Environmental Investigations

UMPQUA RIVER BASIN

FISH AND WILDLIFE RESOURCES AND THEIR WATER REQUIREMENTS

OREGON STATE GAME COMMISSION
1634 S. W. Alder Street
P. O. Box 3503
Portland, Oregon 97208

FISH AND WILDLIFE RESOURCES OF THE UMPQUA BASIN, OREGON, AND THEIR WATER REQUIREMENTS

By

Jim E. Lauman
Kenneth E. Thompson
John D. Fortune, Jr.
Aquatic Biologists

Environmental Management Section
William E. Pitney, Chief

A Report with Recommendations to the
OREGON STATE WATER RESOURCES BOARD

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Completion Report
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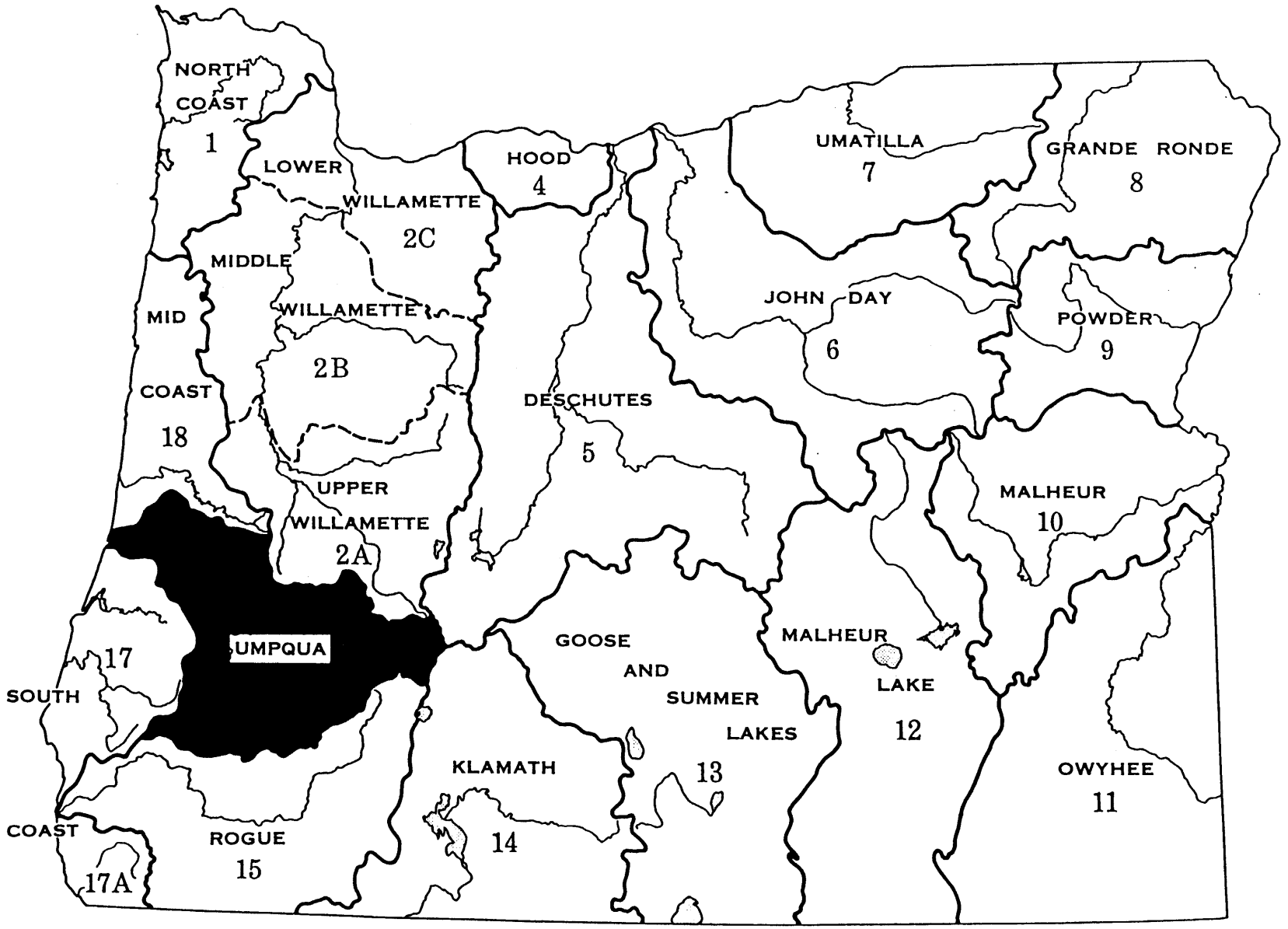
Fig. 1. OREGON DRAINAGE BASINS



