MOLALLA AND PUDDING SUBBASIN

Fish Management Plan

Oregon Department of Fish & Wildlife

MOLALLA AND PUDDING SUBBASIN FISH MANAGEMENT PLAN

Prepared by

Mary Jo Wevers
Douglas Nemeth
John Haxton

Oregon Department of Fish and Wildlife

March 1992

TABLE OF CONTENTS

CONTENTS (continued)

CONTENTS (continued)

INTRODUCTION

A high priority of the Willamette Basin Fish Management Plan (ODFW 1988) was the preparation of plans for subbasins within the Willamette basin. The Molalla and Pudding Subbasin Plan was developed to provide specific direction for management of the fish resources of the Molalla and Pudding subbasins. The scope of the plan includes the main stem Molalla and Pudding rivers and their tributaries. Separate mini-plans will be written for reservoirs and lakes in the subbasin.

ODFW is committed to the planning process as an integral part of all current and future management by the agency. The Molalla and Pudding Plan is one element of the Department's planning efforts. Species plans for coho, steelhead, trout and warmwater game fish have been adopted, and a management plan for chinook salmon is being prepared. 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 out 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 Molalla and Pudding Plan was developed by the Oregon Department of Fish and Wildlife with the assistance of a public advisory committee and a technical advisory committee. The public advisory committee represented user groups and interested members of the community at large. The function of this committee was to help identify objectives and actions and to serve as a sounding board for public interests. The public advisory committee members were:

Member	Affiliation
Frank Amato	Unaffiliated
Herb Barnes	Northwest Steelheaders, Silver Falls
Bob Hardwick	Unaffiliated
Jim Myron	Northwest Steelheaders, Canby
Kathi Myron	Oregon Trout
Bob Peebles	Unaffiliated
Harold Vickery	Northwest Steelheaders, Silver Falls

The technical advisory committee was composed of representatives of federal and state land management agencies. This committee contributed information used in the plans and reviewed drafts of the plans. Members of this committee were:

Member	Affiliation
Bob House	Bureau of Land Management
John Patterson	Oregon Department of Forestry

The habitat, steelhead, and salmon sections of the plan were originally prepared as part of the Integrated System Plan for Salmon and Steelhead Production in the Columbia River basin (ODFW 1990a, Columbia Basin Fish and Wildlife Authority 1990). Those sections have since been modified to fit ODFW's format for subbasin plans and to comply with the ODFW's Natural Production and Wild Fish Management policies (OAR 635-07-521 through 635-07-529).

The plan is divided into sections that deal with habitat, the major fish species or groups of species, and angling access. Each of these sections contains:

1. Background and Status--historical and current information on the topic of that section that helps explain the context of the policies, objectives, and actions that follow.

2. Policies--constraints or principles developed specifically for management activities in the subbasin related to that species or topic.

3. Objectives--what is intended to be accomplished.

4. Actions--solutions or methods for accomplishing the objectives.

GENERAL CONSTRAINTS

Besides the statewide species plans and the Willamette Plan, the Molalla and Pudding Plan must also conform to other established constraints such as federal acts (e.g., Wild and Scenic Rivers, Wilderness, Endangered Species), state statutes, administrative rules, memoranda of understanding and other policies.

Legal Considerations

The Department of Environmental Quality (DEQ) has developed state water quality standards that are in compliance with federal water quality standards. State water quality standards are specifically directed at fish bearing waters. DEQ administrative rules (Chapter 340, Division 41) address water quality standards basin by basin.

Senate Bill 140 (OAR 537.332 through 537.360) directed the Water Resources commission to convert minimum stream flows into in-stream water rights following review. In 1989 the Oregon Fish and Wildlife Commission adopted administrative rules (OAR 635-400-000 through 635-400-040) regarding in-stream water rights. Minimum streamflows were adopted for 10 locations in the Molalla and Pudding subbasins. Although legislation does not guarantee the availability of these flows, it does give minimum flows priority over water rights obtained subsequently.

House Bill 2990 of 1985 (codified in part as ORS 543.015 and ORS 543.017) provides strict standards to protect anadromous fish, resident game fish and recreation from adverse effects of hydroelectric development. Its general impact has been to halt hydro development on anadromous fish streams.

The Oregon Revised Statutes (ORS) require fish ladders and fish screens at dams and water diversions to provide upstream and downstream fish passage.

The Oregon Forest Practices Act (Forest Practices Act) (ORS 527.610 to 527.730) was adopted in 1972. Commercial timber operations on state and private land are regulated by the act, which is administered by the Oregon Department of Forestry. Forest management activities on U.S. Forest Service and Bureau of Land Management lands are designed to comply with Forest Practices Act rules and state water quality standards. The Forest Practices Act does not apply within the urban growth boundary of towns and cities.

The Oregon Removal-Fill Law requires a permit for the removal or filling of 50 cubic yards or more of material in natural waterways. The Division of State Lands oversees the program, reviews applications and issues permits, and enforces the law.

The Oregon Riparian Tax Incentive Program of 1981 provides a tax exemption to land owners for riparian lands included in a management plan developed by the land owner and ODFW personnel.

The Oregon Land Conservation and Development Commission has developed statewide planning goals. Goals that affect fishery resources include Goal 5,

which addresses fish and wildlife areas and habitats, and Goal 6, which addresses water quality.

Oregon Senate Bill 523 of 1985 initiated a coordinated effort among state resource agencies for planning and management of the state's water resources.

ODFW goals and policies for commercial and sport fishing regulations, fish management, and salmon hatchery operation, including the Natural Production and Wild Fish Management policies, are adopted as Oregon Administrative Rules (OAR).

County land-use plans contain general goals and policies for protection of habitat.

Procedures Developed by ODFW

A Department Guide for Introductions and Transfers of Finfish into Oregon Waters (1982) and Fish Disease Control Guidelines (1979) provide direction for management of fish.

Agreements with Other Agencies

Each of the land and water management agencies in the Molalla and Pudding subbasins has regulatory authority over some aspect of land or water use, or has overall responsibility for specific land or water areas. Each agency has its own policies, procedures, and management directives associated with its area of responsibility. No single agency has total jurisdiction over an entire river basin. For this reason, coordinated involvement and cooperation among fishery, land, and water managers is necessary to achieve comprehensive management of a watershed to the benefit of the entire system and its resources.

Memoranda of understanding among ODFW and the Bureau of Land Management (BLM), and the U.S. Forest Service (USFS) describe cooperative activities for protecting and improving fish habitat on federal lands. Contractual agreements exist with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service concerning Columbia River and ocean salmon fisheries, marine fish investigations, and hatchery production.

ODFW comments on USFS and BLM project proposals as well as the general land management plans. The plan review process provides a forum for the state to address habitat improvement or protection for fishery resources. The BLM has initiated its planning process for western Oregon. BLM fish habitat improvement projects require close coordination with the Department of Fish and Wildlife's Salmon and Trout Enhancement Program (STEP).

ODFW and the state Water Resources Department (WRD) have a memorandum of understanding to coordinate review and action on water rights applications that conflict with protection of fish and wildlife habitats (Memorandum of Understanding, Oregon Department of Fish and Wildlife - Oregon Water Resources Department 1990). WRD is currently updating its management programs for the

Willamette basin. Programs affect future water rights, set priorities for water use, and prescribe actions to solve water problems. ODFW, along with other state natural resource agencies, has identified issues that ODFW will cover and contribute to the Water Resources Department's planning process. Final adoption of new programs is expected in 1991.

The Governor's Watershed Enhancement Board provides an opportunity for private individuals as well as organizations to become involved in watershed rehabilitation projects. An Oregon Fish and Wildlife Commission member is a member of this board.

General Policies

The following general policies apply to all subbasin plans in the Willamette basin, including the Molalla and Pudding subbasins.

Policy 1. To the extent authorized by law, the Department shall seek compensation for losses of production due to development and other man-made causes.

Policy 2. Hatchery production shall be evaluated to determine if benefits exceed costs.

Policy 3. The number of hatchery fish stocked in the Willamette Basin, regardless of species and size, shall not be increased and stream systems not currently receiving hatchery fish shall not be stocked, with the following exceptions:

(a) Experimental programs where the number of fish released is relatively small and a planned and funded evaluation program exists;
(b) Rehabilitation programs for native species;
(c) As provided for in subbasin plans adopted by the Commission in public hearing; and
(d) Special situations approved by the Commission in public hearing.

Policy 4. Stocking levels and areas shall be addressed in subbasin plans.

HABITAT

Background and Status

Basin Description

The Molalla and Pudding subbasins drain a northeastern section of the Willamette basin. The Molalla River (EPA Reach 1709.0009.001.00.00) is 49 miles long and originates on the west slope of the Cascade Range (Figure 1). It empties into the Willamette River at River Mile (RM) 36 and drains 348 square miles of south-central Clackamas County (Water Resources Department 1967). The Pudding River (EPA Reach 1709.0009.002.00.00) is 62 miles long and enters the Molalla River at RM 0.75, draining 530 square miles of central Marion County. The subbasin also includes lesser Willamette tributaries from the Santiam River north to Canby. An exception was made in the case of Mill Creek (Salem). Since this stream is supplemented heavily with water from the North Santiam River, it was included in the Santiam and Calapooia Subbasin Plan.

The headwater areas of the Molalla subbasin (elevation approximately 2,600 feet) are heavily forested with Douglas Fir, red alder, western red cedar and western hemlock. Farther downstream, the river flows through Dickey Prairie, an area of gradual slopes with stands of fir and hardwoods intermixed with grasslands. The Molalla River then flows through grassland and cropland on the Willamette Valley floor.

The Pudding River originates in the low elevation Waldo Hills (elevation 800 feet) located east of Salem. However three tributaries of the Pudding River, Butte Creek, Abiqua Creek, and Silver Creek, originate at higher elevations in the Cascade Range and drain areas similar to those drained by the Molalla River. At lower elevations the Pudding River flows through grass and cropland.

Gradient is slight (0.2 percent) for the lower 20 miles of the Molalla River, increasing progressively as one moves upstream (Table 1). The lower reaches of the Molalla are used primarily by fall chinook while the upper, higher gradient reaches are used by native winter steelhead and spring chinook. Reach gradient can be quite steep in many of the smaller tributaries of the upper Molalla subbasin, occasionally prohibiting access to winter steelhead.

The Pudding River has a low gradient (0.04 percent for the first 50 miles) with numerous long, slow-moving pools and few riffle areas. This sort of habitat is not preferred by anadromous salmonids. Cutthroat trout can reside here provided other factors are suitable.

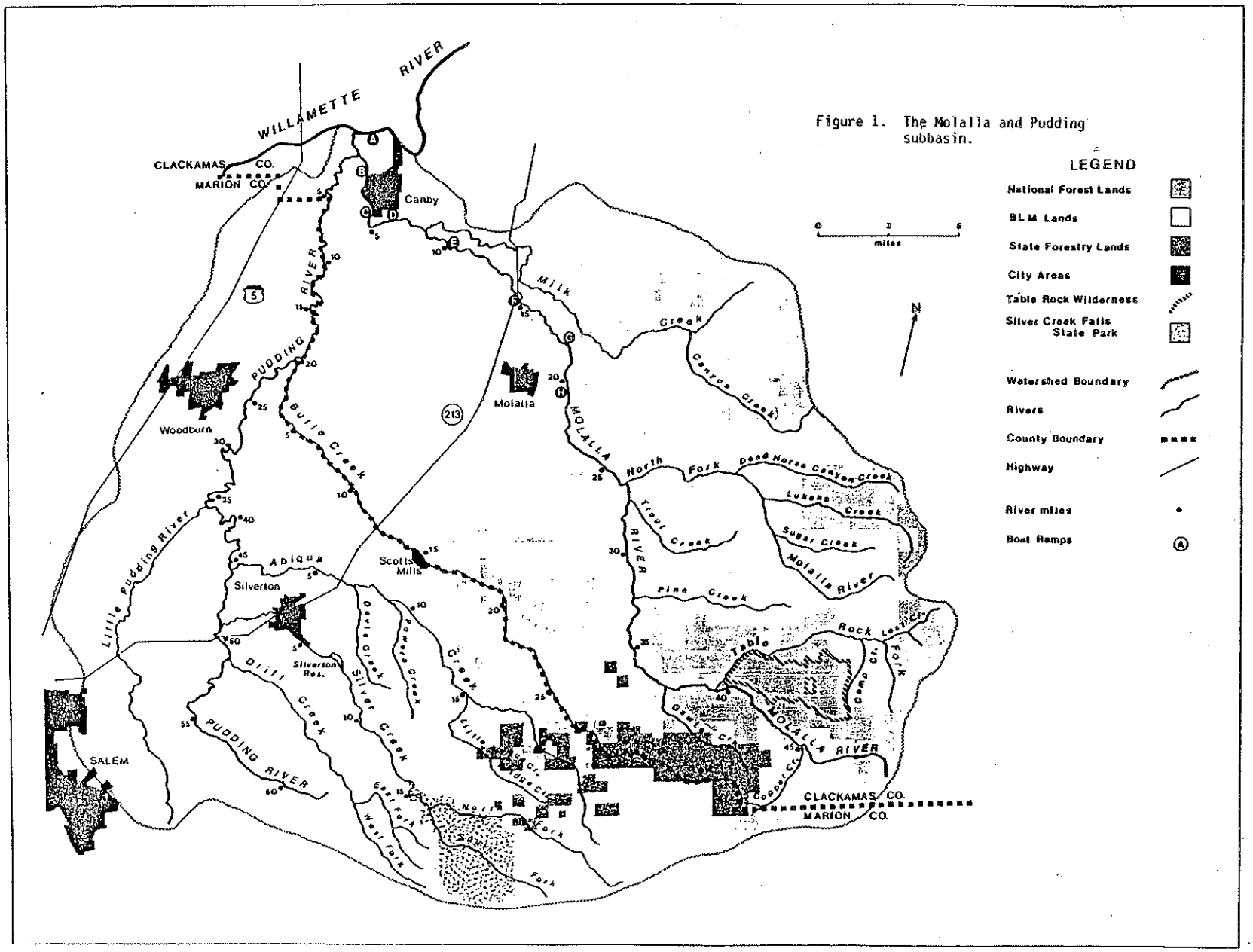


Figure 1. The Molalla and Pudding subbasin.

Table 1. Summary of streams surveyed within the Molalla and Pudding subbasins.

Stream and reach (RM)	Year surveyed	Stream order	Width (ft)	% pool	Gradient %	Spawning gravel (yd^2)	Conduct. (1 mho)	Species distrib.	Barriers	Remarks
Molalla R. RM 0-21	1980	7th	100	66	.25	75,407	--	St, Ch, RT, TRF	None	High temp. Low flows
Molalla R. RM 21-47	1981	6th	55	41	1.2	24,963	--	St & Ch=31-46 RT = 21-47 TRF = 21-39	Falls RM 46	
Milk Cr. RM 0-22	1983	6th	41	54	0.7	7,400	--	St, Co, RT = 0-22 TRF=0-13	None	Irrigation (35 sites)
No. Fk. Molalla R. RM 0-16	1982	6th	26	26	3.5	1,968	--	St=0-14 Ch=0-6 RT=0-15	Collapsed bridge RM 14; Falls RM 15	
Dead Horse Canyon Cr. RM 4-6	1981	4th	11	40	7.0	3	52	RT	None	
Cougar Cr. RM 0-4	1989	4th	13	20	7.4	249	57	St=0-2 RT=0-4	None	Wood lacking
Trout Cr. RM 0-7	1988	4th	13	21	5.2	200	43	St=0-2 RT=0-7	Falls & jams	
Pine Cr. RM 0-5	1988	4th	16	33	7.9	396	24	St=0-1 RT=0-7	Falls & jams	
Gawley Cr. RM 0-5	1988	4th	17	21	7.8	275	37	St=0-2 RT=0-6	Jams & gradient	Torrent event

(continued)

Table 1 continued.

Stream and reach (RM)	Year surveyed	Stream order	Width (ft)	% pool	Gradient %	Spawning gravel (yd^2)	Conduct. (1 mho)	Species distrib.	Barriers	Remarks
Table Rock Fk. RM 0-12	1984	5th	30	25	3.0	2,705	--	St=0-11 Ch=0-7 RT=0-12	None	Torrent event
Copper Cr. RM 0-3	1989	4th	22	19	4.4	229	24	St, RT	None	Wood lacking
Pudding R.										
Butte Cr. RM 0-15	1985	5th	31	57	0.4	5,841	53	St, Co, RT =0-15 TRF=0-14	Dams & falls	High temp. Low flow
Butte Cr. RM 15-33	1986	5th	31	34	2.2	2,044	51	St=15-29 Co=15-20 RT=15-36	Chute	Bedrock

Porous volcanic rock, such as basalt, has the capacity to store and yield water. Butte, Abiqua and Silver creeks, and the upper Molalla watershed are underlain with volcanic basalts, which help maintain flows and cooler water temperatures during summer and early fall. The lower Molalla and Pudding rivers and those tributaries lying to the west are underlain with Willamette Valley alluvium, which has little storage capacity (Burroughs et al. 1973). Consequently, these streams experience lower flows and higher water temperatures than streams to the east of the Pudding River (Table 2).

Table 2. High water temperatures recorded in the lower Molalla River (RM 6) during 1988 (unpublished data, ODFW).

Date	Time	Temperature (°F)
July 16	1800	72
17	1800	73
18	1800	74
19	1800	74
20	1800	78
21	1730	78
24	2000	73
25	2000	76
26	2030	77
27	2000	75
28	1900	77
29	1600	78
30	1730	79
31	1600	74
August 1	1800	74
2	1800	74
3	1900	76
4	1800	78
7	1700	74
8	1830	74
9	1800	77
10	1730	73

The subbasin has a modified marine climate characterized by moderate temperatures and heavy rainfall during the winter. Annual precipitation on the valley floor averages about 45 inches while that in the Cascade Range can be as high as 120 inches (Water Resources Department 1961). Snowmelt contributes to flows in the Molalla watershed, although the quantity is not as great as in other Cascade drainages which have higher elevations. The lower elevation Pudding system has no snowpack.

Streamflows closely follow seasonal rainfall patterns. With the onset of the rainy season in October and November, flow rates increase rapidly. They remain relatively high through April, after which declining rapidly, reaching their lowest point in August.

The decreased volume, depth, and velocity of the water during low flows increase the rate of solar heating, especially in areas with poor riparian habitat. Generally, water temperatures are higher in the Pudding watershed than in the Molalla watershed. High temperatures favor production of warmwater game fish and nongame species while posing stressful or lethal conditions for salmonids.

Holding areas for adult salmonids become crowded during low flow periods. Low flows limit the amount of habitat available for late spawning fish such as spring and fall chinook. As flows diminish, so do the areas available for juvenile rearing. Juvenile fish may be forced to rear in less suitable habitats decreasing their chances for survival. Aquatic insect production, which is dependent on riffle area and water velocity, decreases during low flow periods; thus food availability for fish is affected.

Water quality problems in the subbasin occur primarily in the Pudding subbasin, and are associated with non-point source runoff and treated sewage discharged during low flow periods when insufficient water is available for adequate dilution of pollutants (Department of Environmental Quality 1988). Water quality during high flow periods decreases due to increased sediment loads.

To an extent, erosion and sedimentation are natural occurrences, particularly during high flow periods. Heavy stream sediment loads can affect salmonid production in several ways. High turbidities associated with excessive sediment suspension can stop or delay adult migration. Fine sediments can cement spawning gravel together making redd construction difficult. Egg and fry survival is decreased when silt prevents adequate water circulation. Holding and rearing areas decrease when pools become silted in. Production of aquatic insects, the major food of salmonids, is decreased. Prolonged exposure to suspended sediments can be directly injurious to fish by damaging gill surfaces (Bottom et al. 1985). Suspended sediments are usually not a problem in the Molalla River and its tributaries, although they can be in portions of the Pudding system.

Generally, gravel quantity and quality are not limiting in the Molalla drainage (Table 1), except in certain localized areas such as those affected by torrent events. Substrate in the Pudding watershed is mainly mud and silt. Salmonid production in this type of substrate is low due to poor egg and fry survival, and low insect production (Reiser and Bjornn 1979). Abiqua and Silver creeks have gravel suitable for spawning throughout their lengths. Butte Creek has gravel in its upper reaches.

In-stream structure provides hiding cover, supports aquatic insect production, and promotes channel stability. Structure in the main stem Molalla is primarily in the form of boulders and rock ledges. Large woody debris occurs primarily in Molalla tributary streams, although it is not present in great abundance. Structure is lacking in much of the Pudding system.

Natural recruitment of large woody debris in the near future is limited in the subbasin. In the Molalla system, this is primarily due to extensive

logging prior to 1970, and an overly aggressive ODFW stream clean-out program that has since been abandoned. In the Pudding system, extensive agricultural activity has limited the recruitment of in-stream structure.

Heavy rains in the early 1970s culminated in a number of torrent events in upper watersheds of the Molalla drainage (personal communication from R. House, BLM, Salem, Oregon). As a consequence many of these systems are channelized and lack woody debris and spawning substrate.

A healthy riparian zone is essential for optimum fish production. Riparian vegetation stabilizes streambanks, maintains water quality, is a source of terrestrial insects, and provides in-stream structure. Most of the streams in the Molalla watershed have at least a narrow strip of vegetation along their banks which consists primarily of red alder, other hardwoods, and shrubs. Generally, riparian vegetation in agricultural areas of the Pudding system is mainly grasses and shrubs.

Land Use

The Molalla subbasin is managed mainly as forest land (Table 3). Agricultural and rangeland dominate the Pudding subbasin. Nearly 90 percent of the land in the Molalla and Pudding subbasins is privately owned (Table 4). Control over land-use practices that influence fish production is usually more limited on private land than on public land.

Table 3. Approximate land use (%) adjacent to major streams of the Molalla and Pudding subbasins (WRD 1980).

Stream	Agricultural and Urban	Forest Land
Molalla R.	25	75
Milk Cr.	50	50
North Fork	0	100
Table Rock Fork	0	100
Pudding R.	100	0
Butte Cr.	30	70
Abiqua Cr.	40	60
Silver Cr.	30	70

Table 4. Land ownership (acres) in the Molalla and Pudding subbasins (WRD, unpublished data).

Watershed	BLM	USFS	State	Private
Molalla R.	29,097	8,497	41	126,774
Pudding R.	1,460		11	112,378
Butte Cr.	3,840		5,100[a]	51,126
Abiqua Cr.	2,186		7,957	71,113
Total	36,583	8,497	8,009	361,391
Percent	8.8	2.0	1.9	87.2

[a] Estimated from Oregon Department of Forestry map (1986).

Forestry

Timber production is the dominant land use in the Molalla drainage. Most of the drainage has been logged and is currently in a recovery process. Timber production in the Pudding system occurs primarily in the upper areas of the Butte, Abiqua, and Silver Creek watersheds (Table 3). These three watersheds contain most of the anadromous salmonid production water in the Pudding subbasin.

The BLM is currently negotiating a land swap with a private timber company in the Molalla drainage. If this land swap is completed, the BLM will gain about 5,500 acres in the Molalla drainage. This will place most of the Molalla River between RM 28-43 in public ownership as well as the lower six miles of Table Rock Fork.

The 5,750-acre Table Rock Wilderness Area is situated along the south bank of the Molalla's Table Rock Fork. This wilderness designation, however, provides protection for only about 3.75 miles of river used by anadromous salmonids.

Agriculture

Agricultural activities predominate in the Pudding watershed. Quantitative information is not available regarding specific impacts of such activities on fish production in the subbasin. Nonetheless, activities such as clean-tilling of the soil, disruption and removal of riparian vegetation, and stream channelization affect water quality and hydrology and thus impact fish production (Bottom et al. 1985). Increased runoff results from agricultural activities. The DEQ has recognized that significant quantities of non-point source pollution are entering the Pudding River (DEQ 1988).

Confined animal feeding operations are relatively concentrated in the Pudding subbasin. There are approximately 33 dairies (about 40,000 animals), 20 hog operations (the largest has 1,800 animals), at least 12 mink operations (the largest handles up to 30,000 animals annually), and about 70 horse stables (10 to 30 horses each) in Marion county (SCS, unpublished

information). This does not include the beef, turkey, chicken, exotic animal, and llama operations in the watershed.

