Steelhead hatchery programs occur in the Deschutes, Umatilla, Walla Walla, Grande Ronde, and Imnaha subbasins. Generally smolts are acclimated prior to release. However, there is a concern that straying is higher than desired due to homing behavior problems associated with fish passage along the mainstem Columbia River migration corridor, including artificial transportation of juveniles in barges and trucks. Steelhead hatchery programs may also impact redband trout if the hatchery juveniles residualize rather than smolt after release.

Most trout hatchery programs use a domesticated coastal rainbow that was founded from wild *O. mykiss* in northern California about 100 years ago. Most trout releases are in high mountain lakes that do not have wild populations, although some have outlets and hatchery fish may stray out of them downstream into trout and steelhead populations. Stream releases of legal-sized hatchery rainbow also occur in the upper Deschutes, John Day, Grande Ronde, Pine, Burnt, and Powder subbasins. Exotic trout, including brook and brown trout, have also been released into the inland *O. mykiss* range.

Inland steelhead populations can be affected by the mixed-stock Zone 6 gill-net fishery in the Columbia River.

Table 6. Inland Columbia Redband/Steelhead (*Oncorhynchus mykiss gairdneri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Mid-Columbia: Deschutes to Walla Walla	**COLUMBIA RIVER ***		
	Mosier Creek	**Winter**	
	1. Mosier Creek above falls		**Resident**
	Chenowith Creek	**Winter**	
	Mill Creek (population 1)	**Winter**	
	1. Mill Creek (population 2)		**Resident**
	Threemile Creek above falls		**Resident**
	Fifteenmile Creek	**Winter**	
	1. Fifteenmile Cr. above falls		**Resident**
	2. Cedar Creek above falls		**Resident**
	Deschutes River *		

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 6. Inland Columbia Redband/Steelhead (*Oncorhynchus mykiss gairdneri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Mid-Columbia: Deschutes to Walla Walla (continued)	1. Mainstem below Pelton Dam (pop. 1)	**Summer**	
	2. Mainstem below Pelton Dam (pop. 2)		**Res./Fluvial**
	3. Buck Hollow Creek		**Resident**
	a. Upper Buck Hollow Cr., upper basin		**Resident**
	b. Finnegal Cr., upper basin		**Resident**
	4. Oak Springs Cr. above barrier		**Resident**
	5. Bake Oven Cr., upper basin		**Resident**
	6. Nena Cr., upper basin		**Resident**
	7. Eagle Cr., upper basin		**Resident**
	8. Warm Springs River		**Resident**
	9. Shitake Creek		**Resident**
	10. Mud Springs Cr. above man-made barrier		**Resident**
	11. Little Trout Cr. above falls		**Resident**
	12. Willow Creek (above Madras)		**Resident**
	a. Willow Cr. (below Madras)		**Resident**
	John Day River *		
	1. Lower John Day (mouth to S. Fork)	**Summer**	
	a. Rock Cr., above barrier		**Resident**
	i. M.Fk Rock Creek		**Resident**
	b. Jackknife Creek		**Resident**
	c. Thirtymile Creek		**Resident**
	d. Pine Hollow Creek		**Resident**
	e. Butte Creek		**Resident**
	f. Pine Creek		**Resident**
	g. Cherry Creek		**Resident**
	h. Bridge Creek		**Resident**
	i. Basin from Rowe Creek to Forks		**Resident**
	j. N.Fk John Day River	**Summer**	
	i. Big Creek		**Resident**
	ii. Holmes Creek		**Resident**
	iii. M.Fk John Day River	**Summer**	
	A. Meadow Brook Creek		**Resident**
	- E.Fk Meadow Brook		**Resident**
	k. Upr. John Day (above S.Fk) (pop. 1)	**Summer**	
	l. Upr. John Day (above S.Fk) (pop. 2)		**Res./Fluvial**
	Willow Creek		**Resident**
	Umatilla River (pop. 1)	**Summer**	
	1. Umatilla River (population 2)		**Resident**
	2. Butter Creek		**Resident**
	3. McKay Cr. above McKay Dam		**Resident**
	4. Birch Creek		**Resident**
	5. Wildhorse Creek		**Resident**
	Juniper Canyon Creek		**Resident**
	Walla Walla River (population 1)	**Summer**	
	1. Walla Walla River (population 2)		**Resident**
	2. Pine Creek		**Resident**
	3. Mill Creek		**Resident**
	4. Cottonwood Creek		**Resident**
	5. Birch Creek		**Resident**
	6. Spring Brook Creek		**Resident**
White River	**White River above High Falls**		**Res./Fluvial**
	1. Tygh Creek above falls		**Resident**
	a. Badger Cr. above Diversion Dam		**Resident**

** Populations are present only in the tributaries of this water body as listed below it.*

*** Season of adult spawning migration.*

Table 6. Inland Columbia Redband/Steelhead (*Oncorhynchus mykiss gairdneri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
White River (continued)	2. Jordan Cr. above falls		**Resident**
	3. Crane Creek		**Resident**
	a. Forest Creek		**Resident**
Upper Deschutes: Above Pelton/Round Butte Dams	**Deschutes River ***		
	1. Crooked River *		
	a. Lower Crooked River		**Resident**
	b. McKay Creek		**Resident**
	c. Ochoco Cr. (below Ochoco Dam)		**Resident**
	d. Ochoco Cr. (above Ochoco Dam)		**Resident**
	e. Marks Creek		**Resident**
	f. Bingham Springs		**Resident**
	g. Bear Creek		**Resident**
	h. Upper Bear Creek		**Resident**
	i. N.Fk Crooked River *		
	i. N.Fk Crooked River below falls		**Resident**
	ii. N.Fk Crooked River between falls		**Resident**
	A. Fox Canyon Creek		**Resident**
	iii. Upper N.Fk Crooked R. (above all falls)		**Resident**
	A. Deep Creek		**Resident**
	B. Peterson Creek		**Resident**
	C. Allen Creek		**Resident**
	D. N. Summit Prairie Tributaries		**Resident**
	j. Camp Creek		**Resident**
	k. S.Fk Crooked River		**Resident**
	l. Beaver Creek		**Resident**
	2. Metolius River		**Res./Fluvial**
	a. Lake Creek		**Resident**
	i. Link Creek		**Resident**
	3. Squaw Creek		**Resident**
	4. Tumalo Creek		**Resident**
	5. Deschutes R., to Steelhead Falls		**Resident**
	6. Deschutes R., to Big Falls		**Resident**
	7. Deschutes R., to Odin Falls		**Resident**
	8. Deschutes R., to Cline Falls		**Resident**
	9. Deschutes R., to Awbrey Falls		**Resident**
	10. Deschutes R., to N. Canal Dam		**Resident**
	11. Deschutes R., N. Canal to Bend Hydro		**Resident**
	12. Deschutes R., Bend H. to Colorado St. Dam		**Resident**
	13. Deschutes R., Colorado St. Dam to Wickiup		**Resident**
	a. Little Deschutes R.		**Resident**
	i. Upr. Little Deschutes R.		**Resident**
	A. Crescent Creek		**Resident**
	b. Fall River		**Resident**
	c. Deschutes R., above Wickiup Res.		**Res./Adfluvial**
	d. Deschutes R., above Crane Prairie		**Res./Adfluvial**
	Davis/Odell Basin *		
	1. Odell Creek		**Res./Adfluvial**
South Fork John Day	**John Day River ***		
	1. S.Fk John Day River	**Summer**	
	a. Cabin Creek		**Resident**
	i. Murders Creek		**Resident**
	b. Wind Creek		**Resident**
	c. Upr. basin above Izee Falls		**Resident**

** Populations are present only in the tributaries of this water body as listed below it.*
*** Season of adult spawning migration.*

Table 6. Inland Columbia Redband/Steelhead (*Oncorhynchus mykiss gairdneri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Lower Snake: Hells Canyon Dam to Border	**SNAKE RIVER ***		
	Snake Mainstem (Stateline to Hells Canyon Dam)		**Res./Fluvial**
	Grande Ronde River *		
	1. Lower Grande Ronde up to Wallowa R. (population 1)	**Summer**	
	2. Lower Grande Ronde up to Wallowa R. (population 2)		**Res./Fluvial**
	3. Joseph Creek (population 1)	**Summer**	
	4. Joseph Creek (population 2)		**Res./Fluvial**
	a. Upr. Joseph Cr. above Swamp Cr.		**Resident**
	5. Wenaha River (population 1)		**Res./Fluvial**
	6. Wenaha River (population 2)	**Summer**	
	7. Lookingglass Cr. above Weir		**Resident**
	a. Jarbeau Cr. above falls, RM 3.25		**Resident**
	8. Clarks Cr. above falls, RM 10.75		**Resident**
	a. M.Fk. Clarks Cr. above falls, RM 1.5		**Resident**
	9. Catherine Creek		**Resident**
	a. Little Cr. above falls, RM 9.0		**Resident**
	10. Beaver Creek		**Resident**
	a. Dry Beaver Creek		**Resident**
	b. Upr. Beaver Cr. above dam, RM 12.75		**Resident**
	11. E.Fk Grande Ronde R. above falls, RM 2.5		**Resident**
	12. Wallowa River (pop. 1)	**Summer**	
	13. Wallowa River (pop. 2)		**Res./Fluvial**
	a. Minam River (pop. 1)	**Summer**	
	b. Minam River (pop. 2)		**Res./Fluvial**
	i. Little Minam R. above falls, RM 3.5		**Resident**
	c. E.Fk Wallowa R. above falls		**Resident**
	d. W.Fk Wallowa R. above falls		**Resident**
	14. Upr. Grande Ronde, Rondowa to headwaters		**Resident**
	Cook Creek above falls		**Resident**
	Cherry Creek above falls		**Resident**
	Imnaha River (population 1)	**Summer**	
	1. Imnaha River (population 2)		**Res./Fluvial**
McGraw Creek	**Snake River ***		
	McGraw Cr. above falls		**Resident**
Upper Snake, Burnt & Powder Rivers	**Snake River ***		
	Deep Cr. above falls		**Resident**
	Pine Creek		**Resident**
	Snake Mainstem above Brownlee Dam		**Resident**
	Powder River *		
	1. Powder R., Snake R. to Thief Valley Dam		**Resident**
	a. Eagle Creek		**Resident**
	2. Powder River, Thief Valley Dam to Mason Dam		**Resident**
	3. Powder River, above Mason Dam		**Resident**
	Burnt River		**Resident**
	1. N.Fk and S.Fk Burnt River		**Resident**
	a. S.Fk above Unity Dam		**Resident**
Malheur River	**Snake River ***		
	Malheur River		**Resident**
	1. Willow Creek		**Resident**

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** *Season of adult spawning migration.*

Table 6. Inland Columbia Redband/Steelhead (*Oncorhynchus mykiss gairdneri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Malheur River (continued)	2. Bully Creek above Bully Cr. Dam		**Resident**
	3. Cottonwood Creek		**Resident**
	4. Squaw Creek		**Resident**
	5. Calf Creek		**Resident**
	6. Hunter Creek		**Resident**
	7. N.Fk Malheur River		**Res./Fluvial**
	a. Warm Springs Creek		**Resident**
	b. Little Malheur River		**Resident**
	c. Upper N.Fk Malheur River		**Resident**
	8. S.Fk Malheur River		**Res./Fluvial**
	9. M.Fk Malheur R. abv. Warm Springs Dam		**Res./Fluvial**
	a. Stinkingwater Creek		**Resident**
	b. Pine Creek		**Resident**
	c. Wolf Creek		**Resident**
Owyhee River and Succor Creek	**Snake River ***		
	Owyhee River		**Resident**
	1. Dry Creek		**Resident**
	2. Upr. Basin above Owyhee Dam, RM 28.75		**Resident**
	3. Crooked Creek		**Resident**
	4. Jordan Creek		**Resident**
	5. N.Fk Owyhee River		**Resident**
	6. Little Owyhee River		**Resident**
	Succor Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

The distribution of inland Columbia Basin redband/steelhead (*Oncorhynchus mykiss gairdneri*) extends from the Cascade crest in the Columbia Basin to Washington and Canada, and up the Snake Basin into Idaho. It includes anadromous steelhead and resident redband trout. Steelhead and redband trout are sympatric in all basins that contain steelhead. Sympatric populations with different life histories form different populations due to assortative mating, but are not reproductively isolated from each other (Currens 1987). Each morphology appears to be able to produce offspring of the other type, and redband males have been observed to pair with steelhead females, particularly when steelhead populations are small. Redband trout populations also occur above barriers to anadromous fish. Only four winter steelhead populations, from Fifteenmile Creek and three adjacent creeks, have been described in this subspecies in Oregon, although several may exist in the same reach of the Columbia Basin in Washington. This boundary has been determined on the basis of allozyme data (Schreck et al. 1986). Further study of the trout and steelhead in the Hood, Fifteenmile and adjacent systems is warranted. It is possible that the coastal and inland subspecies naturally overlap and interbreed in this area.

The systematics of *O.m. gairdneri* are better studied in Oregon than the systematics of the coastal subspecies, but several unresolved areas still exist. Several very unique groups that are isolated by natural barriers have been found, and more may be located with further investigation. Many of the biochemical surveys of this subspecies have been conducted by different laboratories using different techniques and focused on different characteristics, sometimes making the results difficult to compare. Some basins have been locally studied, but statistical comparisons between basins have not been done. A comprehensive review of the group that pulls all of the existing data into a single analysis would be informative. Some of the groups described here may include subgroups upon further study.

Known groupings in the *O.m. gairdneri* range are as follows.

Mid-Columbia from Fifteenmile Creek to Walla Walla (with exceptions, see below):

This group contains sympatric redband trout and summer steelhead populations in the lower Deschutes, John Day, Umatilla, and Walla Walla rivers, and redband trout and winter steelhead populations from Fifteenmile Creek and adjacent areas. Steelhead and trout in the Umatilla, John Day, and Deschutes have all been studied biochemically in some detail and populations have been compared within basins. However, comparisons between the basins have not been analyzed. The populations as a group are clearly different from the populations in Oregon's Snake River, but differences within the group may also exist (Currens 1987, Currens and Stone 1989, unpublished data and personal communication).

White River: This unique redband trout group is located above a large barrier waterfall on the lower White River, a tributary to the lower Deschutes River. The White River redband trout does not appear to be closely related to any other *O. mykiss* in the Deschutes and may constitute its own subspecies. The group is unique in both allozyme and meristic characteristics (Currens et al. 1990). Additional natural barriers subdivide this group.

Upper Deschutes Above Pelton/Round Butte Dams: This group includes redband trout populations in the upper Deschutes Basin. The Deschutes Basin is subdivided by the impassable artificial barrier of the Pelton/Round Butte Dam complex. This barrier causes a phenotypic difference between the upper and lower Deschutes *O. mykiss* population groups because the steelhead morphology is extinct above the dams, but present below it. A series of natural barriers starting with Steelhead Falls also separates the upper Deschutes from the Crooked and Metolius rivers and Squaw Creek. The effect of these barriers on gene flow has not yet been studied. Anadromous fish did not pass Big Falls historically. Willow Creek is now artificially isolated between Pelton and Round Butte dams. The relationship of populations in the upper Deschutes, and between groups in the upper and lower basin is considered unresolved at this time. It is unlikely that the upper Deschutes populations should be placed in the same gene conservation group as those in the lower basin, but the location of the boundary between the groups requires further study. The decision may hinge on whether Pelton/Round Butte dams are to remain permanently impassable to steelhead or whether steelhead are to be reintroduced above the dams. The upper Deschutes will be separated for this report at Pelton/Round Butte dams since the groups are completely reproductively isolated and management and status issues vary considerably above and below this point. However, this boundary may change to reflect historical natural barriers in the future.

South Fork John Day: This group includes steelhead and redband trout in the South Fork of the John Day River. The uniqueness of this group has been determined by allozyme and ecosystem comparisons within the John Day Basin. No comparisons have been made outside of the John Day (Currens and Stone 1989). There is a barrier falls, Izee Falls, in the upper South Fork. However, the uniqueness of the South Fork group appears to extend below this barrier, therefore the boundary is drawn at the mouth of the South Fork. The uniqueness of the South Fork *O. mykiss* may result from two factors. First, the South Fork environment comprises a desert ecotype that is unique when compared to the rest of the John Day Basin. This feature may produce unique selection pressures on the South Fork populations compared to the rest of the John Day. Second, Bisson and Bond (1971) detected unique related species assemblages in the South Fork John Day and in the mid-Silvies River in the Malheur Lakes Basin that suggest a recent (within the last 10,000 years) stream exchange between these basins. This exchange appears to have transferred fish in both directions. The uniqueness of the redband trout in this group may be partly explained by an historical event that naturally introduced novel genetic variation into the South Fork John Day from the *O. mykiss* population in the Silvies River.

Lower Snake From Hells Canyon Dam to the Oregon/Washington Border: This group includes summer steelhead and redband trout in the Snake, Grande Ronde, and Imnaha rivers. Steelhead in this group are being studied by Waples et al. (1991) while redband trout have been sampled by Currens (personal communication). Systematic comparisons between this group and other Oregon populations outside of the study area have not been made. Allozyme data does indicate that the populations in these basins differ from those in the Yakima and above the Hells Canyon complex of dams (Waples et al. 1991; Currens 1988, 1990, 1991, 1992, unpublished data, and personal communication). The groups are definitely reproductively isolated from Columbia River populations in Oregon, although intermediate populations extend down the Snake River in Washington.

McGraw Creek: This group consists of a unique redband trout population isolated above a high waterfall on lower McGraw Creek. This creek is a direct tributary of the Snake River at the Hells Canyon Reservoir. The population does not appear to be closely related to any other Snake River *O. mykiss*. It is unique in both allozyme and meristic characteristics and may comprise its own subspecies (Currens 1991).

Burnt and Powder Rivers: Populations in several tributaries of these basins have been studied (Currens 1991). Significant allozyme differences exist between populations within the group, and between this group and populations farther up the Snake River and below the Hells Canyon Dam complex. These basins may have had steelhead present prior to the construction of the dams, but the life history is now extinct.

The Snake River subbasins above the Hells Canyon dams become progressively more desert-like upstream compared to those in the lower river. This ecological change may provide different selection pressures that account for some of the variation observed. The fish in these subbasins show the warm water tolerance that is considered to be a classic characteristic of redband trout. Extreme water temperatures and summer dewatering of the lower basins may contribute to limited migration potential and reproductive isolation of populations. Small population sizes with associated genetic drift, and the absence of hatchery influence in the upper Snake subbasins probably also contribute to the high level of variation among populations.

Malheur Basin: Populations in several Malheur tributaries have been studied. Significant differences in allozyme characteristics exist within this basin, and between this basin and other Snake subbasins (Currens 1988, 1991, 1992 and unpublished data).

Succor Creek and Owyhee River: These upper-most populations in the Oregon Snake River Basin deviate furthest from the rest of the Snake, based on allozyme data (Currens 1990, unpublished data). The progression of effects caused by the desert conditions described above probably account for these differences.

Status Report

Listing Status

The resident life history of the inland Columbia Basin subspecies, redband trout, is listed as a state "sensitive" species effective in 1990 and as a federal Category 2 candidate species. The National Marine Fisheries Service (NMFS) is currently conducting a status review of inland steelhead under the federal Endangered Species Act.

Specific Status Conditions

Mid-Columbia from Fifteenmile Creek to Walla Walla, and South Fork John Day Groups: These groups include summer steelhead populations, redband trout populations below barriers, and four winter steelhead populations in streams on the western boundary of the subspecies. The abundance of steelhead in these groups is monitored in combination with all other inland steelhead at a counting station in a fish ladder at Bonneville Dam. Type "A" summer steelhead, including all Oregon populations, can be distinguished from Type "B" steelhead by run time at that dam. Combined abundance of all Type "A" inland steelhead since 1939 is provided in Figure 71. It is difficult to differentiate the groups at other Columbia or Snake river dams farther upstream because delays in passage allow Type "B" steelhead to overlap Type "A" fish. The 1993 and 1994 runs at Bonneville Dam consisted of 22,600 and 17,732 steelhead, respectively and represented the normal 50% split between one and two salt fish. Type "A" steelhead abundance increased substantially in numbers during the late 1980s. However, this increase largely reflected the size and success of new hatchery programs for this subspecies rather than a large increase in the wild run. The 1994 return of wild Type "A" steelhead past Bonneville Dam was the lowest since 1984, when wild and hatchery fish were first differentiated.

Steelhead run sizes are also monitored in the Deschutes River at Sherars Falls trap (Figure 72), in the Umatilla River at Threemile Dam (Figure 73), and by spawning ground counts on the John Day River. Abundance trends in each basin are similar to the trends observed at Bonneville Dam. While all of the populations are larger than the conservation threshold of 300 fish, the runs of wild steelhead into all Oregon tributaries continue to be below escapement goals.

Steelhead populations in these groups pass one to four mainstem Columbia River dams during migrations to and from the ocean. Impacts caused by the dams include physical injury to juvenile fish when passing the dams, increased migration times in reservoirs, delayed condition effects that decrease survival during passage into salt water, and physical injury and stress during adult migration. Habitat degradation has also lowered productivity in the subbasins. Major production areas have been lost in the Deschutes basin due to the construction of Pelton/Round Butte dams which completely block access to habitat historically used by steelhead. Irrigation diversions have lowered streamflows in all basins, but have been a particular impact in the Umatilla Basin, where reaches of the mainstem are completely dewatered seasonally. Juvenile and adult migration windows have probably narrowed in the lower mainstems of the John Day, Umatilla, and Walla Walla as summer water temperatures and flows make these reaches inhospitable. Cattle grazing has altered stream channels and has removed riparian vegetation in all basins. Gold mine dredging historically affected John Day populations by severely disrupting stream channels. Steelhead production areas in these basins are now restricted to tributaries where adequate adult holding pools and juvenile rearing areas remain.

Before the construction of Pelton and Round Butte dams in 1958, Deschutes resident redband trout and anadromous summer steelhead were sympatric from the mouth of the river to Big Falls (RM 132), including tributaries Squaw Creek and Crooked River. After completion of the dam complex, steelhead were lost above the dams and the trout were fragmented into populations above, between, and below the dams.

The population of trout in the lower mainstem Deschutes is one of the most robust in Oregon for the resident life history of this subspecies. Abundance of redband trout larger than 8 inches has been estimated in specific areas of the Deschutes River during the 1970s and 1980s. Redband trout in the lower mainstem Deschutes River are most abundant between the Pelton Regulating Dam and Maupin and least abundant below Sherars Falls. Measurements of density of redband trout in the mainstem above Sherars Falls have ranged from 640 to 2,560 fish/mile. However, most resident populations in tributaries of the lower Deschutes Basin may be small, especially recently due to seven cumulative years of drought and due to heavy land use impacts, including cattle grazing and irrigation diversions.

Deschutes *O. mykiss* spawn during spring and early summer with most of the spawning occurring from April to July. However, anecdotal observations from field biologists and anglers indicate that mature redband trout may be present nearly year round. Most of the suitable spawning gravel in the Deschutes River is in the area from White River upriver to Pelton Regulating Dam. Important spawning tributaries for fluvial trout include Buckhollow, Bakeoven, and Trout creeks on the east side, and Warm Springs River and Shitike Creek on the west side. Spawner access and utilization of east side tributaries have been severely impacted in recent years due to water withdrawals, cattle grazing in riparian areas and drought conditions. Spawning areas in the mainstem below Pelton Dam have been impacted by the loss of flushing flows, lack of recruitment of new gravel as a result of dam construction, sedimentation, and siltation.

Little information is available on the current status of the winter steelhead and redband trout populations in the Fifteenmile Creek drainage. What limited information is available indicates that relatively low numbers of redband trout can be found throughout much of the drainage. In tributaries Fivemile and Eightmile creeks, redband trout may occur sympatrically with cutthroat trout. It is assumed that past and present land management practices have significantly reduced the quantity and quality of available trout habitat in the drainage.

Abundance and distribution of redband trout are not routinely indexed in the John Day Basin. Juveniles with trout and steelhead life history types are difficult to differentiate where the two populations coexist, making independent monitoring difficult. At this time, abundance estimates of John Day trout populations are unknown. Summer distribution of redband trout is limited to headwater areas, similar to John Day cutthroat and bull trout, by a variety of land use impacts including stream dewatering from irrigation diversions and temperature barriers caused by stream alterations due to cattle grazing and timber harvest.

Umatilla and Walla Walla redband trout are present throughout headwater areas of these basins. Similar to the John Day system, summer distribution is limited due to extensive agricultural development in the lower rivers. Systematic abundance or distribution estimates over time have not been collected and again, since redband trout and steelhead coexist throughout most of these basins, juveniles of these life history types are difficult to distinguish. At this time, with the exception of East Birch Creek, abundance estimates are unknown for redband trout populations in the Umatilla and Walla Walla systems.

There are major steelhead hatchery programs in the Deschutes and Umatilla rivers and a small Oregon program in the upper Walla Walla River. All of these use broodstocks that were founded from the local wild population, although the Deschutes stock has undergone some artificial selection. Trout hatchery programs, using domestic coastal rainbow stock, are present in tributaries of the John Day River and the mainstem Umatilla River. Releases of legal-sized hatchery rainbow trout into tributaries of the Walla Walla and Umatilla rivers where wild redband and bull trout are present were discontinued after 1993. The current Umatilla River releases of hatchery trout are in sections of the mainstem in the town of Pendleton where wild trout are not present. Evaluation of stream trout stocking in the John Day Basin is funded in 1995. Release locations and numbers for 1992 and 1993 are provided in Appendix A. The lower mainstem Deschutes is managed for wild trout only, and the John Day is managed for wild steelhead only. A trap operated in the Walla Walla in Oregon captured only 2.3% stray hatchery steelhead in 1993 and 1% strays in 1994. The proportion of hatchery fish passing Threemile Dam on the Umatilla has averaged 20% of the run for the past five years (Figure 73). Hatchery steelhead straying into the Deschutes and John Day from other Columbia Basin hatcheries has been significant. However, spawning surveys in the John Day indicate the strays are not spawning with the indigenous wild fish. Hatchery steelhead, including a large portion that are strays from outside of the system, are present in the Deschutes Basin every month of the year (Figure 72). The number of hatchery fish spawning in Deschutes tributaries appears to be very low, but the number spawning in the mainstem is unknown. Limited mark - recapture information indicates that many of the outbasin strays leave the Deschutes prior to spawning.

Some inland hatchery steelhead juveniles tend to residualize after release, rather than migrating. This may be an artifact of the management effort to produce all even-sized yearling smolts when the wild phenotype includes 2- and 3- year smolts and perhaps trout. The potential impacts of residualized hatchery steelhead smolts are unknown. The fish may compete with wild juveniles and may also acquire resident life histories and interbreed with resident trout. Both the Deschutes and Umatilla steelhead hatchery programs intentionally select for large, yearling smolts in an effort to reduce residualization, including grading and removal of some juveniles.

With the exception of the John Day and the Walla Walla basins, angling in this group requires the release of all wild steelhead. Emergency angling regulations were enacted in the John Day, Umatilla, and Walla Walla rivers in 1990, 1993 and 1994 because of low runs. During those three years, the bag limit was reduced to two fish per year, with the exception of the Walla Walla River where catch and release of wild steelhead was required in 1994.

White River: The redband trout in the White River are naturally isolated by a series of three waterfalls with a cumulative drop of 180 feet. This group has been isolated for a geologically long time and is unique enough from all other *O. mykiss* that it may constitute a separate subspecies with its total distribution restricted to the White River.

Abundance of redband trout age 1 year and older in the White River system above White River Falls was estimated by Oregon Department of Fish and Wildlife et al. (1985). The density of redband trout over 6 inches, which are probably breeding age, ranged from 56 fish per mile (Little Badger Creek) to 445 fish/mile (Threemile Creek) whereas the density of redband trout under 6 inches ranged from 316 fish/mile (Clear and Frog creeks) to 2,897 fish/mile (Jordan Creek). Abundance of redband trout in the White River system was greatest in the mainstem and in tributaries of the lower mainstem below RM 12. About 30% of the redband in the mainstem White River were over 6 inches long as compared to other streams within the basin, which ranged from 3% in Little Badger Creek to 18% in Clear Creek. The mainstem population appears to have a fluvial life history that may be an adaptation to seasonal high sediment loads caused by White River Glacier at the head of the mainstem.