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INTRODUCTION

Fish and wildlife resources of the Umpqua Basin, their present status and distribution, biological requirements, limiting factors, water needs and values are discussed in this report.

The study was made and recommended flows developed so that fish and wildlife water needs might be considered in Oregon's multi-purpose water use programs. Recommendations in Appendix 1 and 2 are a refinement of former flow recommendations submitted to the Oregon State Water Resources Board and published in their report on the Umpqua Basin in July 1958. This investigation also provides information on fish requirements to effect better management of the fish resources of the state.

Field studies were conducted by the authors. Additional information included in this report was provided by Oregon State Game Commission biologists, Jerry A. Bauer, Ronald L. McDivitt, and William L. McCaleb, Jr. Shellfish and commercial harvest data were provided by the Fish Commission of Oregon. Certain stream discharge data were obtained from United States Geological Survey

stream gages. Editorial reviews were made by William E. Pitney and Rollie F. Rousseau, Environmental Management Section, Oregon State Game Commission.

FISH RESOURCES

Inventory and Distribution

Game Fish

Eleven races of salmon and trout inhabit the Umpqua River system. Six races are anadromous, using the stream system for spawning and juvenile rearing and the ocean for growth to maturity. Table 1 gives estimated spawning escapement of anadromous salmonids for the basin. Variation in population composition between stream systems is the result of different biological requirements of species and races, plus hatchery release programs. Anadromous salmonids use over 135 Umpqua Basin streams for production, many being small tributaries (Table 2 and Figures 16-18). Nearly all streams with year-around flows support at least one species of freshwater game fish. To maintain desirable populations of these fish, a comprehensive water use program must be developed. Minimum stream flow recommendations on 109 of the most important fish production streams are designed to maintain minimum desirable fish populations in Umpqua Basin streams (App. 1).

Table 1. Estimated number of adult anadromous salmonids spawning in Umpqua Basin river systems 1/ 2/

Stream System	Chinook Spring	Chinook Fall	Coho	Steelhead Winter	Steelhead Summer	Sea-run Cutthroat
Smith River	0	1,000	5,000	10,000	0	10,000
Umpqua River (total)	0	2,200	15,000	10,500	0	8,000
Elk Creek	0	200	3,500	4,000	0	2,800
Calapooya Creek	0	0	2,000	2,500	0	1,500
North Umpqua River (total)	12,000	300	1,000	9,500	12,000	2,000
Little River	0	0	550	1,000	225	200
Rock Creek	500	0	0	1,100	225	200
Steamboat Creek	100	0	40	500	2,060	300
South Umpqua River (total)	600	1,500	4,000	10,000	0	10,000
Myrtle Creek	0	0	750	1,000	0	1,500
Lookingglass Creek	0	0	300	600	0	800
Cow Creek	0	300	1,450	4,050	0	1,000
Basin Totals	12,600	5,000	25,000	40,000	12,000	30,000

1/ Estimates by Oregon State Game Commission.

2/ Estimates include hatchery contributions.

Table 2. Number of streams used by anadromous fish, streams with Game Commission flow recommendations, and streams with State Water Resources Board programs for fish life, Umpqua Basin

River system	Streams used by anadromous fish 1/	Streams with OSGC flow recommendations for fish life	Streams with SWRB programs for fish life as of Jan. 1972
Smith River	36	18	3
Umpqua River	39	29	2
North Fork Umpqua	25	23	1
South Fork Umpqua	39	39	2
Totals	139	109	8

1/ Includes only streams with known anadromous fish use.