Because of the high cost of state-of-the-art waste disposal facilities, wastes are often disposed of by spreading across cropland using large sprinklers. Much of this waste enters the river through runoff and erosion. During the summer, fecal coliform counts in the Pudding River near Aurora (RM 9) exceed water quality standards (DEQ 1988).

Channelization of streams often occurs through efforts to increase the amount of land available for crop production and to decrease flooding. Channelization affects fish production by decreasing in-stream habitat diversity (Bottom et al. 1985). Channelized streams generally have a uniform bottom and width, an incised channel, higher peak flows and velocity, lower low flows, little in-stream structure, few meanders, and a reduced stream length. Much of the Pudding system, the lower Molalla River, and Molalla tributaries affected by torrent events in the early 1970s have been channelized.

Mining

Gravel mining occurs in the lower 20 miles of the Molalla River. Three mining sites are currently active. Mining activity may be broadening the channel profile of the river, creating shallow riffles which can impede migrating fall chinook.

Residential and Commercial Development

Most of the urban and residential development in the subbasins occurs on the valley floor in the Pudding subbasin. Relatively little development exists in the Molalla watershed. Rural residences occur throughout the subbasins. Most residential areas are concentrated in or near the towns and cities listed in Table 5.

The Pudding River is currently classified by the DEQ as a water quality limited stream due to insufficient dissolved oxygen concentrations (<6 mg/l) during low flow periods (DEQ 1988). This problem has been attributed to discharge from the Woodburn sewage treatment plant (RM 27).

Table 5. Incorporated towns and cities in the Molalla and Pudding subbasins.

Town	County	Population[a]	Location[b]
Aurora	Marion	567	RM 9 Pudding R.
Barlow	Clackamas	118	
Canby	Clackamas	8,983	
Donald	Marion	316	
Gervais	Marion	992	
Hubbard	Marion	1,881	
Molalla	Clackamas	3,651	RM 20 Molalla R.
Mount Angel	Marion	2,778	
Scotts Mills	Marion	283	RM 15 Butte Cr.
Silverton	Marion	5,635	RM 4 Silver Cr.
Woodburn	Marion	13,404	

[a] April 1, 1990 census, Center for Population Research and Census, School of Urban and Public Affairs, Portland State University, Oregon.

[b] RM = river mile.

Dams and Hydropower Projects

A number of small dams occur on Butte, Abiqua, and Silver creeks. These dams are laddered to provide fish passage, however the effectiveness of the ladders is unknown. A private hydropower facility supplying power to a single residence is located on Woodcock Creek, above the upstream range of anadromous fish.

Oregon law requires any person who constructs, operates, or maintains any dam or artificial obstruction on a waterway to provide an adequate fish ladder for upstream and downstream fish passage (ORS 509.605; 498.268). The Habitat Conservation Division will be developing standards, criteria, and procedures for evaluating and resolving fish laddering needs at in-stream obstructions. Fish laddering needs in the Molalla and Pudding subbasins will then be identified and resolved as part of a coordinated Department effort.

Stream reaches in the Molalla and Pudding subbasins protected from further hydroelectric development by the Northwest Power Planning Council are identified in Table 6.

Table 6. Stream reaches in the Molalla and Pudding subbasins protected for anadromous fish under the Northwest Power Planning Council's hydroelectric planning authority.

Stream	Reach (RM)
Molalla R.	RM 0-49
Gribble Cr.	RM 0-4.5
Milk Cr.	RM 0-22
Nate Cr.	RM 0-6.5
Canyon Cr.	RM 0-8
Mill Cr.	RM 0-2.5
Cedar Cr.	RM 0-4
Russell Cr.	RM 0-4
No. Fk. Molalla R.	RM 0-15
Dead Horse Canyon Cr.	RM 0-7
Lukens Cr.	RM 0-8
Cougar Cr.	RM 0-5
Trout Cr.	RM 0-8
Pine Cr.	RM 0-7
Gawley Cr.	RM 0-5
Table Rock Fk.	RM 0-11
Camp Cr.	RM 0-4
Lost Cr.	RM 0-4
Copper Cr.	RM 0-1
Pudding R.	RM 0-49
Butte Cr.	RM 0-35
Abiqua Cr.	RM 0-25
Powers Cr.	RM 0-2
Little Abiqua Cr.	RM 0-3
Silver Cr.	RM 0-17
No. Fk. Silver Cr.	RM 0-10

Diversions and Withdrawals

Naturally low flows during the summer months are aggravated by water withdrawal for crop irrigation and to a lesser extent for municipal uses (Table 7). Supplementation of flows in the Molalla and Pudding subbasins is not possible because no major water storage facilities exist. The largest storage facility is Silver Creek Reservoir located at RM 6.5 on Silver Creek. Silver Creek Reservoir has 60 surface acres and provides a backup water supply for the city of Silverton. The primary water supply for Silverton comes from a dammed diversion on Abiqua Creek.

Table 7. Water rights* by use type for the Molalla and Pudding subbasins (WRD, unpublished data).

	Agricultural		Municipal		Indust.	Domestic	Recreational
	cfs	ac-ft	cfs	ac-ft	cfs	cfs	cfs
Molalla	148	11	26		<1	<1	6
Pudding	292	1,309	5	1,300	<1	<1	4

* A water right is the amount of water legally allotted to users, not necessarily the amount actually used.

Oregon law requires a diverter to provide and maintain an adequate fish screen at a diversion to prevent fish from leaving the stream (ORS 509.615; 498.248). ODFW's Habitat Conservation Division has completed a summary report identifying fish screening needs at water diversions throughout the state. Screening needs in the Molalla and Pudding subbasins will be addressed according to their state-wide priority as part of an overall Department fish screening program that is currently being developed.

In-stream water rights were established at 13 sites on 8 streams in the Molalla and Pudding subbasins during 1964, 1983, 1988 and 1990 (Table 8). Oregon Senate Bill 140 (ORS 537.346 and OAR 690-77-050) allowed for conversion of minimum streamflows into in-stream water rights as of February 1, 1989. Seven of the in-stream water rights are from conversion of minimum perennial streamflows (MPS) and six were established by application.

Table 8. In-stream water rights adopted for the Molalla and Pudding subbasins. (WRD 1985).

Stream	RM	Month						Date
		Nov-May	Jun.	Jul.	Aug.	Sep.	Oct.	
Molalla R.	6	60	60	60	60	60	60	6-22-64
Molalla R.	0-8	500	500	200	100	150	450	12-22-88
Molalla R.	8-21.5	300	200/150[a]	100/80[a]	80	80/300[a]	300	10-11-90
Molalla R.	32.5	35	35	35	35	35	35	6-22-64
Milk Cr.	0	85	60/45[a]	40/30	20	20	20/40	11-3-83
Trout Cr.	0-5	25/35[a]	8/6[a]	4	4	4	10/15[a]	10-11-90
Pudding R.	40.4	10	10	10	10	10	10	6-22-64
Pudding R.	9	35	35	35	35	35	35	6-22-64
Pudding R.	0-8	80	60	50/40	40	40	60	7-13-89
Drift Cr.	0-10	20/40[a]	20/5[a]	3	2	2	3/10[a]	10-18-90
Butte Cr.	0-15	75	75/50	25	12	20	75	12-22-88
Silver Cr.	3.2	60	50/35	23	23	23	23/60	11-3-83
Abiqua Cr.	0	75	60/40	25/20	15	15	40/60	11-3-83

[a] The first numeral is the required flow for the first 15 days of the month, the last numeral is the required flow for the remainder of the month.

Streams listed in Table 9 are high priority for additional in-stream water rights.

Table 9. Streams considered high priority for the attainment of in-stream water rights in the Molalla and Pudding subbasins.

Subbasin	
Molalla	Pudding
Molalla R., No. Fork	Powers Cr.
Jackson Cr.	Drift Cr., E. Fk.
Nate Cr.	Drift Cr., W. Fk.
Woodcock Cr.	Little Abiqua Cr.
Canyon Cr.	
Mill Cr.	
Gribble Cr.	
Cedar Cr.	
Dickey Cr.	
Pine Cr.	
Gawley Cr.	
Molalla R., Table Rock Fork	
Ogle Cr.	

While in-stream water rights undoubtedly aid in maintaining streamflows for fish production, they are not guaranteed. The law does not require that the flows be maintained below the last site prescribed unless specified otherwise, and are subordinate to those with an earlier priority date. Consequently, these flows are not always achieved and out-of-stream water rights can actually exceed the amount of water in the stream (Table 10). Most of the flows acquired prior to 1988 are not optimum for fish production. Many are not even minimum flows, but what the Water Resources Board allocated to ODFW. In-stream water rights acquired in 1988 and 1989 more closely approach optimal flows for fish production.

Table 10. Average low flow, minimum perennial streamflow, and total water rights for the Molalla and Pudding rivers (WRD, unpublished data; WRD 1985; USGS, unpublished data).

Stream	RM	Avg. August flow	Min. August flow	Total water rights[a] cfs	ac-ft
Molalla R.	6	106	60	95	0
Pudding R.	8	31	10	95	53

[a] Water rights for the entire stream, not just above the river mile specified.

Habitat Protection

ODFW has several roles in habitat protection issues. Enforcement authority for fish screens and fish passage was granted ODFW by ORS 509.605 - 509.640. ODFW can apply for in-stream water rights to protect fish habitat and can collect costs of habitat damage from polluters. ODFW has authority under ORS 468.745 to recover both the value of fish and wildlife destroyed by pollution and all costs of restoring production of fish and wildlife including restoration of their habitat. ODFW has written policy and procedures for investigation of fish kills resulting from pollution, as well as draft administrative rules to determine the monetary value of fish losses, which will be presented to the Fish and Wildlife Commission for adoption as an OAR in the near future.

ODFW coordinates with local, state, and federal agencies regarding their habitat protection and management programs. Often this involves making recommendations to minimize impacts from various land and water use practices which conflict with fishery interests, or to provide full habitat compensation. Fish production must compete with other land and water uses such as timber production, irrigation, and hydroelectric power production. Activities which may affect threatened or endangered species must be coordinated with the U.S. Fish and Wildlife Service (USFWS). Activities by other state agencies that may affect threatened or endangered species must be coordinated with ODFW (ORS 496.182). Applications for permits issued by other agencies for land use activities are forwarded to the ODFW for review and

comment. ODFW currently has interim policies on screening, fill and removal, and habitat mitigation, which will be before the Fish and Wildlife Commission in the near future. ODFW is a co-equal participant with the NMFS and USFWS in the administration of the Fish and Wildlife Coordination Act.

Fishery managers recognize that habitat degradation and loss is a serious threat to the maintenance of healthy fish populations. Enforcing local, state and federal laws for protecting fish habitat is essential to sustaining a vital habitat base. Consequently, ODFW must be a consistently strong advocate for protection and proper management of fish habitat.

Habitat Restoration

Habitat improvement projects have been undertaken in the Molalla and Pudding subbasins by Salmon and Trout Enhancement Program (STEP) volunteers (Table 11). Four projects involving in-stream structures occurred in 1987 and 1988 and five projects were undertaken involving passage improvement from 1984 to 1986.

Table 11. Habitat improvement projects undertaken by STEP volunteers in the Molalla and Pudding subbasins, 1984-1988 (ODFW, unpublished data).

Watershed and stream	In-stream structures	Passage improvements	Side channel
Molalla			
Milk Cr.	1988	--	--
Lukens Cr.	--	1985	1986
Pudding			
Labish Ditch	1988	--	--
Butte Cr.	1987	1986	--
Silver Cr.	1987	1985	--
Povers Cr.	1986	--	--

Policies

Policy 1. The Department shall actively pursue and promote habitat protection and improvement necessary to achieve the objectives for management of the subbasin's fish resources.

Policy 2. The Department shall coordinate with and advise agencies that manage the land and water resources of Willamette subbasins.

Policy 3. Habitat protection shall be emphasized over habitat rehabilitation and enhancement.

Policy 4. Potential losses of fish production from habitat alteration shall be prevented or reduced to the extent possible.

Objectives

Objective 1. Provide necessary in-stream flows for fish production.

Assumptions and Rationale

1. Adequate in-stream flows are necessary for fish passage, spawning, and rearing.

Actions

1.1 Obtain in-stream water rights for the Molalla and North Fork Molalla rivers, Jackson, Nate, Woodcock, Canyon, Mill, Gribble, Cedar, Dickey, Pine, and Gawley creeks, Table Rock Fork of the Molalla River, and Ogle Creek in the Molalla subbasin.

1.2 Obtain in-stream water rights for Powers, East and West Forks of Drift, and Little Abiqua creeks in the Pudding subbasin.

1.3 Reapply for in-stream water rights where current in-stream water rights are inadequate to protect fish and wildlife uses.

1.4 Recommend to the Water Resources Department that during May-October the subbasins be classified for domestic, livestock, fish and wildlife, recreation, pollution abatement, and wetlands maintenance uses only. Further recommend that new applications for water storage for irrigation or other use during the period November-April will only be allowed for those flows in excess of that needed for fish production and recreation.

1.5 Encourage public utility districts to promote water conservation.

1.6 Encourage the Northwest Power Planning Council through the Bonneville Power Administration to impose water conservation measures on public utility districts in the subbasin.

Objective 2. Protect existing stream habitat from degradation associated with timber harvest, road construction, and related activities on forested watersheds.

Assumptions and Rational

1. Land use practices associated with timber harvesting can reduce fish production in forested watersheds.

Actions

2.1 Ensure compliance with state and federal forest management regulations and consideration of ODFW recommendations.

2.2 Request that state and federal land management agencies conduct periodic monitoring programs on the success and effectiveness of stream riparian and water quality protection measures.

Objective 3. Protect existing stream habitat in lowland areas from degradation associated with agricultural, residential and commercial development, and other human activities.

Assumptions and Rationale

1. Channel erosion, sedimentation, loss of riparian vegetation, and pollution reduce fish production.

Actions

3.1 Cooperate with other agencies to increase protection of stream habitat.

3.2 Request that new operators have more stringent requirements for new permits, such as limiting removal to no more than one foot above low water, to prevent impacts of commercial gravel operations on the Molalla River on fish production and angling. Encourage the Division of State Lands to limit current operators to existing permit areas.

Objective 4. Improve the water quality of the subbasin.

Assumptions and Rationale

1. High quality water is essential for game fish production.

2. Fish production in some streams in the subbasin has declined because of poor water quality.

Actions

4.1 Coordinate with state and county agencies to improve monitoring and enforcement of water quality standards.

a. Urge the Department of Environmental Quality to increase water quality monitoring especially in drainages suffering from poor water quality and important production areas (Milk, Butte, Silver, Abiqua, and Drift creeks) and determine point and non-point pollution sources.

b. Encourage increased cooperation among confined animal feeding operations and the Oregon Department of Agriculture and the Soil Conservation Service to decrease the amount of animal waste entering the Pudding system.

c. Urge the Department of Environmental Quality to prosecute confined animal feeding operations causing violation of water quality standards.

d. Because of the water quality limited classification of the Pudding River, recommend conditions in permits which do not allow water removal during the summer.

4.2 Coordinate with county and state agencies and actively pursue regulations for the establishment and maintenance of quality riparian zones in agricultural and urban lands, especially along small tributaries in the Pudding system.

Objective 5. Provide adequate upstream and downstream passage for fish at water diversions, dams, and other artificial obstructions.

Assumptions and Rationale

1. Adequate fish passage is necessary to prevent injury, delay or loss of fish as a result of any water development project.

Actions

5.1 Evaluate suspected passage problems at the Butte, Silver and Abiqua Creek dams. Recommend improvements.

5.2 Evaluate other water diversions and artificial obstacles for potential problems. Recommend improvements.

5.3 Inventory culverts for passage problems. Make recommendations to other agencies and landowners to improve upstream passage at culverts.

5.4 Work with the ODFW Fish Passage Coordinator to establish an implementation schedule for subbasin screening projects listed in the ODFW report on fish screening needs (as presented to the 66th Legislature; January 1991).

Objective 6. Develop subbasin specific knowledge that integrates fish distribution and abundance information, habitat characteristics and potential for improvement, and sensitive watershed areas into the Department's Habitat Database system.

Assumptions and Rationale

1. Better understanding of factors that affect fish distribution and abundance will lead to more effective habitat protection.

2. Computerized information will readily allow access by anyone in ODFW for habitat protection issues.

Actions

6.1 Inventory stream and watershed characteristics that affect fish production.

6.2 Promote increased interagency sharing of inventory information.

6.3 Incoordination with BLM, private landowners, and volunteers, survey streams to determine specific habitat problems and opportunities for habitat protection projects.

6.4 Ensure that all survey information is entered into the Habitat Database system.

WINTER STEELHEAD

Background and Status

Origin

Winter steelhead are native to the Molalla and Pudding subbasins. In the Molalla subbasin the native late-run Willamette stock is entirely naturally produced. Big Creek stock winter steelhead are an early-run stock that were introduced in 1971. It is thought that some natural production of this stock occurs. Because of the difficulties of distinguishing these fish from native winter steelhead, the contribution of Big Creek stock to natural production in the subbasin is unknown.

The winter steelhead run in the Pudding system is primarily from natural production. Big Creek stock winter steelhead were released into the Pudding subbasin in the late 1960s and early 1970s. In recent years, late-run North Santiam stock fry have been released from Salmon and Trout Enhancement Program (STEP) hatch-boxes. A naturally produced early winter steelhead run currently exists in Abiqua and Silver creeks. The origin of these fish is unknown.

Life History and Population Characteristics

Distribution

Native winter steelhead occur throughout the Molalla subbasin, but use the upper reaches more extensively. The distribution of the Big Creek stock in the Molalla subbasin is unknown. In the Pudding subbasin, steelhead occur primarily in the Butte, Abiqua, and Silver creek watersheds.

Run Timing

Naturally produced fish have been observed in the subbasins as early as December. Whether these fish are native Willamette stock or naturally produced fish of another stock is unknown.

Based on scale information, Willamette Falls counts, and spawning surveys, most of the native late-run winter steelhead enter the Molalla River from about mid-February to early May, with peak numbers entering in late March to early April.

Based on creel information, Big Creek winter steelhead enter the Molalla from about late November through late February, with peak entry occurring from late January to mid-February.

Run Size

The Molalla and Pudding subbasins do not have fish counting stations. To estimate numbers of Big Creek winter steelhead returning to the Molalla and Pudding (Table 12), the number of steelhead passing Willamette Falls between November 1 and February 15 (Big Creek stock) was divided among the three

subbasins they return to above Willamette Falls -- the Tualatin, Molalla and Pudding, and Coast Range subbasins -- as follows:

Run size = (Punch-card catch for subbasin / punch-card catch for all three subbasins) X Willamette Falls "early" winter steelhead count.

The assumptions of this estimator are:

1) Exploitation rates are similar in all three subbasins.

2) The early-run stock returns only to these subbasins.

3) Catch of early-run stock above the falls in the main stem Willamette River is zero.

4) All Big Creek stock (early-run) steelhead pass Willamette Falls between November 1 and February 15. No other steelhead stocks pass the falls during this period.

Table 12. Big Creek winter steelhead run size estimates for the Molalla and Pudding subbasin (ODFW 1990b, Foster 1990).

	Run year													
Subbasin	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	Ave.
Estimated harvest from salmon and steelhead angler catch records:														
Tualatin	207	296	37	379	318	292	252	333	445	335	297	315	95	277
Molalla & Pudding	398	616	253	916	728	341	265	470	459	439	593	697	578	519
Coast Range	24	202	49	121	262	104	62	77	118	111	125	221	141	124
Total	629	1,114	339	1,416	1,308	737	579	880	1,022	885	1,015	1,233	814	921
Willamette Falls "early run" winter steelhead counts:														
	5,327	8,599	2,861	6,258	7,662	6,117	4,592	6,664	4,549	8,475	8,543	8,371	4,211	6,325
Run size estimate:														
Molalla & Pudding	3,371	4,755	2,135	4,048	4,264	2,830	2,102	3,559	2,043	4,204	4,991	4,732	2,990	3,540

The average annual run returning to the Molalla and Pudding subbasins during 1976-77 through 1988-89 was estimated to be 3,540 fish.

Stream surveys in the Molalla subbasin indicate average redd densities in winter steelhead spawning areas are about 18 redds per mile. Approximately 110 miles of stream are used by winter steelhead for spawning. Using a 1:0.8

female-to-male sex ratio, a minimum run size of about 3,560 adult fish would be needed to seed the available habitat.

Average redd densities in the Pudding subbasin are estimated to be about 10 redds per mile. Approximately 57 miles of stream are used by winter steelhead for spawning. Using a 1:0.8 female-to-male sex ratio, a minimum run size of about 1,030 adult fish would be needed to seed the available habitat.

Results of spawning surveys in selected reaches of index streams are provided in Table 13.

Table 13. Redds per mile for winter steelhead in Molalla and Pudding subbasin index streams.

Stream	Miles surveyed	Redds per mile							Ave.
		1985	1986	1987	1988	1989	1990	1991	
Molalla R.	2.6	26.2	21.2	19.6	22.3	19.2	12.7	12.7	19.1
Milk Cr.	0.9	3.3	5.6	6.7	6.7	2.2	4.4	3.3	4.6
North Fork	0.5	14.0	22.0	14.0	10.0	6.0	10.0	4.0	11.5
Dead Horse Cny. Cr.	0.5	22.0	20.0	20.0	22.0	16.0	20.0	10.0	18.6
Lukens Cr.	0.7	22.9	11.4	15.7	18.6	10.0	7.1	2.9	12.7
Table Rock Fork	1.0	24.0	18.0	28.0	19.0	9.0	14.0	12.0	17.7
Camp Cr.	0.3	30.0	23.3	30.0	26.7	13.3	26.7	20.7	25.2
Copper Cr.	1.5	25.3	20.0	28.0	26.0	20.7	19.3	12.7	21.7
Pudding R.									
Butte Cr.	1.2	5.0	9.2	9.2	5.8	2.5	5.0	4.0	5.8
Abiqua Cr.	--	31.6	--	--	--	27.0	--	--	29.3
Little Abiqua Cr.	--	25.0	--	--	--	--	--	--	25.0
Late-run winter steelhead passing Willamette Falls		16,043	12,776	7,630	15,007	5,361	9,229	2,613	9,808

Age, Size, and Sex Ratio

About 62 percent of the naturally produced fish return as 2-salt fish (two years spent in the ocean) and 35 percent as 3-salts (Table 14). More naturally produced fish return as 3- and 4-salts than hatchery fish. About 70 percent of the hatchery produced Big Creek stock steelhead return as 2-salt fish (Table 14).

About 15 percent of the naturally produced fish sampled from the Molalla River during 1979-88 were repeat spawners, compared to 5 percent of the hatchery produced Big Creek stock fish.

Length of naturally produced 2-salt fish averaged 27 inches, while that of Big Creek stock hatchery fish was only slightly smaller (26.2 inches) (Table 14).

Table 14. Age structure and length (inches) at age of naturally produced and hatchery produced winter steelhead in the sport catch of the Molalla River, 1979-88.

Ocean Age	Naturally produced n	Naturally produced Ave. Length	Hatchery produced n	Hatchery produced Ave. Length
2	123	27.0	127	26.2
3	69	28.5	52	28.9
4	7	31.0	4	30.4

The female-to-male ratio of naturally produced fish sampled from the Molalla River during 1979-88 was 1-to-0.5 as opposed to 1-to-0.8 for Big Creek hatchery fish. This ratio may be biased toward females as males turn dark faster and are more likely to be released by anglers.

Time and Location of Spawning

Native winter steelhead spawn from early April through late May, with peak activity from about late April to early May. Big Creek stock steelhead probably reach peak spawning activity in late February, based on the time of spawning of naturally produced Big Creek stock in the Coast Range subbasin. No spawning surveys have been conducted in the Molalla or Pudding subbasins in late February.

Spawning reaches in the Molalla and Pudding systems total 110 and 57 miles of stream, respectively (Table 15). About 87 miles of stream in the Molalla system and about 45 miles in the Pudding system are considered to be primary spawning reaches.

Table 15. Suspected spawning areas of winter steelhead in the Molalla and Pudding subbasins.