Hatchery rainbow from a coastal rainbow hatchery stock have been released into the White River and tributaries since 1934. The number released has varied through time, but most recently included 6,000 legals into White River and 1,000 legals into Badger Creek. Recent stocking sites have been White River at Farmers Road (RM 17.5), at Tygh Valley Bridge (RM 6.5), and below the Highway 197 bridge (RM 5.0); and Badger Creek at Bonney Crossing (RM 7.0). Stream stocking in the White River System was discontinued after 1993. However, Pine Hollow (10,000 legals and 25,000 fingerlings), Rock Creek (16,000 legals) and Smock Prairie (3,000 legals) reservoirs; Badger (3,000 legals), Clear (17,000 legals) and Frog (6,000 legals) lakes; and Baker Pond (1,000 fingerlings) continue to be stocked annually. The stocking of these lakes, ponds and reservoirs will impact the wild trout if the hatchery fish stray from the release locations. It is not known whether the hatchery fish stray. Evaluate of these programs are recommended as part of the draft Lower Deschutes Subbasin Fish Management Plan, which is proposed for Commission review and adoption in 1995.

Upper Deschutes (above Pelton/Round Butte Dams): The principal redband trout production areas above Lake Billy Chinook are fragmented from lower Deschutes trout by Pelton-Round Butte dams. Populations that were historically continuous with the lower Deschutes include those in the mainstem up to

Steelhead Falls, in Squaw Creek, and in the Crooked and Metolius rivers. The amount of genetic interchange between these areas was never measured, but historically there were no physical barriers to stop movement. The steelhead phenotype has been lost from this group.

The Deschutes between Lake Billy Chinook and Steelhead Falls is located in a relatively pristine semi-remote canyon that excludes grazing and agricultural development. This area has not been routinely sampled, but snorkel surveys in 1989 and 1991 estimate 1,600 to 1,700 redband trout greater than 6 inches in length, or of probable breeding age, per mile.

Redband trout populations in the Crooked River are fragmented, isolated from each other, and depressed throughout the basin due to barriers caused by dams, dewatering, and temperature extremes. Dewatering, unscreened irrigation diversions, channelization, loss of riparian vegetation, and poor water quality have made many of the Crooked River streams on private lands either uninhabitable by redband trout, or only able to maintain extremely low abundance. Recent stream surveys indicate that remnant populations are primarily on public lands, in headwater areas (USFS and BLM lands), and in the Crooked River from Bowman Dam to Lake Billy Chinook.

Trout populations in the lower Crooked River and Ochoco Creek below Bowman and Ochoco dams may be predominately naturalized fish of hatchery origin. Extensive chemical treatment projects in the South Fork and mainstem Crooked rivers above Prineville Reservoir, mainstem Crooked below Prineville Reservoir and mainstem Ochoco Creek above and below Ochoco Reservoir, accompanied by widespread fish habitat degradation that continues to occur, may have eliminated native redband trout in those areas. Hatchery rainbow have been planted below the dams. A 1989 population estimate in the Crooked River indicated 4,130 trout in the five miles immediately below Bowman Dam for an average of 826 trout per mile. Population estimates in 1994 averaged over 4,000 redband trout per mile in this same study reach. The increase in abundance may be a result of increased average winter flow during intervening years. The origin of these fish will be better understood when the results of a genetic survey of redband trout, initiated throughout the Crooked River Basin in 1993, are completed in 1994.

Stocking records indicate that the planting of hatchery rainbow was widespread in the Ochoco Creek and Crooked River drainages as early as 1925. Planting of hatchery trout was discontinued in Deep Creek after 1990, and in upper Ochoco Creek above the reservoir and in Marks Creek after 1992. The only stream stocking that remains in the Crooked River Basin is in Ochoco Creek below Ochoco Dam and in the South Fork Crooked River.

Abundance estimates are not available for most populations in the Crooked River Basin, however 101 streams in the basin were surveyed for fish distribution in 1993. Abundance of wild trout is thought to be low, especially after the recent seven years of cumulative drought, which increased the effect of heavy land use impacts. Some populations appear to have had little or no successful reproduction during the most serious drought conditions, particularly in 1992 as indicated by surveys conducted in 1993, which found few or no subadult fish in some areas.

The Metolius River has long been known as a popular area to fly fish for rainbow trout. However, the status of the wild redband trout population has come into question in recent years.

Beginning in the 1920s hatchery rainbow trout from coastal rainbow stock have been released into the Metolius River to supplement sport fishing demand. Initially starting with fingerling releases, the program expanded with the construction of Wizard Falls Hatchery in 1947 and eventually peaked at over 40,000 legal-sized trout annually in the 1970s. Since 1988, releases have been reduced to 17,500 legals annually. Genetic samples collected from wild trout above the Camp Sherman Bridge (the upper two miles of the basin) in 1985 provided allozyme evidence of introgression between the coastal and inland subspecies indicating significant hatchery influence on fish rearing in that area (Currens 1987). Subsequent genetic sampling indicated that the hatchery influence may be greatly diminished farther down river below the release sites (R. Williams and R. Leary, personal communication). An experimental effort to reduce the interbreeding between hatchery rainbow and wild redband that was conducted in 1993 and 1994. The upper limit of stocking was moved downstream and stocking was discontinued a month earlier to reduce the hold-over of hatchery fish in the upper most redband trout spawning areas. Preliminary results indicate that hold-over in the upper spawning area was reduced. Further information on possible lower river spawning areas and potential hatchery impacts in these areas is required.

Complete population abundance and distribution studies have never been conducted along the entire Metolius River. The high gradient and semi-remote nature of the lower river has always made fish sampling extremely difficult. The sampling that has been conducted (1981-84 and 1992 to present) has been concentrated in the upper four miles (of 28 total miles of river). This area is believed to be a significant spawning area, but its relationship to other potential spawning areas is unknown. Results of these studies to date indicate that the numbers of adult wild trout in the upper four miles may be extremely low. There is some evidence for a fluvial life history in this population. Peak spawning in the study area by unmarked wild trout occurs in December-

January, with a broad distribution from November to July. The winter spawning peak occurs at the same time that hatchery trout spawning in the hatchery which provides a significant potential for interbreeding.

It is unknown if the measurements of population density and behavior, and hatchery influence are a local artifact of the long-standing hatchery program or whether they are representative of the other 24 miles of stream that have not been systematically sampled. Further investigations will help answer these management questions. The policy question of whether hatchery stocking should continue will be addressed in the Upper Deschutes Fish Management Plan which is scheduled for completion in 1995.

Abundance and distribution of redband trout populations in the remainder of the Deschutes Basin above Steelhead Falls (RM 128) are affected to varying degrees by habitat degradation due to irrigation and hydroelectric development in the upper basin. As a result of natural features, such as Steelhead Falls and Big Falls, and of artificial blockages caused by hydropower dams and irrigation diversions, fish passage barriers are present along the mainstem at RM 128, 132, 140, 157, 165, 166, 167, 181, 216 and 227. The numerous irrigation diversions and two hydropower projects are unscreened or ineffectively screened with significant losses of trout occurring annually.

Historically stream flow was very stable in the river downstream of the Wickiup Dam site, ranging between 700 cfs and 1,000 cfs annually. Presently the flow between Wickiup and Bend is subject to extreme fluctuation ranging from 20 cfs during winter up to 2,100 cfs during summer months. As a result, successful redband trout spawning in this reach of river appears to be extremely limited.

Summer irrigation withdrawals create a 30-cfs river below Bend down to RM 132, where large springs substantially increase flows. There are only two tributaries below Bend, Tumalo Creek (RM 160) and Squaw Creek (RM 123). Both are heavily impacted by unscreened irrigation withdrawals, but Squaw Creek does provide about two miles of good spawning and rearing habitat in its upper basin. Tumalo Creek is dewatered by the time it reaches the Deschutes due to diversion facilities that have been operating since 1913. Low summer flows in this reach of the main Deschutes cause very warm water temperatures (80°F) and greatly reduce summer rearing area. The warm water has nearly eliminated redband from RM 155 down to RM 132.

Redband populations above Lake Billy Chinook have not been routinely sampled in recent years, but snorkel surveys in 1989 and 1991 estimate 3,500 redbands larger than 6 inches per mile in the reach from Steelhead Falls to Big Falls; 17 larger than 6 inches per mile near Tetherow Crossing; and 120 larger than 6 inches per mile near mouth of Tumalo Creek. Redband trout above Bend were extremely difficult to locate during these surveys. In the Little Deschutes River, redband trout are at a very low density due to stream flow fluctuations from irrigation development (Crescent Lake/Crescent Creek project) and due to competition from introduced brown and brook trout. Redband trout in the Deschutes River above Crane Prairie Reservoir have been monitored annually by spawning ground counts since 1988. Spawner abundance appears to fluctuate annually relative to the amount of rearing habitat available downstream in Crane Prairie Reservoir. In years of severe reservoir draw-down subsequent spawner numbers appear to be less robust.

The only ongoing stream stocking program in this area is in the Deschutes mainstem from Wickiup Dam to Benham Falls where 25,000 legal-sized coastal rainbow are stocked annually. Historically, additional legal rainbow were stocked above Crane Prairie Reservoir (6,000-10,000 annually - discontinued in 1990) and from Bend downstream to Lower Bridge (1,000-43,000 during the period 1954 to 1977). Hatchery Deschutes redband fry have also been stocked in the Deschutes and tributaries Fall River and Spring River (up to 100,000). This program was discontinued after 1993. Other hatchery stocking still occurs in many high Cascade lakes. Full stocking data for 1992 and 1993 is provided in Appendix A. Since the Cape Cod stock hatchery rainbow currently stocked in the Deschutes are not resistant to the parasite *Ceratomyxia shasta*, which is endemic to this reach of Deschutes, it is believed that few, if any, of the stocked fish survived to spawn. The Deschutes stock hatchery redband (Lot 66) were founded from wild fish in the lower Deschutes and are resistant to *C. shasta*. These stocked fish could survive to interbreed with the wild redband trout.

Lower Snake from Hells Canyon to the Oregon/Washington Border: Anadromous steelhead, and resident and fluvial redband trout are sympatric throughout the reaches of the Grande Ronde and Imnaha basins that allow access to anadromous fish. The three forms are probably not reproductively isolated from each other. There are six known populations of resident redband trout that are isolated by major geological barriers in the Grande Ronde Basin. These are located in the upper East and West Forks of the Wallowa River (two miles above Wallowa Lake), in Hurricane Creek (tributary to the Wallowa River), in Little Creek (tributary of Catherine Creek), in Jarbo Creek (tributary of Lookingglass Creek), and in Limberjim Creek (tributary of the upper Grande Ronde River).

Grande Ronde and Imnaha steelhead populations are monitored by spawning ground counts. Abundance trends in the basins track the trends observed at Bonneville Dam (Figure 60) and are currently low. Wild trout distribution surveys conducted in the Grand Ronde drainages in 1991 indicated that redband trout were widespread and abundant in all streams surveyed.

Habitat degradation is the major factor limiting production of redband trout and steelhead in the Grande Ronde and Imnaha basins. Steelhead populations in these basins are impacted by decreased survival during passage at eight mainstem Columbia and Snake river hydroelectric dams. Impacts caused by the dams include physical injury to juveniles when passing the dams, increased migration time and increased predation through the reservoirs, delayed effects of decreased condition that cause mortality during saltwater entry, and physical injury and stress to migrating adults during dam passage. Mitigation measures that remove and artificially transport juvenile fish collected at two Snake River dams may also be impacting steelhead by interfering with homing behavior and increasing straying by adults. Inbasin activities such as channel alterations, grazing, mining, agricultural practices, and timber harvest all affect steelhead and redband production in the basins. Irrigation withdrawals using both seasonal and permanent diversion structures prevent free movement of fish, increase water temperatures, and dewater habitat. Water quality problems, including temperature, sediment, and organic pollution have also affected populations. In some cases these impacts have been reduced compared to historic levels; in others the impacts are continuing.

Both hatchery steelhead and rainbow trout are released into this group. Actual release numbers and locations for 1992 and 1993 are provided in Appendix A. Trout releases into the Imnaha were discontinued in 1991. The Imnaha steelhead program uses a broodstock founded from the local wild population. The Grande Ronde steelhead broodstock was founded from fish collected at one of the Snake River dams and probably included fish from throughout the Snake Basin. Acclimation facilities with adult traps are used or are planned for all releases in this group. Spawning ground surveys indicate that there is little straying by hatchery steelhead. Some hatchery steelhead smolts are known to residualize. These fish may ecologically impact wild trout and steelhead by competitive interactions and may potentially adopt resident life histories and interbreed with redband trout.

Hatchery rainbow trout from coastal rainbow stocks have been used to enhance fishery opportunities and harvest in the Grande Ronde Basin since 1925. Historically, releases have consisted of fry, fingerling, and legal-sized fish. Some streams were stocked only once and many others were stocked annually until the mid-1950s. From 1977 through 1984, fingerling rainbow trout were released into the lower Grande Ronde and Wallowa rivers to provide an alternative fishery when numbers of wild summer steelhead adults declined as a result of hydropower development and high harvest rates in the Snake and Columbia river systems. These releases ranged from 35,000 to 140,000 fingerlings annually. Large numbers of residual hatchery summer steelhead smolts have been using these same areas in recent years. Fingerling trout releases have been discontinued and catch-and-release regulations on wild trout have been adopted to encourage harvest of the residual hatchery steelhead. Catch-and-release regulations are also in effect for all wild steelhead in this group. An evaluation of the hatchery trout stocking program in the Wallowa River is funded for 1995.

McGraw Creek: McGraw Creek is a direct tributary to the Snake River. The redband population in it is naturally isolated above a high waterfall. Recent genetic surveys of this group indicate that it is very unique and unlike any other *O. mykiss*. It may constitute a separate subspecies endemic to McGraw Creek.

Fish habitat and population estimates were conducted for this group in 1993. There are no hatchery fish planted in the group.

Burnt and Powder Rivers: The steelhead phenotype was lost from this area with the closure of the Hells Canyon Dam complex. The remaining redband populations are permanently isolated from Snake River *O. mykiss* below the dams.

Wild trout distribution surveys conducted in the Eagle and Powder drainages in 1991 indicate that redband trout are widespread and abundant in all streams surveyed. Habitat degradation is the major factor limiting production of redband trout in the Powder and Burnt River basins. Activities such as channel alterations, grazing, mining, agricultural practices, and timber harvest all affect trout populations. Irrigation withdrawals using both seasonal and permanent diversion structures prevent free movement of fish, increase water temperatures, and dewater habitat. Water quality problems, including elevated temperatures, sedimentation, and organic pollution have affected trout populations. In some cases these impacts have been reduced compared to historic levels; in others the impacts are continuing. Habitat degradation from historical gold mining operations is particularly severe in the Powder River, where dredging altered stream channels.

Hatchery trout releases in this group for 1992 and 1993 are provided in Appendix A. A domestic coastal rainbow stock is used for all releases. A recent genetic survey of several wild trout populations in the Powder found no evidence of interbreeding between the hatchery fish and at least some of the wild populations (Currens 1991).

Malheur River: The upper Malheur Basin historically supported abundant populations of both resident redband and anadromous steelhead trout until the construction of Warm Springs Dam on Middle Fork Malheur (1919) and Agency Dam on North Fork Malheur (1935) blocked runs of anadromous fish. Construction of the Hells Canyon Dam complex eliminated any steelhead access to the Malheur Basin. Biological surveys conducted over the last 30 years indicate that resident and fluvial redband trout still persist in most perennial streams in the basin, however, many of the populations are now isolated by impassable dams and water diversions.

Trout populations in the Malheur mainstem below Warm Springs Reservoir and in the North Fork Malheur below Beulah Reservoir are believed to be predominately naturalized hatchery fish. Extensive chemical treatment projects have occurred in these areas (1963, 1973, 1977 and 1987) with subsequent releases of hatchery coastal rainbow trout.

Life history studies of redband trout in southeast Oregon indicate that in a stream environment many populations mature by the third or fourth year of life and then die following spawning. Evidence of fluvial life histories has been determined through scale analysis from fish collected in the Middle, North and South Fork Malheur drainages.

Headwater areas of the Malheur Basin, including the Middle Fork, North Fork and Little Malheur rivers along U.S. Forest Service Road·16, were stocked with legal rainbow trout from the mid-1950s until 1993. This program was discontinued after 1993. Several of the isolated populations of Malheur redband trout have been analyzed genetically. This analysis demonstrated the uniqueness of the group, and also indicated that there has been little interbreeding with hatchery rainbow, at least in the populations sampled. Intensive fish and habitat surveys were completed on the North and Middle Fork Malheur River in 1992, 1993, and 1994.

Owyhee/Succor Creek: Anadromous steelhead were lost to the Owyhee Basin with completion of Owyhee Dam in 1932. Redband trout probably existed throughout much of the mainstem Owyhee River until dam construction and treatment projects eliminated them. Redband trout presently are known to exist in Jordan Creek, North Fork Owyhee, Middle Fork Owyhee, West Little Owyhee, and Dry Creek. Redband trout are also present in Succor Creek, including Carter Creek. Succor Creek is a direct tributary to the Snake upriver from the Owyhee River.

In summer of 1990 during a survey of smallmouth bass populations in mainstem Owyhee River in the Three Forks area, several *O. mykiss* trout were observed. These trout had external phenotypic characteristics of both hatchery rainbow and redband trout. Other populations in these basins that have been genetically sampled showed no evidence of hatchery influence.

The only place where hatchery trout are stocked in the basin in Oregon is in the 10 miles immediately below Owyhee Dam. Due to extensive chemical treatment projects in this area all native redband trout are believed to have been extirpated. Headwater areas of the East Fork Owyhee on the Duck Valley Indian Reservation in Nevada are periodically stocked with a legal-sized hatchery rainbow. The effect of these fish on downstream redband trout populations in Oregon is unknown. These fish are funded by the Fish and Wildlife Program of the Bonneville Power Administration (BPA). The Department has notified BPA of our concerns and the need to conduct further genetic sampling.

Actions Under Way

The upper and lower Deschutes and Grande Ronde basin plans are in draft form. The Malheur Basin plan has been adopted.

Experimental strategies to decrease interbreeding between hatchery rainbow trout and wild Metolius redband trout were initiated in 1993. The strategies involve the modification of release locations and stocking schedule. The success of the experimental strategies are being evaluated and final strategies will be presented to the public in the upper Deschutes Basin Plan.

Monitoring of Group A steelhead will continue at Bonneville Dam. Inbasin redd counts and monitoring of steelhead populations at the Umatilla and Sherars Falls (Deschutes) traps will continue.

Redband trout in the Deschutes River above Crane Prairie Reservoir have been monitored annually by spawning ground counts in late spring since 1988. The trout population below Bowman Dam on the Crooked River have recently been sampled in 1993 and 1994. Annual snorkel surveys have been conducted on the upper Metolius since 1992.

Genetic samples were collected from Crooked River redband populations in 1993. Further sampling will occur in 1994, and will be expanded to the upper Deschutes. Umatilla steelhead and trout were also genetically sampled in 1993.

A research project on the extent of residualization of hatchery steelhead in the Grande Ronde Basin was initiated in 1993.

OREGON BASIN REDBAND TROUT (*Oncorhynchus mykiss newberri*)

Subspecies Overview

The Oregon basin redband trout occupies remnant streams in seven Pleistocene lake beds in Oregon: Lake Modoc (now Klamath Basin), Lake Chewaucan (now Summer Lake and Abert Lake basins), Goose Lake, Warner Lake, Catlow Lake, Fort Rock Lake (now Fort Rock Valley, Christmas Valley, Fossil Lake and Silver Lake), and Malheur Lake. This subspecies, according to current taxonomy, is also found in several northern California closed basins. Populations in each of these basins are completely isolated by natural geological features, except for those in the Klamath Basin. The Klamath River drains to the Pacific Ocean although it is now artificially blocked by several dams. Steelhead migrated from the ocean to the Klamath Lake area prior to dam construction on the lower Klamath River.

During the Pleistocene, Great Basin redband trout occupied large alkaline lakes. The desiccation of the lakes formed stream/marsh/lake or stream/marsh complexes. In most basins, it appears the redband trout established adfluvial life histories, migrating among highly productive rearing areas in lakes with adjacent marshes and spawning areas in streams (as in Goose Lake, Warner Lake, Klamath Lake, and Malheur Lake basins) or among productive marshes and streams (as in Paulina Marsh in Fort Rock Basin, Chewaucan Marsh, and Catlow Marsh). The marshes and lakes connected various populations that entered them from different drainages in the basins. During drought episodes that caused complete desiccation of the lakes and marshes, streams provided refuges for populations that returned to the lakes when they refilled.

The major human impact over the last 150 years has been the fragmentation and loss of components of the marsh/lake/stream systems. Basin floors were developed for agriculture, which included extensive diking, channeling, draining and loss of marshlands. Irrigation diversions were constructed on most streams and caused dewatering and physical blockages for both upstream and downstream migrating trout. Cattle grazing also contributed to channel destruction in some locations. In several cases, the loss of adjacent marshlands appears to be related to an increased alkalization of the lakes. Lake and marsh rearing habitat and functioning migration corridors have been lost as a result. Most of the impacts have occurred on private lands.

The loss of access between lakes, marshes and streams has interfered with the migratory life histories of redband trout. Population productivity has been compromised because of the loss of the important lake and marsh rearing areas. Gene flow among populations has ceased and populations are seriously fragmented. Some populations have been completely lost. Many of the isolated fragments that persist on public lands are locally productive, although with very restricted distributions. Some of the life history options that carried populations through natural drought cycles or provided for recolonization are no longer available.

Great Basin redband trout have also been impacted by the introduction of exotic species and subspecies. Hatchery rainbow trout (*O.m. irideus*) have been planted in each basin and there is both meristic and biochemical evidence that hatchery fish have interbred with wild fish in some areas. Coastal rainbow hatchery fish are poorly adapted to the warm and often alkali waters of many Great Basin streams. This condition provides a competitive advantage to the indigenous populations, but also increases the fitness impact of any interbreeding that may occur. Exotic warm water species have invaded many of the natural lakes and artificial impoundments in the basins. The impact of the exotic species is variable, ranging from little impact to serious competition, predation, and habitat destruction.

Table 7. Oregon basin redband trout (*Oncorhynchus mykiss newberri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Klamath Lake	**Klamath River** *		
	1. Fall Creek (above falls)		**Resident**
	2. Klamath Mainstem, below Lake (Spencer Creek)		**Fluvial**
	3. Crystal Creek *		
	a. Rock Creek		**Resident**
	4. Wood River		**Res./Adfluvial**

** Populations are present only in the tributaries of this water body as listed below it.*
*** Season of adult spawning migration.*

Table 7. Oregon basin redband trout (*Oncorhynchus mykiss newberri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Klamath Lake (continued)	5. Williamson River *		
	a. Lower Williamson River		**Adfluvial**
	i. Spring Creek		**Adfluvial**
	ii. Kirk Reach Williamson		**Adfluvial**
	b. Sprague River *		
	i. Lower Sprague		**Adfluvial**
Upper Williamson River - Klamath Marsh	**Klamath River ***		
	1. Williamson River *		
	a. Upper Williamson River		**Resident**
Jenny Creek	**Klamath River ***		
	1. Jenny Creek (above falls)		**Resident**
Upper Sprague River - Sycan Marsh	**Klamath River ***		
	1. Williamson River *		
	a. Sprague River *		
	i. Upper Sprague River		**Res./Adfluvial**
	ii. Sycan River		**Resident**
Catlow Valley	**Catlow Lake Basin ***		
	1. Home Creek		**Resident**
	2. Threemile Creek		**Resident**
	3. Skull Creek		**Resident**
	4. Rock Creek		**Resident**
Fort Rock Basin	**Fort Rock Lake Basin ***		
	1. Buck Creek		**Resident**
	2. Bridge Creek		**Resident**
	3. Silver Creek		**Resident**
Chewaucan Basin	**Summer Lake Basin ***		
	1. Foster Creek		**Resident**
Chewaucan Basin (continued)	**Abert Lake Basin ***		
	1. Chewaucan River		**Resident**
	a. Crooked Creek		**Resident**
	i. Loveless Creek		**Resident**
	b. Willow Creek		**Resident**
Goose Lake Basin	**Goose Lake Basin ***		
	1. Kelly Creek		**Resident**
	a. Sugar Creek		**Resident**
	2. Tandy Creek		**Resident**
	3. Coqswell Creek		**Resident**
	a. N. Fk. Cogswell		**Resident**
	b. S. Fk. Cogswell		**Resident**
	4. Crane Creek		**Resident**
	5. Thomas Creek		**Res./Adfluvial**
	a. Cox Creek		**Resident**
	i. Camp Creek		**Resident**
	ii. Bauer Creek		**Resident**
	6. Cottonwood Creek		**Resident**
	a. above Cottonwood Reservoir		**Resident**
	i. Mesman Creek		**Resident**
	b. above Cottonwood Meadows Res.		**Resident**
	7. Antelope Creek		**Resident**
	8. Drews Creek		**Res./Adfluvial**
	a. Green Creek (above Dog Lake)		**Resident**
	b. Drews Creek (above Reservoir)		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 7. Oregon basin redband trout (*Oncorhynchus mykiss newberri*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Goose Lake Basin (continued)	i. Dent Creek		**Resident**
	ii. Howard Creek		**Resident**
	iii. Quartz Creek		**Resident**
	9. Mill Creek		**Resident**
	a. Venator Creek		**Resident**
	10. Dry Creek		**Res./Adfluvial**
	a. McCoin Creek		**Resident**
	b. Fall Creek		**Resident**
Warner Basin	**Warner Basin** *		
	1. Deep Creek below falls		**Res./Adfluvial**
	a. Deep Creek above falls		**Resident**
	2. Honey Creek		**Res./Adfluvial**
	3. Twelvemile Creek *		
	a. Twentymile Creek		**Res./Adfluvial**
Donner und Blitzen River	**Malheur Lake Basin** *		
	1. Donner und Blitzen River		**Res./Adfluvial**
	a. Krumbo Cr. above dam		**Resident**
	b. Bridge & Mud Creeks		**Resident**
	c. Fish Creek		**Resident**
	d. Little Blitzen River		**Resident**
Silvies River	**Malheur Lake Basin** *		
	1. Silvies River		**Resident**
	a. Lower basin		**Resident**
	b. Emigrant Creek		**Resident**
	c. Middle basin		**Resident**
	d. Upper Basin		**Resident**
	e. Poison Creek		**Resident**
	i. Devine Canyon Creek		**Resident**
	2. Rattlesnake Creek		**Resident**
Silver Creek	**Malheur Lake Basin** *		
	1. Silver Creek above dam		**Resident**
Riddle and Keiger Creeks	**Malheur Lake Basin** *		
	1. Riddle Creek		**Resident**
	2. Kiger Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

The range of the Oregon Basin redband group as proposed by Behnke, the isolating mechanisms, and the controversy about the subspecies divisions have been described above. The following groups have been placed under *O.m. newberrii*, following the convention published by Behnke (1992), and pending future publication of new subspecies designations or alternative subspecies boundaries by other authors.

Klamath Lake Trout: This group is unique in terms of life history, meristics, disease resistance, and allozyme variation (Buchanan and Currens, unpublished data). It may constitute its own subspecies, or it may belong in the coastal subspecies (*O.m. irideus*). The group extends south to the Oregon border below Klamath Lake, up the Sprague River to Trout Creek, and up the Williamson River to the outlet of Klamath Marsh. Populations within the group are highly variable and many appear to share little gene flow with adjacent populations in spite of their proximity and absence of physical barriers. The steelhead life history morphology was historically present in this group, but is now extinct. This life history probably was probably introduced into upper Klamath Basin after the closed Modoc Basin opened to the Pacific Ocean, and the novel traits in this group may have resulted from the interbreeding of the new invading *O. mykiss* with the original resident of the basin. It is not known whether the steelhead in the upper Klamath River had the half-pounder life history that is known from the lower Klamath and Rogue basins.