Shad, sturgeon, and striped bass are common in restricted portions of the watershed as are several species of warm-water game fish (Fig. 20).

Steelhead trout is the most abundant and widely distributed species of anadromous game fish in the Umpqua Basin (Tables 1 and 3, Fig. 18). Summer steelhead, which enter the system primarily during spring and summer, are less numerous than winter steelhead and spawn only in the upper North Umpqua River system. Unlike the winter race, summer steelhead delay spawning for all or part of one year after entering freshwater; therefore, they must endure the low and warm flows of summer as adults (Fig. 2).

Two races of chinook salmon are found in the Umpqua River system (Table 1 and Fig. 16). Spring chinook enter the North Umpqua and upper South Umpqua River systems in spring, hold in these areas during summer, and spawn in early fall. Fall chinook salmon, which return and spawn in the fall, are not subjected to the hazards of prolonged freshwater life as is the spring race. North Umpqua River system has the largest run of spring chinook (Tables 1 and 3); whereas, the South Umpqua River system contains more fall chinook.

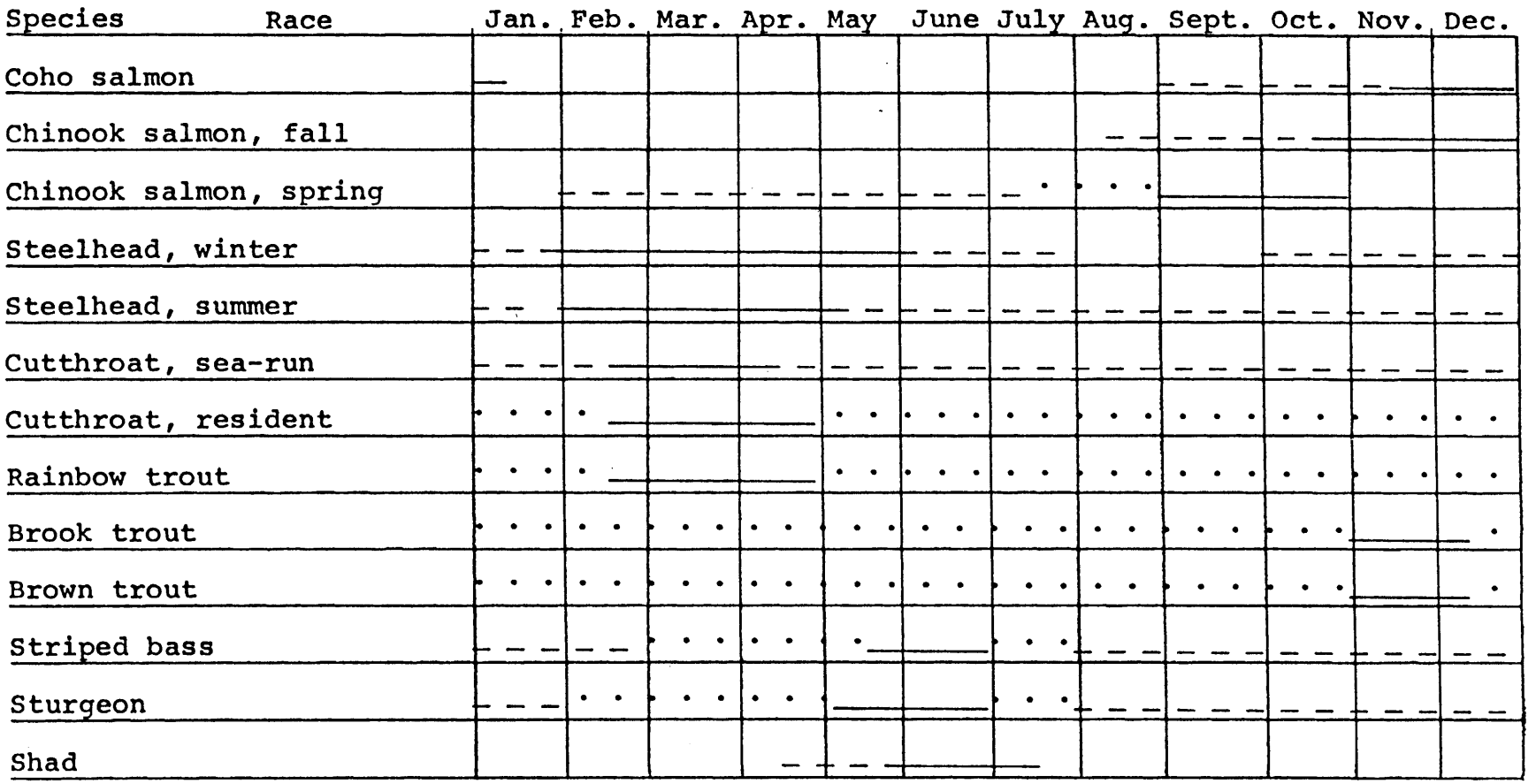


Fig. 2. Fish spawning and migration periodicity, Umpqua Basin.

Table 3. Winchester Dam fish counts, North Umpqua River, 1958-1970 1/

Year	chinook salmon spring	chinook salmon fall	steelhead summer	steelhead winter	coho salmon	sea-run cutthroat
1958	4,398	61	2,041	6,350	573	87
1959	3,787	111	2,049	6,372	818	108
1960	4,050	71	2,732	6,138	346	48
1961	5,253	90	3,141	5,192	531	106
1962 2/	6,650	104	3,072	7,734	548	306
1963	11,020	185	4,827	5,847	1,227	308
1964	8,803	372	2,900	7,726	1,166	142
1965	11,730	182	5,428	9,472	2,262	420
1966	7,269	304	6,185	9,935	917	796
1967	9,036	719	4,818	8,589	1,295	2,364
1968	9,262	124	5,178	9,863	1,647	2,200
1969 3/	20,777	263	14,931	8,122	563	1,031
1970	12,970	199	15,580	12,115	204	942

1/ Source: Oregon State Game Commission.

2/ Incomplete count.

3/ Affected by dam closure for repairs.