Stream	River mile
Molalla R.	0.0-46.0
Pudding R.	--
Butte Cr.	0.0-25.8
Abiqua Cr.	9.9-20.5
Powers Cr.	0.0- 2.0
Little Abiqua Cr.	0.0- 3.0
Silver Cr.	0.9-16.4
Milk Cr.	12.5-20.3
Canyon Cr.	0.0- 4.1
Jackson Cr.	0.0- 2.0
Cedar Cr.	0.0- 0.5
Russell Cr.	0.0- 0.1
North Fork	0.0-14.4
Dead Horse Canyon Cr.	0.0- 2.3
Lukens Cr.	0.0- 6.7
Cougar Cr.	0.0- 3.5
Trout Cr.	0.0- 2.0
Pine Cr.	0.0- 1.2
Gawley Cr.	0.0- 2.1
Table Rock Fork	0.0-10.1
Camp Cr.	0.0- 2.5
Hunter Cr.	0.0- 1.5
Lost Cr.	0.0- 0.9
Copper Cr.	0.0- 2.2

Juvenile Life History

Based on time of spawning, the suspected time of emergence of native steelhead occurs from about mid-May to late June. Emergence of naturally produced Big Creek stock fish most likely occurs earlier.

Based on creel census information and work by Buchanan and Wade (1982) at Willamette Falls, emigration of native winter steelhead from the Molalla occurs from late March to late May, with the peak migration in early to mid-May. Based on the capture of Big Creek smolts at Willamette Falls that were released into the Molalla River in 1982 (Buchanan and Wade 1982), Big Creek stock smolts begin migrating past Willamette Falls in mid-April with the peak of the migration occurring in late April to early May.

Scale analysis from winter steelhead caught during 1980 to 1986 show that about 88 percent of the naturally produced fish rear in fresh water for two years and 12 percent for three years.

Big Creek stock hatchery steelhead are reared to one year of age. Smolts average about 5.9 fish per pound at release. Smolts are usually released in April, however releases have occurred as early as March and late as May.

Hatchery Production

Description of Hatcheries

No hatcheries are located in the subbasin. Eggs of Eagle Creek and North Santiam stock used in STEP hatch-boxes are supplied by the Clackamas Hatchery (see the Clackamas Subbasin Plan) and Marion Forks Hatchery (see the Santiam and Calapooia Subbasin Plan), respectively. Big Creek stock winter steelhead eggs are taken primarily at Big Creek Hatchery, east of Astoria.

Big Creek stock steelhead smolts currently released into the Molalla subbasin are reared mainly at Gnat Creek hatchery (east of Astoria) and Roaring River hatchery (in the Santiam subbasin). Steelhead production at Gnat Creek Hatchery is discussed in the Lower Columbia River Plan.

Hatchery Releases

Big Creek winter steelhead were introduced into the Molalla subbasin to extend the winter steelhead fishery by providing an early-run fish.

Since 1975, smolt releases into the Molalla have been primarily Big Creek stock (Appendix Table A-1). In recent years about 72,000 smolts have been released annually (Appendix Table A-1). Smolts are released only into the lower 20 miles of the Molalla to reduce the potential for interbreeding and competition with the native stock and to maximize return of adults to the fishery.

Eagle Creek fry releases in the Molalla were restricted to STEP hatch-boxes in Milk Creek. This program was terminated in 1987.

Alsea stock steelhead were released in the Molalla River in the early 1970s (Appendix Table A-1). Since then it has been discovered that coastal steelhead stocks are susceptible to *Ceratomyxa shasta*, a parasite found in the Willamette basin. Alsea stock is no longer released in the Molalla subbasin.

STEP releases in the Pudding system were intended to supplement the native winter steelhead run. The contribution of these releases to adult returns is unknown.

In the Pudding system, Big Creek stock steelhead adults were released into Abiqua Creek and Silver Creek primarily in the late 1960s and early 1970s (Appendix Table A-1). More recently, releases have been restricted to STEP

fry of North Santiam stock. Fry releases have been made in Butte, Silver, and Abiqua creeks (Appendix Table A-1).

In 1988, the Pudding River, Butte Creek, and Abiqua Creek were classified for management of wild fish only under the wild fish policy (ODFW 1988). This designation restricted releases of hatchery fish.

Angling and Harvest

Angling pressure for winter steelhead increased steadily from 1980 and appeared to peak in 1987 (Figure 2). Catch rates for all winter steelhead from the Molalla River (1982-1986) averaged 79 hours per fish for bank fishing and 35 hours per fish for boat fishing. Harvest in the Molalla River has averaged about 1,080 winter steelhead from the 1976 to 1986 (Table 16).

Based on scale samples collected from anglers by ODFW personnel from 1979 through 1985, hatchery-produced Big Creek stock accounted for about half of the total winter steelhead catch on the Molalla River (Table 16 and Figure 3). An evaluation of the performance of Big Creek and North Santiam stocks was conducted with the 1982 release groups. Generally, Big Creek adults returned at a rate of 3-to-1 over North Santiam adults.

Harvest of winter steelhead in the Pudding subbasin during 1976-86 averaged 5 fish from the Pudding River, 28 fish from Butte Creek, 95 fish from Abiqua Creek, and 12 fish from Silver Creek (Table 16).

Harvest of winter steelhead complies with general ODFW sport fishing regulations. Harvest of steelhead from the Molalla River is monitored through non-statistical creel surveys and salmon and steelhead tag returns. Harvest of steelhead from other streams in the subbasin is estimated through salmon and steelhead tag returns only.

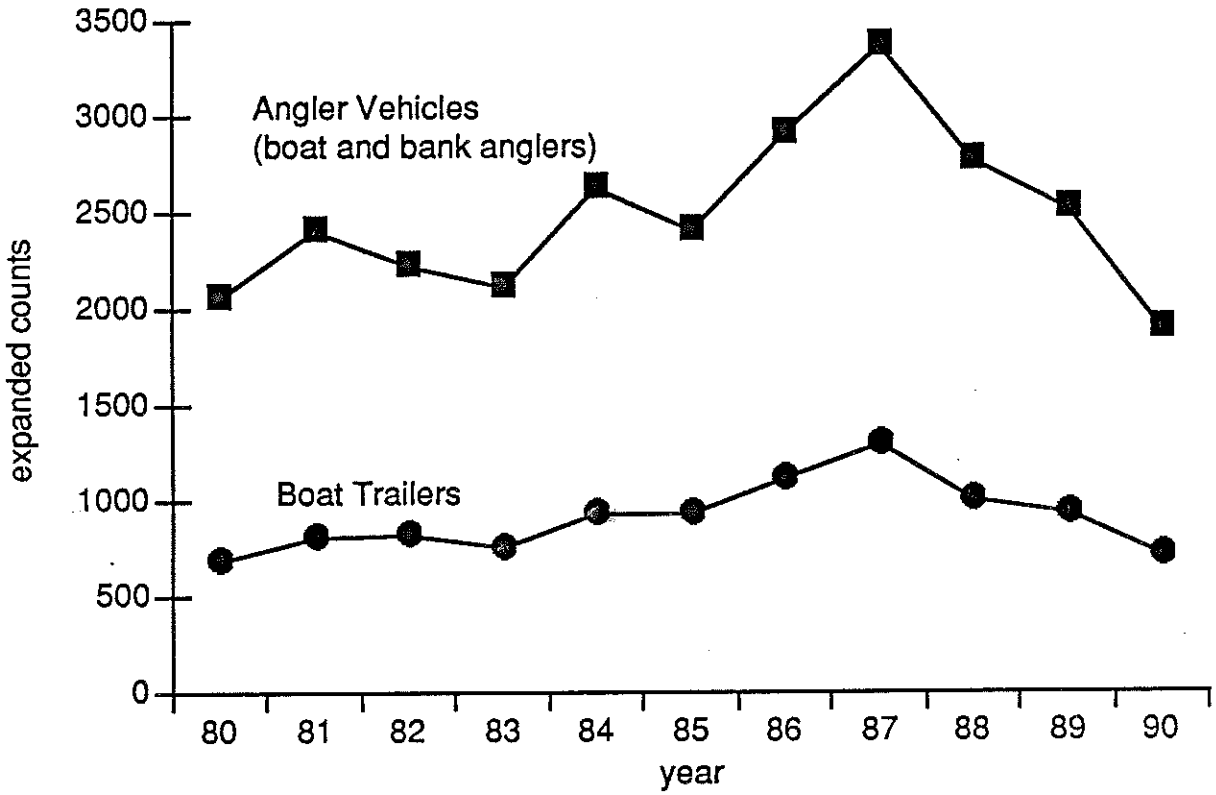


Figure 2. Winter steelhead angling pressure on the Molalla River, 1980-90 (ODFW, unpublished data).

Table 16. Harvest of winter steelhead from the Molalla and Pudding subbasins, 1977-86. Harvest is estimated from returns of salmon and steelhead angling tags corrected for non-response bias. Harvest of naturally produced and hatchery produced stocks is based on the average percent of naturally produced and hatchery produced steelhead caught by month as determined from analysis of scales collected from anglers.

Stream	Run year												
	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89
Molalla R., Nat.[a]	481	678	241	1,146	715	485	262	653	569	658	735	522	386
Molalla R., Hatch.[b]	398	616	253	916	728	341	265	470	459	439	593	697	578
Pudding R.	0	4	15	9	0	0	10	3	0	8	28	12	0
Butte Cr.	21	32	16	36	59	13	11	6	21	61	40	49	44
Abiqua Cr.	207	111	35	253	10	136	41	71	40	42	30	58	0
Silver Cr.	0	0	0	20	18	7	30	13	30	0	10	16	12

[a] Naturally produced native and Big Creek stocks.

[b] Hatchery produced Big Creek stock.

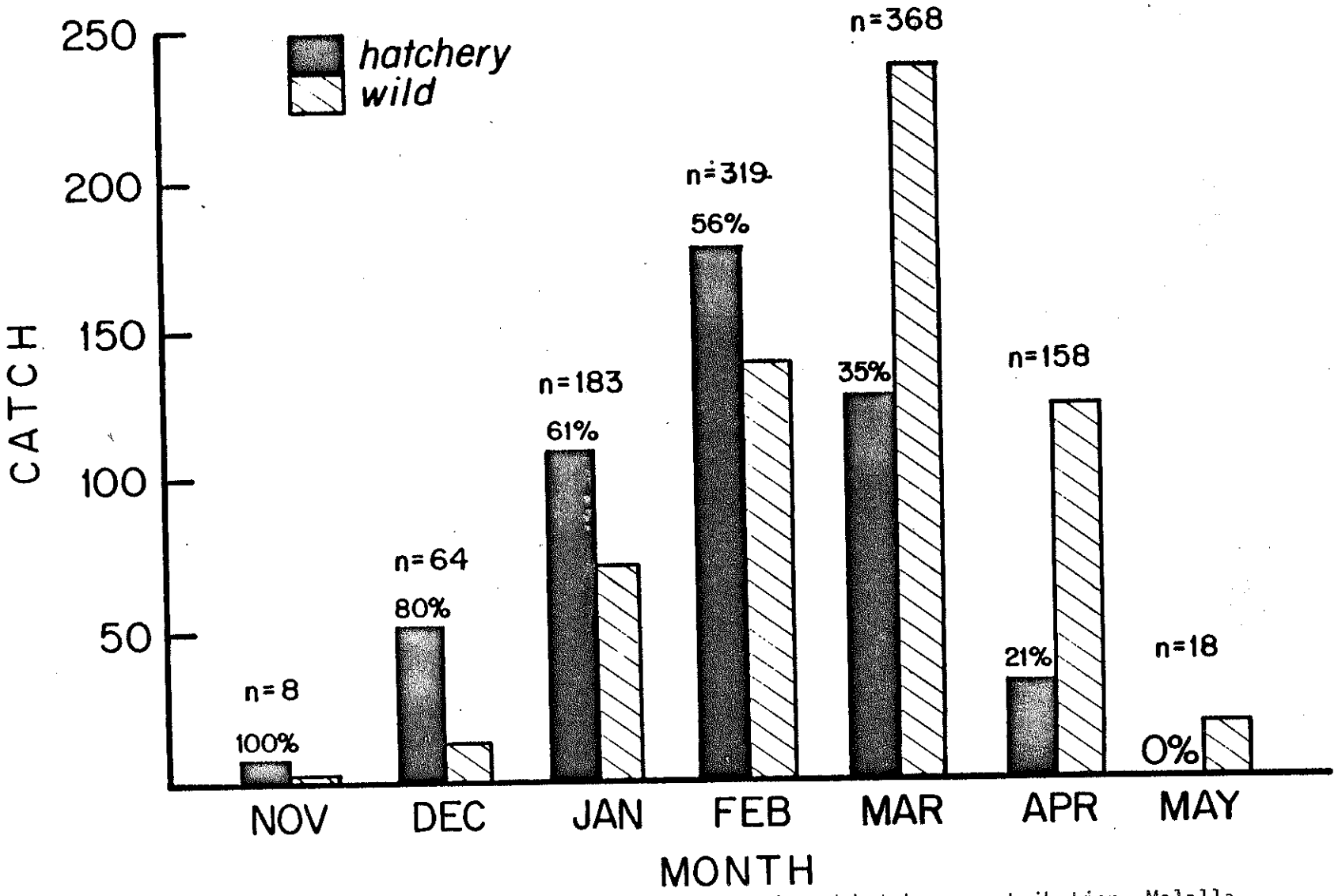


Figure 3. Average monthly winter steelhead catch and hatchery contribution, Molalla River, 1979-1986 (ODFW unpublished data).

Management Considerations

Low summertime flows and high temperatures are the most important limiting factors for winter steelhead production in the two subbasins. The Pudding system is also limited by poor water quality. The impact of future land management activities on winter steelhead production is unknown.

The native late-run Willamette winter steelhead occurs throughout the Molalla subbasin and in Abiqua and Butte creeks in the Pudding subbasin. Big Creek winter steelhead have been introduced into the Molalla River to extend the winter steelhead fishery by providing an early-run fish. They are released only into the lower 20 miles to protect native winter steelhead spawning in upper reaches of the subbasin. Big Creek steelhead were established in the Pudding subbasin from releases made prior to 1974. The distribution and extent of natural production of Big Creek stock in the subbasins is unknown.

The extent of interbreeding and competition between introduced stocks, such as Skamania summer steelhead and Big Creek winter steelhead, and the native winter steelhead stock is unknown. The origin of the early-run naturally produced winter steelhead in the subbasin is unknown.

Rainbow trout spawn in the spring when hatchery steelhead smolts are released. Some hatchery steelhead smolts are precocious and may spawn with trout. The proportion of hatchery releases that are precocious and that contribute to natural production of rainbow trout requires monitoring and evaluation. Changes in steelhead hatchery programs may be required in order to meet Wild Fish Management Policy guidelines for trout.

Big Creek stock accounts for about 45 percent of the total winter steelhead catch from the Molalla. Angler effort in the Molalla is greatest in January and February when Big Creek stock steelhead are most abundant.

The Molalla River trout fishery was once suspected to be exerting a significant impact on steelhead production through the removal of steelhead smolts. Since 1982, the opening of trout season has been delayed until late May to minimize impacts on steelhead production. This delay allows the bulk of steelhead smolts to emigrate to the Willamette River before trout season begins. The Molalla River trout fishery is probably exerting only a minimal impact on winter steelhead production today (Haxton 1985).

Policies

Policy 1. The native winter steelhead stock has priority over all other non-native stocks and species in the Molalla and Pudding subbasins.

Policy 2. Winter steelhead in the Molalla subbasin shall be managed for natural and hatchery production.

Policy 3. Winter steelhead in the Pudding subbasin shall be managed for natural production. No hatchery-produced winter steelhead, including STEP fry, shall be released into the Pudding subbasin.

Policy 4. Spawning escapement has priority over harvest.

Objectives

Objective 1. Maintain the genetic integrity and productivity of the native late stock.

Assumptions and Rationale

1. ODFW's Wild Fish Management Policy places a high priority on the protection of native stocks.

2. The Molalla and Pudding subbasins are two of three systems above Willamette Falls containing native winter steelhead that have not been severely impacted by hydropower development.

3. Competition and interbreeding with hatchery fish may decrease the survival rate and adaptability of the native Molalla steelhead.

Actions

1.1 Determine the stock composition of winter steelhead on spawning grounds. Survey upper Molalla tributaries for the presence of spawning hatchery-produced adults.

1.2 If it is determined that Big Creek hatchery fish contribute more than 10% to the total number of winter steelhead spawners, then modify the Big Creek program to bring it into compliance with the WFMP. One possibility would be to maintain temporal separation of spawning time between Big Creek and native stocks by releasing Big Creek hatchery smolts from early spawning parents.

1.3 Monitor the sport catch of winter steelhead in the Molalla and note capture location of fin-clipped hatchery fish as a method of gaining information regarding the distribution of hatchery produced steelhead.

1.4 Determine if foreign and native stocks and their crosses can be distinguished. If feasible, sample naturally produced adults and juveniles to determine their stock origin.

Objective 2. Maintain an average annual escapement of at least 3,500 late-run winter steelhead in the Molalla system.

Assumptions and Rationale

1. Stream surveys of Molalla index streams indicate average redd densities are about 18 redds per mile. Approximately 110 miles of stream are used by winter steelhead for spawning. Using a 1:0.8 female-to-male sex ratio, about 3,560 adult fish would be needed to seed the available habitat.

2. The smolt production of the Molalla subbasin using the gradient-area-flow methodology (Washington Department of Wildlife) is estimated as 77,427 smolts. Using an egg-to-smolt survival rate of 1 percent, fecundity of 4,000 eggs per female, one female per redd, and a 1:0.8 female-to-male sex ratio, an escapement of at least 3,500 steelhead would be needed to produce the estimated number of smolts.

3. Habitat quality will be maintained or improved.

4. Some of these actions could be funded by the USACE and PGE as mitigation for loss of wild winter steelhead above Willamette Falls.

Actions

2.1 Continue to monitor late-run winter steelhead escapement, population distribution and abundance, as measured by redd counts, the number of miles of production, and an estimate of the number of fish per redd in the Molalla subbasin through annual spawning surveys in the following index streams:

Molalla River
Milk Creek
North Fork of the Molalla River
Dead Horse Canyon Creek
Lukens Creek
Table Rock Fork of the Molalla River
Camp Creek
Copper Creek

Using redd counts, the number of miles of production, and an estimate of the number of fish per redd, estimate the escapement to these areas.

2.2 Develop a methodology to use winter steelhead counts made at Willamette Falls to estimate escapement to the Molalla subbasin.

2.3 Continue to limit angling for winter steelhead in the main stem Molalla to below Horse Creek (RM 38.5) to protect spawning native winter steelhead in the upper Molalla drainage.

2.4 Continue to have a late opening for trout on the Molalla main stem to protect emigrating winter steelhead smolts.

2.5 Monitor the incidental catch of native winter steelhead in the spring chinook and summer steelhead fisheries during the spring.

2.6 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 3. Maintain an average annual escapement of at least 1,250 winter steelhead in the Pudding system.

Assumptions and Rationale

1. Stream surveys of Pudding subbasin index streams indicate average redd densities are about 10 redds per mile. Approximately 57 miles of stream are used by winter steelhead for spawning. Using a 1:0.8 female-to-male sex ratio, about 1,030 adult fish would be needed to fill the available habitat.

2. The smolt production of the Pudding subbasin using the gradient-area-flow methodology (Washington Department of Wildlife) is estimated as 27,737 smolts. Using an egg-to-smolt survival rate of 1 percent, fecundity of 4,000 eggs per female, one female per redd, and a 1:0.8 female-to-male sex ratio, an escapement of at least 1,250 steelhead would be needed to produce the estimated number of smolts.

3. Habitat quality will be maintained or improved.

Actions

3.1 Identify suitable areas in the Pudding subbasin to monitor steelhead escapement, population distribution, abundance, and relative trends through annual spawning surveys. Possible index streams and reaches include:

Pudding River
Butte Creek
Abiqua Creek, RM 19-20
Little Abiqua Creek

Using redd counts, the number of miles of production, and an estimate of the number of fish per redd, estimate the escapement to these areas.

3.2 Develop a methodology to use winter steelhead counts made at Willamette Falls to estimate escapement to the Pudding subbasin.

3.3 Develop a program to sample juvenile steelhead distribution and density in the Pudding subbasin. When considering sample sites, Silver Creek should be given a high priority.

3.4 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 4. Maintain a potential average annual sport harvest of about 600 late-run winter steelhead from the Molalla subbasin.

Assumptions and Rationale

1. The average annual harvest of late-run winter steelhead during 1980 to 1986 averaged about 600 fish.

2. It has been estimated that average escapement was sufficient during this period to attain full seeding.

Actions

4.1 Continue to monitor harvest through expanded catch estimates based on salmon and steelhead tag returns.

Objective 5. Continue to provide an average annual sport catch of at least 500 early-run hatchery produced winter steelhead in the Molalla River, primarily during December through February.

Assumptions and Rationale

1. Harvest of Big Creek stock averaged about 500 fish annually during 1980-86.

2. Current release levels will continue to provide an average harvest of about 500 fish.

3. Information gathered through angler questionnaires indicated that most Molalla anglers were in favor of continuing releases of early-run smolts at the current level.

4. Releasing hatchery smolts in the lower river results in returning adults holding there where they are subjected to heavier angling pressure.

Actions

5.1 Continue to release enough Big Creek stock hatchery smolts annually in the lower 20 miles of the Molalla River to meet harvest objectives. Currently 75,000 smolts provide adequate returns.

5.2 Investigate the use of acclimation facilities at release sites to improve survival and harvest of hatchery fish and to decrease straying into other tributaries.

5.3 Minimize the proportion of hatchery steelhead smolts that are precocious and their impact on spawning trout populations. This

may be accomplished through removal of precocious fish during marking of hatchery steelhead.

5.4 If necessary modify hatchery steelhead programs to minimize their effect on native trout populations and to be in compliance with Wild Fish Management Policy guidelines.

5.5 Continue to monitor the harvest of early-run winter steelhead through expanded catch estimates based on salmon and steelhead tag returns.

5.6 Determine the catch composition (hatchery:wild ratios) through creel surveys.

Objective 6. Maintain an annual sport harvest of about 100 winter steelhead from the Pudding subbasin.

Assumptions and Rationale

1. The annual harvest from the Pudding subbasin during 1981-86 was about 100 winter steelhead.

2. Opportunities to increase harvest are limited by the small size of the streams and the large amount of private ownership limiting angler access.

3. The potential for increasing the run is uncertain.

4. Spawning escapement has priority over harvest.

Actions

6.1 Continue to monitor harvest through expanded catch estimates based on salmon and steelhead tag returns.

SUMMER STEELHEAD

Background and Status

Origin

Summer steelhead are not native to the Molalla and Pudding subbasins. Skamania stock smolts were first released into the Molalla River in 1984. Little information regarding natural production of summer steelhead in the Molalla is available, but it is thought to be minimal. Natural production of summer steelhead is not desirable because of concerns for the native winter steelhead stock. No releases have been made into the Pudding subbasin.

Life History and Population Characteristics

Except for run size estimates, all quantitative information reported below for the Molalla subbasin was collected through an ODFW creel survey conducted from 1986 to 1988.

Distribution

Summer steelhead have been observed in the main stem Molalla up to Henry Creek Falls (RM 46), an impassable barrier, and in some upper tributaries. Most, however, occur below Turner Bridge (RM 35).

Run Timing

Summer steelhead enter the Molalla River from early March through late September with peak entry occurring around mid-June to early July.

Run Size

The average summer steelhead run in the Molalla River during 1986-90 was 3,778 fish (Table 17). Summer steelhead run size estimates were calculated using differential survival rates for subbasins. Smolt-to-adult survival rates for the McKenzie and Middle Fork Willamette subbasins are believed to be 2%, and for the Molalla and Santiam subbasins 7%. Run size of summer steelhead in the Molalla subbasin for the year (y) was estimated as follows:

Run size (y) = Molalla smolt releases (y-2) / {2/7[McKenzie + Middle Fork smolt releases (y-2)] + Santiam smolt releases (y-2)} X Willamette Falls summer steelhead count (y).

Table 17. Estimated run size of summer steelhead in the Molalla River (ODFW, unpublished data).