Upper Williamson River: The population in the upper Williamson River above Klamath Marsh shows "ancient redband" morphologies and has unique allozyme characters that suggest that it may be a remnant from the original Lake Modoc redband trout (Buchanan and Currens, unpublished data). This population, along with the upper Sprague River and Jenny Creek trout described below may constitute a unique subspecies. The upper Williamson group is isolated from the upper Sprague group by the distribution of the Klamath Lake group, which lies between them.

Jenny Creek: The Jenny Creek trout are isolated by an impassable waterfall on lower Jenny Creek. Morphologies and allozyme characters indicate that they constitute a gene conservation group and may belong in a unique subspecies along with the upper Williamson and Sprague rivers populations (Currens 1990).

Upper Sprague River: The populations in the upper Sprague River have unique allozyme and morphological characteristics and may belong in a subspecies with the Jenny Creek and upper Williamson River populations (Buchanan and Currens, unpublished data).

Catlow Valley: Limited data from east-side tributaries of the Catlow Basin indicate that this group is unique and may constitute a separate subspecies (Currens, personal communication citing unpublished data from W. Berg). The distribution of Catlow redband is split into two isolated groups. Most of the populations occupy small streams along the Steens Mountain (east) side of the basin. However, one population is present in Rock Creek on the Hart Mountain (west) side of the basin. While the Steens Mountain populations may have shared gene flow through Catlow Marsh, at least in high water years, the Rock Creek population has been disconnected from the rest of the group since the original desiccation of Catlow Lake, perhaps 10,000 years ago. The Rock Creek group will be studied when it recovers from the recent drought and may constitute its own gene conservation group. One of the Steens Mountain populations was sampled in 1993.

Fort Rock Basin: Allozyme data collected from several Fort Rock populations in the 1970s indicate that this group is unique enough that it may constitute its own subspecies (Currens 1990, citing R. Wilmot unpublished data). Two populations were again sampled in 1993.

Chewaucan Basin: A genetics survey of this group has never been conducted. However, the amount of uniqueness observed in all great basin populations that have been studied, and the obvious reproductive isolation afforded by the closed basin indicate that populations in this group form at least one gene conservation group. The Chewaucan Basin includes two isolated population centers, one with several populations in tributaries of Chewaucan Marsh and the other a single population isolated in upper Foster Creek in a hanging valley on Winter Rim above Summer Lake. The Summer Lake subbasin became isolated from the rest of the Chewaucan Basin during the fluctuation and desiccation of Lake Chewaucan due to the formation of a dune ridge that split the basin. This isolated population will be studied in the future and may constitute a separate gene conservation group. Several Chewaucan River populations were sampled in 1993.

Goose Lake Basin: Redband trout in this basin have been studied by W. Berg unpublished data) who is expected to propose a formal subspecies designation for it in the near future. This group is very unique in terms of allozyme variation, but is closely aligned to Pit River redband trout in Northern California. Goose Lake still occasionally spills into the Pit River, although any current gene flow is only in one direction out of Goose Lake since the spillway is an impassable waterfall for any fish that would attempt to migrate back upstream from the Pit River. Several additional populations in this group were sampled in 1993.

Warner Basin: A genetics survey of this group has never been conducted. However, the amount of uniqueness observed in all great basin populations that have been studied, and the obvious reproductive isolation afforded by the closed basin indicates that the population in this group from at least one gene conservation group. There is an impassable waterfall on Deep Creek that further subdivides this group. Several populations in this group were sampled in 1993.

Donner und Blitzen River: Redband trout populations in the Donner und Blitzen subbasin appear to be the most closely related to the Malheur River redband trout of any of the Malheur Lake Basin populations, although it shows unique characters indicating its several thousand years of reproductive isolation since a lava dam isolated Malheur Lake from the Malheur River (Currens 1990). One population in this group was sampled in 1993. Most authors place this group in the inland Columbia Basin redband subspecies [*O.m. gairdneri*, according to Behnke's (1992) designation].

Silvies River: Populations in the Silvies subbasin includes a unique life history and allozyme variation that differentiates it from other Malheur Lake Basin populations. Bisson and Bond (1971) suggest that a stream exchange with the South Fork John Day River may have occurred some time in the last 10,000 years. This exchange may have introduced novel genetic variation from the John Day Basin into the Silvies subbasin. The novel genetic variation may have been restricted to the Silvies subbasin by intolerable alkali conditions in Malheur Marsh and Malheur Lake that currently isolate the subbasins from each other. This group may also belong in *O.m. gairdneri*.

Silver Creek: Limited biochemical data is available for this group, but it appears to share similarities with other Malheur Lake Basin populations while showing evidence of a long period of isolation. Bisson and Bond (1971) suggested that this subbasin has been isolated since desiccation of historical Lake Malheur due to intolerable alkali conditions in the lower river and in Harney Lake. This population was sampled in 1993. This group may belong in *O.m. gairdneri*.

Riddle Creek and Kiger Creek: Limited biochemical data from Riddle Creek indicates that this basin, which terminates in Malheur Marsh along with Kiger Creek, has unique characteristics (Currens, ODFW, unpublished data). This group appears to constitute a separate gene conservation group, but warrants further study. Both populations were sampled in 1994. This group may belong in *O.m. gairdneri*.

Status Report

Listing Status

Redband trout in the Oregon Great Basins are listed as state "sensitive" species, effective in 1990, and are listed as federal Category 2 candidate species.

Specific Status Conditions

Klamath Basin (Klamath Lake, upper Williamson Basin, upper Sprague River and Jenny Creek groups): The Klamath Basin redband trout populations have adfluvial or resident life histories. The Klamath Basin includes several lake/marsh/stream subsystems. The Klamath Lake system supports the most functional adfluvial life history system among the Great Basins. The Wood, lower Williamson and Sprague rivers still provide access to Klamath Lake and regular, annual migrations of redband trout still occur. In the Williamson and Sprague headwater areas, migration corridors between Klamath and Sycan marshes and their adjacent streams are less functional due to irrigation diversions and thermal blockages. The steelhead life history is extinct in this basin in Oregon due to the construction of Copco Dam in 1917 on the Klamath River.

The Klamath Lake group includes a population below Klamath Lake, as well as those in the lower Wood, Williamson and Sprague rivers above the lake. The population in the Klamath River below the lake is subdivided by Boyle and Keno dams, both of which have fish passage facilities. The spawning population is monitored in Spencer Creek and includes over 1,000 spawners. However, most of the spawners appear to come from the "Keno" reach above Boyle Dam. The portion in the "Salt Caves" reach of the Klamath River below Boyle Dam has decreased in size about 99% since the construction of the facility. Inadequate upstream fish passage facilities at Boyle Dam is the probable cause of this decline. These fish are monitored as they migrate over Boyle Dam. Fish counts in 1959 numbered 5,529, while counts in 1991 were only 70. River flows in the mainstem reaches used by this population are highly regulated. Low flows and high temperatures in the river below Klamath Lake were a particular concern during the 1992 drought.

The population in the lower Williamson River is monitored by spawning ground counts and appears to be stable or perhaps increasing with spawners abundant in most areas. The Wood River and lower Sprague populations are depressed due to habitat problems caused by overgrazing and irrigation withdrawals. Angler logbooks and spawning ground counts were initiated on Wood River in 1993. The populations in the Klamath Marsh and upper Williamson system and in the Sycan Marsh and upper Sprague system are also affected by irrigation diversions and cattle grazing. There is some population fragmentation throughout the Klamath Basin due to degraded habitat conditions and the occurrence of artificial barriers.

As of 1993, the only direct stream-release *O. mykiss* hatchery program in this basin occurs in Spring Creek, a tributary of the lower Williamson. All other direct-stream release programs have been discontinued. The hatchery fish are domesticated coastal rainbow stock and are thought to have very poor survival past the first few months after release due to their susceptibility to the disease *C. shasta* in the mainstem Williamson River. Efforts to develop a Klamath-origin hatchery stock that could be used throughout the basin have been unsuccessful. The wild-type hatchery fish did not accomplish the objective of contributing well to the fishery when used in Spring Creek and the *O. mykiss* populations in the Klamath were too diverse and subdivided for a single wild-type broodstock to be used throughout the basin. All other hatchery trout programs in the Klamath Basin are lake or reservoir releases. Generally, there are no wild trout populations at the release sites, although there may be some in downstream river reaches.

Restrictive angling regulations are in effect throughout the Klamath Basin.

Goose Lake Basin: Goose Lake Basin has had a history of natural, extreme water fluctuations over the last 500 years. Water levels ranged from periods where the lake went dry to periods of lake overflow into the Pit River system south of Goose Lake Basin. Goose Lake went completely dry during the 1992 drought for the first time since the 1930s. Any trout that might have been trapped in the lake were lost. After the lake recovered from the 1930s desiccation, the species naturally recolonized it from adjacent stream populations. Recolonization is now unlikely under current habitat conditions.

The last documented strong migration of adfluvial trout between the lake and Oregon streams was in 1978. Many populations have become completely isolated from each other due to artificial barriers, stream channelization, draining of marshlands and dewatered stream reaches. Much of the basin's water resources are over-appropriated. Most of the impacts have occurred on private lands on the basin floor adjacent to the lake.

There is only one trout hatchery program in this basin in Cottonwood Meadows Reservoir. The only trout angling allowed in the basin is in this reservoir. The hatchery fish are domestic coastal rainbow stock. An evaluation of this hatchery program to determine the potential for hatchery fish to leave the reservoir and impact wild trout is funded for 1995 and 1996.

Populations successfully reproduced in the headwater areas of Thomas Creek during the 1992 drought, as evidenced by good age-class distributions found during sam pling by ODFW in 1993. Other populations are very depressed and several are thought to have been recently lost.

Chewaucan Basin: Abert Lake in the Chewaucan Basin is a highly alkali lake that has probably been inhospitable to trout for hundreds of years. The trout in this basin apparently migrated only into Chewaucan Marsh. Chewaucan Marsh is essentially no longer in existence due to extensive channelization, draining of marshlands, and water diversions. All streams now terminate prior to reaching the marsh and their populations are isolated from each other. No adfluvial populations remain in the system. The Chewaucan River population, or populations, is the most robust in the group and survived through the 1992 drought. All other populations are seriously depressed.

The single population in the Summer Lake Basin, in Foster Creek, has been naturally isolated from all other *O. mykiss* for perhaps 10,000 years and may constitute its own gene conservation group. No hatchery fish have ever been planted in this population and the population has not been monitored. This group will be genetically sampled in the future.

Two direct-stream release hatchery rainbow programs occur in this system, one in Dairy Creek and one in the mainstem Chewaucan. These programs use domesticated coastal rainbow stock. These hatchery programs are a concern because the hatchery fish have the potential of interbreeding with wild fish. All other hatchery programs in this basin are in streams or reservoirs that do not have native trout, although straying away from the planting sites into steams with wild trout may be a concern in some cases.

Warner Basin: The Warner Lakes went nearly dry during the 1992 drought. The small wetted area that remained provided for the survival of exotic fish species in the lakes, but any trout that might have been trapped in the area were probably lost. Recolonization by trout from the streams is unlikely under current habitat conditions because most streams are blocked by irrigation diversion structures that dewater streams immediately above the lakes and cause physical blockages. There are probably no adfluvial populations left in this system. Resident populations are fragmented, but reproduction occurred during the 1992 drought in headwater areas in Deep Creek and Honey Creek, based on ODFW sampling in 1993.

Hatchery programs are restricted to reservoirs that do not have native trout. Straying out of reservoirs may be a concern in some cases. Exotic warm water species have been abundant in the Warner Lakes. These species survived the recent drought and there is evidence that their populations are again expanding. The effect of these exotics on wild trout is unknown, but they have been known to prey on and compete with other wild species in the lakes. Brook trout are present in upper Honey Creek and may competitively affect the redband population in that system.

Catlow Basin: Catlow Marsh has been broken into small, discontinuous parcels near the outlets of tributary streams on the east side of the valley. Redband trout populations occupy three streams on the east side: Home, Threemile and Skull creeks. The populations may still have fluvial or adfluvial life histories. Several small irrigation diversions in the lower reaches of these streams may interfere with passage, but the populations may still have access to limited rearing areas in Catlow Marsh. Sampling in Home and Threemile creeks in 1993 demonstrated that the populations are extremely small and have declined substantially relative to abundances observed during sampling in the 1970s. Other observations indicate that the Skull Creek population is also very small. All of the populations are now isolated from each other due to the fragmentation of the marsh.

The Rock Creek population is on the west side of Catlow Valley. It is naturally isolated from the rest of the system and has been so since the original desiccation of Catlow Lake, perhaps 10,000 years ago. It may constitute its own gene conservation group. The population appears to have been very depressed by the 1992 drought, based on observations made by U.S. Fish and Wildlife Service staff at Hart Mountain wildlife refuge. The creek is contained within the boundaries of the wildlife refuge. All angling on this population was closed in 1992.

There are no hatchery programs in the Catlow Valley group.

Fort Rock Basin: Paulina Marsh is much smaller than its historical range and has been broken into small, discontinuous fragments near the outlets of tributary streams. Extensive draining and channelization has occurred over much of the original marsh. Populations are present in Silver, Buck, and Bridge creeks. Little information is available on the abundance or life histories of these populations. Limited sampling in about a mile each in lower Buck and Bridge creeks in 1993 captured 30 to 35 fish of all age classes. The populations are all isolated from each other.

There is only one hatchery program in this basin in Thompson Reservoir in upper Silver Creek. It is suspected that hatchery fish escape this reservoir in some years and may have interbred with wild Silver Creek fish downstream of the reservoir if wild fish still exist there. This section of Silver Creek is annually dewatered to satisfy downstream irrigation demands. The hatchery fish are domesticated coastal rainbow stock. The other two populations in this group are not affected by current hatchery programs.

Malheur Lake Basin (Donner und Blitzen River, Riddle and Kiger creeks, Silver Creek and Silvies River groups): Malheur and Harney lakes are no longer accessible to trout due to irrigation diversions, channelization, draining of marshlands and high alkalinities. An exotic carp population is present in Malheur Lake and has caused habitat damage to the extent that the lake would probably not provide trout habitat even if the populations could gain access to it. Harney Lake is highly alkali and has probably been inhospitable to trout for many years. Bisson and Bond (1971) proposed that high alkalinities around Malheur and Harney lakes caused the natural isolation of the major subbasins in this basin over the last several thousand years. Possibly only the Donner und Blitzen River, and perhaps Riddle and Kiger creeks actually had natural access to Malheur Marsh and lake in recent history.

The Silver Creek group was seriously depressed by an extensive fire that occurred in the basin in 1990. Ongoing habitat problems, including cattle grazing and water withdrawals, and the effects of the 1992 drought may have further restricted reproductive success since the fire. Sampling by ODFW in 1993, however, provided evidence that breeding occurred in 1993 since young of the year were found.

Recent population abundance estimates are not available for Donner und Blitzen River, Riddle and Kiger creeks, or Silvies River. Populations in all of these subbasins are thought to be depressed due to the combined effects of habitat problems, including cattle grazing, water withdrawals and passage barriers, and the 1992 and 1994 droughts.

A hatchery program in the Donner und Blitzen River at Page Campground was discontinued after 1992. Hatchery plantings will continue in Krumbo Reservoir and may be affecting the population above the reservoir. All other hatchery programs in the Malheur Lakes Basin are now restricted to reservoirs that do not have native trout. The potential for hatchery fish straying from some of these planting locations may require evaluation.

Actions Under Way

An extensive trout research project has been completed in the Klamath Basin. This research study provided substantial information on population and gene pool structure and life histories. Population monitoring including creel sampling, dam counts and spawning ground counts continues. Habitat projects include fencing, construction of instream structures to increase habitat complexity and diversion screening.

ODFW is participating in a Goose Lake Basin working group with federal agencies, local government and landowners to develop a recovery program for wild fish species in this basin. Stream surveys have been conducted and more are planned. Angling was closed in all trout waters except one reservoir in 1993.

Tissue samples were collected from several Thomas Creek populations in Goose Lake Basin, from several locations in the Chewaucan River from Honey and Deep creeks in Warner Basin, from Home Creek in Catlow Valley, from Bridge and Buck creeks in Fort Rock Basin, and from Silver and Indian creeks in Malheur Lake Basin for genetic analysis; preliminary results are expected in 1994.

Angling was closed in Rock Creek in Catlow Valley in 1992.

Sampling in Kiger and Riddle creeks in Malheur Lake Basin occurred in 1994. There is a need to compile the data from past genetic surveys in this basin into a single basin report. BLM is writing a wild and scenic river management plan for part of the Donner und Blitzen River. Grazing has been curtailed along several tributaries of the Donner und Blitzen River. Some further presence/absence inventories are being conducted in this basin.

CHAPTER 4: CUTTHROAT TROUT
(*Oncorhynchus clarki*)

Species Overview

Cutthroat trout (*Oncorhynchus clarki*) is considered to be the first species to diverge from the ancestral *Oncorhynchus* lineage. It includes eight recognized subspecies, plus several other potential ones that have not been formally described. The range of three subspecies extends into Oregon, including the Lahontan cutthroat trout (*O. c. henshawi*) in southeastern Oregon the Coastal cutthroat trout (*O. c. clarki*) west of the Cascade Mountains and a disjunct segment of the Westslope cutthroat trout (*O. c. lewisi*) in the John Day River basin.

The different subspecies of *O clarki* are highly divergent, especially on a biochemical level. Some systematists have suggested that it may be appropriate to split the current species into three or four species. Should this split occur, each of the Oregon subspecies could be placed in a different species. Each subspecies is treated separately in the following status review.

LAHONTAN CUTTHROAT TROUT (*Oncorhynchus clarki henshawi*)

Subspecies Overview

The Lahontan cutthroat trout complex occupies remnant streams throughout the basin of historical Lake Lahontan in Nevada, southern Oregon, and eastern California. The group evolved since the early Pleistocene in an alkaline, deep lake environment where they were probably of large size, piscivorous, and had an exceptional tolerance of high alkaline conditions. These traits are still expressed in the subspecies when it occurs in large lake environments that contain other fish species like, for example, in the original Pyramid Lake population. The trout's environment changed dramatically with the natural desiccation of Lake Lahontan in the last 10,000 to 15,000 years. The current distribution is broken into small, reproductively isolated groups generally restricted to small streams and frequently without other fish species present. Fish living under these conditions are small-sized and opportunistic feeders. Some populations may be naturally vulnerable depending on the success of their adaptive response to these extreme, but natural, environmental changes.

Human activities over the last 150 years have caused additional habitat changes, such as further desiccation of streams from irrigation diversions, modification of channel structure, and elimination of riparian vegetation from grazing. Further population fragmentation has resulted from these actions. These habitat conditions have been aggravated by severe drought conditions over the last few years. All populations became further depressed during the drought due to increased mortality and poor reproduction.

Some Lahontan populations have been modified by the introduction of coastal rainbow trout (*O. mykiss irideus*), which hybridized with the cutthroat trout. The hybrid offspring were fertile and successfully backcrossed with the parent cutthroat trout subspecies. Evidence of this introgression is still evident in that some biochemical and meristic phenotypes include rainbow-trout-like characters. The fitness impact of this introgression was apparently minor since the affected populations have persisted successfully for many generations since hybridization occurred.

Table 8. Lahontan cutthroat (*Oncorhynchus clarki henshawi*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous*	Life history: Freshwater
Willow Creek (Coyote Lake Basin)	**Willow Creek**		**Resident**
Whitehorse Creek (Coyote Lake Basin) [Some naturalized populations of Whitehorse cutthroat from Willow and Whitehorse Cr'ks are in streams located in Alvord or Quinn Basins]	**Whitehorse Creek**		**Resident**
	1. Little Whitehorse Creek		**Resident**
	[Fifteenmile Creek]		**Resident**
	[Antelope Creek]		**Resident**
	[Twelvemile Creek]		**Resident**
	[Denlo Creek]		**Resident**
	[Van Horn Creek]		**Resident**

* *Season of adult spawning migration.*

Table 8. Lahontan cutthroat (*Oncorhynchus clarki henshawi*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous*	Life history: Freshwater
Whitehorse Creek (Coyote Lake Basin) (continued)	**[Pike Creek]**		**Resident**
	[Cottonwood Creek]		**Resident**
	[Willow Creek]		**Resident**
	[Mosquito Creek]		**Resident**
	[Little McCoy Creek]		**Resident**
Alvord Lake Basin	**Trout Creek**		**Resident**
Quinn River Basin [Naturalized populations of Quinn River cutthroat]	**McDermitt Creek**		**Resident**
	1. Sage Creek		**Resident**
	2. [Indian Creek]		**Resident**
	3. Line Canyon Creek		**Resident**
	Oregon Canyon Creek		**Resident**
	1. [Tenmile Creek]		**Resident**

* *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

Behnke (1992) proposed that this subspecies (*O.c. henshawi*) be further divided into several subspecies, including three in Oregon, based on meristic criteria.

Behnke's "Lahontan" cutthroat trout subspecies, contained in tributaries of the western Lahontan Basin in Nevada, is considered to be the ancestor of the other groups. This group does not extend into Oregon.

The "Humboldt" cutthroat trout subspecies in eastern Nevada differs from the Lahontan cutthroat in both meristic and biochemical characteristics. This group is thought to have become isolated from the Lahontan group during an early desiccation of Lake Lahontan at least 15,000 years ago. This group does not extend into Oregon.

Willow and Whitehorse Creeks: The origin of the "Whitehorse" cutthroat trout subspecies, contained in creeks associated with the Coyote Lake playa, is a mystery because the probable geological connections between this basin and others are unknown. The fish could be related to either the Humbolt group (based on meristic data), the Lahontan group (based on biochemical data), or the Alvord group (based on the most likely geological connections). Within this group, the fish in Willow Creek are isolated from those in the Whitehorse Basin and have been so since the most recent desiccation of Coyote Lake, probably 3,000 to 5,000 years ago. Biochemical data indicates that the two groups have diverged slightly in that a unique mtDNA haplotype was present in the Whitehorse system, but absent in Willow Creek and in all other populations studied (Williams 1991). Based on this information, the Whitehorse cutthroat is split into two gene conservation groups -- one in Willow Creek and one in the Whitehorse Basin.

Alvord Lake: The "Alvord" cutthroat trout subspecies is considered by Behnke (1992) to be extinct. ODFW considers this group to persist in Trout Creek, although with possible introgression with *O. mykiss* from an historical hatchery planting by Nevada. Behnke's conclusion is based on the loss, alteration or repression of certain phenotypes originally associated with the Alvord cutthroat trout. ODFW's conclusion is based on the fact that the cutthroat lineage was not broken in Trout Creek, therefore the genetic variation originally contained in the group has not been lost. The Trout Creek fish have not been studied biochemically, but a study of Virgin Creek fish in the southern Alvord Basin indicates that genetic variation from the Alvord cutthroat trout lineage persists in that system even though there is evidence of introgression with *O. mykiss* (Bartley and Gall 1991). According to Behnke (1992), the Alvord cutthroat became separated from the Lahontan cutthroat due to a landslide that redirected Mahogany Creek from the Lahontan Basin to the Alvord Basin approximately 20,000 years ago.

Quinn River: The Quinn River, located in an isolated basin north of the Humboldt Basin, is thought to have been historically connected to the Humboldt. The Quinn River cutthroat trout have been taxonomically associated with Humboldt cutthroat by Behnke (1992) based on meristic characteristics, and with Lahontan cutthroat by Williams (1991) based on biochemical characteristics. Quinn River cutthroat extend from northern Nevada into several Oregon tributaries, including McDermitt and Oregon Canyon creeks.

Status Report

Listing Status

Lahontan Cutthroat trout were originally listed as "endangered" in 1969 under the federal Endangered

Species Conservation Act of 1969. They were downlisted to "threatened" in 1975 under the act. The populations in Oregon were listed as "threatened" by the state in 1991.

Specific Status Conditions

Willow Creek: This group consists of a single, naturally isolated population. The isolation was caused by the desiccation of Coyote Lake. The creek currently terminates in the Coyote Lake sink.

There is no history of hatchery plantings, either of cutthroat, rainbow, or other exotics, into this group.

This group is naturally small and isolated, but has been further depressed by poor habitat conditions including channel structure modification and loss of riparian vegetation caused primarily by past cattle grazing practices. Ninety percent of the habitat is owned by BLM and is currently under restrictive grazing allotment management plans that should improve riparian cover and channel structure.

Extensive fish population surveys were conducted throughout the Willow Creek Basin in 1994.

Whitehorse Creek: This group consists of two wild populations and up to 10 naturalized populations. All of the populations are protected under the ESA listing and are treated like wild populations by ODFW.

The wild populations are continuous with each other, but are naturally isolated from all other populations in the subspecies. The isolation was caused by the desiccation of Coyote Lake. The creek currently terminates in the Coyote Lake sink.

The naturalized populations were transplanted from Whitehorse Creek in the early 1970s or early 1980s. Founding populations were very small, consisting of about 25 fish. Several of the transplant locations are in other basins. Each of the transplanted populations are isolated. The persistence of two of the transplanted populations was verified in 1992. The status of the other transplants is uncertain.

There is no history of hatchery plantings, either of cutthroat, rainbow, or other exotics, into this group.

This group is depressed by poor habitat conditions including channel structure modification, loss of riparian vegetation, and decreased water flows caused primarily by historical cattle grazing and water diversions. Ninety percent of the habitat is owned by BLM and is currently under restrictive grazing allotment management plans that should improve riparian cover and channel structure.

Extensive fish population surveys were conducted throughout the Whitehorse Creek Basin in 1994.

Alvord Lake Basin: This group consists of a single population in Trout Creek. Trout Creek terminates in the Alvord Lake sink.

Coastal rainbow trout are suspected to have been planted in this population by the Nevada Department of Wildlife in the 1940s, although there are no ODFW records to this effect. Introgression with rainbow trout is evidenced by the occurrence of rainbow-like meristic traits in the population. The fitness impact of this introgression was apparently minor since the population has successfully persisted. A genetic survey of this group is planned and will be implemented when funding becomes available.

This group is depressed by poor habitat conditions including modification of channel structure, loss of riparian vegetation, and low water flows caused primarily by historical cattle grazing and water diversions. Forty percent of the habitat is owned by BLM and is currently under restrictive grazing allotment management plans that should improve riparian cover and channel structure in some of the basin.

Quinn River Basin: This group extends into Nevada. Only the Oregon populations are reviewed in this document. The group consists of three wild populations and three naturalized populations.

All of the wild populations are currently isolated from each other due to habitat impacts including dewatered reaches and artificial barriers. They were probably seasonally continuous through a connection to the Quinn River in recent history until irrigation diversions blocked access.

Rainbow trout are known to have been planted in the mainstem Quinn River by the Nevada Department of Wildlife. Strays from these plantings are suspected to have entered the Indian and Tenmile populations. Rainbow trout also are suspected to have been planted in the Oregon Canyon population, although there are no records of plantings by Oregon. A genetic survey of this population is planned and will be conducted when funding becomes available.

Nevada reported that several of its Quinn River populations became extinct during the recent drought. Oregon's populations were depressed, but persisted.

This group is depressed by poor habitat conditions including dewatering, passage barriers, modification of stream channels, and loss of riparian vegetation caused primarily by historical cattle grazing and water diversions. Fifty percent to 80% of the habitat occupied by these populations is owned by Bureau of Land Management and is currently under restrictive grazing allotment management plans that should improve riparian cover and channel structure.

There are currently no plans to reconnect the isolated streams to the Quinn River because of the presence of rainbow trout in the lower Quinn basin. Therefore the fragmented conditions in this group will continue.