Coho salmon spawn in many of the same areas used by fall chinook. But, unlike chinook, coho will ascend high into stream systems on their spawning migration, readily utilizing small streams (Fig. 17). Coho in the Umpqua Basin are most abundant in the main Umpqua River, Smith River, and South Umpqua River systems; however, Little

River, and several smaller tributaries of the North Umpqua River have supported an annual spawning escapement of about 1,000 fish (Table 1). Because coho spawn late in the fall and early winter, stream flows are normally much higher than flows recommended in Appendices 1 and 2.

Sea-run cutthroat trout utilize nearly all stream systems of the Umpqua Basin. Highest populations seem to occur in streams where coho populations are highest.

Rainbow and cutthroat are the predominant species of resident trout. Both fish can be found in nearly all streams. Rainbow is the species most commonly stocked and can be found in some high lakes (App. 7 and 8). Rainbow and cutthroat trout spawn during the spring when low flows are rarely encountered. Like most salmonids, their populations are limited by low flows in late summer.

Brook trout are residents of the upper North Umpqua River system and many high lakes (Fig. 19). In the South Umpqua drainage, stocks introduced into Fish Lake have become established in Fish Lake Creek. Being residents of cool, headwater streams, mature fish seldom exceed 7 inches in length.

Brown trout inhabit waters of the North Umpqua River (Fig. 19). But, unlike brook trout, the range of browns extends the entire length of the North Umpqua River. Brown trout are the least common species of trout in the Umpqua River system.

Kokanee have been stocked in Lemolo and Hemlock Lakes in the upper North Umpqua River system. Spawning fish make use of the river system above the Lemolo Lake. Adult sockeye salmon passing Winchester Dam are thought to be the result of these releases.

Shad are anadromous fish which enter the Umpqua, lower North and South Umpqua, and Smith Rivers during late spring and spawn early in the summer (Fig. 20).