Year	Run size
1986	4,768
1987	3,310
1988	5,921
1989	1,021
1990	3,872

Age, Size, and Sex Ratio

About 70 percent of the summer steelhead caught in the Molalla are 2-salt fish, and 30 percent are 3-salts (Table 18). Average length at age for summer steelhead caught from the Molalla was 27.5 inches for 2-salts and 31 inches for 3-salts (Table 18). The female-to-male ratio of angler-caught summer steelhead is about 1:1 (n=51).

Table 18. Age structure and average length at age of summer steelhead in the sport catch of the Molalla River (ODFW, unpublished data).

Ocean Age	n	Length (inches)
2	35	27.5
3	15	31.2

Juvenile Life History

All scales taken from summer steelhead caught in the Molalla River from June through October through 1990 (n=78) showed juvenile patterns characteristic of hatchery rearing. Summer steelhead are hatchery reared for one year and released in April at a size of about 5.6 fish per pound.

Hatchery Production

Description of Hatcheries

No hatcheries exist in the Molalla and Pudding subbasins. Summer steelhead released into the Molalla subbasin are reared at Gnat Creek Hatchery (see the Lower Columbia River Plan) and Roaring River Hatchery (see the Santiam and Calapooia Plan).

Hatchery Releases

The summer steelhead program was initiated to increase angling opportunities in the Molalla River, which formerly consisted only of the four-month winter steelhead fishery and the two-month hatchery trout fishery. Through the introduction of summer steelhead, angling opportunities now exist year-round.

Summer steelhead have only been released into the main stem Molalla River. Releases have averaged 62,000 smolts annually (Table 19). The current allocation is 70,000 smolts for the main stem Molalla River. Summer steelhead smolts are released between RM 21 and 35. Summer steelhead angling is permitted up to RM 38.5.

Table 19. Releases of Skamania stock summer steelhead smolts into the Molalla River, 1984-90 (unpublished data, ODFW).

Brood year	Release year	Hatchery	Number released
1983	1984	Gnat Cr.	38,651
		Roaring R.	15,552
1984	1985	Gnat Cr.	60,842
		Roaring R.	12,078
1985	1986	Gnat Cr.	43,362
		Roaring R.	26,894
1986	1987	Gnat Cr.	52,182
		So. Santiam	9,325
1987	1988	Gnat Cr.	30,446
		Roaring R.	35,191
1988	1989	Gnat Cr.	58,704
		Roaring R.	7,110
1989	1990	Gnat Cr.	28,919
		Roaring R.	36,169
1990	1991	Gnat Cr.	35,088
		Roaring R.	30,686

Angling and Harvest

Harvest of summer steelhead from the Molalla River is monitored through non-statistical creel surveys and salmon and steelhead angling tag returns. Complete catch estimates from returns of salmon and steelhead angling tags for the 1986-87 through 1988-89 run years are given in Table 20.

Table 20. Harvest of summer steelhead in the Molalla River (ODFW 1990b).

Run Year	Catch
1986-87	746
1987-88	821
1988-89	1,488

Information gathered through the Molalla creel census program indicates that summer steelhead are being caught by anglers throughout the year.

Harvest of summer steelhead complies with general ODFW sport fishing regulations.

Management Considerations

Summer steelhead were first released into the Molalla River in 1984 to extend the steelhead fishery. Summer steelhead in the Molalla River are caught by anglers throughout the year.

The extent of natural production of summer steelhead in the subbasin is unknown. Limited scale sampling (n=78) of adults in the creel showed juvenile patterns characteristic of hatchery rearing only.

Summer steelhead have been released into lower reaches of the main stem Molalla River to avoid potential negative effects on the native winter steelhead. Although some summer steelhead have been observed up to RM 46 and in some upper tributaries, most adults have been observed below RM 35. The extent of competition between the native winter steelhead and summer steelhead is unknown. The potential for summer steelhead to hybridize with native winter steelhead stock is unknown.

Rainbow trout spawn in the spring when hatchery steelhead smolts are released. Some hatchery steelhead smolts are precocious and may spawn with trout. The proportion of hatchery releases that are precocious and that contribute to natural production requires monitoring and evaluation. Changes in steelhead hatchery programs may be required in order to meet Wild Fish Management Policy guidelines for trout.

As summer flows decrease and high temperatures increase, especially in the lower river, habitat conditions for returning adults and angling conditions deteriorate. As a result, adult fish may be delayed, experience higher mortality, or stray to other Willamette basin tributaries. The extent to which this occurs is unknown.

Policies

Policy 1. Summer steelhead in the Molalla subbasin shall be managed for harvest of hatchery fish. The run shall be monitored for possible natural production.

Policy 2. Summer steelhead hatchery releases shall be confined to reaches below RM 35 in the main stem Molalla River to avoid interactions with native winter steelhead in upper reaches of the subbasin and to provide better harvest opportunities.

Policy 3. Summer steelhead smolts shall be released into streams that have suitable adult holding habitat throughout the summer and where adults will provide optimum recreational opportunity.

Policy 4. Only smolt-sized fish will be released to minimize competition with native salmonids.

Objectives

Objective 1. Increase the potential average annual sport catch to 2,450 fish from an average annual return of 4,900 fish.

Assumptions and Rationale

1. Return rates of adults to the Molalla from current release levels of about 70,000 smolts have averaged 7.5%. Survival and returns can be increased to 8% by advancing the time of return.

2. Harvest rates of 50 percent can be achieved.

3. Based on current stocking levels and survival rates, returns of 4,900 fish are achievable.

Actions

1.1 Continue to release enough smolts annually between RM 21 and RM 35, where fishing access is greatest, to meet harvest objectives.

1.2 If feasible, consider advancing the peak time of entry by one month by selecting early-returning brood stock. Adults will enter the Molalla River under more favorable temperature and flow conditions, increasing returns and potential harvest.

1.3 Evaluate the success of selecting for early-returning brood stock by differentially marking these fish and monitoring their returns to the fishery.

1.4 Monitor harvest through expanded catch estimates based on salmon and steelhead tag returns.

Objective 2. Minimize the potential impacts of summer steelhead on native winter steelhead and trout.

Assumptions and Rationale

1. ODFW's Wild Fish Management Policy places a high priority on the protection of native stocks.

2. Natural spawning by summer steelhead is not desirable because of the potential impact on production of native winter steelhead.

3. Releases of precocious hatchery steelhead smolts near areas where spawning of trout occurs may decrease the genetic fitness of wild trout populations.

4. Changes in the summer steelhead program may be required to achieve this objective. These changes may make achievement of the harvest objective (Objective 1) unfeasible.

Actions

2.1 Determine the impact of the current summer steelhead hatchery program on the production of native winter steelhead in the Molalla and Pudding subbasins. Specifically,
   a) define the extent of spawning by summer steelhead,
   b) the duration of spawning by summer steelhead, and
   c) the potential for interbreeding between summer steelhead and native winter steelhead.

2.2 Monitor the summer steelhead fishery for unmarked fish in the creel, evidence of natural production.

2.3 Continue to use an early spawning (January) brood stock of summer steelhead to minimize the potential for interbreeding with the native winter steelhead.

2.4 Minimize the proportion of hatchery steelhead smolts that are precocious and their impact on spawning trout populations. This may be accomplished through removal of precocious fish during marking of hatchery steelhead.

2.5 Make any necessary changes in the current hatchery program for summer steelhead to minimize their effects on native winter steelhead and trout populations and to be in compliance with Wild Fish Management Policy guidelines.

COHO SALMON

Background and Status

Origin

Coho salmon are not native to the Willamette basin above Willamette Falls. They were first introduced above the falls in the 1920s. Releases occurred throughout the Willamette basin from the 1950s through early 1970s, and in selected portions of the basin in the 1980s. Releases were primarily early-run stock, although coastal stocks and the late-run Cowlitz stock were occasionally used. Concerns for the effect of coho on native cutthroat trout and winter steelhead and uncertainties regarding their contribution to Oregon fisheries resulted in termination of the coho program above Willamette Falls. The current Willamette Basin Fish Management Plan prohibits hatchery releases in the subbasin except for experimental groups of pre-smolts to evaluate their contribution to ocean and Columbia River fisheries.

The extent of any natural production within the subbasin is unknown. However, runs that might have been generated as a result of the most recent hatchery program would be expected to fall below self-sustaining levels within 3-4 years following the termination of stocking.

Life History and Population Characteristics

Suspected spawning areas are believed to be confined to areas most recently stocked (Table 21).

Table 21. Suspected coho spawning areas in the Molalla and Pudding subbasins.

Subbasin and stream	River mile From	River mile To
Molalla		
Milk Cr.	13.8	21.6
Nate Cr.	0.0	5.5
Canyon Cr.	0.0	4.1
Jackson Cr.	0.0	2.0
Mill Cr.	0.0	1.5
Pudding		
Butte Cr.	7.0	19.5
Abiqua Cr.	10.0	20.6
Powers Cr.	0.0	4.0
Little Abiqua Cr.	0.0	3.0
Davis Cr.	0.0	3.0
Silver Cr.	0.9	16.4
Drift Cr.	0.0	10.7
East Fork	0.0	2.0
West Fork	0.0	3.5

Hatchery Production

Description of Hatcheries

There is no hatchery production of coho in the Molalla and Pudding subbasins. Past releases of early-run coho were supplied by Bonneville, Oxbow, Eagle Creek, Cascade, and Sandy hatcheries. Eggs used in STEP hatch boxes were supplied by Sandy Hatchery.

Hatchery Releases

Coho were stocked in the Molalla and Pudding subbasins during the 1950s through 1970s as part of an effort to establish a self-sustaining run of coho to the upper Willamette basin (Table 22 and Appendix Table B-1). This program was terminated when returns did not reach expectations (Williams 1983a). In the 1980s, coho were stocked in an attempt to alleviate depressed ocean and Columbia River fisheries. Hatchery releases of coho were terminated by 1988.

Angling and Harvest

Harvest of coho in the Molalla and Pudding subbasins is negligible. Punch card estimates of annual catch for 1977-89 range from 0 to 39 fish. Coho produced in the Willamette basin contribute almost entirely to ocean and Columbia River fisheries (ODFW 1988).

Management Considerations

Coho are not native to the subbasin. Past efforts to establish coho through stocking have met with little success. Returning coho do not contribute significantly to subbasin sport fisheries due to their dark color and poor quality flesh.

The potential exists for coho to compete with native species such as winter steelhead and cutthroat trout.

Releases of hatchery fish have been discontinued.

Table 22. Summary of coho releases in the Molalla and Pudding subbasins, 1952-87 (Williams 1983b, ODFW unpublished data).

Year	Fry	Fingerling	Yearling	Adult
1952	--	50,000	--	--
1953	--	--	--	--
1954	--	50,000	--	--
1955	--	6,000	5,000	--
1956	--	--	--	--
1957	--	50,000	25,000	--
1958	--	143,520	--	--
1959	--	30,000	--	--
1960	--	--	--	--
1961	--	--	--	--
1962	161,200	--	--	--
1963	686,250	--	--	--
1964	--	--	--	2,023
1965	631,295	--	19,720	--
1966	1,762,474	--	14,120	1,007
1967	691,800	268,813	--	1,214
1968	1;205,073	--	--	1,578
1969	1,633,382	249,491	--	1,351
1970	222,500	--	129,602	360
1971	307,638	--	128,055	450
1972	512,512	--	93,315	310
1973	1,091,806	173,890	288,614	171
1974	--	--	316,390	--
1975	290,446	54,921	--	--
1976	--	--	41,004	--
1977	270,389	--	--	--
1978	--	--	--	--
1979	--	--	--	--
1980	--	--	--	--
1981	--	--	--	--
1982	24,000	--	--	--
1983	629,803	--	--	--
1984	--	--	--	--
1985	230,687	491,430	--	--
1986	118,859	187,745	--	--
1987	167,679	--	--	--
1988	24,592	--	--	--

Policies

Policy 1. **Hatchery releases of coho salmon shall be permitted only for the purpose of rehabilitation of self-sustaining populations.**

Objectives

Objective 1. Maintain natural production of coho salmon in the Molalla and Pudding subbasins provided self-sustaining runs are present.

Assumptions and Rationale

1. Coho are not native to the Molalla and Pudding subbasins.

2. Coho do not contribute significantly to fisheries in the Molalla and Pudding subbasins.

3. Maintenance of self-sustaining populations is desirable to provide greater genetic diversity in the Willamette basin.

4. Information on the distribution and abundance of adult and juvenile coho is necessary to determine the status of self-sustaining populations in the subbasin.

5. Coho may compete with native species for spawning and rearing habitats in the Molalla and Pudding subbasins.

6. The management objective for coho will be deleted if it is determined that self-sustaining populations are not present in the Molalla and Pudding subbasins.

Actions

1.1 Implement habitat protection actions outlined under objectives for habitat protection.

1.2 Continue to monitor the harvest of coho in the subbasin through punch card returns.

1.3 Monitor the distribution and abundance of adult coho by conducting annual spawning surveys in selected streams where spawning is known or suspected to occur.

1.4 Monitor the distribution and abundance of juvenile coho by sampling selected streams where natural production is suspected to occur.

1.5 Conduct scale analysis of adult coho returning to the subbasin to determine their origin.

SPRING CHINOOK SALMON

Background and Status

Origin

Spring chinook were native to the Molalla subbasin. The original run is believed to have declined to the point where it can no longer sustain a viable population. Snorkel surveys (Table 23) indicate a steady decline in spring chinook adults from 12 adults per mile in the 1960s to an average of 5 per mile in the early 1970s. By 1975 counts were below 0.5 fish per mile. Extensive logging in the 1960s and improved access to the upper river, which resulted in illegal fishing in important holding areas, probably contributed to there decline.

The spring chinook run in the Molalla increased in the early 1980s to an average of 5 adults per mile. This improvement was thought to have been brought about by increased straying of hatchery chinook. Studies have shown that smolts released below Willamette Falls exhibit stray rates of more than 70%. Records indicate that releasing smolts below the falls may have started as early as the 1940s, and was employed intermittently until the mid-1970s when it became an established program for more than 10 years.

Hatchery releases of spring chinook have been made in the Molalla in an attempt to restore the run. The hatchery program began in 1981 and resting hole counts of spring chinook have subsequently increased (Table 23).

In the Pudding subbasin, reports of spring chinook spawning in Abiqua Creek were noted in the 1940s and 1960s. Since these observations were of spawning rather than holding adults, it is not clear if the fish were spring or fall chinook. Heavy planting of fall chinook occurred in the subbasin during the 1950s. There are no recent accounts of spring chinook in the Pudding subbasin.

Willamette river spring chinook are currently listed as a stock of concern due to diminished habitat, the small percentage of the total run that is of wild origin, and possible genetic impacts from the large hatchery program.

Table 23. Numbers of spring chinook holding in the main stem Molalla river as determined from July snorkel surveys and estimated run size.

Year	Miles surveyed	Adults observed	Sport catch	Minimum[a] run size
1961	19.1	238	32	465
1962	19.1	245	27	472
1963	19.1	274	67	565
1964	19.1	173	55	370
1965	19.1	95	47	220
1966	19.1	214	85	474
1967	19.1	310	56	620
1968	19.7	70	29	152
1969		no survey	39	---
1970		no survey	17	---
1971	19.7	291	14	525
1972	22.5	121	30	216
1973	22.5	181	60	338
1974	22.5	38	3	61
1975	22.5	7	12	23
1976		no survey	0	---
1977		no survey	6	---
1978		no survey	22	---
1979		no survey	0	---
1980	13.9	63	closed	158
1981	14.4	57	closed	158
1982	14.0	26	closed	65
1983	23.1	69	closed	103
1984	17.3	176	closed	352
1985	14.9	117	closed	272
1986	17.1	177	closed	361
1987	18.4	392	closed	740
1988	19.6	273	218	697
1989	21.2	139	59	287
1990	19.6	382	not available	---
1991	19.6	338	not available	---

[a] Run size = (number of adults observed / % of the total holding area inventoried) + sport catch. The total holding area is 34.6 miles. It is assumed that most of the sport catch for the year occurred prior to the survey.

Life History and Population Characteristics

Distribution

Spring chinook are currently found in upper reaches of the main stem Molalla River, primarily above RM 25, and in the North Fork and Table Rock

Fork of the Molalla River. Distribution of spring chinook is at least partially controlled by location of hatchery releases.

Run Timing

Based on passage at Willamette Falls, spring chinook probably enter the Molalla subbasin from mid-April through late June. Peak numbers probably enter from middle to late May (personal communication from E. Smith, ODFW, Springfield, Oregon).

Run Size

Historical information (USFWS 1941) indicates that the Molalla River at one time supported between 1,000 to 1,500 spring chinook. The largest run on record over Willamette Falls consisting of mainly wild fish occurred in 1953. The estimated run returning to the Molalla that year is 760 spring chinook.

Based on snorkel survey information, the estimated annual run size from 1986 through 1990 ranged from 287 to 740 spring chinook (Table 23).

Time and Location of Spawning

Spring chinook spawn from late September to the end of October with peak activity occurring in early to mid-October.

Spawning habitat occurs primarily in the main stem Molalla River (RM 25.0 to RM 46), the North Fork Molalla River (RM 0 to RM 5.5), and the Table Rock Fork of the Molalla River (RM 0 to RM 8). About 13.5 miles of Abiqua Creek (RM 7 to RM 13.5) may be used for spawning.

Hatchery Production

Description of Hatcheries

There are no hatcheries in the Molalla or Pudding subbasins. Spring chinook pre-smolts and smolts are supplied primarily by Willamette and Dexter hatcheries (see the Middle Fork Willamette Subbasin Plan).

Supplementation History

Willamette stock spring chinook pre-smolts, smolts, and adults have been released in the Molalla and Pudding subbasins to reestablish runs and to provide a fishery in the Molalla. Not enough information is available yet to assess the success of the hatchery program in restoring runs.

Spring chinook smolts were released in the upper Molalla subbasin during 1981, 1982, and 1987-90 (Table 24). About 1.2 million pre-smolts have been released annually in the Molalla system since 1983. Pre-smolt releases are confined to specific

Table 24. Releases of Willamette spring chinook in the Molalla and Pudding subbasins.

Release year[a]	Brood year	Hatchery	Number released[b]	Release site
1981	1980	Oak Ridge	83,445 (s)	Molalla R.
1981	1980	Oak Ridge	16,516 (s)	Table Rock Fork
1982	1981	McKenzie	68,928 (s)	Molalla R.
1982	1981	McKenzie	23,499 (s)	NF Molalla R.
1982	1981	McKenzie	7,390 (s)	Rock Fork
1982	N.A.	Dexter	209 (a)	Molalla R.
1983	1982	Willamette	922,591 (fin)	Molalla R.
1983	1982	Marion Forks	148,700 (fin)	NF Molalla R.
1983	1982	Marion Forks	148,607 (fin)	Table Rock Fork
1983	1982	Marion Forks	148,680 (fin)	Abiqua Cr.
1984	1983	McKenzie	707,520 (fin)	Molalla R.
1984	1983	Willamette	577,517 (fin)	Molalla R.
1984	1983	Willamette	151,092 (fin)	NF Molalla R.
1984	1983	Willamette	150,073 (fin)	Table Rock Fork
1984	1983	Willamette	92,252 (fin)	Abiqua Cr.
1984[a]	1984		110,689 (fry)	Abiqua Cr.
1985	1984	Willamette	1,001,251 (fin)	Molalla R.
1985	1984	Willamette	150,075 (fin)	North Fork
1985	1984	Willamette	150,399 (fin)	Table Rock Fork
1985	1984	Willamette	149,997 (fin)	Abiqua Cr.
1986	1985	Willamette	966,542 (fin)	Molalla R.
1986	1985	Willamette	168,890 (fin)	NF Molalla R.
1986	1985	Willamette	162,490 (fin)	Table Rock Fork
1986[a]	1985		108,381 (fry)	Abiqua Cr.
1987	1986	Willamette	986,849 (fin)	Molalla R.
1987	1986	Willamette	154,855 (fin)	NF Molalla R.
1987	1986	Willamette	156,825 (fin)	Table Rock Fork
1987[a]	1986		103,041 (fry)	Abiqua Cr.
1987	1986	Willamette	30,162 (s)	Molalla R.
1988	1986	Dexter	98,178 (s)	Molalla R.
1988	1987	Willamette	450,860 (fin)	Molalla R.
1988[a]	1987		98,222 (fry)	Abiqua Cr.
1988	1987	Willamette	33,030 (s)	Molalla R.
1989	1988	Willamette	1,026,029 (fin)	Molalla R.
1989	1988	Willamette	151,730 (fin)	NF Molalla R.
1989[a]	1988		110,067 (fry)	Abiqua Cr.
1989	1987	Dexter	69,312 (s)	Molalla R.
1989[a]	1988	Dexter	37,772 (fry)	Table Rock Fork
1990	1989	Willamette	99,175 (fin)	Molalla R.
1990	1989	Willamette	150,020 (fin)	NF Molalla R.
1990	1989	Dexter	98,213 (s)	Molalla R.
1990[a]	1989	Dexter	83,278 (fry)	Table Rock Fork
1990	1989	Willamette	999,175 (fin)	Molalla R.
1990	1989	Willamette	150,020 (fin)	NF Molalla R.
1991	1989	Dexter	85,398 (s)	Molalla R.
1991[a]	1990	McKenzie	101,668 (fry)	Table Rock Fork
1991	1990	McKenzie	1,012,703 (fin)	Molalla R.
1991	1990	McKenzie	150,355 (fin)	NF Molalla R.

[a] STEP releases of fry.
[b] (a) = adults, (s) = smolts, (fin) = fingerlings.

areas to minimize competition with native winter steelhead. The dispersal pattern of pre-smolt releases in the subbasin is unknown. An average of 130,000 pre-smolts were released annually into Abiqua Creek from 1983 to 1985. From 1984 to 1989, Abiqua Creek received an average of 106,000 fry from the Salmon and Trout Enhancement Program (STEP).

About 30 percent to 50 percent of the spring chinook smolts are released in November at about 6.9 fish per pound. The remainder are released in March at about 9.2 fish per pound. Pre-smolts are released primarily in March and April at about 385 fish per pound.

Angling and Harvest

During 1975-79 harvest of spring chinook in the Molalla subbasin averaged eight fish per year. The fishery was subsequently closed in 1980. The fishery was reopened in 1988 following implementation of the hatchery program. The sport catch for 1988 and 1989 was 218 and 59 fish, respectively. There was no harvest of spring chinook from Abiqua Creek before the fishery was closed in 1986.

Harvest of spring chinook in the Molalla and Pudding subbasins must comply with ODFW sport fishing regulations. Spring chinook harvest is monitored through return of salmon and steelhead angling tags.

Management Considerations

Natural production levels of spring chinook in the subbasins are unknown. Pre-spawning mortality of spring chinook in the Molalla subbasin is believed to be very high. This is attributed to changes in water quality and flows due to logging activities. Additionally, improved access to areas where the adults hold and subsequent incidental harassment and illegal harvest contribute to mortality. Low flows also tend to crowd fish into available pools during the summer and limit the amount of spawning habitat available. High summer temperatures may reduce fish condition, increase susceptibility to disease, and cause subsequent mortality.

The potential for reestablishing significant levels of natural production are unknown. The contribution of hatchery pre-smolts and smolts to adult returns and natural production is unknown. Pre-smolt releases to date appear to be unsuccessful in establishing healthy runs. However, there has not been a consistent quality hatchery program in the Molalla subbasin for a long enough period of time to determine the potential for reestablishing natural production.

The current hatchery program for spring chinook in the subbasin is most likely out of compliance with the Wild Fish Management Policy. Maintaining the current level of hatchery production in the subbasin, which provides for important ocean and in-river fisheries, and coming into compliance with the Wild Fish Management Policy may not be feasible.

Policies

Policy 1. **Spring chinook salmon in the Molalla subbasin shall be managed for natural and hatchery production.**

Policy 2. **Spring chinook salmon in the Pudding subbasin shall be managed for natural production. Hatchery-produced spring chinook salmon shall only be released into the Pudding subbasin for the purpose of reestablishing a run.**

Policy 3. **Reestablishment of spring chinook salmon runs in the Molalla subbasin has priority over harvest.**

Objectives

Objective 1. **Protect, restore, and enhance spring chinook salmon habitat in the Molalla and Pudding subbasins.**

Assumptions and Rationale

1. Protection and enhancement of spring chinook populations can be achieved principally through habitat protection and improvement.