Actions Under Way

The U.S. Fish and Wildlife Service has written a draft recovery plan for Lahontan cutthroat. A final recovery plan was completed in 1994 and is awaiting adoption by the Portland Regional office of the USFWS. ODFW has contributed information to the recovery planning effort. ODFW recently completed the Lahontan Basin Fish Management Plan, adopted by the Oregon Fish and Wildlife Commission in December 1993. Population and habitat surveys were conducted throughout the subspecies range between 1990 and 1992. Further population surveys in Willow and Whitehorse creeks were completed in 1994. The department has also cooperated with the U.S. Fish and Wildlife Service and the Bureau of Land Management in advocating changes in grazing practices on federal lands that would improve riparian vegetation and channel structure. ODFW is also monitoring stream flows and pursuing instream water rights to improve flows. Angling in streams is permitted only in Trout, McDermitt, and Oregon Canyon creeks.

WEST SLOPE CUTTHROAT TROUT (*Oncorhynchus clarki lewisi*)

Subspecies Overview

Westslope cutthroat trout is a subspecies of cutthroat trout common to the west slope of the Rocky Mountains of Idaho, Alberta, and British Columbia. It is also found in the upper Missouri River Basin of Montana and Wyoming. Sporadic, disjunct populations are present in eastern Oregon and Washington. The known distribution in Oregon is limited to the John Day Basin. The origin of these disjunct groups is unknown. One possible theory is that the subspecies may have been carried to the Oregon and Washington locations during the Bretz floods, 10,000 to 12,000 years ago. Westslope cutthroat occupied Lake Missoula, the origin of the catastrophic floods, and the disjunct populations are scattered along the route of the floods (Allen et al. 1986).

The westslope cutthroat trout practices one of three lifestyles over its range: adfluvial -- migrating between lakes and streams; fluvial -- migrating between small tributaries and main rivers; or resident -- remaining a non-migratory resident of tributaries. In contrast to other subspecies of cutthroat trout, the westslope subspecies does not appear to be highly predaceous on other fish. Behnke (1992) attributes the weak development of piscivory by westslope cutthroat trout to its evolution with two fish-eating species, the bull trout and northern squawfish. By specializing as invertebrate feeders, westslope cutthroat trout have avoided direct feeding competition with these other species.

The introduction of non-native fishes such as rainbow, brook, and brown trout, kokanee and lake whitefish as well as environmental impacts from logging, grazing, agriculture and dam construction has caused a dramatic decline in the distribution and abundance of westslope cutthroat throughout its range. In addition, this subspecies is vulnerable to exploitation by anglers, but conversely can rapidly respond to protective angling regulations with dramatic increases in abundance and survival of older age fish.

Table 9. Westslope cutthroat (*Oncorhynchus clarki lewisi*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene Conservation Groups have not been described for this subspecies.	**John Day River ***		
	1. North Fork John Day River *		
	a. Desolation Creek *		
	i. S.Fk Desolation Creek		**Resident**
	b. Granite Creek *		
	i. Lake Creek		**Resident**
	2. Fields Creek		**Resident**
	a. Buck Cabin Creek		**Resident**
	3. McClellan Creek		**Resident**

** Populations are present only in the tributaries of this water body as listed below it.*
*** Season of adult spawning migration.*

Table 9. Westslope cutthroat (*Oncorhynchus clarki lewisi*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene Conservation Groups have not been described for this subspecies.	4. Beech Creek *		
	a. Cottonwood Creek		**Resident**
	5. Canyon Creek		**Resident**
	a. Berry Creek		**Resident**
	b. E.Fk Canyon Creek		**Resident**
	c. Middle Fk. Canyon Creek		**Resident**
	6. Little Pine Creek		**Resident**
	7. Dog Creek		**Resident**
	8. Pine Creek		**Resident**
	9. Indian Creek		**Resident**
	a. Little Indian Creek		**Resident**
	b. Overholt Creek		**Resident**
	10. Squaw Creek		**Resident**
	11. Strawberry Creek		**Resident**
	12. Reynolds Creek		**Resident**
	13. Upper Mainstem		**Resident**
	14. Derdorff Creek		**Resident**
	15. Rail Creek		**Resident**
	16. Roberts Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Based on stream surveys conducted by the Aquatic Inventory Project during 1990 and 1992, 23 breeding populations have been identified. All of Oregon's populations currently have a resident life history. Basin-wide summer distribution is now only 41% of the suspected historical habitat (73 of 179 miles). The Middle Fork and most of the North Fork John Day drainages are the principal areas where westslope cutthroat are now absent, although there is no historical evidence to indicate that Westslope cutthroat were ever present in the Middle Fork Subbasin.

Habitat modifications in the John Day River have primarily included changes in channel structure, loss of riparian vegetation, dewatering, and changes in the hydrographs in the mainstem and major tributaries. These impacts are principally the result of agricultural development, irrigation diversions, and loss of riparian vegetation from cattle grazing and timber harvest. At this time the John Day populations are isolated from each other at least during summer months due to warm water and low stream flows.

The John Day cutthroat trout are now considered to be resident populations, but may have also had a fluvial life history historically, as evidenced by catches of downstream migrant juveniles at irrigation diversion bypass traps. Trap counts of cutthroat trout at these diversions, if representative of population abundance, indicate a serious decline in abundance over the past 20 years. This decline would not be unexpected since there has been an increased use of these streams for grazing, irrigation, and timber harvest.

Most populations are located on private land and there is limited public access to these fish. General statewide angling regulations for streams (five fish larger than 6 inches per day) apply for John Day cutthroat trout, but due to the relatively small size of the fish and poor public access, angler harvest is not considered a limiting factor at this time.

There is currently no stocking of hatchery rainbow or cutthroat trout into areas that have access to cutthroat populations in the upper mainstream John Day and nearby tributaries. However, naturalized populations of brook trout are present in the upper mainstream John Day and Strawberry Creek, and may occupy habitat historically used by cutthroat. Hatchery cutthroat trout, using a broodstock developed from the Lahontan subspecies, are periodically released into Olive, Lost, and Jump off Joe lakes and may pose some risk to westslope cutthroat trout in the South Fork Desolation and Lake creeks.

Based on 1990 and 1992 stream surveys, almost all John Day cutthroat trout populations have more than 300 spawners, although actual population sizes are unknown.

Actions Under Way

Stream surveys documenting westslope cutthroat trout distribution and abundance in the John Day Basin were conducted in 1990 and 1993. Downstream migrant cutthroat trout are monitored annually at irrigation diversion bypass traps. An angler education program using fish identification cards is currently in development with the Malheur National Forest.

COASTAL CUTTHROAT TROUT (*Oncorhynchus clarki clarki*)

Subspecies Overview

The coastal cutthroat trout is distinguished from all other *O. clarki* by the dense pattern of spots across the body, by differences in life history, by biochemical differences, and by the number of chromosomes present. The subspecies includes both anadromous and resident forms. Searun individuals often are silvery in color, and the characteristic spotting may be masked. Coastal cutthroat trout that remain in fresh water throughout their life usually are darker than anadromous individuals and may have a "coppery" coloration. Searun cutthroat trout in Oregon rarely exceed a length of 20 inches or a weight of four pounds.

Coastal cutthroat trout are distributed along the Pacific Coast from northern California's Eel River to Prince William Sound, Alaska. In Oregon and Washington, coastal cutthroat trout extend to the crest of the Cascade Mountains and in British Columbia and Alaska to the crest of the Coast Range. Their distribution rarely extends inland more than 100 miles. This geographical pattern corresponds closely to the distribution of the coastal rain forest belt in the Pacific Northwest. In Oregon, coastal cutthroat trout are distributed in almost all rivers from the Winchuck River north into the Columbia system. In the Columbia Basin, coastal cutthroat trout reside in all Oregon tributaries east to Fifteenmile Creek, including the Willamette basin to its headwaters.

Coastal cutthroat trout exhibit diverse patterns in life history and migration behaviors. Populations of coastal cutthroat trout show marked differences in their preferred rearing environments (river, lake, estuary, or ocean); size and age at migration; timing of migrations; age at maturity; and frequency of repeat spawning. Four major life history patterns have been described for the subspecies:

1. Anadromous or searun populations migrate to the ocean (or estuary) for usually less than a year before returning to fresh water. Anadromous cutthroat trout either spawn during the first winter or spring after their return or undergo a second ocean migration before maturing and spawning in fresh water. Anadromous cutthroat are present in most coastal rivers.

2. Fluvial populations are fish that undergo in-river migrations between small spawning tributaries and main river sections downstream, similar to the ocean migrations of searun cutthroat trout. This pattern is common in larger river systems such as the Willamette, Rogue, Umpqua, and Nehalem.

3. Adfluvial populations migrate between spawning tributaries and lakes or reservoirs. Migrations may involve inlet or outlet streams. Juveniles may spend from one to three years in tributaries before migrating into the lake. Adfluvial populations occupy select lake systems in the Cascade Mountains and along the coast.

4. Nonmigratory (resident) forms of coastal cutthroat trout occur in small headwater streams and exhibit little instream movement. They generally are smaller, become sexually mature at a younger age, and may have a shorter life span than many migratory cutthroat trout populations. Resident cutthroat trout populations are often isolated and restricted above waterfall barriers, but may also coexist with other life history types.

Cutthroat trout populations with different life history patterns may be sympatric in the same river. The level of genetic exchange between cutthroat trout of different life history types, for example, between searun and resident forms, is poorly understood. A single population may be polymorphic for several life histories; or the life histories may form separate breeding populations through assortative mating, but still exchange low levels of gene flow; or the life history types may form completely reproductively isolated gene pools. Extensive genetic and life history surveys will be needed to clarify these relationships.

Coastal cutthroat trout tend to spawn in very small (first and second order) tributaries. Young fry move into channel margin and backwater habitats during the first several weeks. During the winter, juvenile cutthroat trout use low velocity pools and side channels with complex habitat created by large wood.

Habitat use by juvenile cutthroat trout is affected by interactions with other salmonids although the extent of the affect is poorly understood. It is known, however, that while juveniles prefer to rear in pools, young-of-the-year cutthroat trout may be displaced into low gradient riffles, particularly by the more dominant coho salmon. The selection of small tributaries for spawning and early rearing may help to reduce competitive interactions between cutthroat trout and steelhead trout or coho salmon. Differential selection of spawning habitat also may help to minimize hybridization with rainbow/ steelhead.

Very little is known about the habitat requirements and preferences of searun cutthroat trout in estuarine environments. Juvenile and adult cutthroat trout spend considerable time in tidal rivers and low-gradient estuarine sloughs and tributaries during spawning and feeding migrations. Large wood likely is an important habitat component for cutthroat trout during their estuarine residence. Cutthroat appear to remain near shore, probably near the mouth of their natal river, during their marine occupancy.

We do not have consistent indicators of trends in abundance for most populations of searun cutthroat trout. However, anecdotal information, creel surveys, and fish counts at dams have raised concerns that anadromous populations in Oregon may be experiencing a widespread decline. Because populations in Oregon occur near the extreme southern edge of the range of the subspecies, they may be particularly vulnerable to climatic change, habitat loss, or the cumulative effects of these and other disturbances. Critical cutthroat trout habitat is often overlooked and severely impacted by logging, grazing, road building, and land development activities that impact water quality and stream flows, and decrease habitat complexity. Life history characteristics make anadromous coastal cutthroat trout sensitive to disruptions in over-wintering freshwater habitat as well as in estuarine and near-shore ocean ecosystems.

Systematic abundance estimates also are not available for most resident, fluvial or adfluvial cutthroat populations. However, anecdotal observations indicate that they remain relatively abundant, even in streams where the abundance of searun fish has sharply declined. This pattern suggests that anadromous populations are most impacted by problems that are occurring along migration corridors, in estuaries, or in near-shore marine environments.

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	**Necanicum River**	**Summer/Fall**	**Resident**
	1. Beerman Cr. above 15 falls @ RM 2		**Resident**
	2. S.Fk Necanicum River above numerous falls		**Resident**
	a. Brandis Cr. above 8' falls @ RM 0.5		**Resident**
	3. Lindsley Cr. above 15' falls @ RM 0.25		**Resident**
	4. Grindy Creek above 50' falls		**Resident**
	Indian Creek	**Summer/Fall**	**Resident**
	Canyon Creek	**Summer/Fall**	**Resident**
	1. Canyon Cr. above 15' falls @ RM 0.25		**Resident**
	Ecola (Elk) Creek	**Summer/Fall**	
	1. W.Fk Ecola Cr. above 12' falls		**Resident**
	2. N.Fk Ecola Cr. above 10' falls and 15' falls		**Resident**
	Fall Creek		**Resident**
	Asbury Creek	**Summer/Fall**	**Resident**
	Arch Cape Creek below falls	**Summer/Fall**	
	1. Arch Cape Cr. above falls		**Resident**
	Short Sands Creek	**Summer/Fall**	**Resident**
	Nehalem River *		
	1. Lower Nehalem (below Hwy 26 Bridge)	**Summer/Fall**	
	2. Cronin Creek *		
	a. S.Fk Cronin Cr. above 8' falls		**Resident**
	3. Spruce Run Cr. above 30' cascade		**Resident**
	4. Lost Lake Cr. above 30' falls		**Resident**
	5. Humbug Creek *		
	a. W.Fk Humbug Cr. above 8' falls		**Resident**
	6. Quartz Creek above falls		**Resident**
	7. Lost Cr. above 25' falls		**Resident**
	8. N.Fk Nehalem River - falls laddered	**Summer/Fall**	
	9. Unnamed Trib above 40' falls		**Resident**
	a. Fall Cr. above 35' falls		**Resident**

***** *Populations are present only in the tributaries of this water body as listed below it.*
****** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene conservation groups have not been described for this subspecies.	i. W.Fk Fall Cr. above 75' falls		**Resident**
	10. Salmonberry River - upper river above falls		**Resident**
	a. N.Fk Salmonberry River above 10' falls		**Resident**
	b. Wolf Cr. above 13' falls		**Resident**
	c. Pennoyer Cr. above falls		**Resident**
	11. Upper Nehalem (above Hwy 26 Bridge)	**Summer/Fall**	
	a. Big Rackheap Cr. above 20' falls		**Resident**
	b. Grassy Lake Cr. above 40' falls		**Resident**
	c. Grassy Lake		**Adfluvial**
	d. Cougar Cr. above 10' falls		**Resident**
	e. Trail Cr. above 10' falls		**Resident**
	f. Umbrella falls Cr. above 15' falls		**Resident**
	g. Soapstone Creek		
	i. Buchanan Cr. above 20' falls		**Resident**
	12. Fishhawk Cr. above 50' falls		**Resident**
	a. Little Fishhawk Cr. above 50' falls		**Resident**
	b. Fishhawk Cr. above 12' and 20' falls		**Resident**
	Spring Creek	**Summer/Fall**	
	Rock Creek	**Summer/Fall**	**Fluvial**
	Watseco Creek	**Summer/Fall**	**Resident**
	Whitney Brook	**Summer/Fall**	**Resident**
	Lagler Creek		**Resident**
	Tillamook Bay *		
	1. Hobson Creek	**Summer/Fall**	**Resident**
	2. Lagler Creek	**Summer/Fall**	**Resident**
	3. Miami River	**Summer/Fall**	
	a. Moss Creek	**Summer/Fall**	**Resident**
	b. Minich Creek	**Summer/Fall**	**Resident**
	4. Electric Creek	**Summer/Fall**	**Resident**
	5. Larson Creek	**Summer/Fall**	**Resident**
	6. Patterson Creek	**Summer/Fall**	**Resident**
	7. Jacoby Creek	**Summer/Fall**	**Resident**
	8. Doty Creek	**Summer/Fall**	**Resident**
	9. Vaughn Creek above Barrier		**Resident**
	10. Kilchis River	**Summer/Fall**	**Resident**
	a. S.Fk Kilchis River	**Summer/Fall**	**Resident**
	11. Wilson River	**Summer/Fall**	**Resident**
	a. Wilson River above RM 35 (landslide)		**Resident**
	b. Hughey Creek		**Resident**
	c. Ming Creek		**Resident**
	d. Deadman Creek		**Resident**
	e. Jack Creek		**Resident**
	f. Smith Creek		**Resident**
	g. Slide Creek		**Resident**
	h. Fern Creek		**Resident**
	i. Zigzag Creek		**Resident**
	j. Kansas Creek		**Resident**
	k. Devil's Lake Fork	**Summer/Fall**	**Resident**
	12. Trask River	**Summer/Fall**	**Resident**
	a. Green Creek	**Summer/Fall**	**Resident**
	b. Gold Creek		**Resident**
	i. N.Fk Gold Creek		**Resident**
	c. Cedar Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	d. Panther Creek		**Resident**
	e. Hatchery Creek		**Resident**
	f. Blue Ridge Creek		**Resident**
	g. N.Fk Trask River	**Summer/Fall**	**Resident**
	i. Bark Shanty Creek	**Summer/Fall**	**Resident**
	h. Mid. Fork - N.Fk Trask above Barney Res.		**Resident**
	i. Elkhorn Creek		**Resident**
	A. Cruiser Creek		**Resident**
	13. Tillamook River	**Summer/Fall**	**Resident**
	a. Bewley Creek	**Summer/Fall**	**Resident**
	b. Fawcett Creek	**Summer/Fall**	**Resident**
	c. Munson Cr. above falls		**Resident**
	Short Creek		**Resident**
	Netarts Bay *		
	1. Yager Creek	**Summer/Fall**	**Resident**
	2. Jackson Creek	**Summer/Fall**	**Resident**
	3. Whiskey Creek	**Summer/Fall**	**Resident**
	Sand Creek	**Summer/Fall**	**Resident**
	Royer Creek		**Resident**
	Nestucca Bay *		
	1. Nestucca River below McGuire Dam	**Summer/Fall**	**Resident**
	2. Nestucca River above McGuire Dam		**Resident**
	a. Horn Creek	**Summer/Fall**	**Resident**
	b. Three River above water intake in upper rvr.		**Resident**
	i. Cedar Creek		**Resident**
	ii. Alder Creek	**Summer/Fall**	**Resident**
	c. Towne Creek		**Resident**
	d. Saling Creek		**Resident**
	e. Alder Creek		**Resident**
	f. Clarence Cr. above falls		**Resident**
	g. Mina Cr. barrier @ RM 0.25		**Resident**
	h. Elk Cr. above falls		**Resident**
	i. Tributary B.		**Resident**
	ii. Tucca Creek		**Resident**
	i. Little Nestucca River	**Summer/Fall**	**Resident**
	3. Daley (Bee) Lake Creek	**Summer**	**Resident**
	Neskowin Creek	**Summer/Fall**	**Resident**
	Salmon River	**Summer/Fall**	
	1. Treat Creek		**Resident**
	Rock Creek (Devil's Lake)	**Summer/Fall**	**Adfluvial**
	Siletz Bay *		
	1. Siletz River *		
	a. Siletz River below Siletz Falls	**Summer/Fall**	
	b. Siletz River above Siletz Falls		**Resident**
	i. Euchre Creek		**Resident**
	ii. Dewey Creek		**Resident**
	iii. Rock Creek		**Resident**
	A. Big Rock Creek		**Resident**
	B. Little Rock Creek		**Resident**
	iv. S.Fk Siletz River		**Resident**
	2. Drift Creek	**Summer/Fall**	
	a. Sampson Creek		**Resident**
	3. Schooner Creek	**Summer/Fall**	

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	**Fogarty Creek**	**Summer/Fall**	
	Depoe Creek	**Summer/Fall**	
	Spencer Creek	**Summer/Fall**	
	Big Creek	**Summer/Fall**	
	Yaquina Bay *		
	1. Yaquina River	**Summer/Fall**	**Resident**
	a. Big Elk Creek *		
	i. Bear Creek		**Resident**
	b. Little Yaquina River		**Resident**
	c. Buttermilk Lake		**Resident**
	Thiel Creek	**Summer/Fall**	**Adfluvial**
	Beaver Creek	**Summer/Fall**	
	Alsea Bay *		
	1. Alsea River	**Summer/Fall**	
	a. Five Rivers		**Fluvial**
	b. Fall Creek		**Fluvial**
	c. N.Fk Alsea River		
	i. Parker Creek		**Resident**
	ii. Racks Creek		**Resident**
	iii. Klickitat Cr. (plus lake and Lake Cr.)		**Resident**
	d. S.Fk Alsea River		**Resident**
	2. Peak Creek		**Resident**
	3. Drift Creek	**Summer/Fall**	
	a. Cape Horn Creek		
	i. Gopher Creek		**Resident**
	b. Slide Lake		**Adfluvial**
	Big Creek		**Resident**
	Yachats River	**Summer/Fall**	
	Cape Creek	**Summer/Fall**	**Resident**
	Gwynn Creek		**Resident**
	Cummins Creek	**Summer/Fall**	
	Bob Creek	**Summer/Fall**	**Resident**
	Tenmile Creek	**Summer/Fall**	**Resident**
	Rock Creek	**Summer/Fall**	**Resident**
	Big Creek	**Summer/Fall**	**Resident**
	China Creek	**Summer/Fall**	**Resident**
	Cape Creek	**Summer/Fall**	
	Berry Creek/Lily Lake		**Adfluvial**
	Sutton Creek	**Summer/Fall**	**Adfluvial**
	Siuslaw Bay *		
	1. N.Fk Siuslaw River	**Summer/Fall**	
	a. Cataract Creek		**Resident**
	b. Wilhelm Creek (laddered falls)		**Resident**
	2. Siuslaw River	**Summer/Fall**	
	a. Sweet Creek	**Summer/Fall**	**Resident**
	i. Fall Creek		**Resident**
	ii. Beaver Creek		**Resident**
	b. Berkshire Creek		**Resident**
	c. Lake Creek	**Summer/Fall**	**Resident**
	i. Greenleaf Creek	**Summer/Fall**	**Resident**
	ii. Triangle Lake trib. (falls, recently laddered)		**Resident**
	d. Whittaker Creek (falls @ RM 3.9)		**Resident**
	e. Trail Creek		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies	3. Farman Creek (dam RM 3.0, 1970)		**Resident**
	Siltcoos River/Siltcoos Lake	**Summer/Fall**	**Adfluvial**
	1. Woahink Creek *		
	a. Unnamed tributary (above dam)		**Resident**
	Tahkenitch Creek/Tahkenitch Lake	**Summer/Fall**	**Adfluvial**
	Threemile Creek		**Resident**
	Umpqua Estuary *		
	1. Smith River	**Summer/Fall**	**Resident**
	a. N.Fk Smith R. (falls in headwater area)		**Resident**
	b. Wasson Creek (falls in headwater area)		**Resident**
	c. Scare Creek (falls in headwater area)		**Resident**
	2. Umpqua River *		
	a. Basin to N. Fork	**Summer/Fall**	
	b. Mill Creek *		
	i. Camp Creek		**Resident**
	ii. Big Salamander Cr.		**Resident**
	iii. Lake Creek/Loon Lake		**Adfluv./Resid.**
	c. Waggoner Creek		**Resident**
	d. North Umpqua River	**Summer/Fall**	**Fluvial/Resid.**
	i. Little River	**Summer/Fall**	**Resid./Fluvial**
	A. Fall Creek		**Resident**
	ii. Rock Creek		**Fluvial/Resid.**
	iii. Steamboat Creek		**Fluvial/Resid.**
	A. Steelhead Creek		**Resident**
	B. Long's Creek		**Resident**
	iv. Copeland Creek		**Resident**
	v. Boulder Creek		**Resident**
	e. South Umpqua River	**Summer/Fall**	**Resident**
	i. Lookingglass Creek		**Resident**
	A. Olalla Creek		**Resident**
	a. Thompson Creek		**Resident**
	f. South Myrtle Creek		**Resident**
	i. Louis Creek		**Resident**
	g. Cow Creek	**Summer/Fall**	**Resident**
	i. Russel Creek		**Resident**
	ii. Table Creek		**Resident**
	iii. Little Dads Creek		**Resident**
	iv. Cattle Creek		**Resident**
	v. Union Creek		**Resident**
	vi. W.Fk Cow Creek	**Summer/Fall**	**Resident**
	A. Bobby Creek		**Resident**
	B. Upper W.Fk Cow Creek		**Resident**
	vii. Whitehorse Creek		**Resident**
	h. Coffee Creek		**Resident**
	i. Deadman Creek		**Resident**
	Tenmile Creek/Tenmile Lake	**Summer/Fall**	**Adfluvial**
	Coos Bay *		
	1. North Slough	**Summer/Fall**	**Resident**
	2. Palouse Slough	**Summer/Fall**	**Resident**
	3. Kentucky Slough	**Summer/Fall**	**Resident**
	a. Kentucky Creek	**Summer/Fall**	**Resident**
	i. Mettman Creek	**Summer/Fall**	**Resident**
	4. Coos River	**Summer/Fall**	