White and green sturgeon are two of the least common species of fish in the Umpqua Basin. The green sturgeon is less common than the white. Both have spawning ranges restricted to tidewater sections of the Umpqua and Smith Rivers (Fig. 20). Because of the large waters they inhabit and their small population, the details of their life cycle in the Umpqua is not well known.

Striped bass are found in the lower river system (Fig. 20).

They enter the tidal portions of Umpqua and Smith Rivers in the spring and to a lesser extent in the fall to spawn.

Warm-water game fish in the Umpqua Basin include bullheads, crappie, bluegill, largemouth bass, and yellow perch (Table 4). Where these species find suitable environmental niches, they can become very numerous and highly competitive with salmonids.

Table 4. Warm-water game fish distribution, Umpqua Basin

Species	Location
Bluegill	Fords Mill Pond, Plat I Reservoir
Brown bullhead	North Umpqua River, South Umpqua River, Plat I Reservoir, Fords Mill Pond, Canyonville Pond, numerous private ponds, Loon Lake, main Umpqua River, lower Smith River
Yellow bullhead	South Umpqua River, Umpqua River, Cow Creek, Lookingglass Creek
Crappie	Canyonville Pond, Fords Mill Pond, Stewart Park Pond, Loon Lake
Largemouth bass	Canyonville Pond, Fords Mill Pond, Stewart Park Pond, Loon Lake, Plat I Reservoir
Yellow perch	Fords Mill Pond

Non-game Fish

Redside shiners, dace, cottids, suckers, Oregon chub, stickleback, squawfish, and lamprey are the non-game or

"rough" fish which inhabit Umpqua Basin streams.

The estuary contains many other forms of non-game fish. Herring, sea perch, and surf smelt are members of this group which are regularly taken by sport fishermen.

Biological Requirements of Salmonids

A stream must have certain physical characteristics and provide water of adequate quantity and quality to support a population of fish. The requirements discussed here are for salmon and steelhead. Conditions suitable for these anadromous fish will also accommodate resident trout.

Habitat Preferences

Species of fish differ in their requirements or preferences for habitat. Some are best adapted to riffles, while others use pools extensively. Usually the best production of desirable game fish is achieved when a balanced combination of riffles and pools exist, since the production of preferred food organisms is highest in riffles while pools serve as resting areas. The gradient of a stream in combination with the flow govern the ratio between riffles and pools. In a reach of a given gradient, discharge that creates a strong flowing

riffle situation would not be suitable for a quiet-water fish. Conversely, a small flow that reduces the stream to a series of pools, virtually eliminates habitat for the riffle dwellers. Therefore, a consideration must be taken in each particular reach of stream so that stream flows will be maintained that provide habitat best suited for the species in question.

Spawning

Salmon and trout must have gravel for spawning, which should range between 1/4 inch and 6 inches in diameter with extremes in size being least desirable. Chinook salmon normally select slightly larger gravel than do coho and steelhead, while anadromous cutthroat and resident trout use smaller gravels. Gravel must be relatively free of sand and silt, and must not be seriously compacted. Excessive sand and silt create adverse conditions for eggs and fry by causing low intra-gravel flows which result in decreased supplies of dissolved oxygen for respiration. Large amounts of fine material can also reduce survival of fry by filling the gravel interstices thus blocking their emergence from the spawning bed. Adequate depth of gravel is necessary for the female fish to construct a redd or nest. Chinook salmon dig slightly deeper redds than do coho salmon and steelhead. Redd depths may vary from

approximately 0.5 to 1.3 foot. Trout redds are seldom deeper than 0.5 foot.

Salmonids require about two months to hatch and another month to emerge from the gravel after hatching. This is controlled primarily by the prevailing water temperature. Suitable water temperatures for spawning range from about 42 to 55 F.

The dissolved oxygen requirement for egg survival is higher (8 ppm) than for fish after hatching (5 ppm). To meet the greater demand of eggs, clean permeable gravel is required to insure adequate flow of intra-gravel water.