2. Habitat protection and enhancement is necessary for the reestablishment of spring chinook runs in the Molalla subbasin.

Actions

1.1 Identify sites for habitat improvement.

1.2 Develop habitat improvement plans.

1.3 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 2. **Reestablish a run of 750 naturally produced spring chinook salmon adults in the main stem, North Fork, and Table Rock Fork of the Molalla River.**

Assumptions and Rationale

1. Willamette spring chinook have been identified by ODFW as a stock of concern. This objective addresses some of the problems with the stock.

2. A run of spring chinook existed in the Molalla prior to the 1970s. Historical information indicates that a run of 1,000-1,500 fish existed before 1940. The 1953 run has been estimated at about 760 adults.

3. Recent attempts to reestablish a run have had little success, but improvements in the Molalla spring chinook hatchery program may lead to reestablishment of runs.

4. Habitat quality will be maintained or improved.

5. A run of 750 fish can be initially produced by releasing 112,000 hatchery smolts, assuming a smolt-to-adult survival of 0.67%. A run approaching 750 adults has been produced by the existing hatchery program.

6. Pre-smolts rear in the Molalla for about a year before emigrating as smolts. Adults returning as a result of a pre-smolt release may be more adapted to the Molalla and may stray less than an adult resulting from a smolt release.

Actions

2.1 Evaluate factors limiting natural production of spring chinook in the Molalla subbasin.

2.2 Release about 18,300 pounds of smolts and about 6,000 pounds of pre-smolts annually (3,800 pounds of smolts) until natural production is established. This is equivalent to about 158,000 smolts (using the release strategy of one-third released in the fall at eight fish per pound and two-thirds released in the spring at nine fish per pound) and about 1.2 million pre-smolts released at 200 per pound.

2.3 Continue to snorkel resting holes in the Molalla during the summer to estimate returns of spring chinook.

2.4 Identify index areas and conduct spawning surveys in the Molalla River during late September to estimate natural production.

2.5 Determine the magnitude of pre-spawning mortality.

2.6 Investigate methods to reduce pre-spawning mortality.

2.7 Adjust pre-smolt release numbers as natural production becomes established.

2.8 Mark all hatchery smolts for determination of percent hatchery fish in the run and to estimate contribution to natural production.

2.9 Evaluate the impacts of pre-smolts on native winter steelhead.

2.10 Determine the impacts of summer steelhead and early-run hatchery produced winter steelhead on natural production of spring chinook.

Objective 3. Provide a potential harvest of 300 spring chinook salmon in the Molalla River.

Assumptions and Rationale

1. Harvest in 1988 and 1989 was estimated to be 218 and 59 fish, respectively.

2. Current levels of hatchery releases have resulted in runs approaching 750 fish.

3. A harvest rate of about 50% can be achieved.

Actions

3.1 Release about 18,300 pounds of smolts and about 6,000 pounds of pre-smolts annually (3,800 pounds of smolts new production) until natural production is established. This is equivalent to about 158,000 smolts (using the release strategy of one-third released in the fall at eight fish per pound and two-thirds released in the spring at nine fish per pound) and about 1.2 million pre-smolts released at 200 per pound.

3.2 Continue to monitor the sport harvest of spring chinook in the Molalla through the use of salmon and steelhead tag returns.

Objective 4. Determine the status of spring chinook salmon in the Pudding subbasin.

Assumptions and Rationale

1. Willamette spring chinook have been identified by ODFW as a stock of concern. This objective addresses some of the problems with the stock.

2. Abiqua Creek and possibly other streams in the Pudding subbasin, such as Butte Creek, have suitable habitat for spring chinook.

3. Habitat quality will be maintained or improved.

Actions

4.1 Evaluate factors limiting natural production of spring chinook in the Pudding subbasin.

4.2 Snorkel resting holes in Abiqua Creek during the summer to estimate returns of spring chinook.

4.3 Conduct spawning surveys in Abiqua Creek during late September to estimate natural production if snorkel counts show presence.

FALL CHINOOK SALMON

Background and Status

Origin

Fall chinook are not native to the Molalla and Pudding subbasins. Releases of "tule" stock have been made in the Molalla subbasin since 1967. The run is composed of both naturally produced and hatchery fish. Although an estimate is not available for the proportion of the run that is naturally produced, about 30 percent of the adults returning to Willamette Falls are naturally produced (Smith et al. 1987).

Life History and Population Characteristics

Distribution

Fall chinook occur in the lower Molalla River. Distribution is determined primarily by hatchery release location.

Run Timing

Based on counts made at Willamette Falls, fall chinook probably enter the Molalla subbasin from early August through late October. The run probably peaks around mid-September.

Run Size

Fall chinook run size in the Molalla has been very variable. The average run size during 1976-88 ranged from about 180 to 4,300 fish (Table 25).

Hatchery fish contribute about 70 percent to the run above Willamette falls (Smith et al. 1987).

Age, Size, and Sex Ratio

Scales taken from chinook carcasses in the Molalla River during 1976-78 revealed that virtually all of the chinook return as 3- and 4-year-olds (Hansen and Williams 1979) (Table 26). The proportion of 3- and 4-year-olds varied from year to year.

The female-to-male sex ratio of fall chinook in the Molalla River during 1976-78 varied from 1:2 to nearly 2:1 (Hansen and Williams 1979) (Table 26). This pattern has also been observed in other Willamette basin streams.

Table 25. Fall chinook spawning redds by reach and estimated run size in the Molalla River, 1976-88 (Hansen 1977, 1978; Hansen and Williams 1979; Smith et al. 1982, 1983, Smith et al. 1985; ODFW, unpublished data).

	Run Year												
Reach (RM)	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0.0-3.6	37	34	46	29	87	34	38	31	0	1	0	7	5
3.6-6.0	100	68	57	33	44	50	94	51	1	2	5	17	25
6.0-10.1	234	142	152	41	47	40	330	135	31	27	21	10	8
10.1-14.4	146	179	115	7	1	52	379	113	20	12	104	0	11
14.4-18.6	89	262	97	0	5	2	230	289	1	2	56	0	1
18.6-20.7	12	51	5	2	0	1	5	2	0	0	26	0	0
20.7-26.5	37	31	13	7	0	6	1	2	0	1	2	0	0
Total redds	655	767	533	119	184	185	1,077	473	64	45	214	34	50
Fish/redd factor[a]	4.4	3.8	2.7	3.8	3.2	6.8	4.0	4.7	--	--	6.5	5.4	5.9
Run size[b]	2,889	2,930	1,439	452	589	1,258	4,308	2,223	--	--	1,391	184	295

[a] The fish/redd factor was calculated by dividing the number of fish passing Willamette Falls by the total number of fall chinook redds counted above Willamette Falls.

[b] Run size was calculated by multiplying the fish/redd factor by the total number of redds.

Table 26. Age structure and sex ratio of fall chinook in the Molalla River as determined from carcasses (Hansen and Williams 1979).

	Age				Sex	
Year	2	3	4	5	Male	Female
1976	2(1%)	199(86%)	27(12%)	2(1%)	161(67%)	79(33%)
1977	0	13(27%)	35(73%)	0	54(40%)	81(60%)
1978	0	35(26%)	96(72%)	2(2%)	18(36%)	32(64%)

Time and Location of Spawning

Based on spawning surveys in the Molalla River during 1976-84, nearly 60 percent of the fall chinook spawn below RM 10.1 and 95 percent below RM 18.6 (Table 25).

Juvenile Life History

Based on time of spawning, fry probably emerge in November.

Chinook juveniles emigrate from the Molalla at approximately five months of age and a size of about 2 inches (Hansen 1978). Out-migration occurs mainly in April (Hansen 1978).

Hatchery Production

Description of Hatcheries

No hatcheries are located in the Molalla or Pudding subbasins. Eggs to support the Willamette fall chinook program are supplied by Bonneville Hatchery. Unfed tule fry from Bonneville Hatchery are reared at Aumsville Pond until mid-February and then shipped to Stayton Pond (Santiam subbasin) for final rearing.

Hatchery Releases

Fall chinook releases were made in the Molalla as part of a program to develop the salmon production potential of the Willamette basin (Hansen 1977).

An average of about 645,000 smolts have been released annually into the lower 20 miles of the Molalla River since 1984, except in 1985 when none were released (Table 27). Smolts are released in late April through early May. The current hatchery allocation for fall chinook in the Molalla is 300,000 smolts.

Table 27. Releases of tule stock fall chinook into the Molalla subbasin, 1967-89.

Brood year	Release year	Hatchery	Number[a] released
1966	1967	Big Cr.	479,235 (f)
1966	1967	Big Cr.	510,150 (fi)
1966	1967	Cascade	792,000 (f)
1966	1967	Oxbow	500,132 (fi)
1967	1968	Spring Cr.	1,032,000 (f)
1969	1970	Salem Pond	646,803 (s)
1970	1971	Salem Pond	478,743 (s)
1971	1972	Stayton	513,583 (s)
1972	1973	Stayton	1,383,990 (s)
1973	1974	Stayton	1,109,676 (s)
1974	1975	Stayton	1,077,025 (s)
1975	1976	Stayton	471,924 (s)
1978	1979	Stayton	829,405 (s)
1979	1980	Stayton	1,165,305 (s)
1980	1981	Stayton	992,787 (s)
1981	1982	Stayton	1,090,815 (s)
1982	1983	Stayton	1,090,021 (s)
1983	1984	Stayton	688,312 (s)
1985	1986	Stayton	717,593 (s)
1986	1987	Stayton	728,338 (s)
1987	1988	Stayton	692,924 (s)
1988	1989	Stayton	400,003 (s)

[a] (f) = fry (>125 fish/lb), (fi) = fingerling (20-125 fish/lb), (s) = smolt (<20 fish/lb).

Angling and Harvest

There has never been a fishery for fall chinook in the Molalla subbasin. Since tule fall chinook spawn shortly after entering the Willamette River, they are usually dark, have poor quality flesh, and do not bite well. Low flows during time of entry could create a problem with illegal snagging. Currently no open season exists for fall chinook in the subbasin. A recent angler survey conducted among Molalla River anglers indicated that most favored a closed season for fall chinook.

Management Considerations

Fall chinook are not native to the subbasin. Hatchery releases have been made in the Molalla since 1967. The current hatchery allocation for fall chinook in the Molalla is 300,000 smolts.

About 9 percent of the total fall chinook redds above Willamette Falls are in the Molalla River. The amount of natural production occurring in the Molalla is unknown. However, natural production accounts for about 30 percent of the fall chinook adults passing Willamette Falls.

Low flows and high temperatures are the main production constraints to fall chinook in the Molalla subbasin. High summer water temperatures generally limit successful rearing by spring chinook, steelhead and trout in the lower Molalla River. Tule fall chinook, however, spend only a few months as juveniles rearing in the river before they emigrate in the spring. Fall chinook, therefore, are able to make use of this marginal habitat while creating little if any potential impact to other salmonids. However the impacts of fall chinook on spring chinook and native winter steelhead production is unknown. Low September river flows can limit upstream passage of adult fall chinook. Activities such as gravel removal, which tend to cause channel braiding, can contribute to upstream passage problems.

There is no sport fishery for fall chinook in the Molalla River. However, fall chinook produced in the subbasin contribute to the offshore and Columbia River fisheries. As a result of the United States-Canada Pacific Salmon Treaty, maintaining production of tule stock for harvest in Canadian waters will result in reduced harvest of other less abundant or more important Oregon chinook salmon stocks.

Policies

Policy 1. Fall chinook salmon in the Molalla subbasin shall be managed primarily for production of hatchery fish.

Policy 2. Fall chinook salmon shall not be stocked above RM 20 on the Molalla River to avoid potential negative impacts on native species.

Objectives

Objective 1. Provide a harvest of fall chinook salmon in ocean and Columbia River fisheries.

Assumptions and Rationale

1. Fall chinook do not contribute to fisheries in the subbasin.

2. Willamette tule fall chinook survive at higher rates than tule stock produced at other hatcheries in the Columbia basin.

3. The annual migration and spawning activity of fall chinook in the Molalla River provides a watchable wildlife opportunity and increases public awareness of water quality for the stream.

Actions

1.1 Release about 300,000 hatchery smolts in the Molalla River.

1.2 Confine fall chinook releases to the lower 20 miles of the Molalla River.

1.3 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 2. Monitor the distribution and abundance of spawning populations.

Assumptions and Rationale

1. Information on spawning distribution and abundance is necessary to assess the amount of natural production which may occur in the subbasin.

2. Information on straying and spawning distribution is necessary to assess the potential impacts on native species.

Actions

2.1 Continue spawning surveys in the Molalla River.

TROUT AND WHITEFISH

Background and Status

RAINBOW TROUT

Origin

Rainbow trout are thought to be indigenous to the Molalla and Pudding subbasins. They may also be the progeny of winter steelhead or stocked catchable rainbow trout. Isolated rainbow trout populations above barriers may have originated through introductions of rainbow or juvenile steelhead or from strays from high lake stocking.

Willamette basin rainbow trout are currently listed by ODFW as a stock of concern due to insufficient information regarding their status. Rainbow trout should be given a high priority with respect to future population and habitat inventory and monitoring activities in the Willamette basin.

Life History and Population Characteristics

Distribution

Because of the difficulties in distinguishing juvenile steelhead from resident rainbow trout, the distribution of resident rainbow trout in the Molalla and Pudding subbasins is unknown. Fish resembling rainbow trout reside in the main stem Molalla River. However steelhead are the dominant salmonid in the Molalla (Haxton 1985), so any rainbow found here may actually be residual steelhead.

An isolated population of rainbow trout is found in Cutting Creek, a small tributary of Dead Horse Canyon Creek. Gawley Creek in the upper Molalla subbasin, Butte Creek above the falls at RM 28, and Abiqua Creek above the falls at RM 20 contain isolated mixed populations of rainbow and cutthroat trout. Other isolated populations may exist which have not been identified yet.

Abundance

There are no population estimates of rainbow trout in the Molalla and Pudding subbasins.

Size

During an electrofishing survey of Butte Creek in 1986, a single rainbow found at RM 27 was 8.2 inches long. Seven rainbow found at RM 35 were 2.2-5.7 inches in length (unpublished survey records, J. Haxton, ODFW).

Spawning Areas

Spawning areas in the Molalla and Pudding subbasins have not been identified.

Hatchery Production

Description of Hatcheries

Hatchery rainbow trout released in the Molalla and Pudding subbasins are raised at Leaburg and Roaring River hatcheries (see the McKenzie and Santiam Subbasin plans, respectively). Cape Cod, Oak Springs, Roaring River, and Willamette stocks have been released from these hatcheries. Only Cape Cod stock has been released during the past ten years.

Hatchery Releases

Releases of catchable rainbow trout are made in the Molalla and Pudding subbasins to provide a sport fishery. Streams in the Molalla subbasin have been stocked as far back as the 1920s. Catchable rainbow trout are currently released in the main stem Molalla between RM 14.5 and 38.5 and in Abiqua Creek between RM 12.7 and 14.2. Annual stocking levels during 1978-89 have averaged 11,987 catchable rainbow in the Molalla River and 2,510 in Abiqua Creek (Table 28 and Appendix Table C-1). Catchable rainbow released into Silverton Reservoir can drift downstream into Silver Creek.

Table 28. Summary of hatchery releases of catchable rainbow trout in the Molalla and Pudding subbasins, 1978-89 (unpublished data, ODFW).

Release Year	Molalla R.	Abiqua Cr.	Silver Cr.
1978	14,998	4,002	500
1979	9,996	3,002	502
1980	11,503	2,999	---
1981	11,006	2,998	---
1982	11,993	2,164	---
1983	11,997	2,051	---
1984	12,236	3,006	---
1985	12,057	2,002	---
1986	12,082	1,898	---
1987	12,017	2,000	---
1988	11,988	1,996	---
1989	11,976	2,000	---
12-year average	11,987	2,510	---

Angling and Harvest

The main stem fishery on the Molalla River below RM 38.5 targets catchable rainbow with few native cutthroat, rainbow and steelhead juveniles harvested (Figure 4). The few native rainbow harvested are indicative of a relatively small wild rainbow population (Haxton 1985). Angling effort and harvest in this reach is greatest during the first two weeks of the trout season (Table 29). In 1983 the catchable trout fishery on the Molalla had a harvest rate of 43% (Haxton 1985). Angler hours totaled 8,684. Catch rates averaged 0.35 fish per hour.

The trout fishery in the Molalla and its tributaries above RM 38.5 harvests mostly cutthroat with few rainbow and some juvenile steelhead (Figure 5). The number of angler hours provided was ten times less than in the lower reach (RM 27.0-38.5). Catch rates averaged 1.55 fish per angler during 21 May-15 July, 1983 (Table 30).

There is no information on trout harvest in the Pudding subbasin.

Daily catch limit for trout is 5 fish. The minimum size limit is 6 inches. Rainbow over 20 inches are considered to be steelhead. There is no winter season. The Molalla River up to Horse Creek bridge (RM 38.5) has a late opening to protect winter steelhead smolts.

Table 29. Estimates of angling effort and catch in the main stem Molalla River, RM 27.0-38.5 (1983) (Haxton 1985).

Dates	Angler hours	Total catch	Fish/ hour
21 May-3 June	3,248	990	0.28
4-17 June	1,770	760	0.39
18 June-1 July	1,728	743	0.38
2-15 July	1,938	581	0.27
Total	8,684	3,074	0.35

Figure 4. Composition of sport catch in the Molalla River, RM 27.0-38.5, 1983 (Haxton 1985).

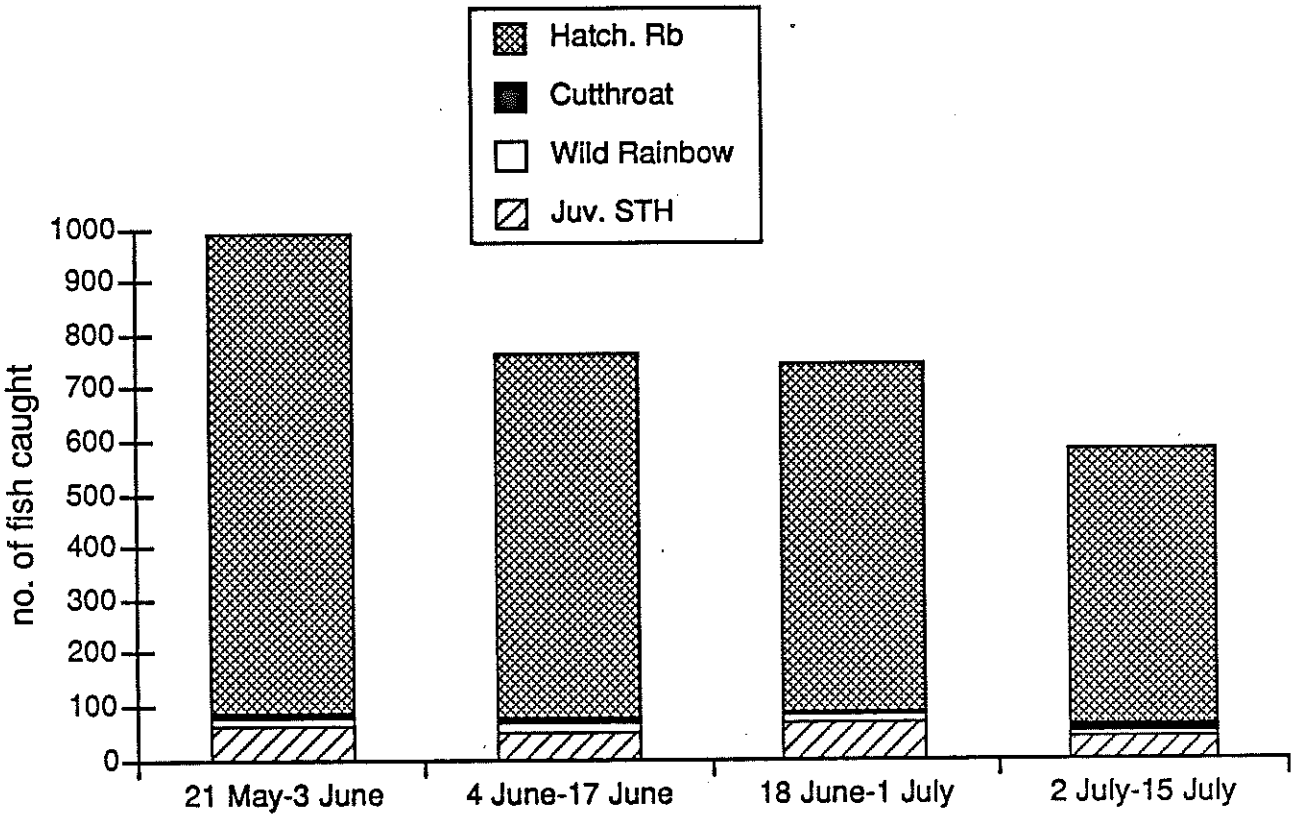


Figure 5. Composition of sport catch in the Molalla River and its tributaries, above RM 38.5, 1983 (Haxton 1985).

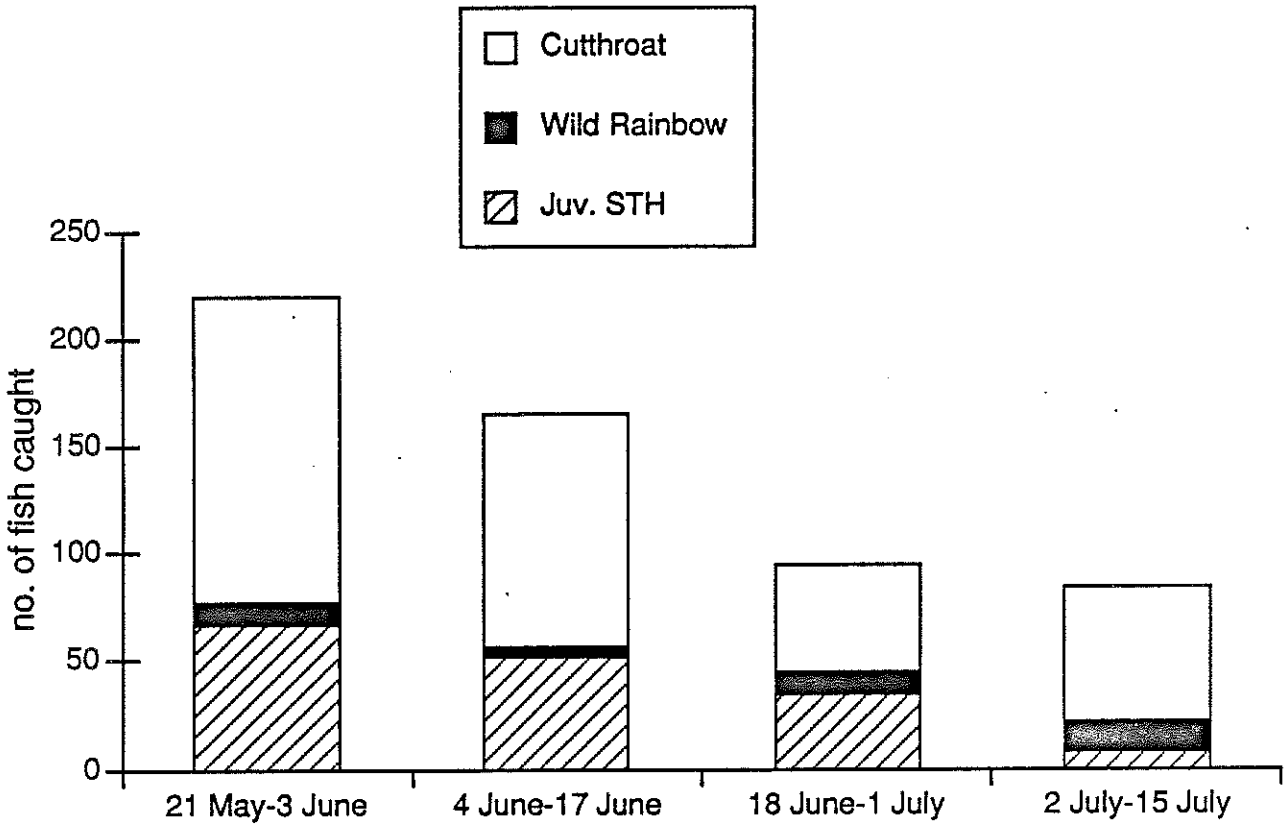


Table 30. Estimates of angling effort and catch in the Molalla River and its tributaries above RM 38.5 (1983) (Haxton 1985).