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*** Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene conservation groups have not been described for this subspecies.	a. S.Fk Coos River	**Summer/Fall**	
	i. Elk Creek		**Resident**
	ii. Fall Creek		**Resident**
	iii. Tioga Creek	**Summer/Fall**	**Resident**
	5. Millicoma River	**Summer/Fall**	
	a. E.Fk Millicoma River	**Summer/Fall**	**Resident**
	i. Glenn Creek	**Summer/Fall**	**Resident**
	ii. Matson Creek	**Summer/Fall**	**Resident**
	Miner Creek	**Summer/Fall**	**Resident**
	Big Creek	**Summer/Fall**	**Resident**
	Twomile Creek	**Summer/Fall**	**Resident**
	Whiskey Run Creek	**Summer/Fall**	**Resident**
	Cut Creek	**Summer/Fall**	**Resident**
	Coquille Bay *		
	1. Lower Coquille River *		
	a. Ferry Creek	**Summer/Fall**	**Resident**
	b. Fahy Creek		**Resident**
	2. N.Fk Coquille River	**Summer/Fall**	**Resident**
	a. E.Fk Coquille River	**Summer/Fall**	**Resident**
	i. Camas Creek		**Resident**
	3. South Fork Coquille River	**Summer/Fall**	**Resident**
	a. Yellow Creek		**Resident**
	b. Baker Creek		**Resident**
	4. Middle Fork Coquille River	**Summer/Fall**	**Resident**
	a. Endicott Creek		**Resident**
	b. Myrtle Creek		**Resident**
	c. Slide Creek		**Resident**
	d. Twelvemile Creek		**Resident**
	i. Bridge Creek above falls		**Resident**
	Johnson Creek	**Summer/Fall**	**Resident**
	Crooked Creek	**Summer/Fall**	**Resident**
	China Creek	**Summer/Fall**	**Resident**
	Twomile Creek	**Summer/Fall**	**Resident**
	Floras Creek/Floras Lake	**Summer/Fall**	**Adfluvial**
	1. Willow Creek		**Resident**
	Sixes River	**Summer/Fall**	**Resident**
	1. Crystal Creek		**Resident**
	2. Beaver Creek		**Resident**
	3. Edson Creek		**Resident**
	4. Elephant Rock Creek		**Resident**
	5. S.Fk Sixes River		**Resident**
	Elk River	**Summer/Fall**	
	1. Indian Creek		**Resident**
	2. Rock Creek		**Resident**
	3. Anvil Creek		**Resident**
	4. Bald Mountain Creek		**Resident**
	a. Bear Creek		**Resident**
	b. S.Fk Bald Mountain Cr.		**Resident**
	5. Slate Creek		**Resident**
	6. Purple Mountain Creek		**Resident**
	7. Red Cedar Creek		**Resident**
	8. Sunshine Creek		**Resident**
	9. Panther Creek		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	a. E.Fk Panther Creek		**Resident**
	b. W.Fk Panther Creek		**Resident**
	10. Butter Creek		**Resident**
	11. Milbury Creek		**Resident**
	12. Blackberry Creek		**Resident**
	13. N.Fk Elk River		**Resident**
	14. S.Fk Elk River		**Resident**
	Hubbard Creek	**Summer/Fall**	**Resident**
	Brush Creek	**Summer/Fall**	**Resident**
	1. Bear Trap Creek		**Resident**
	Mussel Creek	**Summer/Fall**	**Resident**
	1. Myrtle Creek		**Resident**
	Euchre Creek	**Summer/Fall**	**Resident**
	1. Cedar Creek		**Resident**
	a. Rock Creek		**Resident**
	2. Boulder Creek		**Resident**
	3. Crew Canyon Creek		**Resident**
	Rogue River *		
	1. Rogue Basin, mouth to Illinois River	**Summer/Fall**	
	2. Indian Creek		**Resident**
	3. Squaw Creek		**Resident**
	4. Kimbal Creek		**Resident**
	5. Lobster Creek		**Resident**
	a. S.Fk Lobster Creek		**Resident**
	6. Bradford Creek		**Resident**
	7. Wake Up Rilea Creek		**Resident**
	8. Nail Keg Creek		**Resident**
	9. Painted Rock Creek		**Resident**
	10. Illinois River	**Summer/Fall**	**Fluvial**
	a. Silver Creek *		
	i. N.Fk Silver Creek, above falls		**Resident**
	ii. S.Fk Silver Creek above falls		**Resident**
	b. Fall Creek		**Resident**
	c. E.Fk Illinois River		**Resident/Fluv.**
	i. Sucker Creek		**Resident/Fluv.**
	A. Cave Creek above falls		**Resident**
	ii. Althouse Creek above falls		**Resident**
	11. Rogue Basin, Illinois to Gold Ray Dam	**Summer/Fall**	**Fluvial**
	12. Shasta Costa Creek		**Resident**
	13. Watson Creek		**Resident**
	14. Flora Dell Creek		**Resident**
	15. Blossom Bar Creek		**Resident**
	16. Stair Creek		**Resident**
	17. Grave Creek *		
	a. Poorman Cr. above falls		**Resident**
	b. Tom East Creek		**Resident**
	18. Taylor Creek *		
	a. Burned Timber Cr. above falls		**Resident**
	19. Jumpoff Joe Cr. above falls		**Resident**
	20. Applegate River below Applegate Dam		**Fluvial**
	a. Slagle Cr. above dam		**Resident**
	b. Forest Cr. above dam		**Resident**
	21. Applegate River above Applegate Dam		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene conservation groups have not been described for this subspecies.	a. Squaw Cr. above Squaw Lake Dam		**Resident**
	b. Carberry Creek *		
	i. Steve's Fork Carberry Cr.		**Resident**
	ii. Sturgis Fork Carberry Cr.		**Resident**
	c. Elliot Creek		**Resident**
	22. Jones Creek Diversion		**Resident**
	23. Evans Creek *		
	a. Fielder Cr. above falls		**Resident**
	b. Bear Branch above dam		**Resident**
	c. Pleasant Creek *		
	i. Ditch Cr. above dam		**Resident**
	d. May Cr. above dam		**Resident**
	24. Sardine Creek *		
	a. Right Fk. Sardine Cr. above falls		**Resident**
	25. Rogue Basin, Gold Ray Dam to Lost Cr. Dam		**Fluvial**
	26. Bear Creek *		
	a. Willow Creek		**Resident**
	b. Larsen Creek		**Resident**
	c. Ashland Creek		**Resident**
	d. Emigrant Cr. above Emigrant Reservoir		**Resident**
	e. Walker Cr. above Culvert		**Resident**
	27. Little Butte Creek *		
	a. Antelope Creek		**Resident**
	i. Dry Creek		**Resident**
	ii. Yankee Creek		**Resident**
	b. S.Fk Little Butte Creek *		
	i. Lost Creek		**Resident**
	28. Elk Creek		**Fluvial**
	a. Dodes Creek		**Resident**
	29. Big Butte Creek		**Resident**
	a. Clark Cr. above falls		**Resident**
	b. McNeil Cr. above falls		**Resident**
	c. Dog Cr. above falls		**Resident**
	d. S.Fk Big Butte Cr. above falls		**Resident**
	e. Skeeter Creek		**Resident**
	30. Rogue Basin above Lost Cr. Dam		**Resident**
	31. S.Fk Rogue River		**Resident**
	a. Beaverdam Cr. above falls		**Resident**
	b. Middle Fk. Rogue River		**Resident**
	i. Red Blanket Cr. above falls		**Resident**
	ii. Halifax Cr. above falls		**Resident**
	iii. Honeymook Cr. above falls		**Resident**
	c. Buck Cr. above falls		**Resident**
	32. N.Fk Rogue River above falls		**Resident**
	a. Barr Cr. above falls		**Resident**
	b. Mill Cr. above falls		**Resident**
	c. National Creek		**Resident**
	Hunter Creek	**Summer/Fall**	
	1. Big S.Fk Hunter Creek		**Resident**
	2. N.Fk Hunter Creek		**Resident**
	3. Upper Left Fk. Hunter Cr.		**Resident**
	Pistol River	**Summer/Fall**	
	1. E.Fk Pistol River		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	**Burnt Hill Creek**		**Resident**
	Thomas Creek		**Resident**
	Lone Ranch Creek		**Resident**
	Shy Creek	**Summer/Fall**	
	Harris Creek	**Summer/Fall**	
	Chetco River	**Summer/Fall**	
	1. Ferry Creek		**Resident**
	2. Joe Hall Creek		**Resident**
	3. Jack Creek		**Resident**
	a. Hamilton Creek		**Resident**
	b. Jordan Creek		**Resident**
	4. N.Fk Chetco River		**Resident**
	5. Bravo Creek		**Resident**
	a. Ransom Creek		**Resident**
	6. Big Emily Creek		**Resident**
	7. Elk Creek		**Resident**
	8. Nook Creek		**Resident**
	9. Big Redwood Creek		**Resident**
	10. Second Creek		**Resident**
	11. S.Fk Chetco River		**Resident**
	a. Quail Prairie Creek		**Resident**
	i. N.Fk Quail Prairie Creek		**Resident**
	ii. Quail Prairie Creek, Trib. A		**Resident**
	iii. Quail Prairie Creek, Trib. B		**Resident**
	b. Basin Creek		**Resident**
	c. S.Fk Chetco River, Trib. A		**Resident**
	d. S.Fk Chetco River, Trib. B		**Resident**
	e. S.Fk Chetco River, Trib. D		**Resident**
	f. S.Fk Chetco River, Trib. E		**Resident**
	g. S.Fk Chetco River, Trib. F		**Resident**
	h. West Coon Creek		**Resident**
	i. Red Mountain Creek		**Resident**
	i. Red Mountain Creek, Trib. A		**Resident**
	j. Coon Creek		**Resident**
	12. Panther Creek		**Resident**
	13. Eagle Creek *		
	a. Mineral Hill Fk. Eagle Cr.		**Resident**
	b. N.Fk Eagle Creek		**Resident**
	14. Mislatnah Creek		**Resident**
	15. Boulder Creek		**Resident**
	a. Boulder Creek, Trib. C		**Resident**
	b. Boulder Creek, Trib. D		**Resident**
	i. Boulder Creek, Trib. D, Trib. D1		**Resident**
	16. Tincup Creek		**Resident**
	a. Fall Creek		**Resident**
	b. Darling Creek		**Resident**
	c. Tincup Creek, Trib. A		**Resident**
	d. Heather Creek		**Resident**
	e. Lucky Creek		**Resident**
	17. Box Canyon Creek		
	a. Box Canyon Creek, Trib. A		**Resident**
	18. Sluice Creek		**Resident**
	19. Slide Creek		

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Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	a. Miller Creek		**Resident**
	20. Carter Creek		**Resident**
	21. Little Chetco River		**Resident**
	a. Henry Creek		**Resident**
	b. Hawk Creek		**Resident**
	Winchuck River	**Summer/Fall**	**Resident**
	1. Wheeler Creek		**Resident**
	Smith River (Calif. River)	**Summer/Fall**	**Resident**
	COLUMBIA RIVER		
	Youngs Bay *		
	1. Skipanon River	**Summer/Fall**	**Resident**
	2. Lewis & Clark River *		
	a. Lewis & Clark River below falls	**Summer/Fall**	
	i. Hortill Cr. above 50' falls		**Resident**
	b. Lewis & Clark R. above falls in headwaters		**Resident**
	3. Youngs River *		
	a. Youngs River below falls	**Summer/Fall**	
	b. Youngs River above falls		**Resident**
	i. Moosmoos Cr. above 30' cascade		**Resident**
	4. Klaskanine River	**Summer/Fall**	
	a. Walluski River	**Summer/Fall**	
	b. S.Fk Klaskanie R. above falls at 6 mi.		**Resident**
	c. S.Fk Klaskanie R. above falls at 8.5 mi.		**Resident**
	d. N.Fk Klaskanie R. above hatchery barrier		**Resident**
	e. N.Fk-N.Fk Klaskanie R. " " "		**Resident**
	Mill Creek	**Summer/Fall**	
	John Day River	**Summer/Fall**	
	Marys Creek	**Summer/Fall**	
	Bear Creek	**Summer/Fall**	
	1. Bear Cr. Res. - Artificial Impoundment		**Resident**
	2. Middle Lake - Artificial Impoundment		**Resident**
	3. Wickiup Lake - Artificial Impoundment		**Resident**
	Ferris Creek	**Summer/Fall**	
	1. Hillcrest Cr. above 6' falls		**Resident**
	Big Creek		**Resident**
	1. Little Cr. above 15' falls at RM 3.5		**Resident**
	2. Pigpen Cr. above 20' falls at RM 1.5		**Resident**
	Gnat Creek *		
	1. Gnat Cr. below falls	**Summer/Fall**	
	2. Gnat Cr. above falls near Hatchery		**Resident**
	3. Gnat Cr. above falls above McNary Cr.		**Resident**
	Hunt Creek *		
	1. Hunt Cr. below falls	**Summer/Fall**	
	2. Hunt Cr. above falls at RM 0.25		**Resident**
	Plympton Creek *		
	1. Plympton Cr. below falls	**Summer/Fall**	
	2. Plympton Cr. above series of falls		**Resident**
	a. Lost Lake		**Resident**
	Clatskanie River	**Summer/Fall**	
	1. Fall Cr. above falls at RM 0.25		**Resident**
	2. Scout Lake		**Resident**
	3. Beaver Creek *		
	a. Beaver Cr. below falls	**Summer/Fall**	

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Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	b. Beaver Cr. above falls at RM 5		**Resident**
	c. Beaver Cr. above falls at RM 6.5		**Resident**
	d. Beaver Cr. above falls at RM 14		**Resident**
	e. Beaver Cr. above falls at RM 14.8		**Resident**
	Green Creek *		
	1. Green Cr. below falls	**Summer/Fall**	
	2. Green Cr. above 10' falls at RM 0.25		**Resident**
	Nice Creek	**Summer/Fall**	
	Fox Creek	**Summer/Fall**	
	Goble Creek	**Summer/Fall**	
	Tide Creek	**Summer/Fall**	
	Milton Creek *		
	1. Milton Cr. below natural barrier	**Summer/Fall**	
	2. Milton Cr. above natural barrier		**Resident**
	a. Salmon Cr. above natural barrier		**Resident**
	McBride Creek	**Summer/Fall**	
	Scappoose Creek *		
	1. Scappoose Cr. below barrier	**Summer/Fall**	
	2. Scappoose Cr. above natural barrier		**Resident**
	a. Honeyman Cr. above natural barrier		**Resident**
	b. S.Fk Scappoose Cr. above natural barrier		**Resident**
	i. Gourlay Cr. above an artificial barrier		**Resident**
	c. N.Fk Scappoose Cr. above a natural barrier		**Resident**
	i. Fall Cr. above a natural barrier		**Resident**
	WILLAMETTE RIVER *		
	Clackamas River *		
	1. Clackamas River below barriers	**Summer/Fall**	
	2. Rock Cr. above natural barrier		**Resident**
	3. Clear Creek *		
	a. Clear Cr. below natural barriers	**Summer/Fall**	
	b. Little Clear Cr. above natural barrier		**Resident**
	c. Clear Cr. above natural barriers		
	4. Deep Creek *		
	a. Deep Cr. below natural barrier	**Summer/Fall**	
	b. N.Fk Deep Cr. above natural barrier		**Resident**
	c. Deep Creek above barrier	**Summer/Fall**	
	5. Eagle Creek *		
	a. Currin Cr. above natural barrier		**Resident**
	b. Eagle Cr. above falls		**Resident**
	c. N.Fk Eagle Cr. above natural barrier		**Resident**
	d. S.Fk Eagle Cr. above natural barrier		**Resident**
	6. Wade Cr. above a man-made barrier		**Resident**
	7. Three Lynx Cr. above a man-made barrier		**Resident**
	8. Cripple Cr. above a man-made barrier		**Resident**
	9. Oak Grove Fk. Clackamas R. above nat. barrier		**Resident**
	a. Skunk Cr. above natural barrier		**Resident**
	b. Shell Rock Creek		**Resident**
	c. Peavine Cr. above natural barrier		**Resident**
	d. Anvil Cr. above natural barrier		**Resident**
	10. Tag Creek above natural barrier		**Resident**
	11. Tar Creek above natural barrier		**Resident**
	12. Trout Creek above natural barrier		**Resident**
	13. Collowash River *		

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	a. Hot Spgs. Fk. Collowash R. above nat. barrier		**Resident**
	i. Dutch Cr. above natural barrier		**Resident**
	ii. Pansy Cr. above natural barrier		**Resident**
	iii. Whetstone Cr. above natural barrier		**Resident**
	iv. Lake Creek/Elk Lake		**Adfluvial**
	b. Buckeye Cr. above natural barrier		**Resident**
	14. Pot Creek above natural barrier		**Resident**
	15. Pinhead Cr. above natural barrier		**Resident**
	a. Last Cr. above natural barrier		**Resident**
	16. Rhondendrum Cr. above natural barrier		**Resident**
	17. Fawn Cr. above natural barrier		**Resident**
	18. Hunter Cr. above natural barrier		**Resident**
	19. Cub Creek above natural barrier		**Resident**
	a. Berry Cr. above natural barrier		**Resident**
	20. Squirrel Creek		**Resident**
	21. Upper Clackamas R. above barriers		**Resident**
	Abernathy Creek	**Summer/Fall**	
	Beaver Creek	**Summer/Fall**	
	1. Beaver Cr. above natural barrier		**Resident**
	Tualatin River *		
	1. Tualatin River below barriers		**Resid./Fluvial**
	2. McFee Creek above natural barrier		**Resident**
	3. Dairy Creek		**Resid./Fluvial**
	a. McKay Creek		**Resid./Fluvial**
	b. E.Fk Dairy Creek		**Resid./Fluvial**
	i. Murtaugh Cr. above natural barrier		**Resident**
	c. W.Fk Dairy Creek		**Resid./Fluvial**
	i. Sadd Cr. above natural barrier		**Resident**
	4. Gales Creek		**Resident**
	a. Clear Cr. above natural barrier		**Resident**
	i. Roaring Cr. above natural barrier		**Resident**
	b. Iller Cr. above natural barrier		**Resident**
	c. Coffee Cr. above natural barrier		**Resident**
	d. S.Fk Gales Cr. above natural barrier		**Resident**
	5. Scoggins Creek		**Resident**
	a. Tanner Creek		**Resident**
	b. Parsons Creek		**Resident**
	6. Lee Cr. above natural barrier		**Resident**
	7. Sunday Cr. above natural barrier		**Resident**
	8. Maple Cr. above natural barrier		**Resident**
	9. Tualatin R. above natural barriers		**Resident**
	Molalla River		**Fluvial**
	1. Pudding River		**Fluvial**
	a. Butte Cr. above Butte Cr. Falls		**Resident**
	i. Beaver Creek		**Resident**
	ii. Coal Creek		**Resident**
	iii. Fall Creek		**Resident**
	b. Abiqua Cr. above Abiqua Falls		**Resident**
	i. Wildcat Cr. above impassable culvert		**Resident**
	c. S.Fk Silver Cr. above 93' and 177' falls		**Resident**
	d. N.Fk Silver Cr. above 178' falls		**Resident**
	2. N.Fk Molalla River		**Resident**
	a. Dead Horse Canyon Cr. above falls		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	i. Cutting Creek		**Resident**
	3. Trout Cr. above falls at RM 6.4		**Resident**
	4. Pine Cr. above 20' & 40' falls at RM 2.6 & 2.8		**Resident**
	a. Bauer Creek		**Resident**
	5. Shotgun Creek		**Resident**
	a. Gawley Creek *		
	i. Unnamed trib. above falls		**Resident**
	6. Horse Creek		**Resident**
	7. Ogle Creek		**Resident**
	8. Molalla R. above natural barrier		**Resident**
	Yamhill River *		
	1. N.Fk Yamhill River below barriers		**Resid./Fluvial**
	a. Panther Creek *		
	i. Baker Cr. above Cascade at RM 11.1		**Resident**
	ii. Kane Cr. above falls at RM 0.4		**Resident**
	b. Haskins Cr. above dam at RM 4.0		**Resident**
	2. S.Fk Yamhill R. below barriers		**Resid./Fluvial**
	a. Mill Creek above falls at RM 10		**Resident**
	b. Willamina Cr. above falls at RM 11		**Resident**
	i. Gilbert Cr. above falls at mouth		**Resident**
	c. Cosper Cr. above falls at RM 0.25		**Resident**
	d. Rock Cr. above falls at RM 4.75		**Resident**
	e. Agency Creek *		
	i. Yoncalla Cr. above falls at mouth		**Resident**
	Glenn Creek		**Fluvial**
	1. Brush College Cr. above dam at mouth		**Resident**
	Mill Creek		**Fluvial**
	Rickreall Creek *		
	1. Basin below Mercer Dam		**Resid./Fluvial**
	2. Basin between Mercer Dam and falls on forks		**Resid./Adfluv.**
	3. S.Fk Rickreall Cr. above falls		**Resident**
	4. Basin above Silver Falls RM 31.0		**Resident**
	Luckiamute River *		
	1. Luckiamute R. below falls		**Resid./Fluvial**
	2. Little Luckiamute R. below Falls *		
	a. Teal Creek *		
	i. Grant Creek		**Resident**
	ii. S.Fk Teal Creek		**Resident**
	iii. N.Fk Teal Creek		**Resident**
	3. L.Luckiamute R. between falls RM 13.0 & 19.75		
	4. L. Luckiamute R. above falls at RM 19.75		
	5. Rock Pit Creek above culvert		**Resident**
	Santiam River *		
	1. Santiam River below dams		**Fluvial**
	2. North Santiam River *		
	a. Basin below barriers		**Fluvial**
	b. Stout Creek above falls		**Resident**
	i. Ayers Creek		**Resident**
	ii. Shelburg Creek		**Resident**
	iii. L. N.Fk Santiam R. abv. falls abv. Gold Cr.		**Resident**
	A. Sinker Cr. above falls		**Resident**
	B. Little Sinker Cr. above falls		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	C. Elkhorn Cr. above falls		**Resident**
	i. Rock Cr. above falls		**Resident**
	ii. Mad Cr. above falls		**Resident**
	iii. Sevenmile Cr. above falls		**Resident**
	c. Upper N. Santiam R. above Detroit Dam		**Resident**
	i. Kinney Cr. above falls		**Resident**
	ii. Box Canyon Cr. above falls		**Resident**
	iii. Blowout Cr. above falls		**Resident**
	iv. Boulder Cr. above falls		**Resident**
	v. Whitewater Creek		
	A. Russell Creek/Whitewater Lake		**Adfluvial**
	vi. Pamelia Lake and tributaries		**Adfluvial**
	A. Hunts Lake & tribs isolated from Pamelia by falls		**Resident**
	vii. Minto Creek		
	A. Bingham Lake		**Adfluvial**
	viii. Marion L. & tribs isolated by falls at outlet		**Adfluvial**
	3. **South Santiam ***		
	a. South Santiam R. below Foster Dam		**Fluvial**
	b. Thomas Cr. above falls at RM 32.5		**Resident**
	c. Crabtree Creek		
	i. Roaring R. above Hatchery		**Resident**
	d. Hamilton Cr. above falls		**Resident**
	e. McDowell Cr. above falls		**Resident**
	f. Ames Cr. above falls		**Resident**
	g. Wiley Cr. above falls		**Resident**
	h. S. Santiam R. above Foster Dam		**Resident**
	i. S. Santiam R. above House Rock Falls		**Resident**
	j. Middle Santiam (above Green Peter Dam)		**Resident**
	i. Quartzville Creek		**Resident**
	A. Packers Gulch Creek		**Resident**
	B. Canal Creek		**Resident**
	a. Elk Creek		**Resident**
	C. Tally Creek		**Resident**
	ii. Donaca Lake & tributaries above falls in Donaca Creek drainage		**Adfluvial**
	iii. Pyramid Creek *		
	A. Riggs Lake and tribs above falls		**Adfluvial**
	B. Daly Lake and tribs above falls		**Adfluvial**
	iv. Canyon Cr. above falls		**Resident**
	A. Moose Lake		**Adfluvial**
	v. Moose Cr. above falls		**Resident**
	vi. Soda Fork above falls		**Resident**
	A. Johnny Lake and tribs		**Adfluvial**
	B. Gordon Lakes		**Adfluvial**
	vii. Sheep Cr. above falls		**Resident**
	viii. Sevenmile Cr. above falls		**Resident**
	Calapooia River *		
	1. Basin below falls		**Resid./Fluvial**
	2. Calapooia R. above falls at RM 73		**Resident**
	3. McKinley Cr. above falls		**Resident**
	4. N.Fk Calapooia R. above falls		**Resident**
	Mary's River *		

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	1. Basin below barriers		**Resid./Fluvial**
	2. Greasy Creek *		
	a. Rock Creek *		
	i. N.Fk Rock Creek		**Resident**
	3. Tum Tum River *		
	a. Hymes Creek		**Resident**
	Long Tom River *		
	1. Long Tom R. below Stroda Dam at RM 9.6		**Fluvial**
	2. Long Tom R. between Stroda and Fern Ridge		**Resident**
	3. Long Tom R. above Fern Ridge Dam		**Adfluv./Resid.**
	McKenzie River *		
	1. McKenzie below barriers		**Fluvial**
	a. Mohawk River		**Resident**
	i. McGowan Cr. above 20' falls at RM 4.6		**Resident**
	ii. Shotgun Creek		**Resident**
	A. Crooked Cr. above 7' falls at RM 1.4		**Resident**
	b. Holden Cr. above 11' falls at RM 1.1		**Resident**
	c. Cogswell Cr. above 10' falls at RM 2.2		**Resident**
	d. Hatchery Cr. above 8' falls		**Resident**
	e. Indian Cr. above 15' falls at RM 0.3		**Resident**
	f. Gate Creek		**Resident**
	i. N.Fk Gate Creek		**Resident**
	A. Unnamed creek above 7' falls at RM 0.7		**Resident**
	g. Tom's Cr. above 20' falls at RM 0.3		**Resident**
	h. Marten Cr. above 8' falls at RM 2.2		**Resident**
	i. Bear Cr. above 8' falls at RM 0.6		**Resident**
	j. Quartz Creek *		
	i. Doe Cr. above 20' falls at RM 2.0		**Resident**
	ii. Indian Cr. 1 above 12' falls at RM 0.3		**Resident**
	iii. Indian Cr. 2 above 30' falls at RM 1.0		**Resident**
	k. Blue River above Reservoir		**Resident**
	i. Lookout Cr. above 9' falls		**Resident**
	A. McCrea Cr. above 7' falls		**Resident**
	ii. Tidbits Cr. above 7' falls at RM 2.7		**Resident**
	iii. Quentin Cr. above 30' falls at RM 1.0		**Resident**
	l. S.Fk McKenzie R. above Cougar Res.		**Resident**
	i. French Pete Cr. above 10' falls at RM 3.0		**Resident**
	A. Olallie Cr. above falls		**Resident**
	ii. Hardy Cr. above 10' falls at RM 3.0		**Resident**
	A. Buoy Creek/Hidden Lake		**Adfluvial**
	B. Augusta Cr. above 8' falls at RM 2.4		**Resident**
	C. Elk Cr. above 9' falls at RM 2.4		**Resident**
	m. Mill Cr. above 20' falls at RM 2.0		**Resident**
	i. Pasture Cr. above 7' falls at RM 0.5		**Resident**
	ii. Pothole Cr. above 5' falls at RM 0.5		**Resident**
	iii. Mosquito Cr. above 20' falls at RM 0.6		**Resident**
	iv. Separation Cr. above falls		**Resident**
	A. Nash Lake		**Adfluvial**
	v. Lower Horse Lake		**Adfluvial**
	vi. Middle Horse Lake		**Adfluvial**
	n. Lost Cr. above 10' falls at RM 2.5		**Resident**
	i. Deer Cr. above 60' falls at RM 5.0		**Resident**
	A. County Cr. above 25' falls at RM 0.1		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	o. McKenzie R. between Trail Bridge and Tamolitch Falls		**Resident**
	i. Smith River above Smith Dam		**Resident**
	ii. Bunchgrass Cr. above 17' falls at RM 0.3		**Resident**
	p. McKenzie R. between Carmen Dam and Sahalie Falls		**Resident**
	q. Above Sahalie Falls *		
	i. Ikenick Creek/Clear Lake		**Resid./Adfluv.**
	r. Hackleman Cr./Fish Lake above Lava Dam		**Resid./Adfluv.**
	s. Parks Cr. above Lava Flow		**Resident**
	t. Lava Lake above Lava Dam		**Adfluvial**
	Coast Fork Willamette River *		
	1. Basin below barriers		**Resid./Fluvial**
	2. Row River above Dorena Dam		**Resident**
	3. Coast Fork above Cottage Grove Res.		**Resident**
	Middle Fork Willamette River *		
	1. Basin below barriers		**Adfluvial**
	2. Wineberry Cr. above falls at RM 4.0		**Resident**
	3. Andy Cr. above falls at RM 0.2		**Resident**
	4. Portland Cr. above falls at RM 2.0		**Resident**
	5. Upper Fall Cr. above falls at RM 29		**Resident**
	a. Delp Cr. above falls at RM 0.5		**Resident**
	6. M.Fk Willamette R. above Dexter Dam		**Resident**
	a. Salmon Cr. above falls at RM 6.0		**Resident**
	7. M.Fk Willamette R. above Hills Cr. Dam		**Resident**
	8. N.Fk Middle Fork Willamette R.		**Resident**
	Sandy River *		
	1. Sandy River (below barriers)	**Summer/Fall**	**Resident**
	2. Trout Cr. above natural barrier		**Resident**
	3. Bull Run River *		
	a. S.Fk Bull Run R. above artificial barrier		**Resident**
	b. Camp Cr. above artificial barrier		**Resident**
	c. N.Fk Bull Run R. above artificial barrier		**Resident**
	d. Fir Cr. above natural barrier		**Resident**
	e. Log Cr. above natural barrier		**Resident**
	f. Blazed Alder Cr. above natural barrier		**Resident**
	g. Bull Run River above falls		**Resident**
	h. Bull Run Lake above Lava Dam		**Resident**
	4. Cedar Cr. above natural barrier		**Resident**
	5. Badger Cr. above natural barrier		**Resident**
	6. Whiskey Cr. above natural barrier		**Resident**
	7. Alder Cr. above natural barrier		**Resident**
	8. Wildcat Cr. above natural barrier		**Resident**
	9. Salmon R. above natural barrier		**Resident**
	a. Boulder Cr. above natural barrier		**Resident**
	i. N. Boulder Cr. above natural barrier		**Resident**
	b. S.Fk Salmon R. above natural barrier		**Resident**
	i. Mack Hall Cr. above natural barrier		**Resident**
	c. Mud Cr. above natural barrier		**Resident**
	10. Zig Zag River		**Resident**
	a. Still Creek		**Resident**
	b. Henry Creek		**Resident**
	c. Camp Creek		**Resident**

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** *Season of adult spawning migration.*

Table 10. Coastal cutthroat (*Oncorhynchus clarki clarki*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this subspecies.	11. Clear Creek		**Resident**
	12. Lost Creek		**Resident**
	a. Cast Creek		**Resident**
	13. Clear Fork		**Resident**
	Tanner Creek below falls	**Summer/Fall**	
	Hood River *		
	1. Basin below barriers	**Summer/Fall**	**Resident**
	2. New Creek		**Resident**
	3. Odell Creek		**Resident**
	4. W.Fk Hood River		**Resident**
	a. Greenpoint Creek		**Resident**
	b. Lake Branch Fork Hood R.		**Resident**
	i. Lake Branch Fork, Trib. A		**Resident**
	ii. Lake Branch Fork, Trib. B		**Resident**
	iii. Lake Branch Fork, Trib. C		**Resident**
	iv. Mosquito Creek		**Resident**
	v. Lake Branch Fork, Trib. E		**Resident**
	vi. Divers Creek		**Resident**
	vii. Laurel Creek		**Resident**
	viii. Skipper Creek		**Resident**
	ix. Indian Creek		**Resident**
	x. No Name Creek		**Resident**
	xi. Midget Creek		**Resident**
	xii. Washout Creek		**Resident**
	xiii. Buckpoint Creek		**Resident**
	5. E.Fk Hood River		**Resident**
	6. M.Fk Hood River		**Resident**
	a. Clear Branch Creek		**Resident**
	b. Pinnacle Creek		**Resident**
	c. Baldwin Creek		**Resident**
	d. Cat Creek		**Resident**
	e. Dog River		**Resident**
	i. Puppy Creek		**Resident**
	f. Pollallie Creek		**Resident**
	Mosier Creek		**Resident**
	Chenowith Creek		**Resident**
	1. Brown Creek		**Resident**
	Mill Creek		**Resident**
	1. N.Fk Mill Creek		**Resident**
	2. S.Fk Mill Creek (above dam)		**Resident**
	Threemile Creek		**Resident**
	Fifteenmile Creek		**Resident**
	1. Fivemile Creek		**Resident**

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** *Season of adult spawning migration.*

Status Report

Listing Status

Coastal cutthroat trout are state listed as "sensitive" for anadromous populations in the lower Columbia River, and for all populations in the Umpqua Basin below natural barriers. The National Marine Fisheries Service proposed in July 1994 that all cutthroat trout populations in the Umpqua Basin be listed as an endangered species under the federal Endangered Species Act (ESA). A final decision on this proposal is expected in 1995.