Dates	No. anglers	Angler hours	Total catch	Fish/ angler	Fish/ hour
21 May-3 June	133	340	220	1.65	0.65
4-17 June	100	216	165	1.65	0.76
18 June-1 July	56	121	94	1.68	0.78
2-15 July	74	149	84	1.14	0.56
Total	363	826	563	1.55	0.68

Management Considerations

Warm water temperatures in portions of the Molalla and Pudding and competition with steelhead may limit production of native rainbow trout.

Rainbow trout spawn in the spring when hatchery steelhead smolts are released. Some hatchery steelhead smolts are precocious and may spawn with trout. The proportion of hatchery releases that are precocious and that contribute to natural production requires monitoring and evaluation. Changes in steelhead hatchery programs may be required in order to meet Wild Fish Management Policy guidelines for trout.

Rainbow trout in the Willamette basin are currently listed by ODFW as a stock of concern because of insufficient information regarding their status. More information is needed concerning the status of rainbow trout in the Molalla and Pudding subbasins. The origin of rainbow trout in the Molalla and Pudding subbasins and their relationship to the native winter steelhead is unknown.

CUTTHROAT TROUT

Origin

Cutthroat trout are native to the Molalla and Pudding subbasins. Willamette cutthroat trout are considered to be the coastal subspecies of *Oncorhynchus clarki clarki* (Moring 1978). However, anadromous stocks do not occur above Willamette Falls.

Willamette basin cutthroat trout are currently listed by ODFW as a stock of concern due to insufficient information regarding their status. Cutthroat trout should be given a high priority with respect to future population and habitat inventory and monitoring activities in the Willamette basin.

Life History and Population Characteristics

Distribution

Cutthroat trout are found throughout the upper reaches of the Molalla and Pudding subbasins. Rainbow trout occupy some of the same reaches as cutthroat but they are not as widespread and numerous in the subbasins as cutthroat. There are few native trout in the main stem Molalla River (Haxton 1985).

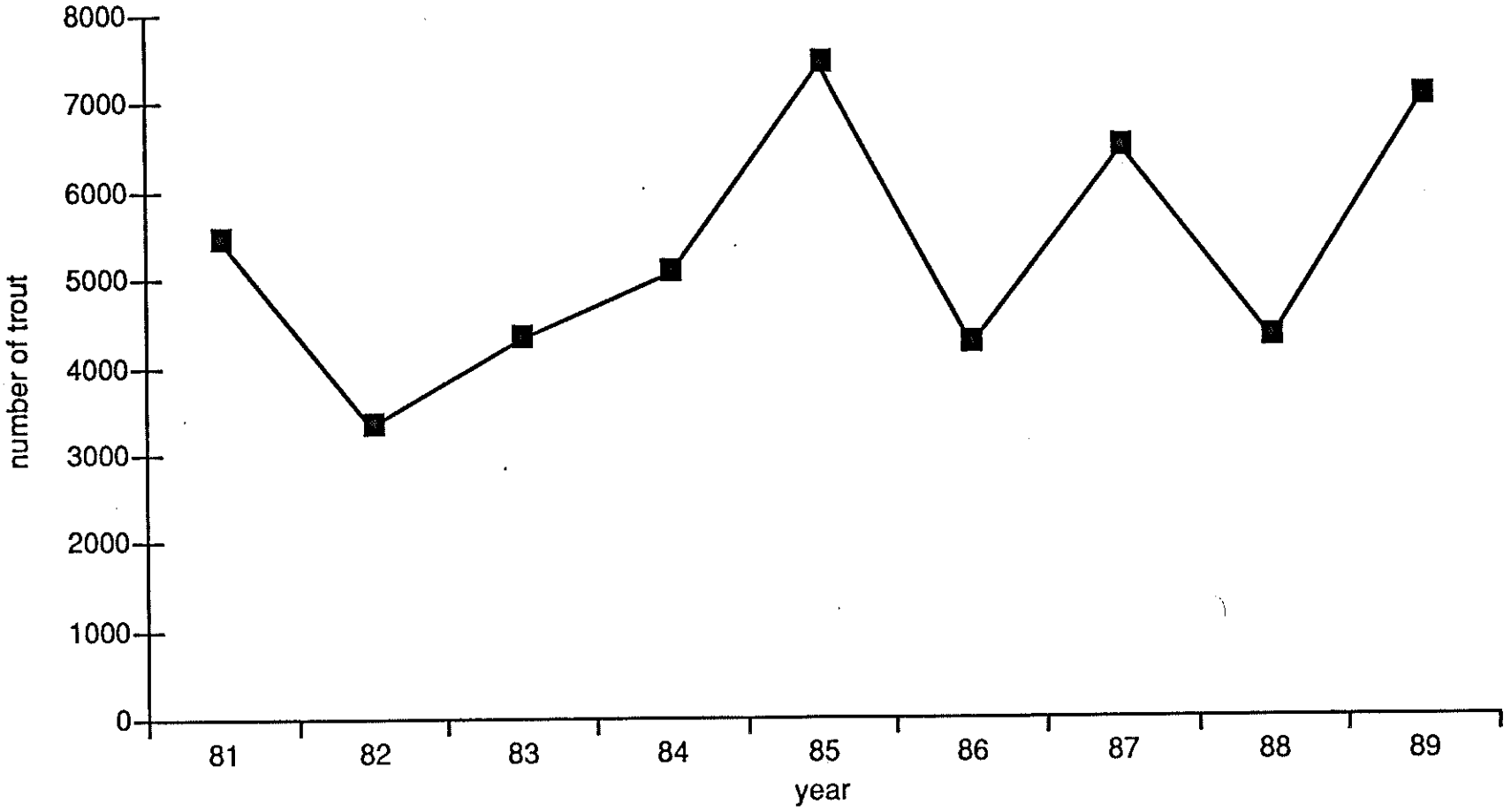
Within the Molalla and Pudding subbasins, 16 trout populations have been found above impassible barriers. In the Molalla subbasin, isolated populations are located in Dead Horse Canyon Creek, the upper North Fork of the Molalla River, Trout, Pine, Shotgun, Gawley, Horse, Ogle, Henry, and Wilson creeks, and the upper Molalla River. In the Pudding drainage, isolated populations have been found in Beaver, Coal, and Falls creeks, Butte Creek and tributaries above the falls, and above Silver Creek Falls, Abiqua Falls, and East Fork Drift Creek falls.

Abundance

Where steelhead or rainbow and cutthroat coexist, cutthroat abundance is often depressed. Population estimates from five 4th order tributaries in the Molalla subbasin found lower reaches dominated by steelhead with cutthroat densities averaging only 288 fish per mile. In the absence of steelhead or native rainbow, cutthroat densities averaged 2,960 fish per mile (unpublished data, J. Haxton, ODFW).

Population estimates have been made for an isolated population of cutthroat trout in a two mile reach of Dead Horse Canyon Creek during 1981-89 (unpublished data, R. House, BLM, Salem, Oregon). This stream received very little angling pressure in the past. Since 1987 public access has been closed by the landowner. Population abundance has fluctuated annually, but has been relatively stable over time, averaging 5,288 trout, or 2,644 trout per mile (Figure 6).

Figure 6. Cutthroat trout population abundance in a two mile reach of Dead Horse Canyon Creek, Molalla subbasin, 1981-89 (unpublished data, R. House, BLM, Salem).



Age Structure

Generally, less than 1% of tributary populations are older than 3 years. In larger streams, 4 and 5 year-olds average about 3% of the population. As well as having older cutthroat, larger streams also have a wider range of sizes of trout. Reduced numbers of smaller sizes in larger streams suggests that most recruitment is coming from smaller tributaries (Moring and Youker 1979).

Cutthroat trout collected during 1977-79 in Molalla subbasin streams were primarily age 2 fish (Figure 7) (Moring and Youker 1979). Cutthroat collected in the South Fork Silver Creek, Pudding subbasin were age 0 and 1.

About 97% of the cutthroat trout sampled in Dead Horse Canyon Creek were age 2 or younger (unpublished data, R. House, BLM, Salem, Oregon). Age 0 trout appear to be under-represented in the samples. Most cutthroat trout sampled during 1981-89 (average 82%) were age 0 and 1+ (Figure 8).

Length at Age

Age 1 cutthroat trout sampled from the Molalla and Pudding subbasins during 1977-79 were about 3-6 inches, age 2 were about 4-8 inches, age 3 were about 6-10 inches, and age 4 trout were generally larger than 8 inches (Table 31) (Moring and Youker 1979). Age-specific length of cutthroat trout sampled from a two mile reach of Dead Horse Canyon Creek during 1981-89 was about 1-3 inches for age 0+, about 3-6 inches for age 1+, about 5-7 inches for age 2+, about 6-8 inches for age 3+, and generally greater than 8 inches for age 4+ (Table 32) (unpublished data, R. House, BLM, Salem, Oregon). Isolated populations and populations in small tributaries have few large fish.

Table 31. Length at age of cutthroat trout from the Molalla and Pudding subbasins (Moring and Youker 1979).

Subbasin	Fork length range (inches) at age			
	1	2	3	4
Molalla	3.1-6.1	4.8-8.2	6.5-9.7	8.1-9.3
Pudding	2.9-5.7	3.9	---	---

Figure 7. Age structure of cutthroat trout populations in the Molalla and Pudding subbasins (Moring and Youker 1979).

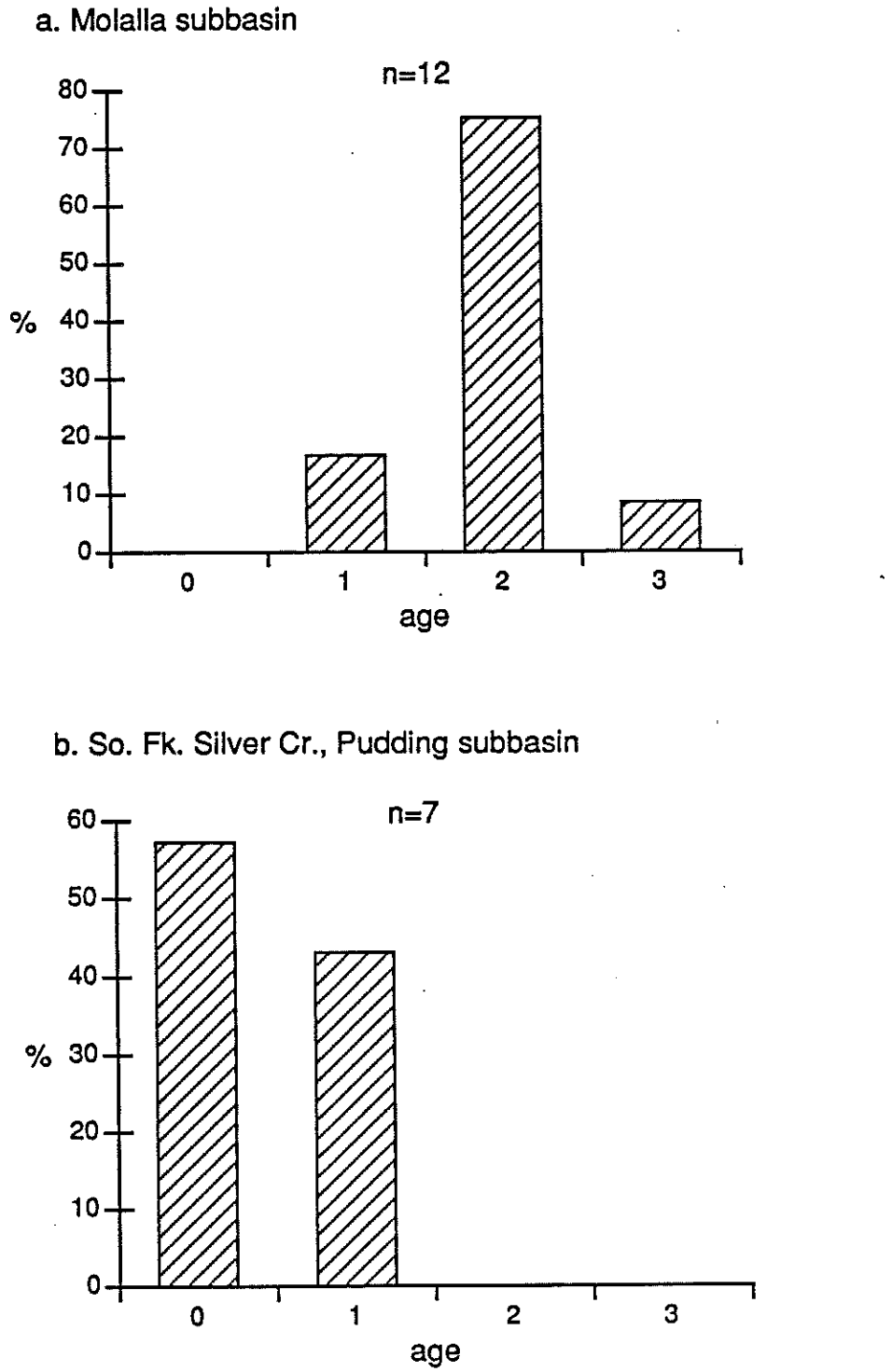


Figure 8. Age structure of cutthroat trout in Dead Horse Canyon Creek, Molalla subbasin, 1981-89 (unpublished data, R. House, BLM, Salem).

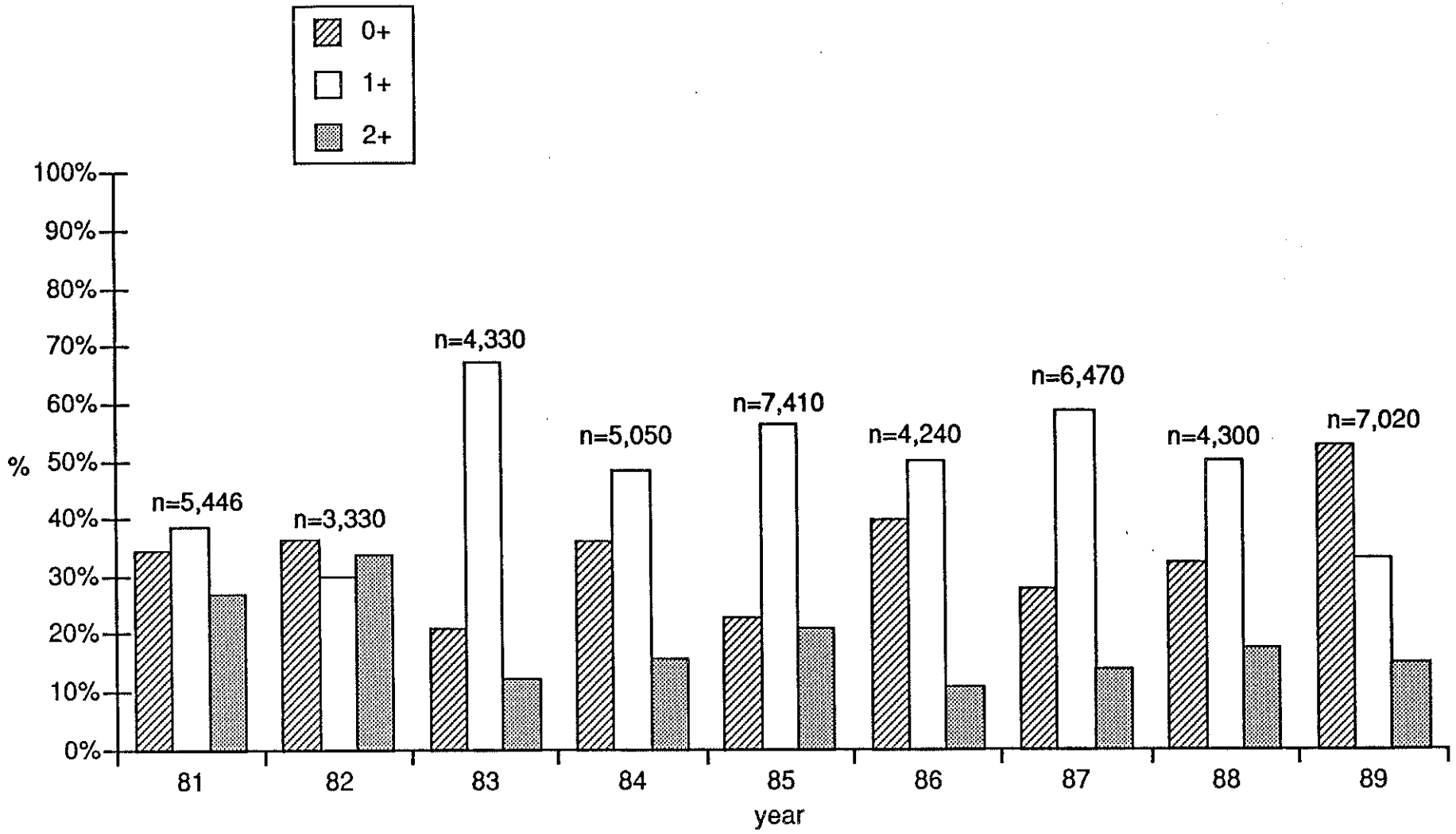


Table 32. Length at age for cutthroat trout in Dead Horse Canyon Creek, Molalla subbasin, 1981-1989 (unpublished data, R. House, BLM, Salem).

Age	N	Size range (inches)	Ave. length (inches)
0+	806	1.1-2.9	1.8
1+	1,063	3.0-5.5	4.1
2+	335	5.1-6.9	5.7
3+	64	6.5-7.8	7.1
4+	7	7.9-8.4	8.2

Age at Maturity

Cutthroat trout usually mature at age 2 or 3 (Nicholas 1978).

Time of Spawning

Cutthroat trout spawn from January through July (Nicholas 1978).

Spawning Areas

Small tributaries are the primary spawning areas used by cutthroat trout, although large streams may also be used (Nicholas 1978, Moring and Youker 1979). Cutthroat have been observed spawning in streams with a flow of less than 1.0 cfs (Moring and Youker 1979).

Movement and Migration

Anadromous stocks do not occur above Willamette Falls (Moring 1978). However, potamodromous cutthroat often migrate shorter distances within streams and rivers, utilizing larger rivers of the Willamette system for accelerated growth (Moring 1978). Adults migrate back into small streams in the fall and winter to spawn. Some cutthroat populations do not migrate, but reside in the same area permanently (Dimick and Merryfield 1945).

Hatchery Production

No hatchery releases of cutthroat have been or are currently made in streams or rivers of the subbasins.

Angling and Harvest

In the Molalla system, harvest of cutthroat occurs primarily above RM 38.5 in the main stem Molalla and in tributary streams (Figures 4 and 5) (Haxton 1985). Cutthroat harvest in the reach below (RM 27.0-38.5) is very low. Harvest of cutthroat trout during the first four weeks of trout season during 1983 was 364 fish (Haxton 1985).

There is no information on trout harvest in the Pudding subbasin.

Daily catch limit for trout is 5 fish. The minimum size limit is 6 inches. There is no winter season. The Molalla River up to Horse Creek bridge has a late opening to protect winter steelhead smolts.

Management Considerations

Low flows and high temperatures during the summer months are the primary factors limiting trout production. Inadequate protection from land use practices such as timber harvesting and farming along streams important for spawning and rearing also limit trout production. Interspecific competition between resident trout species and coho or steelhead may further constrain cutthroat trout production (Nicholas 1978).

Cutthroat trout in the Willamette basin are currently listed as a stock of concern by ODFW due to insufficient information regarding their status. More information in needed regarding the status of cutthroat trout in the Molalla and Pudding subbasins.

BROOK TROUT

Brook trout are not native to the Molalla and Pudding subbasins. Releases of brook trout were made in the Molalla subbasin in the 1920s and 1930s. From the 1960s to the early 1980s, releases were made in lakes only. Brook trout releases in the subbasin were terminated in the early 1980s. Although populations are established in headwater lakes, no self-sustaining populations have been found yet in outlet streams in the Molalla and Pudding subbasins.

WHITEFISH

Origin

Whitefish are a member of the trout and salmon family Salmonidae and are native to larger streams in the Willamette basin. There is no hatchery production of whitefish.

Life History and Population Characteristics

Whitefish have been found in the Molalla River up to RM 47. During a 1973 snorkel survey, density of whitefish was estimated to be 14.7 fish per 100 feet of stream between RM 0-47, and 26.4 fish per 100 feet between RM 21-46 (Whitworth and Collins 1973). Whitefish are also present in the North Fork of the Molalla and in the lower reaches of Table Rock Fork up to RM 12.

Whitefish are probably not present in the Pudding subbasin.

Mountain whitefish mature at 3 to 4 years of age and spawn in the fall and early winter (Daily 1971). Length at maturity in most waters is less than 12 inches (ODFW 1987).

Mountain whitefish are usually found in riffles in the summer and in pools in winter. They have a diet similar to trout.

Angling and Harvest

Whitefish is not a species targeted by anglers in the Molalla subbasin. They are caught incidentally in the trout fishery. During 1983, less than 1% of the estimated catch of the Molalla main stem trout fishery was whitefish (Haxton 1985). In the lower reach (RM 27.0-38.5) 26 whitefish were caught out of a total harvest of 3,105 fish. In the upper reach (above RM 38.5) 3 whitefish were caught out of a total harvest of 566 fish.

Although whitefish can be caught on natural bait and flies, they are seldom sought by anglers. Whitefish have a potential for increased sport use.

Whitefish may be taken from any water open to salmon, steelhead or trout angling. There is no bag limit.

Management Considerations

Whitefish are underutilized in the sport fishery. it is thought that populations in the Molalla and Pudding subbasins can support a fishery and provide additional angling diversity.

Policies

Policy 1. **Hatchery rainbow trout shall be stocked only where native rainbow trout do not occur. Releases of hatchery rainbow trout in the Molalla and Pudding subbasins shall be confined to the following areas:**

RM 14.5-38.5 of the Molalla River
RM 0-14.5 of Abiqua Creek
RM 0-7 of Silver Creek

Objectives

Objective 1. **Maintain the genetic diversity and adaptiveness of native trout and whitefish populations.**

Assumptions and Rationale

1. Willamette basin rainbow and cutthroat trout have been identified as stocks of concern. This objective addresses some of the problems with these stocks.

2. There is an ODFW policy which constrains the introduction of fish above natural barriers.

3. Monitoring the distribution and abundance of populations of wild trout will provide an indication of their health and adaptiveness.

4. There is a high probability that releases of precocious hatchery steelhead smolts near areas where spawning of trout occurs will decrease the genetic fitness of native trout populations.

Actions

1.1 Establish population trends of trout distribution and abundance in selected index streams. Possible index streams include reaches of Milk and Dead Horse Canyon creeks, and Table Rock Fork in the Molalla subbasin and Butte and Abiqua creeks in the Pudding subbasin.

1.2 Monitor population trends of isolated populations of trout. Determine how to manage these populations to be in compliance with the Wild Fish Management Policy.

1.3 Test trout populations for resistance to *Ceratomyxa shasta* to determine their relationship to other Willamette valley populations.

1.4 Determine the distribution and upper limits of resident trout in streams and define individual populations.

1.5 Initiate studies to determine the extent of use of the subbasin by potamodromous cutthroat trout.

1.6 Minimize the proportion of hatchery steelhead smolts that are precocious and their impact on spawning trout populations. This might be accomplished through removal of precocious hatchery steelhead during marking.

Objective 2. Protect, restore, and enhance native trout and whitefish habitat.

Assumptions and Rationale

1. Protection and enhancement of native trout and whitefish populations can be achieved principally through habitat protection and improvement.

Actions

2.1 Recommend to the Department of Forestry that they change their policy to provide full riparian protection to all streams containing resident trout populations.

2.2 Identify habitat deficiencies and sites for habitat improvement.

2.3 Develop habitat improvement plans.

2.4 Work with volunteers, sporting clubs, landowners and agencies to implement habitat improvement projects, such as along the valley floor in Butte Creek above RM 15 and near urban centers.