Specific Status Conditions

Lower Columbia Tributaries: The abundance of searun cutthroat trout in the lower Columbia Basin appears to have significantly declined in recent years. Although these populations are not routinely monitored, angler surveys conducted in the lower mainstem Columbia during the 1970s typically observed annual catches of up to 5,000 fish. Similar data in the late 1980s estimate the annual catch as low as 500 fish. Effective in 1994, all wild cutthroat trout caught by anglers in the Columbia River must be released unharmed.

The effects of long-term hatchery releases of searun cutthroat trout on wild stock abundance in this group is unknown. The hatchery broodstock used in most programs was developed from the wild population in Big Creek on the lower Columbia River. Legal size hatchery releases that were annually made into the Lewis and Clark River (10,000-15,000) were discontinued in 1990, and annual releases into the Klaskanine River (5,000), Big Creek (5,000), Gnat Creek (3,000), and Scappoose Creek (4,000) were discontinued after 1993. Starting in 1994, remaining lower Columbia River cutthroat trout releases have been switched to standing water bodies. Actual hatchery releases for 1992 and 1993 are provided in Appendix A.

Most lower Columbia tributaries downstream of the Willamette River are located on privately owned timberlands. The status of resident cutthroat trout in these streams is unknown, but population productivity has probably been decreased due to habitat impacts caused by logging activities on these lands.

On the lower Sandy River, two to three dozen searun cutthroat trout historically entered Sandy Hatchery each fall, but only a few do now. This general trend of lower cutthroat trout abundance is also reflected in comments from anglers. No large cutthroat trout have been counted upstream past Marmot Dam since counting facilities have been available. This may be a result of Marmot Dam dewatering the reach of the Sandy River below the dam to less than 5 cfs during summer and fall months between 1910 and 1970.

The Bull Run River, a major tributary of the Sandy River, probably was a significant producer of searun cutthroat trout prior to the construction of City of Portland water development projects, starting in 1910. Now all migrations are blocked by several large impassable dams. Resident cutthroat trout remain abundant in the tributaries and reservoirs of the Bull Run as well as in the rest of the upper Sandy Basin. A possibly unique adfluvial population of resident cutthroat trout is present in Bull Run Lake. This population is isolated from the rest of the basin by several natural barriers. Genetic samples of this and other Sandy Basin cutthroat trout populations were collected during 1993. Results of these collections should be available in 1995.

Columbia Gorge streams such as Latorurell, Bridal Veil, Multnomah, Oneonta, Horsetail, McCord, Moffett, Tanner, Eagle, and Herman creeks all historically had small searun cutthroat trout runs in the lower reaches below barrier falls. An unknown species of resident trout, possibly either rainbow or cutthroat trout, is present above most of these falls. Searun cutthroat trout in Gorge tributaries are not routinely indexed. There is concern about the effects of upstream passage barriers at hatchery diversion dams on Eagle and Tanner creeks.

Both resident and anadromous cutthroat trout are present in the mainstem Hood River and its tributaries, including the East Fork. Punchbowl Falls on the West Fork Hood River may be at least a partial or seasonal barrier to anadromous cutthroat trout production, since limited sampling above the falls has failed to turn up any cutthroat trout. The Hood River appears to contain some taxonomically unusual trout. The basin is located on the eastern boarder of both the coastal cutthroat and coastal rainbow subspecies distributions. It may also contain inland redband and westslope cutthroat, and may form a natural hybrid zone between the various subspecies and species. Fish from several populations of unknown taxonomy, as well as apparent coastal cutthroat, were collected from the Hood River for genetics analysis in 1993. Sampling in this basin will continue in 1994-95.

Hatchery searun cutthroat trout smolts (Nehalem, Alsea and Big Creek stocks) were released into Hood River in 1956, from 1974-78 and from 1985-87. The number released ranged from 538 to 32,949 smolts. It is unknown how many adults returned from these releases.

Run size estimates of searun cutthroat trout past Powerdale Dam were made during 1963-71. In those years, escapement estimates ranged from 17 adults in 1964 to 134 adults in 1968. Powerdale trap estimates in 1992 and 1993 were four and two searun cutthroat trout, respectively. No searun cutthroat trout were captured at the Powerdale trap in 1994. Effective in 1994, all wild cutthroat trout caught by anglers in the mainstem Hood River must be released unharmed.

In the Fifteenmile Creek drainage, cutthroat trout are known to be present in Fivemile Creek and are suspected to also be present in Eightmile Creek. Cutthroat trout abundance and distribution, and their relationship with the rainbow and steelhead trout that are also present in the basin, is not known. Genetic samples from cutthroat trout were collected in Fivemile Creek in 1993. Results should be available in 1995.

Willamette Basin: Only tributaries of the lower Willamette River below Willamette Falls have searun cutthroat trout. Similar to the Sandy River, searun cutthroat trout of the lower Clackamas River are believed to have been much more abundant historically than they are today. Their historic upstream distribution is not known, but Cazadero Dam near the City of Estacada blocked all upstream passage during 1917-1939. No searun cutthroat trout pass North Fork Dam today. Besides passage barriers and impacts to spawning and rearing habitat, a factor that may have led to the decline of searun cutthroat was the adverse effect due to competition of releases of thousands of presmolt coho into tributaries of the lower Clackamas during the late 1970s and early 1980s. The lower Clackamas tributaries Deep, Clear and Eagle creeks are the suspected spawning areas of the remaining run.

Resident cutthroat trout are abundant and well distributed throughout headwater and lower Clackamas River tributaries. Although there is some overlap in distribution among resident cutthroat trout, rainbow trout, and juvenile steelhead, cutthroat trout predominate in steep, first order tributaries.

Fluvial, adfluvial and resident life history types of cutthroat trout are present throughout the Willamette River mainstem and tributaries above Willamette Falls. Cutthroat trout are the only native trout present in Coast Range tributaries to the Willamette such as the Tualatin, Yamhill, Rickreal, Luckiamute, Marys, and Long Tom rivers. Although rainbow and brook trout have been released into these streams, only cutthroat trout persist through natural production.

The general pattern for these westside streams is for fluvial cutthroat trout to be present in the lower mainstems of each stream. These areas are used for feeding and spawning migrations during fall, winter and spring months. Resident cutthroat trout are dominant in headwater areas, occasionally isolated by barriers. The transition zone between the two life history types below barriers is not well understood. The amount of gene flow between streams such as the Tualatin and Yamhill is unknown, but movement between basins is probably restricted to winter months. Warm water temperatures in the mainstem Willamette River and the presence of the parasite *Ceratomyxa shasta*, to which Willamette cutthroat are susceptible according to challenges conducted by ODFW staff, likely limit interstream movement of cutthroat trout during summer months.

A unique adfluvial cutthroat trout population has developed on the upper Long Tom River since the construction of Fern Ridge Dam. The population was historically fluvial prior to dam construction, but now makes spawning runs upstream out of Fern Ridge Reservoir during late summer each year. When caught by anglers upstream near the town of Noti, these fish are large, often greater than 12 inches in length, with a silver coloration similar to searun cutthroat trout. Cutthroat trout that remain resident in the upper Long Tom seldom exceed eight inches total length and appear "coppery" in coloration. Historically fluvial cutthroat trout in tributaries of the lower Long Tom below Fern Ridge Dam have had their migrations to the Willamette River cut off by additional impassable irrigation dams above the town of Monroe, which were also constructed by the Corps of Engineers at the same time as Fern Ridge Dam.

Even though only a few fluvial cutthroat trout populations have been systematically monitored in recent years (Long Tom and Marys systems), it is believed that cutthroat trout in westside tributaries are generally declining in abundance. This belief is largely based on the ongoing pattern of habitat loss and degradation as a result of agricultural and urban development in the Willamette Valley.

Fluvial cutthroat trout in eastside tributaries of the Willamette Basin are largely restricted to the McKenzie River system. Headwater tributaries of the Molalla, Santiam and Calapooia systems have abundant resident cutthroat trout present, but the lower reaches of these streams are dominated by juvenile steelhead and rainbow trout. An exception is the Crabtree Creek system, which still likely contributes fluvial cutthroat trout to the lower South and mainstem Santiam rivers. Past surveys have estimated 53 and 37 fluvial cutthroat trout per mile in the mainstem Santiam in 1976 and 1977, respectively.

Isolated populations of cutthroat trout are known to occur above natural barriers on all eastside tributaries to the Willamette River. Occasionally abundance estimates have been made for selected cutthroat trout streams, but routine population monitoring is not conducted. As examples, the Blowout Creek system (N. Santiam) averaged 1,364 cutthroat trout per mile (all age classes) in 1980; Packers Gulch Creek (S. Santiam) averaged 1,040 cutthroat trout per mile (all age classes) in 1982.

Wild adfluvial cutthroat populations are present in Cascade Mountain lakes in the Clackamas, Santiam, McKenzie and Middle Fork Willamette subbasins. Populations in Donaca, Pamelia, Moose, Gordon, Bingham, Elk, Fish, Hidden, and Windfall lakes have apparently not been impacted by introduced trout. Populations in Marion, Lava, Whitewater, Riggs, Clear, Nash, and Middle and Lower Horse lakes have been impacted by competitive interactions with introduced brook and rainbow trout.

In the lower McKenzie River, fluvial cutthroat trout dominate trout populations up to approximately RM 17. Mohawk River and Camp Creek tributaries provide abundant spawning and early rearing areas for these cutthroat trout. In this lower gradient section of the main McKenzie River, cutthroat trout apparently have a competitive advantage over rainbow trout. Abundance estimates of cutthroat trout in the lower 11 miles of the McKenzie River during 1988, 1989, 1991 and 1994 ranged from 113 to 340 cutthroat trout greater than 8 inches in length per mile of shoreline sampled.

Downstream migrant trapping of juvenile cutthroat trout was initiated on the Mohawk system in 1993. Very preliminary analyses indicate that the Mohawk River produces a significant number of outmigrant cutthroat trout (approximately 20,000 juveniles based on the volume of water sampled) and may be the primary production area for cutthroat trout in the McKenzie and mainstem Willamette downstream to Harrisburg.

In the remainder of the McKenzie system and throughout the Middle Fork Willamette drainage, cutthroat trout are relegated to small tributary streams and headwater areas. These streams are principally on private and national forest timberlands. Trends in cutthroat trout abundance are not routinely monitored for the majority of these areas, but considerable road building, timber harvest and in-channel modifications of fish habitat has occurred in the past and have probably affected abundance.

One area that is routinely monitored in the upper Willamette Basin is the North Fork of the Middle Fork Willamette. Cutthroat and rainbow trout numbers in this river have been relatively stable since the mid 1970s in 20 standard index pools surveyed by snorkeling. During 1975-1994, these pools averaged 253 rainbow and cutthroat trout between 6 and 12 inches.

The only cutthroat trout stocking in the Willamette system occurs in Cascade Mountain lakes on the eastern border of the basin. Actual stocking information for 1992 and 1993 is provided in Appendix A. Both Twin Lakes cutthroat (a broodstock developed from a Westslope cutthroat trout population in eastern Washington) and Hackleman cutthroat trout (a broodstock developed from a coastal cutthroat population native to upper McKenzie drainage) are stocked. At lakes with outlets, the affects of this stocking on downstream cutthroat trout populations is unknown. A sampling design for a genetic survey of Willamette cutthroat trout is in place and will be implemented when funding becomes available. Samples were collected from Hackleman Creek in the upper McKenzie Basin and in the lower Luckiamute Basin in 1992. Results should be available in 1995.

Coastal Streams: All four life history types (resident, fluvial, adfluvial, and anadromous) are present in cutthroat trout populations in Oregon coastal streams. The various combinations represented in these life history strategies are probably the most complex of any salmonid in Oregon. A genetic survey of coastal cutthroat trout in Oregon has been only recently initiated and the relationship between populations with the various life histories remains unknown.

Resident cutthroat trout are widespread and are believed to be the dominant trout in most headwater tributaries and small direct ocean streams along the coast. There are exceptions, however, in select headwater areas of the Nehalem (Salmonberry), Umpqua, Coquille, Sixes, Elk, Rogue, and Chetco rivers where rainbow trout predominate. Juvenile cutthroat trout of anadromous versus non-anadromous parentage cannot be distinguished in coastal streams below barriers. Genetic analysis during 1991 of several populations in the Coquille basin indicated that an exceptionally high level of genetic divergence exists among populations in the basin. In some cases, this divergence was explained by the presence of natural physical barriers between populations in the form of waterfalls. In other cases, however, a high level of genetic divergence was observed in the absence of any physical barriers. This result suggests that some cutthroat populations move about and mix very little with adjacent populations even though they have the opportunity to do so. The Coquille Basin populations were again sampled in 1994. Elk River populations were sampled in 1992-93 and results should be available in 1995. Tissue samples were also collected from Cummins and Tenmile creeks and from the Siuslaw and Umpqua basins in 1993. Further samples are being collected from these basins. and from the Chetco, Tillamook, Nehalem, and Yaquina in 1994.

Fluvial cutthroat trout are present in larger river systems along the coast. Fluvial populations are believed to be present in the Nehalem (Rock Creek), Nestucca, Wilson (Little N. Fork), Yaquina (Big Elk), Siletz, Alsea (Five Rivers and Fall Creek), Siuslaw (Lake Creek), North Umpqua (Little River and Steamboat Creek) and Rogue (Elk Creek, Applegate and Illinois rivers). There are likely many more of these populations that have not yet been recognized.

Adfluvial cutthroat trout are present in two types of geologic settings along the Oregon coast. Several isolated adfluvial populations rear in natural lakes above barriers to anadromous fish. Grassy (N. Nehalem), Buttermilk (Yaquina), Slide and Klickatat (Alsea), and Loon (Umpqua) lakes are examples of such populations. Non-isolated adfluvial populations are likely present in low elevation lakes along the coast that have stream outlets to the ocean. In these cases, searun cutthroat trout are also present and the relationship between the two populations is unclear. Examples of such settings are Devils, Sutton, Mercer, Siltcoos, Tahkenitch, Tenmile, and Floras lakes.

Anadromous cutthroat trout are believed to be present in all Oregon coastal streams that do not have upstream passage barriers near their confluence with the ocean. By far the majority of coastal streams do not have natural barriers blocking anadromous passage. However, some direct ocean tributaries between the Pistol and Chetco rivers now have isolated cutthroat populations as a result of passage barriers caused by the construction of Highway 101 in the 1960s.

Hatchery searun cutthroat trout smolts have been released for many decades in streams along the Oregon coast. The primary broodstock used at least over the last few decades has been one developed from the wild population in the Alsea River. A second broodstock was developed more recently from the Nehalem River. In the last 10 years, however, there has been a systematic effort to switch hatchery cutthroat trout releases from streams to standing waters. Discontinued stream releases include Winchuck, Chetco, Pistol, Hunter, Coquille, Millacoma rivers and Eel Lake, all discontinued in the mid-1980s; Kilchis, Trask and Three rivers discontinued after 1992; and Scholfield Creek, Nestucca and mainstem Nehalem rivers discontinued after 1993. Stocking programs discontinued after 1994 include the Necanicum (10,000), North Nehalem (3,400), and Smith (4,000) rivers. Releases in the Salmon (3,000), Siletz (10,000), Alsea (10,000) and Siuslaw (30,000) which occurred in 1995 reflect significant reductions, with elimination of these programs proposed in 1996. The genetic consequences of these ongoing programs is unknown.

Lack of inventory data generally precludes quantitative assessment of the status of most searun and resident cutthroat trout populations along the Oregon coast. Occasionally, abundance estimates have been made for resident cutthroat trout in selected headwater streams, but routine population monitoring is not conducted. Incidental information on cutthroat trout densities in some coastal streams has been collected during several research projects by ODFW. An analysis of the data from these studies detected no significant declining trend in central coast populations of cutthroat trout during 1980-1990. However, these data provide no information about longer-term trends, and it is believe that by 1980, populations may have already been much lower than historic levels due to habitat loss. We know from counts over Winchester Dam, for example, that wild populations in the North Umpqua River already had declined to remnant levels well before 1980 (Figure 74). Further, the measurements taken during the studies were generally of subadult fish in fresh water and did not differentiate between the different life histories types.

Annual counts of fish over Winchester Dam on the North Umpqua River provide the best long-term source of information that we have for any searun cutthroat trout population in Oregon (Figure 74). These data indicate a serious decline in that population. From 1946 to 1956, counts of searun cutthroat trout over Winchester Dam averaged about 950 adult fish per year and ranged from 400 to 1,800 fish. Anecdotal reports suggest that runs may have been significantly higher prior to this period. By 1960, the wild run over Winchester Dam had declined to less than 100 fish. A hatchery program using Alsea broodstock was initiated and boosted the run of cutthroat trout to an average of 940 adult fish through 1976. Hatchery fish comprised the major component of the run throughout the 1960-1976 period. When the stocking of smolts was discontinued, the population size returned to the prestocking size. Wild populations have remained low and have exceeded a total count of 100 fish only twice since 1980. They are now considered near extinction with a run of 29 fish recorded in 1993. No searun cutthroat returned to spawn above Winchester Dam in 1992 and 1994. Habitat degradation and associated increases in water temperature in small tributary streams are considered important factors in the decline. Genetic effects of introduced hatchery stock from the Alsea River and of low population sizes, and competition and predation by other species, may make recovery difficult. Recovery strategies are also hampered by a lack of basic life history, genetic, and habitat information. Several studies and surveys are under way to improve the information base in the Umpqua. Recent creel surveys in two other coastal basins, the Alsea and Siuslaw, indicate that a substantial decline in the abundance of anadromous cutthroat has occurred in other areas. Catches of anadromous cutthroat in the 1990s are less than 10% of catches in the late 1960s in both the Alsea and Siuslaw basins. Comparable declines are not apparent in the resident cutthroat populations in these two basins.

Actions Under Way

Management objectives for cutthroat trout have been adopted by the Oregon Fish & Wildlife Commission in the Willamette, Tenmile and Coos basins. Draft management plans are in progress in the Rogue, Coquille, Umpqua, Siuslaw, Alsea, Salmon, Nehalem, Sandy, Hood, and Fifteenmile basins. Genetic samples of cutthroat trout have been collected and are being analyzed for the Hood, Fifteenmile, Sandy, Upper Willamette, Coquille, Elk, Umpqua and several other coastal basins.

Annual population monitoring is in progress on the Hood River at Powerdale Dam, in Willamette Basin tributaries including the Mohawk, McKenzie, North Fork Willamette, Long Tom and Mary's rivers, and on the North Umpqua at Winchester Dam. Native cutthroat trout broodstocks for the Cascade Mountain Lakes Stocking Program are being developed from Hackleman Creek and Pamelia Lake stocks. *C. shasta* resistance testing has been conducted on several Willamette Basin stocks and further testing is proposed on additional stocks. Life history studies of North Umpqua cutthroat trout have been in place for the last several years with a progress report due in 1995. As of 1994, stocking of hatchery searun cutthroat trout has been discontinued in all lower Columbia River tributaries, mainstem Nehalem River, Tillamook Bay tributaries, Nestucca River, and Scholfield Creek. The remainder of the searun cutthroat trout stocking programs in coastal streams is currently under review in development of the Umpqua, Siuslaw, Alsea, and Salmon River basin plans. Catch and fishing effort on wild and hatchery searun cutthroat trout have been recently documented in statistical creel surveys on the Siuslaw, Alsea, and Lower Columbia rivers.

CHAPTER 5: OTHER SALMONIDS

CHUM SALMON (*Oncorhynchus keta*)

Species Overview

The chum salmon is an anadromous species that rears in the Pacific and Arctic oceans and spawns in freshwater streams in North America from the MacKenzie River in Canada to the Sacramento River in California, and in Asia from the Arctic coast of Russia to streams along the Sea of Japan. Most of the chum salmon life span is spent in a marine environment. Adults typically enter spawning streams ripe, promptly spawn, and die within two weeks of arrival. Most spawning runs are over a short distance, although exceptionally long runs occur in some basins in Asia and Alaska. Adults are strong swimmers, but poor jumpers and are restricted to spawning areas below barriers, including minor barriers that are easily passed by other anadromous species. Juveniles are intolerant of prolonged exposure to fresh water and migrate to estuarine waters promptly after emergence. A brief residence in an estuarine environment appears to be important for smoltification and for early feeding and growth. Movement offshore occurs when the juveniles reach full saltwater tolerance and have grown to a size that allows them to feed on larger organisms and avoid predators. Chum salmon mature at 2 to 6 years of age and may reach sizes over 40 pounds.

Oregon is near the southern limit of the species distribution in North America. Historically, the species spawned in the Columbia Basin, at least to Cascade Rapids and in coastal streams south to at least the Coquille River. Historical populations south of the Nestucca River may have been naturally small, but the species was abundant along the north coast and in the lower Columbia River. Oregon currently has 55 populations on its provisional list, including 23 in the Columbia Basin and 32 in coastal basins. The species in Oregon requires typical low gradient, gravel-rich, barrier-free freshwater habitats and productive estuaries. Most Oregon adults mature at 3 to 4 years and weigh 10-15 pounds.

Chum salmon spawning habitat has been impacted in Oregon by siltation, channelization and gravel extraction. Siltation of spawning gravels has resulted from road construction, road failures, and logging. Access to historical spawning areas has been blocked by structures that continue to be passable by other anadromous fish, including tidegates, culverts, and gravel berms. Degradation of estuaries due to diking, water diversions, loss of marsh and cedar boglands, loss of estuary complexity, urbanization, and other actions has probably had a severe effect on chum salmon.

Chum salmon are no longer targeted for consumptive harvest in Oregon. Commercial gill-net harvest in all Oregon rivers and bays, except Tillamook Bay and the Columbia River, stopped in 1957. Commercial gill-net harvest in Tillamook Bay continued until 1962. Chum salmon are still incidentally caught in the Columbia River gill-net fishery. Oregon's populations of chum do not appear to be vulnerable to most off-shore fisheries. Sport harvest continued in streams along the Oregon coast until 1992 when angling was either prohibited entirely or regulated to catch-and-release only.

Oregon has never had a large chum salmon hatchery program, and there are currently no state hatchery programs for the species. One private hatchery has operated in the Nehalem estuary over the past few years. The objective at this hatchery has been to collect all returning hatchery adults, however some straying has occurred. Chum salmon are probably impacted by coho salmon hatchery programs that release large numbers of hatchery smolts into estuaries that are used by rearing juvenile chum. Coho salmon juveniles have been shown to be a major predator on chum juveniles in the Northwest (Hargreaves and LeBrasseur 1986). Juvenile chum salmon may also be affected by large releases of fall chinook salmon hatchery fish, particularly presmolts, since fall chinook juveniles also rear in estuaries and may compete with chum juveniles.

See Kokanee & Bull Trout pp. 171 & 175 Whitefish p. 183

Table 11. Chum salmon (*Oncorhynchus keta*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this species.	**Necanicum River**	**Fall**	
	Nehalem River *		
	1. Basin below Hwy 26 Bridge	**Fall**	
	Tillamook Bay *		
	1. Miami River	**Fall**	
	2. Patterson Creek	**Fall**	
	3. Doty Creek	**Fall**	
	4. Vaughn Creek	**Fall**	
	5. Kilchis River	**Fall**	
	6. Wilson River *		
	a. Beaver Creek	**Fall**	
	7. Trask River	**Fall**	
	8. Tillamook River *		
	a. Bewley Creek	**Fall**	
	Netarts Bay *		
	1. Jackson Creek	**Fall**	
	2. Whiskey Creek	**Fall**	
	3. Crown Z Creek	**Fall**	
	Sand Lake *		
	1. Sand Creek	**Fall**	
	2. Jewell Creek	**Fall**	
	3. Andy Creek	**Fall**	
	Nestucca Bay *		
	1. Nestucca River *		
	a. Horn Creek	**Fall**	
	2. Little Nestucca River *		
	a. Fall Creek	**Fall**	
	Neskowin Creek	**Fall**	
	Salmon River	**Fall**	
	Siletz Bay *		
	1. Siletz River	**Fall**	
	2. Drift Creek	**Fall**	
	Yaquina Bay *		
	1. Wright Creek	**Fall**	
	2. Beaver Creek	**Fall**	
	3. Mill Creek	**Fall**	
	4. Yaquina R., Bear and Simpson creeks	**Fall**	
	Alsea River	**Fall**	
	Yachats River	**Fall**	
	Siuslaw River	**Fall**	
	Umpqua Estuary *		
	1. Smith River	**Fall**	
	Coos Bay *		
	1. Millicoma River *		
	a. Marlow Creek	**Fall**	
	Coquille River	**Fall**	
	COLUMBIA RIVER *		
	Youngs Bay *		
	1. Lewis & Clark River	**Fall**	
	2. Youngs River	**Fall**	
	3. Klaskanine River	**Fall**	
	4. Walluski River	**Fall**	
	Mill Creek	**Fall**	

* *Populations are present only in the tributaries of this waterbody as listed below it.*

** *Season of adult spawning migration.*

Table 11. Chum salmon (*Oncorhynchus keta*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene conservation groups have not been described for this species.	**John Day River**	**Fall**	
	Marys Creek	**Fall**	
	Bear Creek	**Fall**	
	Ferris Creek	**Fall**	
	Big Creek	**Fall**	
	Fertile Valley Creek	**Fall**	
	Gnat Creek	**Fall**	
	Hunt Creek	**Fall**	
	Plympton Creek	**Fall**	
	Clatskanie River	**Fall**	
	1. Beaver Creek	**Fall**	
	Green Creek	**Fall**	
	Nice Creek	**Fall**	
	Fox Creek	**Fall**	
	Goble Creek	**Fall**	
	Tide Creek	**Fall**	
	Milton Creek	**Fall**	
	McBride Creek	**Fall**	

* *Populations are present only in the tributaries of this waterbody as listed below it.*
** *Season of adult spawning migration.*

Status Report

Listing Status

Chum salmon are listed as an Oregon state "sensitive" species throughout their range in Oregon, effective in 1990.

Specific Status Conditions

Chum salmon populations are very depressed to extinct in Oregon subbasins of the lower Columbia River. Small numbers of scattered adults are still observed and might provide the means for naturally recolonizing the area if conditions permitted. However, conditions on the Oregon side of the river are poorly suited to the natural production of chum. Spawning habitat is poor or inaccessible. Large numbers of hatchery coho and chinook are released into some of the potential juvenile chum rearing areas, such as the Youngs Bay area, where 3-5 million coho were released in 1992 and 1993. Gill-net fisheries in October can intercept adult chum salmon. The 1992 Columbia River commercial harvest landed about 700 chum salmon, most of which are thought to have come from Washington rivers (ODFW and WDF 1993). In comparison, Columbia River harvests prior to the 1940s landed 100,000 to 600,000 fish annually.

Efforts to inventory chum salmon in the Necanicum and Nehalem basins increased since 1991. According to surveys conducted by staff in Oregon's North Coast District, spawning occurs in Foley, Bob's, Coal, Boykin, Henderson, Big Rackheap, and Soapstone creeks in the lower mainstem and north fork Nehalem River; and in the lower mainstem Necanicum River. Foley and Bob's creeks, both tributaries of the lower Nehalem River, appear to hold the largest population in this area, which consists of several hundred adults. The spawning area and population in the Necanicum River is small, unstable, and very vulnerable.

Chum salmon releases and adult returns at the private hatchery on the lower Nehalem through 1991 are provided in Table 12. The hatchery fish used in this program originated from Netarts Bay. Hatchery fish strayed into several tributaries of the lower Nehalem basin in 1992. Releases from this hatchery have been limited starting in 1993, and the hatchery does not plan to release any fish in 1994.

Tillamook Bay, Netarts Bay, and the Nestucca River hold the most substantial chum salmon populations in Oregon and are the areas with the longest population monitoring records. Populations have been monitored in the harvest (now discontinued); by spawning ground counts on the Miami, Kilchis, Wilson and Nestucca rivers; and at a trap in Whiskey Creek, a tributary to Netarts Bay. Other smaller populations are also present in other coastal streams in this area. An estimate of the annual number of spawners in Tillamook Bay, which combines eight current populations, is shown in Figure 75. The number of spawners has always been variable, but declined substantially in the 1950s and has never recovered to the levels seen in the 1920s and 1930s. The combined size of the spawning populations was estimated at 10,500 adults in 1992 and 7,500 adults in 1993, based on peak spawning ground counts. Trap counts at Whiskey Creek in Netarts Bay are shown in Figure 76. The high numbers in the late 1970s and early 1980s correspond to experimental chum salmon hatchery operations at the site. A new passage facility was provided at the site in 1991.

Commercial gill-net harvest in Tillamook Bay was curtailed in 1962 and sports angling was restricted in 1992. Catch-and-release sports angling for chum salmon is still permitted in some Tillamook Bay tributaries where there is some concern about potential harassment of spawners by fishermen.

Gravel bar scalping and estuary dredging continue to impact populations in Tillamook Bay. Negotiations are under way to control these activities, with recent success in the Kilchis River.

Chum populations south of the Nestucca River are very depressed or extinct. Chum salmon continue to spawn annually in the Salmon, Alsea, Yaquina, Siletz, and Coos Bay basins. Scattered adults are occasionally seen in other basins. Historical populations in this area may have always been small, but were definitely larger than at present. For example, the estimated number of chum salmon reported in the harvest on the Umpqua River, based on harvest poundage and an estimated average weight of 11 lbs/fish ranged from about 50 to 3,300 fish in the 1920s and early 1930s. In comparison, only a few chum salmon have been observed in spawning groun d counts or dam counts on the Umpqua River in the 1990s.

Table 12. Chum releases and adult returns, private chum hatchery on Nehalem River.

Year	**Juveniles Released**	**Adults Returned**
1981	670,000	0
1982	578,000	0
1983	893,000	170
1984	118,000	321
1985	275,000	700
1986	394,000	257
1987	208,000	200
1988	168,000	534
1989	1,581,000	214
1990	282,000	321
1991	92,000	1,249
1992	694,000	U/A
1993	900,000	U/A

The most robust population in this area appears to be in Mill Creek in the Yaquina River, where a highly variable population is monitored in spawning ground counts. Abundance estimates based on these counts range from about 50 to about 900 since the mid-1980s. Opportunities exist to improve chum salmon habitat in the Yaquina Basin.

A small Coos Bay population spawns in Marlow Creek, where the habitat for chum salmon is stable and in relatively good condition. There is opportunity to expand the amount and quality of habitat in this area.

Some private hatchery releases of chum salmon occurred in Yaquina Bay, the Suislaw River, Coos Bay, and at Sand Lake between 1973 and 1987.

The chum salmon population in the Coquille River may be extinct. Only occasional, possibly nomadic, adults are seen in this basin.

Actions Under Way

Systematic monitoring of chum salmon populations through spawning ground counts will continue in the Tillamook, Netarts, Nestucca, and Yaquina systems. Observations of populations in other areas will be made during the monitoring of other species, especially fall chinook salmon spawning ground counts. Efforts to control gravel bar scalping and estuary dredging in Tillamook Bay will continue. Opportunities for habitat improvement projects have been identified in the Yaquina River and Coos Bay and will be implemented if funding becomes available. All consumptive harvest will continue to be curtailed. No state hatchery programs are planned for this species and basin plans restrict private hatchery production of chum salmon south of the Nestucca River. A limit of 900,000 juveniles was set for releases from the private hatchery in the Nehalem in 1993, along with a requirement for monitoring strays from the hatchery. The hatchery does not plan to release chum in 1994.

KOKANEE AND SOCKEYE SALMON (*Oncorhynchus nerka*)

Species Overview

Sockeye and kokanee are the anadromous and resident life histories of *Oncorhynchus nerka,* respectively. This species requires a lake for part of it's life cycle. Spawning may occur along lake shorelines or in stream gravels, but fry always migrate to lake environments soon after emergence and occupy this habitat during their stay in fresh water. Adult spawning behaviors in lake inlets, outlets, or along lake shorelines; juvenile migration behavior upstream or downstream into lakes; and anadromony behavior all appear to have a genetic component.

Populations with different life histories existing in sympatry may be, but are not necessarily, reproductively isolated from each other.

The *O. nerka* range in North America extends from the Klamath River in California to Point Hope in Alaska, with a few disjunct populations extending to Bathurst Inlet in the Arctic Ocean. In Asia, the species is found from northern Hokkaido, Japan, to the Anadyr River, Russia. Kokanee are found over most of the species range and occur both sympatric with sockeye and in lakes to which anadromous fish no longer have access, including both naturally and artificially blocked lakes. Kokanee also have been introduced outside of their natural distribution in Oregon and elsewhere in North America and have established many naturalized populations.

Both kokanee and sockeye were historically present in two basins in Oregon -- the Grande Ronde River in the Snake River Basin and the Deschutes River in the lower Columbia River Basin. Sockeye are extinct in the Grande Ronde and persist only at extremely low levels in the Deschutes due to the construction of artificial barriers including Pelton and Round Butte dams in the Deschutes and a water storage and diversion structure at the outlet of Wallowa Lake in the Grande Ronde. Kokanee are still present in both basins.

Table 13. Sockeye/Kokanee (*Oncorhynchus nerka*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Deschutes River	**Deschutes River ***		
	1. Below Pelton/Round Butte dams	**Fall**	
	2. Link Creek/Suttle Lake		**Adfluvial**
	3. Metolius River/Lake Billy Chinook		**Adfluvial**
	Odell/Davis Basin (Lava Dam) *		
	1. Odell Lake (possibly a natural population)		**Adfluvial**
Grande Ronde River	**Grande Ronde River ***		
	1. Wallowa Lake (inlet spawners)		**Adfluvial**
	2. Wallowa Lake (shore spawners)		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

The species *Oncorhynchus nerka*, including both resident (kokanee) and anadromous (sockeye) life histories are native to two stream/lake systems in Oregon -- the Grande Ronde River and Wallowa Lake system in the Snake Basin and the Deschutes River and Suttle Lake system in the lower Columbia Basin. The sockeye life history is extinct in the Grande Ronde, but persists in very small numbers in the lower Deschutes. A third potential group consisting strictly of kokanee is present in Odell Lake located in a closed basin that historically connected to the upper Deschutes River. This group may be introduced, although historical records of hatchery plantings and natural spawning observations are inconclusive.

The National Marine Fisheries Service (NMFS) is currently conducting a biochemical and meristic survey of *O. nerka* regionwide that includes samples from all of Oregon's populations except the remnant Deschutes sockeye. Efforts to obtain tissue samples from the sockeye have been unsuccessful because of the low number of fish. The description of a Wallowa Lake gene conservation group and a Deschutes gene conservation group for this species is therefore based on the substantial geographical distance between the two basins and on observed differences in appearance, especially spawning coloration between the groups.

The Deschutes group includes a remnant sockeye population that may spawn below Pelton/Round Butte dams. At least two kokanee populations are present above the dams, one that migrates between Lake Billy Chinook and the Metolius River and one that migrates between Suttle Lake and Link Creek. These are currently isolated from each other by man-made barriers that date to the early 1900s. Both of these kokanee populations are characterized by a distinctive blue-black body coloration during spawning. Preliminary results from the NMFS biochemical survey indicate that both Deschutes populations are unique compared to other Columbia Basin *O. nerka*, and that the two populations have diverged from each other (Robin Waples, personal communication). Both are inlet spawners, but the Suttle Lake/Link Creek population spawns two to three weeks later than the Lake Billy Chinook/Metolius population. The sockeye probably spawn at about the same time as the Lake Billy Chinook/Metolius group, based on their time of arrival at the hatchery trap.

The Odell Lake group is currently grouped with the

Deschutes until further information becomes available. The population contains an unusual amount of polymorphism in spawning coloration, including red, green mottled , striped and blue-black members. Body shape is also highly variable. This level of polymorphism seems unusual for a wild population and is more typical of naturalized populations founded from multiple sources. Odell Lake is naturally isolated by a lava dam in the upper Deschutes and multiple waterfalls in the midmainstem. Historical records do not demonstrate the presence of wild kokanee in any other upper Deschutes lake such as Cultus Lake or Crescent Lake. This group may be declared a natural rather than a wild population, but this decision will be deferred until analysis of the biochemical survey is completed.

The Wallowa kokanee includes two populations, an inlet spawning group and a shoreline spawning group. The shoreline spawners spawn nearly a month later than the inlet spawners and appear to be larger. Preliminary results from the NMFS biochemical survey indicate that the two populations differ from each other (Robin Waples, personal communication). These fish have either the more typical red body/green head spawning coloration or a mottled green color pattern.

Status Report

Listing Status

This species is not listed under the state or federal Endangered Species Acts.

Specific Status Conditions

Grande Ronde/Wallowa Lake: The sockeye morphology became extinct in the Grande Ronde as the result of a barrier constructed at the outlet of Wallowa Lake in 1916. The barrier eliminated sockeye access to Wallowa Lake. Sockeye continued to be observed in Wallowa River below the lake until the early 1930s, when they become extinct.

Two kokanee populations exist in Wallowa Lake, an inlet-spawning population and a shore spawning population. The shore population is a new population discovered in 1993. The two populations are reproductively isolated from all other kokanee.

Kokanee population trends and age-class distribution have been monitored annually by creel sampling and inlet population age-class sampling since 1970. The populations fluctuate over time, but show no particular long-term trend. Models to estimate population sizes are being evaluated, but the spawning populations are known to include hundreds of fish based on observations on the spawning grounds.

Mysis shrimp were introduced into Wallowa Lake in the 1960s. Although the shrimp are eaten in small amounts, they do not appear to be used as a primary kokanee food item and there is concern that they may be affecting the population dynamics of native zooplankton. Zooplankton populations have been monitored annually since 1986.

Hatchery kokanee were planted in this population historically. The hatchery program was discontinued for a period, then reinstated in 1990 using Paulina Lake stock to evaluate the feasibility of using hatchery fish for harvest. Evaluation of catch contribution of these hatchery fish has been conducted annually through angler creel surveys. Preliminary results to date indicate hatchery kokanee have contributed less than 3% to angler catches through 1994. All hatchery fish have been marked. The hatchery fish are of mixed origin and less than 5% can naturally spawn with the wild fish. Marked fish were observed spawning in the shoreline population for the first time in 1993. No hatchery fish have been observed in the inlet population, but sampling of the population has been limited. Hatchery releases were discontinued after 1994. Preliminary results from the NMFS biochemical survey suggest that there has been some hatchery introgression in both populations, most probably from the historical hatchery program (Robin Waples personal communication).

Deschutes/Metolius River/Suttle Lake: The sockeye morphology continues to persist at extremely low levels in the Deschutes River group. Sockeye were blocked first from Suttle Lake by the construction of a barrier at the lake outlet in the early 1900s. The life history persisted by either spawning in the Metolius River and rearing in the Deschutes or in the Columbia, or outmigrants escaped annually over the Suttle Lake barrier. Sockeye spawning runs continued into the Metolius until the construction of the Pelton/Round Butte dam complex in the 1960s. A kokanee population now rears in Lake Billy Chinook, the reservoir behind the dams, and migrates to spawn in the Metolius River. A few sockeye continue to return to the base of the dam complex. Sockeye are observed only when they enter the hatchery trap at the base of the dam. Seven sockeye were captured in the trap in 1992, one was captured in 1993 and fourteen were captured in 1994. The current source of the sockeye is uncertain. They may be from outmigrating kokanee that escape over the Pelton/Round Butte complex, strays from elsewhere in the Columbia Basin, or the sockeye may spawn below the dams and rear in mainstem Columbia River reservoirs.

The two Metolius River kokanee populations are currently isolated from each other by artificial barriers. These barriers are small and it is technically feasible to provide passage. Preliminary biochemical data suggests that the populations have diverged from each other, possibly as a result of the isolation caused by the barriers (Robin Waples, personal communication). The kokanee populations are also isolated from the sockeye population. Passage for sockeye around Pelton and Round Butte dams is technically more difficult. Distance would probably isolate all Deschutes populations from other *O. nerka*, even if artificial barriers were absent.

The spawning run of kokanee in Suttle Lake into Link Creek was intentionally blocked for a number of years to decrease population size and increase size of fish for harvest purposes. Limited spawning did occur however in lower Link Creek below the weir. The population declined as a result. The blockage weir on Link Creek was removed and natural reproduction resumed in 1991. The spawning population includes hundreds of fish, based on observations on the spawning grounds.

The Metolius/Lake Billy Chinook population is monitored in angler creel checks on Lake Billy Chinook (since 1990) and spawner surveys on mainstem Metolius river and tributaries, initiated in 1994. Observations of the spawning population indicate that it includes thousands of fish.

Historical hatchery programs occurred in these populations, but no hatchery fish are currently being released in Lake Billy Chinook/Metolius or Suttle Lake/Link Creek. Hatchery programs in the basin are located in Lake Simtustus (between Pelton and Round Butte dams), and Craine Prairie Reservoir and Paulina Lake in the upper Deschutes. Naturalized populations from past hatchery programs are present in some other upper Deschutes reservoirs and lakes. The hatchery fish can be distinguished from the wild populations in the Deschutes due to the unique color pattern of Metolius fish, and it does not appear that hatchery fish are entering the kokanee populations. Preliminary biochemical data also indicates that there has been no hatchery introgression (Robin Waples, personal communication). It is possible that hatchery kokanee escaping from Lake Simtustus contribute to the lower Deschutes sockeye population, although based on Oregon Department of Fish and Wildlife inventories, most of the kokanee (up to 80% as observed in creel surveys in recent years) in Lake Simtustus are naturally produced fish passing downstream from Lake Billy Chinook. Escape of other species of hatchery fish from Lake Simtustus occurs, but apparently only in small amounts.

The Odell Lake kokanee population may be a natural, rather than a wild population. Kokanee have been observed naturally spawning in the lake since the early 1940s; early hatchery records are inconclusive about planting prior to that time. If it is a wild population, it is naturally isolated by the lava dam that isolates the Davis/ Odell Lake system from the rest of the upper Deschutes Basin.

Actions Under Way

Annual population monitoring and hatchery program evaluation will continue in Wallowa Lake. The feasibility of developing a local Wallowa Lake broodstock will be investigated. Mysis and native plankton monitoring will continue. Tissue samples for genetic analysis have been collected from all Oregon populations including the Odell Lake population and the Paulina Lake hatchery population, and are currently being analyzed by the National Marine Fisheries Service in Seattle. Efforts to collect fin-clip tissue samples from sockeye have been unsuccessful to date, but will continue.

UNIDENTIFIED TROUT (*Oncorhynchus* spp.)

Species Overview

Oregon has at least 28 populations of *Oncorhynchus* trout that are not currently assigned to a taxonomic species. These trout occur in the Columbia Gorge and Hood River above impassable waterfalls. Additional populations may also exist in the Sandy, Clackamas, elsewhere in the Hood, in the Umpqua, and on the south coast. These additional populations are currently assigned to either rainbow or coastal cutthroat, although there is some uncertainty about their actual identification. The fish appear to have some phenotypic characteristics of both species. They are all isolated by natural barriers and all have very restricted distributions, although some of them may be locally abundant. They are not in areas that have been historically or currently stocked with hatchery rainbow or cutthroat. Some of the Columbia Gorge populations require further inventory to determine the exact population boundaries since some streams have multiple waterfalls.

Genetic samples were collected from the four Hood River populations and from one suspect "rainbow" in the Sandy River in 1993. A sampling design for the Columbia Gorge streams will be developed when further inventory information is available.

Table 14. Unidentified trout (*Oncorhynchus* species) population list.

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Gene conservation groups have not been described for this species.	**Latourell Creek above falls**		**Resident**
	Young Creek above falls		**Resident**
	Bridal Veil Creek above falls		**Resident**
	Coopey Creek above falls		**Resident**
	Wahkeena Creek above falls		**Resident**
	Multnomah Creek above falls		**Resident**
	Oneonta Creek above falls		**Resident**
	Tumalt Creek above falls		**Resident**
	McCord Creek above falls		**Resident**
	Moffatt Creek above falls		**Resident**
	Tanner Creek above falls		**Resident**
	1. Tanner Creek above second falls		**Resident**
	Eagle Creek above falls		**Resident**
	1. Eagle Creek above second falls		**Resident**
	Herman Creek above falls		**Resident**
	Lindsay Creek above falls		**Resident**
	Wonder Creek above falls		**Resident**
	Warren Creek above falls		**Resident**
	Cabin Creek above falls		**Resident**
	Starvation Creek above falls		**Resident**
	Viento Creek above falls		**Resident**
	Perham Creek above falls		**Resident**
	Phelps Creek above falls		**Resident**
	Hood River		**Resident**
	W. Fk. Hood River *		
	1. Greenpoint Creek above falls		**Resident**
	E. Fk. Hood River *		
	1. Emile Creek above falls		**Resident**
	2. Robinhood Creek		**Resident**
	3. Pocket Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

BULL TROUT (*Salvelinus confluentus*)

Species Overview

Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) are western North America's most southern derivatives of the genus *Salvelinus*, the arctic charr. Historical investigations indicate that coastal native charr were Dolly Varden and inland native charr were bull trout. Only bull trout are currently present in Oregon. Researchers believe, based on the bull trout's needs for cold water to successfully reproduce, that these populations originated during the last glacial period. The species range is limited to the northern part of the northwest United States (western Montana, Idaho, northern Nevada, northern California, Oregon and Washington) and north into Canada and Alaska. The last California population in the McCloud River is now extinct. ODFW recognizes 70 bull trout populations in the Columbia Basin from the Willamette to the Malheur and nine populations in the Klamath Basin. Populations are extinct from at least 12 additional geographical areas in Oregon.

Oregon's bull trout exhibit three basic life history phenotypes: (1) adfluvial, which migrates between lakes or reservoirs and streams, (2) fluvial, which migrates between small tributaries and main rivers, and (3) resident, which remains non-migratory. These alternative life history strategies are common in arctic charr evolutionary derivatives worldwide.

Bull trout in Oregon evolved as an apex predator in most waters. Slow juvenile growth delays maturation until age 5 or older, and reproduction may only occur on alternate years. They will live for 12 or more years in

Oregon, reaching sizes approaching 30 pounds where adequate forage is available. Their highly piciverous nature and delayed maturity make them vulnerable to over-fishing.

Migratory forms of bull trout may travel long distances to reach wilderness spawning tributaries. Mature bull trout invariably penetrate farther upstream than any other salmonids present in the watershed. The fluvial and adfluvial life history types in Oregon and throughout its range have been seriously impacted by upstream and downstream passage barriers that resulted from the construction of irrigation and hydroelectric dams.

Brook trout (*Salvelinus fontinalis*), a species native to eastern North American, was introduced into Oregon early this century and has established many naturalized populations in the range of bull trout. Where bull trout and brook trout coexist, hybridization that results in sterile offspring may lead to eventual loss of the bull trout population. The introduction of non-native fishes such as brook trout, as well as environmental alterations such as logging, grazing, agriculture and dam construction, has caused a dramatic contraction in distribution and decline in abundance of bull trout in Oregon and elsewhere in its range.

The basins that have the most precarious populations with the highest risk of extinction are the Middle Fork of the Willamette, Hood, Klamath and Powder rivers. The most healthy populations are in northeastern Oregon and in the Metolius/Lake Billy Chinook complex.

No hatchery bull trout are released in Oregon. Brook trout hatchery programs in 1992 and 1993 are listed in Appendix A.

Table 15. Columbia basin bull trout (*Salvelinus confluentus* spp.) population list.

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Willamette Basin	**McKenzie River ***		
	1. Below Trail Bridge Dam		**Fluvial**
	2. Above Trail Bridge Dam		**Adfluvial**
	3. Carmen Reservoir above dam		**Adfluvial**
	4. S.Fk. McKenzie River *		
	a. Above Cougar Dam		**Adfluvial/Fluvial**
	Middle Fork Willamette River *		
	1. Above Hills Creek Dam		**Adfluvial**
Hood/Deschutes	**Hood River (No Reproduction)**		**Fluvial**
	1. Middle Fork Hood River *		
	a. Clear Branch Creek *		
	i. Above Laurance Lake Dam		**Adfluvial/Fluvial**
	Deschutes River *		
	1. Warm Springs River		**Resident/Fluvial**
	2. Shitake Creek		**Resident/Fluvial**
	3. Lake Simtustus (No Reproduction)		**Adfluvial**
	4. Metolius River		**Adfluvial/Fluvial**
Odell Lake	**Odell/Davis Lake Basin ***		
	1. Trapper Creek		**Adfluvial**
Mid-Columbia	**John Day River ***		
	1. N.Fk. John Day River *		
	a. M.Fk. John Day River *		
	i. Clear Creek		**Resident**
	ii. Big Creek		**Resident**
	iii. Granite Boulder Creek		**Resident**
	b. Desolation Creek		**Resident/Fluvial**
	i. S.Fk. Desolation Creek		**Resident/Fluvial**
	c. Big Creek		**Resident/Fluvial**
	d. Granite Creek		**Resident/Fluvial**
	i. Clear Creek		**Resident/Fluvial**
	e. Crane Creek		**Resident/Fluvial**
	f. Trail Creek		**Resident/Fluvial**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Table 15. Columbia basin bull trout (*Salvelinus confluentus* spp.) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Mid-Columbia (continued)	g. Baldy Creek.		**Resident/Fluvial**
	2. Upper mainstem		**Resident/Fluvial**
	3. Indian Creek		**Resident/Fluvial**
	4. Reynolds Creek		**Resident/Fluvial**
	5. Deardorff Creek		**Resident/Fluvial**
	6. Rail Creek		**Resident/Fluvial**
	7. Call Creek		**Resident/Fluvial**
	Umatilla River *		
	1. N. Fk. Umatilla		**Resident/Fluvial**
	2. S. Fk. Umatilla		**Resident**
	Walla Walla River *		
	1. N. Fk. Walla Walla		**Resident**
	2. S. Fk. Walla Walla		**Resident/Fluvial**
	3. Mill Creek		**Resident/Fluvial**
Grande Ronde/Imnaha	**Grande Ronde River ***		
	1. Wenaha River		**Resident/Fluvial**
	2. Wallowa River *		
	a. Minam River		**Resident/Fluvial**
	i. Little Minam River above falls		**Resident**
	b. Deer Creek		**Resident/Fluvial**
	c. Bear Creek		**Resident/Fluvial**
	d. Lostine River		**Resident/Fluvial**
	e. Hurricane Creek above falls		**Resident**
	3. Lookingglass Creek		**Resident/Fluvial**
	4. Indian Creek		**Resident/Fluvial**
	5. Catherine Creek		**Resident/Fluvial**
	6. Chicken Creek *		
	a. Indiana Creek		**Resident**
	7. Limberjim Creek above falls		**Resident**
	8. Clear Creek		**Resident**
	Imnaha River		**Fluvial**
	1. Imnaha River above falls		**Resident**
	2. Big Sheep Creek		**Fluvial**
	3. Big Sheep Creek above dam		**Resident**
	4. Little Sheep Creek		**Resident/Fluvial**
	a. McCully Creek above dam		**Resident**
	5. S.Fk. Imnaha River		**Resident**
	a. Cliff Creek		**Resident**
Malheur	**Pine Creek ***		
	1. E. Pine Creek		**Resident**
	2. N. Pine Creek *		
	a. Elk Creek		**Resident**
	3. Clear Creek *		
	a. Meadow Creek		**Resident**
	4. M.Fk. Pine Creek		**Resident**
	Powder River *		
	1. Eagle Creek		**Resident**
	2. N. Powder River		**Resident**
	a. Anthony & Indian creeks		**Resident**
	3. Cracker Creek *		
	a. Little Cracker Creek		**Resident**
	b. Silver Creek		**Resident**

** Populations are present only in the tributaries of this water body as listed below it.*

*** Season of adult spawning migration.*

Table 15. Columbia basin bull trout (*Salvelinus confluentus* spp.) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history Anadromous**	Life history Freshwater
Malheur (continued)	c. Lake Creek		**Resident**
	Malheur River *		
	1. N.Fk. Malheur River *		
	a. Crane Creek		**Resident/Fluvial**
	i. Little Crane Creek		**Resident/Fluvial**
	b. Elk, Sheep, Flat, and Swamp creeks		**Resident/Fluvial**
	2. M.Fk. Malheur River *		
	a. Big Creek and Lake Creek		**Resident/Fluvial**
Klamath Basin	**Crystal Creek** *		
	1. Cherry Creek		**Resident**
	2. Threemile Creek		**Resident**
	Wood River *		
	1. Annie Creek *		
	a. Sun Creek		**Resident**
	Williamson River *		
	1. Sprague River *		
	a. Sycan River *		
	i. Long Creek		**Resident**
	ii. Coyote Creek		**Resident**
	b. NF Sprague River *		
	i. Boulder and Dixon creeks		**Resident**
	c. SF Sprague River *		
	i. Demin Creek		**Resident**
	ii. Brownsworth		**Resident**
	A. Leonard Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*

Criteria For Describing Gene Conservation Groups

Bull trout have only recently been taxonomically distinguished from Dolly Varden (Haas and McPhail, 1991). Genetic variation within bull trout has been studied by Leary et al. (1993).