2.5 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 3. Continue to provide about 8,500 angler hours under the basic yield management alternative for trout by stocking legal-sized hatchery rainbow trout in some or all of the following stream reaches and reservoirs:

RM 14.5-38.5 of the Molalla River
RM 12.7-14.2 of Abiqua Creek
Silver Creek Reservoir

Assumptions and Rationale

1. The Trout Plan (ODFW 1987) sets management options for trout, one of which is Basic Yield.

2. The consumptive demand for trout is greater than natural production can provide in accessible streams favored by anglers and close to population centers.

3. Additional angling opportunities can be provided through the release of hatchery rainbow.

4. Over time, releases of catchable rainbow may be moved from running waters to standing waters in the subbasin.

5. The current level of hatchery releases provide harvest rates and returns to the angler which satisfy angler demand. In 1983 the catchable trout fishery on the Molalla had a harvest rate of 43% (Haxton 1985). Angler hours totaled 8,684.

6. Harvest rate of catchable rainbow is at least 40% of the number released.

7. The fishery can be monitored with weekend car counts.

Actions

3.1 Continue to release catchable rainbow in the Molalla River at RM 14.5-38.5. The current allocation is 12,000 fish.

3.2 Continue to release catchable rainbow in Abiqua Creek at RM 12.7-14.2. The current allocation is 2,000 fish.

3.3 Continue to evaluate current angling pressure and harvest rates of catchable rainbow through creel studies as described in Haxton 1985. Modify stocking practices to better meet angler demand where necessary.

3.4 If harvest rates fall below 40% then modify stocking practices such as release timing, frequency, and sites to improve harvest rate.

Objective 4. Maximize the harvest of hatchery rainbow trout.

Assumptions and Rationale

1. Angler catch rate of hatchery rainbow can be increased without increasing release numbers.

Actions

4.1 Determine how harvest rates can be increased by modifying stocking schedules, release sites, and release numbers.

Objective 5. Minimize the potentially negative effects of hatchery rainbow on the production and genetic integrity of native trout, whitefish, and winter steelhead.

Assumptions and Rationale

1. Hatchery fish are released in streams and rivers used by native trout and winter steelhead. Hatchery trout may compete with native fish for food and habitat.

2. Cape Cod stock is thought to contribute less than 10% to rainbow trout natural production in the Molalla and Pudding subbasins.

Actions

5.1 Continue to document hold over of hatchery rainbow during creel studies and use this information to estimate the contribution of hatchery rainbow to natural production.

5.2 Continue to release Cape Cod stock unless it is estimated that they are contributing more than 10% to natural production.

Objective 6. Provide angling opportunities for trout and whitefish under the basic yield management alternative for trout (Oregon Department of Fish and Wildlife 1987) in streams and reaches of the Molalla and Pudding subbasins not stocked with rainbow trout.

Assumptions and Rationale

1. The Trout Plan (ODFW 1987) sets management options for trout, one of which is Basic Yield.

2. Most of the trout available to the angler are either from natural production or from drift of catchable rainbow from hatchery releases made upstream.

3. The fisheries on these waters are of a general, consumptive nature.

4. Other species may be present and may have fishery values equal to or greater than trout.

5. Special regulations may be needed to protect native populations without seriously restricting the major fisheries.

6. Whitefish population levels are adequate to support an increased sport fishery.

7. Many people are not aware of the excellent sporting and eating qualities of whitefish.

Actions

6.1 In conjunction with other creel programs, determine the catch of native trout in the Molalla River above RM 38.5 by conducting a road block creel study (as described in Haxton 1985) every 5 years. This action would also provide information on harvest of hatchery rainbow trout, steelhead and chinook.

6.2 Evaluate the exploitation rate of native trout by tagging trout in upper Butte Creek and requesting voluntary return of tags by anglers.

6.3 Publicize information on distinguishing characteristics of whitefish and angling opportunities.

BROOK TROUT

There are no management objectives for brook trout in running waters of the Molalla and Pudding subbasins at this time.

WARMWATER GAME FISH

Background and Status

Origin

Warmwater game fish are not native to the Molalla and Pudding subbasins. There is no documentation of the initial introductions of warmwater game fish in the subbasins. Movement of warmwater species originally introduced into the Willamette River and its larger tributaries probably resulted in establishment of populations in the Molalla and Pudding subbasins. Largemouth bass and panfish have existed in standing and running waters in the Willamette basin since the 1800s.

Life History and Population Characteristics

Distribution

Warmwater game fish are restricted mainly to the Pudding River and lower portions of its larger tributaries. No warmwater game fish were found in the Molalla River upstream from RM 6 during snorkel surveys in 1973 (Whitworth and Collins 1973).

Largemouth bass, black and white crappie, bluegill, pumpkinseed, warmouth, green sunfish, and yellow perch are distributed throughout the slower flowing portions of the subbasin (ODFW 1980). Populations of largemouth bass and brown bullhead are substantial owing to the warm, sluggish flows that prevail in the summer (Willamette Basin Task Force 1969). Bullfrogs are also found in the subbasins.

Abundance

In an electrofishing survey of RM 5.5-8.5 of the Pudding River in 1979, 16 largemouth bass, 1 bluegill, and 3 warmouth were recovered (Table 33).

Table 33. Size frequency of warmwater game fish sampled by electrofishing in the lower Pudding River (RM 5.5-8.5), 1979 (unpublished data, J. Haxton, ODFW).

Species	No. of fish by one-inch size groups (F.L.)										
	4	5	6	7	8	9	10	11	12	13	14
Largemouth bass					2	3	2	4	2	1	2
Bluegill		1									
Warmouth	1	2									

Length

Length of warmwater game fish electroshocked from the lower Pudding River ranged from 8-14 inches for largemouth bass, 5 inches for bluegill, and 4-5 inches for warmouth (Table 33).

Hatchery Production

Hatchery produced fish are used primarily to establish populations of warmwater game fish in the wild (ODFW 1987). Hatchery fish are obtained or reared for specific release programs. Largemouth bass, smallmouth bass, and channel catfish are either purchased or raised. Other species are captured and transplanted.

Description of Hatcheries

There are no hatcheries or rearing facilities for warmwater game fish in the Molalla and Pudding subbasins. Hatchery fish are reared at St. Paul rearing ponds (see the Main Stem Willamette Plan).

Hatchery Releases

Warmwater game fish have been released into the Pudding subbasin. Species include bullhead catfish, largemouth bass, crappie, bullfrogs, and channel catfish (Table 34).

Table 34. Releases of warmwater game fish into the Pudding River, 1937-1990 (unpublished records, K. Daily, ODFW, Salem, Oregon).

Date	Site	Species	No. stocked
1937	Pudding R.	Bullhead catfish	15,000
		Largemouth bass	4,000
		Crappie	15,000
		Bullfrogs	1,000
1963	Pudding R. RM 49	Channel catfish	2,800
1978	Pudding R.	Channel catfish	431

Angling and Harvest

Past and Current Harvest

There is little angling pressure on warmwater species in the subbasins, and little is known of the overall species composition and catch. Poor access to lower reaches of the Pudding River and its larger tributaries limits sport harvest. All species of warmwater game fish are believed to be underutilized.

Current Angling Regulations

The bag limit for bass is 5 per day with no more than 3 over 15 inches. There is no bag limit for bluegill, catfish, crappie, other sunfish and yellow perch.

Management Considerations

Cold water temperatures, lack of habitat, and competition with non-game fish constrain production of warm water fish in running waters of the Molalla and Pudding subbasins.

There is no information concerning the interactions of warmwater game fish and native species in the Molalla and Pudding subbasins. There is the potential for predation and competition from warmwater species to decrease the production of native fish.

This management plan calls for maintaining or increasing natural production of native winter steelhead and for reestablishing natural production of spring chinook in the subbasins. The effects of warmwater game fish species, in particular smallmouth bass and channel catfish, on winter steelhead and spring chinook in the subbasins are unknown. Studies conducted in the Columbia River have shown that smallmouth bass and channel catfish prey on juvenile salmonids (Connolly and Rieman 1988) and may substantially impact their production.

Additional releases of warmwater game fish would not be made unless the "Guidelines for Introductions of Warmwater Game Fishes" in the Warmwater Game Fish Management Plan (1987) were met.

Policies

Policy 1. **Management proposals that initiate or expand release programs for warmwater game fish or that alter the distribution of warmwater game fish shall be reviewed and evaluated for potential effects on indigenous fish species.**

Objectives

Objective 1. **Maintain populations of warmwater game fishes.**

Assumptions and Rationale

1. Little is known about warmwater game fish species presence, distribution, abundance, and population characteristics in flowing waters of the Molalla and Pudding subbasins.

2. Monitoring the distribution and abundance of warmwater game fish populations in the subbasins will provide an indication of population status.

3. Protection of existing warmwater populations can be achieved principally through habitat protection.

Actions

1.1 Inventory RM 0-20 of the Pudding River, and RM 0-4 of the Molalla River for warmwater game fish population distribution and abundance.

1.2 On priority reaches where long-term data sets are necessary to understand population dynamics, carry out routine sampling programs to determine the species composition, distribution, and population structure of warmwater game fish.

1.3 Implement habitat protection actions outlined under objectives for Habitat Protection.

Objective 2. Provide a diversity of warmwater angling opportunities through basic yield management.

Assumptions and Rationale

1. Basic yield management requires little intervention in natural processes affecting production.

2. Running waters will be managed under general statewide regulations for warmwater game fish.

3. Anglers will find variety in species and sizes.

4. Catch rates will be highly variable.

5. Public access limits the warmwater fishery in the Molalla and Pudding subbasins.

Actions

2.1 Collect data on the distribution, abundance, fishing pressure, and harvest of warmwater game fish in the lower Pudding River.

2.2 Implement actions to improve access in the lower Pudding River as outlined under objectives for Access.

Objective 3. Increase public awareness of warmwater angling opportunities in the subbasins.

Assumptions and Rationale

1. The warmwater game fish resource may be underutilized.

2. ODFW's weekly fishing report can be used to provide current information to attract anglers during times of good fishing.

3. Publications can direct people to angling opportunities in specific areas.

Actions

3.1 Provide warmwater fishing information to be included in the weekly fish reports.

3.2 Publish a guide for warmwater game fish in the mid-Willamette Valley.

3.3 Continue to direct anglers to warmwater fishing opportunities in the Molalla and Pudding subbasins when they contact district offices for information.

3.4 Consider involving the public in habitat enhancement projects, sampling studies, and volunteer creel programs.

SAND ROLLER

Background and Status

Origin

The sand roller, *Percopsis transmontana*, a member of the trout-perch family, is native to the Columbia River and its tributaries, including the Willamette. It is currently listed by ODFW as a stock of concern statewide. Populations are suspected of being at low levels, but its exact status is unknown. The sand roller should be given a high priority with respect to future population and habitat inventory and monitoring activities in the Molalla and Pudding subbasins.

Life History and Population Characteristics

Sand rollers are generally found in low gradient reaches of rivers and streams. During daylight hours they hide among large submergent objects such as root wads and under banks. At night they move out in small schools to feeding areas over sandy substrates (personal communication on 23 October 1990 from P. Reimers, ODFW, Charleston, Oregon). Because of their secretive nature during the day, sand rollers often go uncollected during routine stream sampling. Current records for the subbasins may underestimate their distribution.

Sand rollers have been collected from Rock Creek and Mill Creek in the Pudding drainage and from Gribble Creek in the Molalla drainage (Table 35). In addition, 10 sand rollers were sampled at RM 8 during a 1985 survey of Butte Creek (unpublished data, J. Haxton, ODFW).

Sand rollers collected from the Columbia River ranged in age from 1 to 6 years (Gray and Dauble 1979). Sand rollers usually attain sexual maturity at age II. All fish are mature by age III.

Gravid females were collected from sites in the Columbia River from June through mid-July (Gray and Dauble 1979). Females collected from January through July contained 1,106 to 3,369 eggs. Carlander (1969) reports that a single female contained 4,748 eggs. Spawning occurs in the Columbia River in midsummer when water temperatures range from 57-61° F (Gray and Dauble 1979). Emergent fry were collected in mid-August in the Columbia River. Larger fry were collected in mid-September.

Aquatic insects are the main food of sand rollers. Zooplankton may contribute a greater portion of the diet of immature fish (Gray and Dauble 1979).

Table 35. Records of sand rollers collected from rivers and streams in the Molalla and Pudding subbasins (D. Markle, Oregon State University, Department of Fisheries and Wildlife, Corvallis; unpublished records, J. Haxton, ODFW).

Stream	Date	Site	Density No./100 ft.	Comments
Molalla R.				
Gribble Cr.	6-28-82	RM 1.2	0.6	Northrup collection
"	1984	RM 1.2	---	" "
Pudding R.	6-19-79	RM 7.7	---	1 fish collected, distance not recorded
"	6-19-79	RM 8.5	---	2 fish collected, distance not recorded
"	8-14-87	RM 33.2	---	Northrup collection
Mill Cr.	8-10-82	RM 0.9	1.2	" "
"	9-20-82	RM 0.9	1.2	" "
Rock Cr.	9-6-45	RM 7.5	---	OSU data
Butte Cr.	9-6-85	RM 8.0	3.4	

Harvest

Sand rollers are a non-game fish. There are no harvest regulations for sand rollers. There are no records of harvest of sand rollers in the Molalla or Pudding subbasins.

Management Considerations

Sand rollers may be susceptible to habitat degradation and water diversions found in lower reaches of rivers and streams in the subbasins. Channelization of rivers and streams and removal of riparian vegetation reduces the structural complexity required by sand rollers.

The sand roller is listed by ODFW as a stock of concern statewide. Information is needed concerning its status.

Objectives

Objective 1. Determine the distribution, relative abundance, and habitat use of sand rollers in the Molalla and Pudding subbasins.

Assumptions and Rationale

1. The sand roller has been identified as a species of concern statewide. This objective addresses some of the problems concerning the species.

2. Determining the distribution and relative abundance of populations of sand rollers will provide an indication of their health.

3. Information on the distribution and habitat use of sand rollers in the subbasins is necessary in order to implement habitat protection actions.

4. Many of the following actions cannot be accomplished under current levels of funding. If funding continues to be limiting, ODFW will pursue actions according to priority as funds become available.

Actions

1.1 While conducting routine inventories for other fish species, collect more detailed data for sand rollers when present.

1.2 Use inventory data to determine the relative abundance of sand rollers in the Molalla and Pudding subbasins.

1.3 Use inventory data to determine the habitat requirements of sand rollers in the Molalla and Pudding subbasins.

Objective 2. Protect, restore, and enhance sand rollers habitat.

Assumptions and Rationale

1. Protection and enhancement of sand roller populations can be achieved principally through habitat protection and improvement.

Actions

2.1 Advocate riparian protection for river and stream reaches containing sand rollers.

2.2 Develop habitat improvement plans where needed.

2.3 Work with volunteers, landowners, and agencies to implement habitat improvement projects in stream reaches used by sand rollers.

2.4 Implement habitat protection actions outlined under objectives for Habitat Protection.

CRAYFISH

Background and Status

Origin

Crayfish are the most important freshwater invertebrate to Oregon's fisheries. They provide a recreational fishery in the Molalla and Pudding subbasins. They are also important fish forage.

Life History and Population Characteristics

Three species of crayfish are native to Oregon (Hobbs 1976). These species, their subspecies and intergrades are spread statewide, with overlapping distributions. An introduced species found in the Rogue River is not known to occur in the Willamette or its tributary subbasins, including the Molalla and Pudding.

Crayfish breed in the summer, with the first egg-bearing females appearing as early as September. Eggs are carried over the winter and hatch late April to late June. The young are attached to the female by a thread-like material for a short time. Size achieved by zero-age crayfish during the first summer is quite variable due to the long period over which eggs hatch. Age determination by the length-frequency method is extremely difficult.

Females mature at about 18-30 months. Fecundity increases with size and perhaps age. There is evidence to suggest that some or perhaps all females do not breed each year.

Hatchery Production

There is no hatchery production of crayfish in the Molalla and Pudding subbasins. No commercial crayfish culture operations have yet been successful in the state.

Harvest

Commercial Harvest

Crayfish have been fished commercially in Oregon since before 1893 when records were first kept. Markets for bait and for restaurant food dictate the size of landings. Most of the Willamette basin harvest occurs in Multnomah, Clackamas, and Yamhill counties (unpublished data, ODFW). ODFW is not aware of any commercial harvest of crayfish in the Molalla and Pudding subbasins.

The commercial crayfish season is open from April 1 through October 31. Crayfish may be taken only by crayfish pots or ring nets. Only crayfish 3-5/8 inches or longer in length may be taken. Undersized crayfish must be returned unharmed to the water. Any crayfish caught with eggs attached must be returned unharmed to the water. Gear must be labeled with an identification number issued by ODFW.

Sport Harvest

Recreational use of the resource is widespread for bait and direct consumption. No license is required to take crayfish. The daily bag limit is 100 per person. The season is open the entire year at all hours. Estimates of sport harvest levels in the Molalla and Pudding subbasins are unavailable.

Management Considerations

Water pollution, particularly pesticides and some industrial wastes, and flow depletions are the most serious threats to crayfish populations.

Objectives

Objective 1. Assess the population status of crayfish in the Molalla and Pudding subbasins.

Assumptions and Rationale

1. Currently there is no measure of the impact of the recreational harvest or the fishery potential of crayfish.
2. There are no estimates of current harvest or effort.
3. Recreational harvest is widespread and appears to be increasing.
4. Information should be collected for the most heavily fished waters.

Actions

1.1 While conducting routine surveys, determine the size and relative abundance of crayfish.

1.2 Conduct creel studies in key areas to evaluate harvest and effort.

ANGLING ACCESS

Background and Status

The Oregon State Land Board has recognized that the Molalla River from its mouth to the confluence with the North Fork near RM 26.5 shows evidence of navigability based on historical use of the river for log drives (Oregon State Land Board 1983). The state legislature may exercise its full right to declare this river reach navigable, although in the past only the rivers that had navigable use and were also meandered have been recommended.

The Molalla River currently has boat access at Knights Bridge (RM 2.5), Canby Park (RM 4), Wagon Wheel County Park (RM 14.5), and Meadowbrook Bridge (RM 18.5). Improved access is being developed at Feyrer County Park (RM 21). Permanent access or long-term leases are needed at Goods Bridge (RM 6) and Logging Bridge (RM 10) which are on privately owned land.

Nearly all of the land along the Pudding River is in private ownership. Access is needed for a seasonal boat fishery for warmwater game fish. An access site is needed in the lower Pudding near RM 5.

Conflicts between anglers and landowners primarily involve trespass, littering, and damage to vegetation. Incentives need to be developed to encourage private landowners to allow public access and to encourage anglers to respect property rights and to minimize disturbance to wildlife.

Policies

Policy 1. **The Department shall seek to provide access for boat and bank angling that will satisfy public need for a variety of angling opportunities and a dispersion of angling effort throughout the subbasin.**

Policy 2. **Acquisition and development of angler access sites shall be consistent with guidelines and objectives for management of fish species and habitat.**

Objectives

Objective 1. **Provide and maintain 9 permanent boat access sites on the main stem Molalla River and 1 permanent site on the lower Pudding.**

Assumptions and Rationale

1. It is necessary to work with other agencies, public groups, and private landowners to provide and maintain access sites.

2. Boat anglers primarily use the rivers for day-trips. Consequently, access sites need to be relatively close together.

3. Some boat access sites are poorly maintained or are in need of improved or expanded facilities.

4. ODFW may need to acquire boat access sites currently owned by other parties or agencies in order to assure continued operation of facilities.

5. Additional sites are needed on the Molalla and Pudding rivers.

6. Many of the following actions cannot be accomplished under current levels of funding. If funding continues to be limiting, ODFW will pursue actions according to priority as funds become available.

Actions

1.1 Improve the ramp, access road, and parking facilities at Knights Bridge on the Molalla River (RM 2.5).

1.2 Acquire or secure a long-term lease and develop the boat access site at Goods Bridge on the Molalla River (RM 6).

1.3 Acquire and develop a boat access site at Logging Bridge on the Molalla River (RM 10).

1.4 Work with Clackamas County to maintain the facilities at Wagon Wheel Park on the Molalla River (RM 14.5).

1.5 Improve the parking facilities at Meadowbrook Bridge on the Molalla River (RM 18.5).

1.6 Work with Clackamas County to maintain the facilities at Feyrer Park on the Molalla River (RM 21).

1.7 Acquire and maintain the boat access site at The Cedars on the Molalla River (RM 24.5).

1.8 Acquire and develop an access site including a pole slide at Trout Creek on the Molalla River (RM 27).

1.9 Acquire and develop a boat access site at Arndt Road on the Pudding River (RM 5).

Objective 2. Increase bank angling access in the Molalla and Pudding subbasins.

Assumptions and Rationale

1. Additional bank angling access would increase angling opportunities.

2. Much of the shoreline along the Molalla and Pudding rivers is privately owned.

3. Private landowners often attempt to prevent public access on their property.

Actions

2.1 Identify potential sites for bank angling access in the lower 20 miles of the Molalla and Pudding rivers.

2.2 Acquire additional sites for bank angling where desirable.

2.3 Develop incentives to encourage private landowners to allow private access.

2.4 Develop incentives to encourage anglers to respect property rights and minimize disturbance to wildlife.

PLAN ADOPTION AND REVIEW

The Molalla and Pudding Plan should not be viewed as the final statement on the management of the fish and fisheries in the subbasin. Planning is a continuing process. As conditions of the resources and desires of the public change and as new information is obtained, the plan must be responsive and evolve as well. The Molalla and Pudding 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. Every 2 years public meetings will be held to review progress made in implementing the plan. These meetings are intended to provide an opportunity for the public to comment on management direction and progress. This review will precede the preparation of ODFW's biennial budget, which is submitted to the legislature for funding.

This plan is intended to provide both long-term and short-term direction for management of the fisheries in the subbasin. As conditions for the resources and desires of the public change and as new information is obtained, the plan must be responsive and evolve as well.

Upon adoption by the Oregon Fish and Wildlife Commission, the policies and objectives will become Oregon Administrative Rules. Revision of these rules requires action by the Commission. The entire plan, including policies and objectives, will be formally reviewed and revised every 5 years. Emergency changes in administrative rules can be made by the Commission in accordance with the Administrative Procedures Act when needed.

Progress made implementing the actions in the plan will be reported by the Department every 2 years. At that time, implementation priorities will also be reexamined and adjustments made where necessary.

PRIORITY OF ACTIONS

The Molalla and Pudding Subbasin Fish Management plan proposes many actions, more than can be completed within existing budgets. Some actions are currently on-going actions of ODFW and only need to be continued or modified. Other actions are new and need funding before they can be implemented. In order to achieve the objectives of this plan within ODFW's budgetary and staff limitations, priorities for funds and effort must be identified.

High priority actions were identified for habitat protection, species or species groups, and access (Table 36). These priorities reflect what ODFW and the citizens advisory committee believe are the most important actions that should be addressed in the Molalla and Pudding Subbasin Fish Management Plan. The first three actions identified in Table 36 are habitat protection actions which affect more than a single stock or species of fish. The current funding status for each action is indicated. A "yes" in the currently funded column denotes that funding for that action is presently budgeted under existing programs, however current funding may not be adequate. If additional funds are needed, it is noted in the next column.

Table 36. High priority actions in the Molalla and Pudding Subbasin Fish Management Plan and funding status.

Actions	Currently funded	Remarks on funding status
Reduce the impacts of timber harvest activities on fish production	Yes	Included in base budget
Improve habitat conditions for spring chinook in the Molalla subbasin	No	Funding needed for seasonal staff for field surveys
Evaluate passage in Butte Creek	No	Funding needed for ODFW staff
Determine the status of native winter steelhead populations in the Pudding subbasin	No	Additional funding needed for developing technology and seasonal staff for field surveys
Determine the percentage of hatchery stocks spawning with naturally produced fish	No	Additional funding needed for developing methodology and seasonal staff for field surveys

(continued)

Table 36 continued.