Klamath Basin Bull Trout

The greatest division within bull trout separates the fish in the Columbia Basin from those in the Klamath. According to the results of Leary et al. (1993), the two groups are completely divergent at one locus (each group fixed for a different allele), and differ at nine others that are fixed in the Klamath, but are polymorphic in the Columbia. A direct connection between the Columbia and Klamath basins since the invasion of bull trout is unlikely. The most recent alternative configuration of the Klamath Basin is thought to be that of a closed great basin that held glacial Lake Modoc in the Pleistocene. The Klamath and Columbia bull trout probably represent separate invasions from the Pacific that have since diverged. While anadromous bull trout are unknown in Oregon, the life history has been described in Puget Sound and may be ancestral for the species. A possible subspecies designation for the Klamath bull trout has been discussed (Leary et al. 1993). Based on this information, the Klamath bull trout are described here as a potential subspecies and as at least one gene conservation group. The Leary et al. (1993) survey only studied Klamath bull trout from the upper Sprague River. The species distribution is highly fragmented across the Klamath and the populations in the northern and western portions of the basin are remote from those in the upper Sprague. Additional surveys may indicate that further subdivision is appropriate for this group.

Columbia Basin Bull Trout

Within the Columbia Basin, Leary et al. (1993) surveyed Oregon populations in the Deschutes (Metolius), John Day, Grande Ronde, and Malheur, as well as populations in other states. The survey demonstrated that a substantial amount of the genetic variation in the species (40%) occurs among populations. In many cases, this divergence was due to the occurrence of alleles at appreciable frequencies in some populations that were absent in other populations. A geographical pattern to the variation was not evident and Leary et al. (1993) postulated that the high level of divergence was due to population fragmentation, founder effects and genetic drift. Most of

Oregon's Columbia Basin populations probably had both fluvial and resident life histories, with the fluvial members migrating between spawning areas in the tributaries and rearing areas in the mainstem Columbia and Snake rivers. The migrating individuals may have provided gene flow among basins. Dam construction on the mainstem Columbia and Snake rivers and habitat degradation in the lower mainstems of the tributaries now preclude most migration; only the resident life history, or local migrations (for example between the Metolius and Lake Billy Chinook in the Deschutes), persist in most areas.

Leary et al. (1993) were reluctant to propose that the Columbia Basin bull trout should be broken into several "evolutionary significant units" under the Endangered Species Act based on the existing survey. Their concern was that the current pattern of genetic divergence among groups may be caused by fragmentation and an inference that management should intentionally maintain isolation among basins may be unsound. However, they also recognized that the populations in each subbasin are currently reproductively isolated from others, that little genetic variation occurs within populations while substantial variation occurs among them, and that protection of each group is important for the conservation of the species. Therefore, ODFW proposes breaking the Columbia Basin into several gene conservation groups with the recognition that with recovery some of the groups may naturally merge back together. ODFW also intends to expand the existing genetic survey to explore more Oregon populations. The proposed Columbia Basin gene conservation groups and the criteria used to define them are as follows:

Willamette Basin

This group includes several resident populations and at least one fluvial population in the McKenzie and Middle Fork Willamette. This group has not yet been surveyed, but is the only remaining Oregon bull trout west of the Cascade Mountains.

Hood/Deschutes Basin

This group includes a resident population in the Hood River, and several fluvial populations in the Hood and Deschutes rivers that apparently still migrate to the Columbia. Locally fluvial/"adfluvial" groups are present in Laurance Lake/Hood River where they are isolated by Clear Branch Dam, and the Metolius/Lake Billy Chinook and in Lake Simtustus where they are isolated by Pelton and Round Butte dams. Leary et al.'s (1993) study detected a relatively high frequency of a rare allele at one loci in the Metolius group, although this allele also occurred in geographically remote populations in other states.

Odell Lake: This group has not yet been surveyed, but it is the only remaining natural adfluvial population in Oregon and is naturally isolated by a lava dam on the upper Deschutes that probably formed in the last 5,000 to 10,000 years.

Mid-Columbia: This group includes resident populations in the John Day, Umatilla, and Walla Walla rivers. Only one John Day population was studied in Leary et al.'s (1993) survey and was distinguished by being monomorphic for all loci. The populations within this group require further study and may warrant further splitting.

Grande Ronde/Imnaha: This group includes both resident and fluvial populations. There is still a potential for gene flow between these two basins, suggesting that the historical life history pattern may be conserved in this system. An allele unique to the Grande Ronde was detected by Leary et al. (1993).

Malheur: This group includes resident populations in the Malheur and Powder rivers. Like the John Day, the Malheur sample was monomorphic at all loci in Leary et al.'s. (1993) study, although the sample size (four fish) was too small to be conclusive. A fluvial life history (at least one that moved to the Snake) may not have occurred in recent history under natural conditions in the Malheur because of the warm water, desert characteristics of the lower basin.

Status Report

Listing Status

This species is federally listed as a "Category 1" candidate species. It was petitioned for listing under the federal Endangered Species Act on October 28, 1992: The US Fish and Wildlife Service reviewed the petition and concluded that bull trout warranted ESA listing but were precluded by higher priority listings. Bull trout are also listed as a state "sensitive species," effective in 1990.

Status Conditions

Klamath: The nine isolated populations of bull trout in the Klamath Basin are at the southern most edge of the species range. All of these populations are disjunct in part because of a natural drying cycle that dates back to the desiccation of pluvial Lake Modoc, and more recently, due to habitat degradation from grazing and timber harvest, and transfers of exotic brook trout and brown trout into the basin. The most recent fragmentation and isolation of these individual populations of bull trout has eliminated the natural gene flow that probably occurred among streams with the possible result of inbreeding, and loss of fitness and genetic variation. Likely fluvial life histories in the North and South Fork Sprague and Sun Creek/Wood River have also been lost.

Ratliff and Howell (1992) analyzed data collected during extensive department and U.S. Forest Service stream surveys between 1990 and 1992, and concluded that five of the nine Klamath bull trout populations were at a high risk of extinction while the other four were at a moderate risk, based on abundance, habitat quality, the presence of brook trout, and recovery potential. In addition, only hybrid bull trout x brook trout were found in Cherry and Coyote creeks, suggesting that these populations may be extinct. The potential for hybridization with brook trout threatens five of the nine populations. Only Brownsworth, Deming and Long creeks have more than 300 spawners each.

Willamette Basin: Bull trout in the McKenzie and Middle Fork Willamette rivers were historically part of a much larger metapopulation that included populations in the North and South Santiam and Clackamas rivers. Populations in these latter streams were probably lost due to over-fishing, introduction of brook trout, timber harvest, and hydroelectric development.

The historical number of populations of bull trout in the McKenzie River is not clear. Bull trout were once either a single contiguous population ranging from the lower river up to Tamolitch or Koosah Falls and extending up the larger tributaries, or two populations with overlapping distributions and some genetic interchange. If there were two populations, one spawned in the upper reaches of the mainstem and one spawned in the upper reaches of the South Fork. Dams have now divided these fish into three or possibly four populations: (1) McKenzie below Trail Bridge Dam; (2) South Fork McKenzie above Cougar Dam; (3) Trail Bridge Reservoir; and possibly (4) Carmen Reservoir. In the mainstem, Anderson and Olallie creeks have been identified as spawning areas for the McKenzie population below Trailbridge Dam. Only the lower 200 yards of Olallie Creek is available for bull trout because a culvert under Highway 126 is impassable. Redd counts in Anderson Creek have ranged from 7 in 1989 to 30 in 1994.

In 1992, a culvert barrier between Trailbridge Reservoir and Sweetwater Creek was removed by the USFS to reestablish upstream passage into a potential bull trout spawning area. In 1993 and 1994, bull trout fry from Anderson Creek were planted in Sweetwater Creek in an effort to establish a population there. In 1994 bull trout fry from Anderson Creek were also planted in Olallie Creek above the culvert barrier in anticipation of the culvert being modified to provide fish passage in 1995. Monitoring of these fry continues.

Historically, bull trout were present in the Middle Fork Willamette River drainage, probably including the North Fork and Salmon Creek. With the construction of Hills Creek Dam and an accompanying chemical treatment project, bull trout were believed to have been lost. However, angler reports with accompanying photos of fish caught and released since 1990 verify that a few bull trout are still present. In 1993 and 1994, no bull trout were found in the Middle Fork above Hills Creek Reservoir despite surveys covering an extensive area, including intensive surveys in the most likely habitats and reliable angler reports.

Brook trout are present and threaten bull trout in Carmen and Trailbridge reservoirs and in tributaries of the upper mainstem and South Fork McKenzie and upper Middle Fork Willamette rivers.

All populations in this gene conservation group have less than 300 adult spawners per population. In 1991 restrictive angling regulations were put in place to protect bull trout in the Willamette Basin. Low population size, barriers from hydroelectric dams, hybridization with brook trout and timber harvest continue to place these populations at high risk of extinction.

Hood/Deschutes: At present the only known spawning area in the Hood River Basin is in Clear Branch Creek above Laurance Lake. Construction of Clear Branch Dam in 1969 without upstream or downstream passage facilities severed a bull trout population with fluvial life history that included migrations to the Columbia River, and provided possible genetic interchange with populations in the nearby Klickatat and Deschutes rivers.

The population listed in the Hood River below Clear Branch Dam may actually consist of fish that escape from the Laurance Lake population during high water spill. Six upstream migrant adults were trapped and tagged at Powerdale Dam in 1992; two were trapped and tagged in 1993 and seven were trapped and tagged in 1994. Two of the 1992 fish were eventually found at the base of Clear Branch Dam where they attempted to spawn. It is believed that spawning at the base of the dam is largely unsuccessful due to high water temperatures during egg incubation.

Critically low population size of less than 300 fish, and fragmentation of the population by Clear Branch Dam continue to place this population at a high risk of extinction. Brook trout are not present in the Middle Fork of the Hood and restrictive angling regulations protecting bull trout from harvest have been in effect since 1992.

Deschutes River bull trout, including current spawning populations in Shitike Creek, Warm Springs and Metolius rivers, were once part of a much larger fluvial metapopulation that migrated down to the Columbia River. These populations possibly exchanged genetic material with bull trout from the nearby Hood and Klickatat rivers, as evidenced by historical angler catches of large bull trout in the mainstem Columbia near the mouths of these streams. Completion of the Pelton-Round Butte hydroelectric complex (RM 100) in 1964, and subsequent abandonment of downstream passage facilities in 1968, fragmented this complex of populations, isolating Metolius River spawners from bull trout using Shitike Creek and Warm Springs River. The fish observed in Lake Simtustus are thought to be fish that escape Lake Billy Chinook through Round Butte Dam since there is no adequate spawning habitat for the species between the dams.

Pelton and Round Butte dams also blocked off adult sockeye, steelhead, lower river redband trout, and spring chinook salmon from gaining access to the Metolius Basin. Juveniles of these species were important prey items for bull trout. However, an abundant kokanee population has developed in Lake Billy Chinook and provides an alternate prey source. As a result of protection of spawning and rearing areas in the Metolius River and tributaries by the USFS, restrictive angling regulations and abundant kokanee as a food source, the adfluvial Metolius/Lake Billy Chinook bull trout appears to be healthy and increasing. Redd counts of spawning bull trout in Metolius tributaries have increased from a low of 27 redds in 1986 to a high of 330 redds in 1994.

It is believed the Shitike Creek and Warm Springs River populations of bull trout have fluvial as well as resident components. The fluvial components of these populations spawn and rear in the mid-to upper stream reaches or headwater tributaries. A portion of the immature individuals migrant to the Deschutes River to rear for a period of years before returning to the two tributaries to spawn. There is no information that suggests that any bull trout spawning occurs in the mainstem Deschutes River. Tribal biologists annually monitor these populations by conducting spawner surveys on index reaches of each stream during annual spring chinook surveys. Total spawner abundance is unknown.

Odell Lake: Bull trout in Odell Lake are the last remaining of five known adfluvial populations in Oregon. Adfluvial populations were also historically present in Crescent, Davis, Suttle, and Wallowa lakes. Bull trout in Crescent Lake were seriously impacted in 1922 by the construction of an impassable dam on the outlet at Crescent Creek. A few fish persisted in this population until at least 1959, when the population became extinct. The Davis Lake population was lost in 1961 due to a chemical treatment project to eradicate tui chub. Two observations of a bull trout captured in Davis Lake trap-nets in 1966 and 1977 were probably from the Odell Lake population. The Suttle Lake population was lost sometime after 1961 due to a combination of overfishing in Link Creek and hybridization with brook trout. The Wallowa Lake population was lost during the 1950s when a successful eradication project was conducted because bull trout were known predators on juvenile salmon.

Prior to a lava flow damming Odell Creek approximately 5,000 years ago and forming Davis Lake, the Odell and Davis populations were likely part of a much larger metapopulation of fluvial bull trout that included the upper Deschutes River upstream into the area now inundated by Crane Prairie Reservoir. Since large fluvial/adfluvial bull trout were documented in the early 1900s in Crescent Creek, and excellent spawning and rearing habitat still exists throughout the Little Deschutes system, it is also likely that bull trout were historically distributed throughout the Little Deschutes River. Large fluvial bull trout made extensive migrations throughout the upper Deschutes above Bend and were actively pursued by Native Americans at partial upstream migration barriers such as Pringle Falls. These populations were lost as a result of passage barriers and changes in river hydrology due to the construction of Crescent and Crane Prairie dams in 1922 and Wickiup Dam in 1947, as well as the widespread distribution of brook trout throughout the upper mainstem and Little Deschutes rivers in the early 1920s.

Trapper Creek is the only known spawning area for bull trout using Odell Lake. Crystal, Odell, and Warf creeks are also suspected spawning areas, but have not been documented to date. That more than one spawning population may exist at Odell is evidenced by the trap-net capture of five maturing female bull trout during mid October 1992 and two unspawned (1 male, 1 female) bull trout during mid October 1994, both near the outlet of Odell Lake at Odell Creek. These fish were captured approximately one month later than when peak bull trout spawning at Trapper Creek normally occurs, and approximately five miles away.

Annual spawning ground counts of bull trout on Trapper Creek are yet to be undertaken. However, the adult spawner population size is likely less than 100 fish.

Brook trout are present in both Trapper and Crystal creeks and may eventually threaten bull trout there. The great size difference between small brook trout and much larger bull trout spawners is probably keeping the two species from hybridizing for now. Restrictive angling regulations precluding harvest of bull trout have been in effect since 1992.

Mid-Columbia: John Day bull trout populations are currently restricted to headwater tributaries of the North and Middle Forks and upper mainstem. At this time these populations are isolated from each other at least during summer months due to warm water and low streamflows. This isolation is principally the result of agricultural development, irrigation diversions, and the loss of riparian vegetation due to grazing and timber harvest.

Total historic distribution of bull trout in the John Day Basin is unknown, but past angler reports indicate bull trout were well distributed throughout the basin and that adult migrations to and from the Columbia River were likely. The complex of populations in the North

Fork is the largest and has the strongest fluvial life history component in the basin. The three populations of bull trout in the Middle Fork subbasin (Big, Granite Boulder and Clear creeks) are at high risk of extinction due to their extreme isolation and ongoing habitat impact s. Population inventories conducted during 1990 indicate Big and Granite Boulder creeks have more than 300 spawners. Bull trout populations in the upper mainstem are separated from each other during summer months, but may have interchange of spawners during the winter. 1990 population surveys indicate the upper mainstem, and Call and Rail creeks have the strongest bull trout abundance, each with more than 300 spawners. Catches of downstream migrant juvenile bull trout at irrigation diversion bypass traps and numbers observed during angler surveys indicate a serious decline of migratory fish over the past 20 years.

Brook trout are present in the upper mainstem, Strawberry Creek, South Fork Desolation and Desolation creeks, Crane, Baldy, Big, Windom creeks and the upper North Fork. At this time the small size at maturity of brook trout may reduce hybrid pairings. The John Day Basin was closed to the take of bull trout by angling beginning in 1994.

Similar to the John Day Basin, bull trout in the Walla Walla and Umatilla rivers are restricted to several headwater tributaries. Agricultural development, irrigation diversions and loss of riparian vegetation due to grazing and timber harvest are the primary isolating mechanisms. Historic angler accounts indicate bull trout were once well distributed throughout both basins, with seasonal migrations down to the Columbia River likely prior to agricultural development in the basins.

The South Fork Walla Walla and North Fork Umatilla contain the most pristine habitat and healthiest bull trout populations in these basins. Although no population estimates are available, first-time spawner surveys on the South Fork Walla Walla observed 103 bull trout redds in 1993. Spawner surveys in 1994 observed 143 redds in the Walla Walla system, 39 redds in the forks of the Umatilla system and 3 redds in Meacham Creek. The Meacham Creek fish were a newly discovered population. These surveys also revealed the likely presence of both fluvial and resident life histories, with spawner sizes ranging from 8 inches to 24 inches long. Brook trout are not present in these basins. Beginning in 1994 the take of bull trout by angling was closed in the Umatilla and Walla Walla basins.

Grande Ronde/Imnaha: Bull trout in tributaries of the lower Grande Ronde and upper Imnaha basins probably represent the healthiest stream-reared complex of populations in Oregon. Healthy resident and fluvial populations are still present in the Minam, Wenaha and Imnaha rivers, all streams dominated by wilderness areas administered by the USFS. Summertime movement of fluvial adults downstream of the wilderness area in the Imnaha Basin continues to be impacted by agricultural development, unscreened irrigation diversions, and loss of riparian vegetation.

Stream surveys conducted in 1992 in the Wallowa Basin indicated low adult abundance in the Lostine River, and Bear and Hurricane creeks, with naturalized populations of brook trout posing serious threats in all three streams. Although brook trout have not been documented in the Imnaha system, they do occur in Crater and Twin Lakes, which formerly drained into the Imnaha prior to irrigation development that diverted their outflows into the Eagle Creek (Powder River) system.

Wallowa Lake formerly had an adfluvial population of bull trout prior to successful eradication in the early 1950s by biologists who were concerned about bull trout predation on juvenile salmon.

Lookingglass, Indian and Catherine creeks all have low density bull trout populations that are restricted to headwater areas during summer months as a result of downstream land use impacts. Fluvial life histories may still persist and use the mainstem Grande Ronde during winter months, as evidenced by five tagged bull trout in Lookingglass Creek (tagged September 11), one of which was caught by a steelhead angler in the main Grande Ronde River near LaGrande the following March 10 and then recaptured again near the mouth of Lookingglass Creek the following September. Brook trout are present in upper Lookingglass Creek and may threaten bull trout there.

In the upper Grande Ronde Basin above LaGrande, only three isolated resident bull trout populations persist in Indiana, Limber Jim and Clear creeks. Early settlers in the area reported large (average 10 pounds) "mountain trout" in the upper Grande Ronde Basin. Summertime use of the mainstem and most of the tributaries has been lost due to timber harvest, grazing, and irrigation diversions. Brook trout are present in the upper mainstem Grande Ronde River and Beaver Creek and are likely the reason why bull trout are not present in these areas.

Beginning in 1994, the take of bull trout by angling was closed in the Grande Ronde and Imnaha basins.

Powder/Malheur: Similar to the pattern seen throughout much of Oregon, bull trout in the Pine and Powder Creek basins are restricted to headwater areas where adequate temperatures and instream habitat remain. Widespread distribution of brook trout likely also limits bull trout use of these basins. It is possible that bull trout in the Powder Basin could still be seasonally connected to Phillips Reservoir during winter months. A prey base of juvenile anadromous salmonids were lost in these basins with the construction of Hells Canyon, Oxbow and Brownlee dams on the Snake River.

Although abundance estimates have not been made, all populations in the Pine and Powder basins are likely affected by population fragmentation and the low number of adults present.

Bull trout have never been verified in the Burnt River system, but are suspected to have been historically present. Extensive surveys in 1990 failed to find any bull trout. Extensive land use development, unscreened diversions and planting of brook trout (since at least 1924) have likely extirpated any bull trout that may have been in the basin, and the single population still listed in this basin is probably extinct.

The current distribution of bull trout in the Malheur Basin is restricted to the North and Middle Forks of the Malheur River and selective tributaries above Agency and Warm Springs dams. Warm Springs Dam, constructed in 1919, and Agency Dam, constructed in 1935, effectively eliminated anadromous runs into these drainages and blocked off any opportunity for gene flow between the North and Middle Fork bull trout populations.

It is unknown whether North Fork Malheur bull trout are predominately resident or fluvial fish, but a fluvial ecomorph likely still persists as evidenced by a 14 inch bull trout caught by an angler in Buelah Reservoir in 1992 and trapnet catches there in 1995. There are no barriers precluding genetic interchange of bull trout among nearby tributaries in the upper North Fork drainage . Population surveys conducted in 1992 in the North Fork estimated 3,600 bull trout of which 900 were over 6 inches. Population surveys of Middle Fork bull trout were completed in 1994.

Overgrazing and timber harvest of riparian zones, and unscreened irrigation diversions, all on national forest lands, continue to impact these remnant bull trout populations of the upper Malheur Basin. Brook trout are present in the Middle Fork and threaten bull trout there. The take of bull trout by anglers has been closed in the Pine, Powder, Burnt, and Malheur basins since 1992.

MOUNTAIN WHITEFISH (*Prosopium williamsoni*)

Species Overview and Status

Listing Status

Mountain whitefish are not listed in Oregon.

Status Conditions

The mountain whitefish (*Prosopium williamsoni*) occurs in lakes and streams of western North America from northern Utah, Wyoming and western Montana, north into the Saskatchewan River drainage in Alberta, and west to the MacKenzie, Liard and Peace River drainages in British Columbia. It is widespread in British Columbia from the Fraser and Columbia River systems, and throughout Pacific coastal drainages of the Bella Coola, Skeena, Nass, and Stikine rivers. In Oregon, Washington, and Idaho it is common throughout the Columbia River system. It also lives along the east slope of the Sierra Nevadas in California.

Mountain whitefish are the only whitefish native to Oregon. They are found in the Columbia and Snake River basins from the Willamette River to the Owyhee River, and in the closed Malheur Lakes Basin in Donner Und Blitzen and Keiger rivers. There are 63 recognized populations in the state, although some of these may deserve further subdivision.

Mountain whitefish are found both in streams and lakes in Oregon. In streams they are found primarily in riffle areas in summer, but prefer large pools during winter. Generally they inhabit the larger streams, with average temperatures of 48-52° Fahrenheit. Oregon lakes with whitefish include Odell, Davis, Cultus, Winopee, Crescent, Suttle, and Wallowa lakes.

Mountain whitefish are a relatively long-lived salmonid and may reach 11 to 12 years of age. Sexual maturity is reached when the fish are three to four years old. Spawning usually occurs in the fall from October to December. Spawning generally takes place in gravel of stream riffles, but also may occur on gravel shoals along the shores of lakes. Unlike Oregon's native salmon and trout, whitefish do not dig a redd to bury their eggs, but broadcast spawn instead.

As evidenced by their specialized subterminal mouth, whitefish feed primarily on immature forms of bottom dwelling aquatic insects. Populations that occupy lakes feed extensively on zooplankton.

Mountain whitefish populations are not routinely monitored in Oregon. There are, however, numerous annual observations of whitefish in conjunction with monitoring trout populations throughout the state. In areas where they are routinely observed, such as the Upper Willamette, McKenzie, upper and lower Deschutes, Crooked and Metolius basins, mountain whitefish appear to be the most numerous salmonid present.

One area where whitefish may need to be more carefully monitored is upper White River above White River Falls. This population is likely very unique, having been isolated from the rest of the Deschutes Basin for an apparently long geological time. Their distribution is limited to the lower river from just above the falls up to RM 6, and they are not found in any of the tributaries. In 1985, abundance was estimated to be 100 whitefish/mile in the 4.5-mile section immediately above the falls. In contrast, a 1975 population estimate for the mainstem Deschutes River was 5,000 whitefish/mile in the Warm Springs to Trout Creek area of the river.

Other groups that are probably of systematic interest include the populations isolated in the Malheur Lakes Basin. The location of the populations suggest they were part of the fish fauna isolated from the Malheur River Basin by the lava dam that isolated the basin 10,000-15,000 years ago. Likewise, the populations in the Davis/Odell Basin are isolated by a lava dam that is about 5,000 years old.

Additional populations for this species may be described as their distribution relative to other natural barriers is further studied.

There are no hatchery programs for whitefish in Oregon, nor do they hybridize with any species planted.

Table 16. Whitefish (*Prosopium williamsoni*) population list.

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this species.	**Willamette River ***		
	Clackamas River *		
	1. Tributaries below North Fork Dam		**Resident**
	2. Tributaries above North Fork Dam		**Resident**
	Mainstem Willamette River above falls		**Resident**
	Molalla River		**Resident**
	Mill Creek		**Resident**
	Luckiamute River		**Resident**
	Santiam River *		
	1. N.Fk Santiam below Detroit Dam		**Resident**
	2. N.Fk Santiam above Detroit Dam		**Resident**
	3. S.Fk Santiam		**Resident**
	Calapooia River		**Resident**
	Mary's River		**Resident**
	McKenzie River		**Resident**
	1. S.Fk McKenzie R.		**Resident**
	a. above Lookout Point Reservoir		**Resident**
	b. N.Fk above West Fir Dam		**Resident**
	Coast Fork Willamette River		**Resident**
	Middle Fork Willamette River		**Resident**
	Hood River		**Resident**
	Deschutes River *		
	1. Tributaries below Pelton Dam		**Resident**
	a. White River (above falls)		**Resident**
	2. Crooked River (below Prineville)		**Resident**
	a. Ochoco Creek		**Resident**
	3. Metolius River		**Resident**
	a. Suttle Lake and above		**Res./Adfluvial**
	4. Steelhead Falls to Big Falls		**Resident**
	5. Odin Falls to Cline Falls		**Resident**
	6. Cline Falls to Awbry Falls		**Resident**
	7. Awbry Falls to North Canal Dam		**Resident**
	8. North Canal Dam to Wickiup Dam		**Resident**
	a. Little Deschutes River		**Resident**
	i. Crescent Creek		**Resident**
	ii. Crescent Lake		**Res./Adfluvial**
	9. Wickiup Dam to Crane Prairie Dam		**Resident**
	a. Cultus Lake		**Res./Adfluvial**

** Populations are present only in the tributaries of this water body as listed below it.*
*** Season of adult spawning migration.*

Table 16. Whitefish (*Prosopium williamsoni*) population list (continued).

Gene conservation group (described by location)	Population (described by location)	Life history: Anadromous**	Life history: Freshwater
Gene conservation groups have not been described for this species.	b . Winopee Lake		**Res./Adfluvial**
	10. Above Crane Prairie Dam		**Res./Adfluvial**
	Odell Lake Basin *		
	1. Odell Lake		**Adfluvial/Res.**
	2. Odell Creek/Davis Lake		**Adfluvial/Res.**
	John Day River *		
	1. Tributaries below South Fork		**Resident**
	a. N.Fk John Day River		**Resident**
	b. M.Fk John Day River		**Resident**
	2. S.Fk John Day River		**Resident**
	3. Tributaries above South Fork		**Resident**
	Umatilla River		**Resident**
	Walla Walla River		**Resident**
	Snake River *		
	1. Mainstem below Hells Canyon Dam *		
	2. Grande Ronde River *		
	a. Tributaries, mouth to Wallowa River		**Resident**
	b. Wallowa River (below Wallowa Lake)		**Resident**
	i. Minam River		**Resident**
	c. Wallowa River (above Wallowa Lake)		**Res./Adfluvial**
	d. Tributaries, above Wallowa River		**Resident**
	3. Imnaha River		**Resident**
	4. Mainstem Snake River above Brownlee Dam		**Resident**
	5. Pine Creek		**Resident**
	6. Burnt River		**Resident**
	7. Powder River		**Resident**
	8. Malheur River *		
	a. Tributaries, mouth to Namorf		**Resident**
	b. Tributaries, upstream of Namorf		**Resident**
	i. North Fork		**Resident**
	ii. Middle Fork		**Resident**
	9. Owyhee River *		
	a. Tributaries below Owyhee Dam		**Resident**
	b. Tributaries above Owyhee Dam		**Resident**
	Malheur Lake Basin *		
	1. Donner und Blitzen River		**Resident**
	2. Keiger Creek		**Resident**

* *Populations are present only in the tributaries of this water body as listed below it.*
** *Season of adult spawning migration.*