Actions	Currently funded	Remarks on funding status
Advance the run timing of hatchery steelhead stocks released in the Molalla	No	Additional funding needed for determining feasibility and developing technology
Determine the status of spring chinook populations in the Pudding subbasin	No	Additional funding needed for developing technology and seasonal staff for field surveys
Increase natural production of spring chinook in the Molalla subbasin	No	Partially funded by base budget; additional funding needed for smolt releases
Protect and enhance the productivity of native trout	No	Partially funded by base budget; additional funding needed for surveys and habitat improvement
Provide and maintain angling access	No	Maintenance of existing sites is funded in the base budget; additional funding needed for acquisition and development of new sites

REFERENCES

Bottom, D.C., P.J. Howell and J.D. Rodgers. 1985. The effects of stream alterations on salmon and trout habitat in Oregon. Oregon Department of Fish and Wildlife, Portland, Oregon.

Buchanan, D.V., M.G. Wade. 1982. Development and assessment of steelhead in the Willamette River basin. Oregon Department of Fish and Wildlife, Annual Progress Report.

Burroughs, E.R., G.R. Chalfant, M.A. Townsend. 1973. Guide to reduce road failures in western Oregon. Bureau of Land Management, Portland, Oregon.

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology, Volume I. Iowa State University Press, Ames, Iowa.

Columbia Basin Fish and Wildlife Authority. 1990. Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin, public review draft. Columbia Basin Fish and Wildlife Authority, Portland.

Connolly, P.J. and B.E. Rieman. 1988. Population dynamics of walleye and smallmouth bass and potential predation on salmonid smolts in the John Day Reservoir. US DOE Bonneville Power Administration, Vol. I, Final Report of Research 1935-86.

Daily, M.K. 1971. The mountain whitefish: a literature review. Univ. Idaho Forest, Wildlife and Range Expt. Station Paper No. 8. 18 pp.

Department of Environmental Quality. 1988. Problem assessment: Pudding River.

Dimick, R.E. and R. Merryfield. 1945. The fishes of the Willamette River system in relation to pollution. Eng. Exp. Sta., Oregon St. College, Bull. 20.

Foster, C.A. 1990. Fish passage at Willamette Falls in 1989. ODFW, Columbia River Management Annual Report, 33 pp.

Gray, R.H. and D.D. Dauble. 1979. Biology of the sand roller in the central Columbia River. Trans. Amer. Fish. Soc. 108: 646-649.

Hansen, H.L. 1977. Stock assessment and enhancement of fall salmon species in the Willamette River system. Federal Aid Progress Reports, Fisheries. Oregon Department of Fish and Wildlife.

Hansen, H.L. 1978. Stock assessment and enhancement of fall salmon species in the Willamette River system. Federal Aid Progress Reports, Fisheries. Oregon Department of Fish and Wildlife.

Hansen, H.L. and R.H. Williams. 1979. Stock assessment and enhancement of fall salmon species in the Willamette River system. Federal Aid Progress Reports, Fisheries. Oregon Department of Fish and Wildlife.

Haxton, J.C. 1985. The Molalla River trout fishery. Oregon Department of Fish and Wildlife, Annual Progress Report.

Haxton, J.C. 1985. Molalla River catchable trout fishery. Oregon Department of Fish and Wildlife.

Hobbs, Jr., H. H. 1976. Crayfishes (Astacidae) of North and Middle America. U.S.E.P.A. Water Pollution Control Research Series 18050 ELD05/72.

Moring, J.R., ed. 1978. Proceedings of the wild trout--catchable trout symposium, February 15-17, 1978. Oregon Department of Fish and Wildlife, Research Division.

Moring, J.R. and R.L. Youker. 1979. Oregon rainbow and cutthroat trout evaluation. Final report. Oregon Department of Fish and Wildlife, Research Division.

Nicholas, J.W. 1978. A review of literature and unpublished information on cutthroat trout (*Salmo clarki clarki*) of the Willamette watershed. Oregon Department of Fish and Wildlife. Information Report Series, Fisheries No. 78-1.

Oregon Department of Fish and Wildlife. 1980. Willamette basin fish management plan. Portland, Oregon.

Oregon Department of Fish and Wildlife. 1987. Trout plan. ODFW, Portland, Oregon.

Oregon Department of Fish and Wildlife. 1987. Warmwater game fish management plan. Portland, Oregon.

Oregon Department of Fish and Wildlife. 1988. Willamette Basin Fish Management Plan.

Oregon Department of Fish and Wildlife. 1990a. Willamette River Subbasin Salmon and Steelhead Plan, Molalla and Pudding Rivers. Columbia Basin Fish and Wildlife Authority, Portland.

Oregon Department of Fish and Wildlife. 1990b. Oregon salmon and steelhead catch data, 1975-86. Portland, Oregon.

Oregon State Land Board. 1983. Report and recommendation on the navigable waters of Oregon. Division of State Lands, Salem, Oregon.

Reiser, D.W. and T.C. Bjornn. 1979. Influence of forest and rangeland management on anadromous fish habitat in the western United States and Canada. W.R. Meehan. ed. USDA Forest Service General Technical Report PNW96.

Smith, E.M., R.H. Williams and J.C. Zakel. 1982. Willamette River salmon studies. Annual progress report of the Oregon Department of Fish and Wildlife.

Smith, E.M., R.H. Williams and J.C. Zakel. 1983. Willamette River salmon studies. Annual progress report of the Oregon Department of Fish and Wildlife.

Smith, E.M., J.C. Zakel and W.C. Day. 1985. Willamette River salmon studies. Annual progress report of the Oregon Department of Fish and Wildlife.

Smith E.M., J.C. Zakel, W.H. Day, K. Homolka, M.A. Buckman. 1987. Willamette River salmon studies. Annual Progress Report, Oregon Department of Fish and Wildlife.

U.S. Fish and Wildlife Service. 1941. Stream surveys of the Willamette basin, 1940. U.S. Fish and Wildlife Service, Portland, Oregon.

Water Resources Department. 1961. Middle Willamette drainage basin map: average annual precipitation.

Water Resources Department. 1967. Willamette River basin. Salem, Oregon.

Water Resources Department. 1980. Middle Willamette drainage basin map: land Use.

Water Resources Department. 1985. Update: middle Willamette River basin plan.

Whitworth, W.R. and M.D. Collins. 1973. Chemical eradication of nonsalmonids in the Molalla River. Fish Commission of Oregon, Management and Research Division.

Willamette Basin Task Force. 1969. The Willamette basin, comprehensive study of water and related land resources. Appendix D. Fish and Wildlife. Pacific Northwest River Basins Commission.

Williams, R. 1983a. Coho salmon in the upper Willamette River, Oregon. A history of establishing a run of non-indigenous salmon and prospects for renewed efforts to increase the run. (Draft). Oregon Department of Fish and Wildlife.

Williams, R. 1983b. Releases of coho salmon into the upper Willamette River, Oregon. Oregon Department of Fish and Wildlife. Internal Report 833.

Appendices

APPENDIX A
Winter Steelhead

Appendix Table A-1. Releases of winter steelhead into the Molalla and Pudding subbasins, 1958-88 (unpublished data, ODFW).

Brood year	Release year	Stock (hatchery[a])	Number released[b]	Release site
1957	1958	Big Cr. (EC)	13,815 (y)	Abiqua Cr.
1968	1968	Big Cr. (K)	385 (a)	Abiqua Cr.
1968	1968	Big Cr. (BC)	300 (a)	Silver Cr.
1969	1969	Big Cr. (BC)	134 (a)	Silver Cr.
1969	1970	Alsea (A)	30,113 (y)	Molalla R.
1969	1970	Big Cr. (GC)	30,113 (y)	Molalla R.
1970	1970	Big Cr. (K)	386 (a)	Table Rock Fork
1970	1970	Big Cr. (K)	200 (a)	Silver Cr.
1970	1971	Alsea (A)	31,200 (y)	Molalla R.
1970	1971	Big Cr.	9,999 (y)	Molalla R.
1970	1971	Big Cr. (GC)	40,980 (fi)	Molalla R.
1970	1971	Big Cr. (BC)	39,586 (fi)	Table Rock Fork
1971	1971	Big Cr. (BC)	200 (a)	Silver Cr.
1971	1972	Alsea (A)	41,576 (y)	Molalla R.
1972	1972	Big Cr. (K)	200 (a)	Silver Cr.
1972	1973	Big Cr.	54,402 (y)	Molalla R.
1972	1973	Big Cr. (BCC)	31,680 (y)	Butte Cr.
1973	1974	Alsea	53,794 (y)	Molalla R.
1974	1975	Big Cr.	41,172 (y)	Molalla R.
1975	1976	Big Cr.	63,012 (y)	Molalla R.
1976	1977	Big Cr. (RR)	55,202 (y)	Molalla R.
1978	1979	Big Cr. (RR)	81,495 (y)	Molalla R.
1979	1980	Big Cr. (RR)	87,905 (y)	Molalla R.
1980	1981	Big Cr. (RR)	68,528 (y)	Molalla R.
1980	1982	No. Santiam (GC)	23,492 (y)	Molalla R.
1981	1982	Big Cr. (GC)	34,076 (y)	Molalla R.
1982	1982	Eagle Cr. (S)	80,800 (f)	Milk Cr.
1982	1983	Big Cr. (RR)	90,335 (y)	Molalla R.
1983	1983	Eagle Cr. (S)	8,500 (f)	Milk Cr.
1983	1984	Big Cr. (RR)	94,524 (y)	Molalla R.
1984	1984	No. Santiam (S)	38,115 (f)	Butte Cr.
1984	1984	No. Santiam (S)	105,296 (f)	Silver Cr.
1984	1984	No. Santiam (S)	45,000 (f)	Abiqua Cr.
1984	1985	Big Cr. (RR)	70,081 (y)	Molalla R.
1984	1985	Big Cr. (T)	16,439 (y)	Molalla R.
1985	1985	Eagle Cr. (S)	14,831 (f)	Milk Cr.
1985	1985	No. Santiam (S)	94,022 (f)	Butte Cr.
1985	1985	No. Santiam (S)	104,343 (f)	Silver Cr.
1985	1986	Big Cr. (RR)	72,928 (y)	Molalla R.
1985	1986	Big Cr. (T)	13,891 (y)	Molalla R.
1986	1986	No. Santiam (S)	15,193 (f)	Butte Cr.
1986	1986	No. Santiam (S)	55,318 (f)	Silver Cr.
1986	1987	Big Cr. (W)	82,211 (y)	Molalla R.
1987	1987	No. Santiam (S)	36,384 (f)	Butte Cr.
1987	1987	Eagle Cr. (S)	4,955 (f)	Milk Cr.
1987	1988	Big Cr. (RR)	76,481 (y)	Molalla R.
1988	1988	No. Santiam (S)	49,083 (f)	Butte Cr.
1988	1989	Big Cr. (RR)	65,892 (y)	Molalla R.
1989	1990	Big Cr. (RR)	75,398 (y)	Molalla R.
1990	1991	Big Cr. (RR)	76,925 (y)	Molalla R.

[a] EC = Eagle Creek, K = Klaskanine, Bc = Big Creek, A = Alsea, GC = Gnat Creek, RR = Roaring River, S = STEP hatchbox, T = Trojan, W = Willamette.
[b] (f) = fry, (fi) = fingerling, (y) = yearling smolt, (a) = adult.

APPENDIX B
Coho Salmon

Table B-1. Site specific coho releases in the Molalla and Pudding subbasins, 1952-1988 (Williams 1983b; ODFW, unpublished data). No releases of coho were made during 1978-82. Releases were discontinued after 1987.

Release year	Hatchery	Stock	Number released[a]	Release site
1952	Bonneville	Toutle	50,000 (fin)	Molalla R.
1954	Sandy	Toutle	50,000 (fin)	Milk Cr.
1955	Sandy	Toutle	6,000 (fin)	Milk Cr.
1955	Sandy	Toutle	6,000 (y)	Milk Cr.
1957	Sandy	Toutle	25,000 (y)	Milk Cr.
1957	Sandy	Toutle	50,000 (fin)	Milk Cr.
1958	Big Creek	Toutle	39,520 (fin)	Milk Cr.
1958	Sandy	Toutle	52,000 (fin)	Abiqua Cr.
1958	Sandy	Toutle	52,000 (fin)	Butte Cr.
1959	Sandy	Toutle	30,000 (fin)	Silver Cr.
1962	Sandy	Toutle	117,356 (f)	Molalla R. & tribs.
1962	Sandy	Toutle	43,840 (f)	Butte Cr.
1963	Sandy	Toutle	324,329 (f)	Molalla R. tribs.
1963	Cascade	Toutle	98,460 (f)	Abiqua Cr.
1963	Cascade	Toutle	98,460 (f)	Butte Cr.
1963	Cascade	Toutle	165,000 (f)	N. & S.F. Silver Cr.
1964	Cascade	Toutle	1,500 (a)	Molalla R.
1964	Sandy	Toutle	523 (a)	Butte Cr.
1965	Bonneville	Toutle	259,000 (f)	Molalla R.
1965	Bonneville	Toutle	141,000 (f)	Milk Cr.
1965	Sandy	Toutle	19,720 (y)	N.F. Molalla R.
1965	Bonneville	Toutle	120,800 (fin)	Abiqua Cr.
1965	Klaskanine	Toutle	50,400 (fin)	Butte Cr.
1965	Bonneville	Toutle	60,095 (fin)	Silver Cr.
1966	Cascade	Toutle	64,000 (f)	Molalla R. tribs.
1966	Bonneville	Toutle	179,124 (f)	N.F. Molalla R.
1966	Bonneville	Toutle	133,047 (f)	T.R.Fk. Molalla R.
1966	Bonneville	Toutle	475,624 (f)	Molalla R. & tribs.
1966	Bonneville	Toutle	134 (a)	N.F. Molalla R.
1966	Big Creek	Toutle	160 (a)	N.F. Molalla R.
1966	Big Creek	Toutle	225 (a)	T.R.Fk. Molalla R.
1966	Sandy	Toutle	14,116 (y)	Abiqua Cr.
1966	Big Creek	Toutle	254,148 (f)	Abiqua Cr. & tribs.
1966	Sandy	Toutle	90,000 (f)	Butte Cr.
1966	Big Creek	Toutle	139,795 (f)	E.F., W.F. Drift Cr.
1966	Oxbow	Toutle	187,821 (f)	Rock Cr.
1966	Big Creek	Toutle	238,910 (f)	N. & S.F. Silver Cr.
1966	Cascade	Toutle	150 (a)	Butte Cr.
1966	Bonneville	Toutle	138 (a)	Butte Cr.
1966	Big Creek	Toutle	200 (a)	N. & S.F. Silver Cr.
1967	Sandy	Toutle	303,410 (f)	Molalla R. tribs.
1967	Trask	Trask	168,394 (f)	Milk Cr. tributary
1967	Sandy	Toutle	127,672 (fin)	Molalla R.

(continued)

Table B-1 continued.

Release year	Hatchery	Stock	Number released[a]	Release site
1967	Bonneville	Toutle	722 (a)	Molalla R.
1967	Sandy	Toutle	141,141 (fin)	Abiqua Cr.
1967	Cascade	Toutle	220,000 (f)	Butte Cr.
1967	Sandy	Toutle	342 (a)	Abiqua Cr.
1967	Cascade	Toutle	150 (a)	Butte Cr.
1968	Bonneville	Toutle	88,920 (f)	Molalla R.
1968	Sandy	Toutle	653,094 (f)	Molalla R. & tribs.
1968	Sandy	Toutle	121,856 (f)	Milk Cr.
1968	Bonneville	Toutle	946 (a)	Molalla R. & tribs.
1968	Sandy	Toutle	227,467 (f)	N. & S.F. Silver Cr. & tribs.
1968	Sandy	Toutle	113,736 (f)	Abiqua Cr. trib.
1968	Cascade	Toutle	126 (a)	Abiqua Cr.
1968	Bonneville	Toutle	240 (a)	Abiqua R.
1968	Bonneville	Toutle	140 (a)	Butte Cr.
1968	Cascade	Toutle	126 (a)	Silver Cr.
1969	Bonneville	Toutle	420,294 (f)	Molalla R. tribs.
1969	Sandy	Toutle	405,000 (f)	Molalla R.
1969	Bonneville	Toutle	96,264 (f)	Milk Cr.
1969	Sandy	Toutle	94,010 (fin)	Molalla R.
1969	Big Creek	Toutle	155,480 (fin)	Molalla R.
1969	Bonneville	Toutle	150 (a)	Molalla R.
1969	Big Creek	Toutle	300 (a)	N.F. Molalla R.
1969	Sandy	Toutle	151 (a)	T.R.Fk. Molalla R.
1969	Bonneville	Toutle	300,824 (f)	Butte Cr.
1969	Cascade	Toutle	22,856 (f)	E.F. Drift Cr.
1969	Cascade	Toutle	228,320 (f)	N. & S.F. Silver Cr.
1969	Cascade	Toutle	68,496 (f)	Abiqua Cr. trib.
1969	Sandy	Toutle	150 (a)	Abiqua Cr.
1969	Big Creek	Toutle	350 (a)	Butte Cr.
1969	Big Creek	Toutle	350 (a)	Silver Cr. & trib.
1970	Sandy	Toutle	47,975 (y)	Abiqua Cr.
1970	Sandy	Toutle	26,307 (y)	Drift Cr.
1970	Klaskanine	Toutle	46,500 (y)	Silver Cr.
1970	Cascade	Toutle	74,167 (f)	Drift Cr.
1970	Cascade	Toutle	74,167 (f)	N.F. Silver Cr.
1970	Sandy	Toutle	360 (a)	Butte Cr.
1970	Cascade	Toutle	74,166 (f)	Abiqua Cr. trib.
1971	Cascade	Toutle	24,563 (y)	Abiqua Cr.
1971	Alsea	NA[b]	14,985 (y)	Abiqua Cr.
1971	Cascade	Toutle	24,640 (y)	Drift Cr.
1971	Cascade	Toutle	15,067 (y)	Mill Cr.
1971	Cascade	Toutle	48,800 (y)	Silver Cr.
1971	McKenzie	NA[b]	307,638 (f)	Abiqua Cr.
1971	Big Creek	Toutle	150 (a)	Abiqua Cr.
1971	Big Creek	Toutle	150 (a)	Butte Cr.
1971	Bonneville	Toutle	150 (a)	Butte Cr.
1972	Alsea	NA[b]	12,144 (y)	Abiqua Cr.
1972	Cascade	Toutle	13,815 (y)	Abiqua Cr.

(continued)

Table B-1 continued.

Release year	Hatchery	Stock	Number released[a]	Release site
1972	Cascade	Toutle	13,496 (y)	Drift Cr.
1972	Cascade	Toutle	53,860 (y)	Silver Cr.
1972	Klaskanine	Toutle	327,444 (f)	N. & S.F. Silver Cr.
1972	Klaskanine	Toutle	113,888 (f)	Silver Cr. trib.
1972	Klaskanine	Toutle	71,180 (f)	Abiqua Cr. trib.
1972	Bonneville	Toutle	150 (a)	Abiqua Cr.
1972	Sandy	Toutle	160 (a)	Butte Cr.
1973	Bonneville	Toutle	270,839 (y)	Molalla R. & tribs.
1973	Bonneville	Toutle	17,775 (y)	Milk Cr.
1973	Sandy	Toutle	306,696 (f)	Molalla R.
1973	Cascade	Toutle	173,888 (fin)	Molalla R.
1973	Sandy	toutle	381,906 (f)	Butte Cr.
1973	Sandy	Toutle	134,400 (f)	N.F. Silver Cr.
1973	Sandy	Toutle	268,800 (f)	Silver Cr. trib.
1973	Eagle Creek	Toutle	171 (a)	Butte Cr.
1974	Sandy	Toutle	62,437 (y)	Molalla tribs.
1974	Cascade	Toutle	100,144 (y)	Molalla tribs.
1974	Bonneville	Toutle	76,706 (y)	Molalla tribs.
1974	Sandy	Toutle	56,130 (y)	T.R.Fk. Molalla R.
1974	Sandy	Toutle	20,972 (y)	Milk Cr.
1975	Sandy	Toutle	150,792 (f)	Abiqua Cr.
1975	Big Creek	Toutle	54,921 (fin)	Butte Cr.
1975	Big Creek	Toutle	139,654 (f)	Silverton Reservoir
1976	Cascade	Toutle	25,690 (y)	Milk Cr.
1976	Cascade	Toutle	15,314 (y)	Abiqua Cr.
1977	Sandy	Toutle	270,389 (f)	Silver Cr.
1983	Sandy, GC, Cascade	Toutle	273,100 (f)	Pudding R.
1983	Sandy, GC, Cascade	Toutle	333,300 (f)	Milk Cr.
1984	No releases made			
1985	Sandy GC, Cascade	Toutle	469,600 (fin)	Pudding R.
			118,900 (f)	Pudding R.
			74,400 (fin)	Milk Cr.
			663,800 (f)	Milk Cr.
1986	Sandy, GC, Cascade	Toutle	158,200 (f)	Pudding R.
			187,700 (fin)	Milk Cr.
1987	Sandy, GC, Cascade	Toutle	158,200 (f)	Pudding R.
			9,500 (f)	Milk Cr.

[a] (f) = fry, (fin) = fingerling, (y) = smolt or yearling, (a) = adult.

[b] Information not available.

APPENDIX C
Trout

Table C-1. Releases of catchable hatchery rainbow trout in the Molalla and Pudding subbasins, 1976-88 brood years (unpublished data, ODFW).

Brood year	Release year	Hatchery	Stock	No. & lbs.() released	Release site
1976	1978	Leaburg	Roaring River	9,998 (3,571)	Molalla R.
		Roaring River	Willamette	5,000 (1,613)	Molalla R.
		Roaring River	Roaring River	5,000 (1,742)	Mill Cr.
		Roaring River	Roaring River	4,002 (1,303)	Abiqua Cr.
		Roaring River	Roaring River	500 (250)	Silver Cr.
1977	1979	Leaburg	Roaring River	5,001 (1,724)	Molalla R.
		Roaring River	Roaring River	4,995 (1,722)	Molalla R.
		Leaburg	Roaring River	3,002 (942)	Abiqua Cr.
		Roaring River	Oak Springs	502 (173)	Silver Cr.
1978	1980	Leaburg	Roaring River	7,499 (2,629)	Molalla R.
		Roaring River	Cape Cod	4,004 (1,820)	Molalla R.
		Roaring River	Cape Cod	1,509 (656)	Mill Cr.
		Roaring River	Cape Cod	2,999 (1,055)	Abiqua Cr.
1979	1981	Leaburg	Roaring River	6,998 (2,284)	Molalla R.
		Roaring River	Cape Cod	4,008 (1,670)	Molalla R.
		Roaring River	Roaring River	1,498 (599)	Abiqua Cr.
		Roaring River	Cape Cod	1,500 (600)	Abiqua Cr.
1980	1982	Leaburg	Roaring River	9,991 (3,475)	Molalla R.
		Leaburg	Cape Cod	2,002 (715)	Molalla R.
		Roaring River	Cape Cod	2,164 (777)	Abiqua Cr.
1981	1983	Leaburg	Cape Cod	11,997 (4,415)	Molalla R.
		Leaburg	Cape Cod	1,001 (334)	Abiqua Cr.
		Roaring River	Cape Cod	1,050 (350)	Abiqua Cr.

(continued)

Table C-1 continued.

Brood year	Release year	Hatchery	Stock	No. & lbs.() released	Release site
1982	1984	Roaring River	Cape Cod	12,236 (3,875)	Molalla R.
		Leaburg	Cape Cod	3,006 (1,038)	Abiqua Cr.
1983	1985	Roaring River	Cape Cod	12,057 (3,614)	Molalla R.
		Leaburg	Cape Cod	2,002 (667)	Abiqua Cr.
1984	1986	Roaring River	Cape Cod	12,082 (3,776)	Molalla R.
		Leaburg	Cape Cod	1,898 (643)	Abiqua Cr.
1985	1987	Roaring River	Cape Cod	12,017 (3,818)	Molalla R.
		Leaburg	Cape Cod	2,000 (635)	Abiqua Cr.
1986	1988	Roaring River	Cape Cod	11,988 (3,688)	Molalla R.
		Leaburg	Cape Cod	1,996 (644)	Abiqua Cr.
1987	1989	Roaring River	Cape Cod	11,976 (3,905)	Molalla R.
		Leaburg	Cape Cod	2,000 (667)	Abiqua Cr.
1989	1990	Roaring River	Cape Cod	10,992 (3,331)	Molalla R.
		Leaburg	Cape Cod	2,003 (679)	Abiqua Cr.