Biologists have made measurements at numerous redds of three of the anadromous species concerned. From these studies, water depth and velocity criteria for proper spawning conditions have been determined. Minimum water depth for chinook salmon spawning is 0.8 foot, while coho salmon and steelhead require at least 0.6 foot. Trout use a flow depth of at least 0.4 foot. Proper velocities for spawning by the three anadromous species range between 1.0 and 3.0 feet per second as measured 0.4 foot from the bottom. Velocity requirements of trout are less well defined.

Rearing

The most critical time in the freshwater life of young salmonids is the period of low summer flow. Certain species spend up to 3 years in freshwater before migrating to the ocean, while resident trout never leave freshwater. To support fish during this period, a stream must contain sufficient flow to provide food, shelter, and a suitable medium in which to live.

Food: Juvenile salmonids feed primarily on immature aquatic insects. Production of these organisms is confined almost entirely to riffle areas. Best producing riffles are those composed of large gravel or rubble. Clean, well aerated water flowing is necessary to properly maintain these food forms.

Shelter: Shelter has been described as any place a fish will seek when frightened or disturbed. Such places may be found within riffles, but are usually associated with deeper pool areas. Shelter is necessary not only for fish to escape their enemies, but to avoid stress.

Suitable medium: A suitable medium refers primarly to water quality requirements. Good rearing water is high in dissolved oxygen (above 5 ppm), with temperature not exceeding 65 F for extended periods, low in turbidity,

and not greatly acidic or alkaline. High water temperatures contribute to mortalities by simply exceeding tolerances of salmonids. Water loses its capacity to hold dissolved oxygen as its temperature increases, yet the metabolic rate and resultant oxygen requirement of cold blooded animals is greater at higher temperatures. In addition, water temperatures above optimum for salmonids are often ideal for competing species of undesirable fish. Incidence of many diseases increases with rising temperature. Turbid waters generally cause greater damage to fish habitat than to fish themselves, primarily by silting food producing and spawning areas. Heavy silt loads, however, can injure gills and other tender structures and result in mortality. Water highly acidic or alkaline, interferes with the physiology of fish.

Adequate summer stream flows play a vital part in meeting the three basic rearing requirements. Without adequate flow, any or all conditions may be seriously limited and result in substantially decreased fish production.

Passage

By definition, anadromous fish migrate between the ocean and freshwater. To complete this cycle, fish must have adequate stream flow for passage. As upstream migrants,

anadromous salmonids require a portion of the stream cross-section to have sufficient depth so passage will not be impeded. Eight tenths foot for chinook and 0.6 foot for coho, steelhead, and sea-run cutthroat are recommended minimum depths for desirable passage conditions. Abrupt reductions in stream flow retard upstream passage.

A minimum depth of 0.1 to 0.2 foot is required by juvenile fish for intra-stream movement during their rearing period. Flows to insure good survival of juvenile anadromous fish on their seaward migration are greater than those required for intra-stream movement. But, this is usually no problem, because most juvenile anadromous fish migrate downstream during seasons of naturally higher flows.

Factors Affecting Fish Resources

Water Availability

The most important factor limiting fish production in the Umpqua Basin is summer water supply. Critically low flows occur in most streams from July through October (Fig. 3-6, App. 3). Flows during the remainder of the year generally exceed those required by fish, with peak

flows normally occurring during January and February (Fig. 3 and 4).

The North Umpqua River maintains the most favorable flows for game fish production, although many of its tributaries have meager summer flows. The South Umpqua and lower Umpqua River systems historically have more crucial summer water shortages.

Extensive water withdrawals further deplete low natural runoff, thereby intensifying the effects of low flows on fish life (Biological Requirements, pages 12-17). This type of situation severely limits salmonid production in the South Umpqua River system below Tiller (Fig. 5 and 6). Other streams with substantial withdrawals include Calapooya Creek, Elk Creek below Drain, and the North Umpqua River below Glide.

Winter flood flows, which have some adverse effects on fish, occur almost yearly. Directly affected are incubating eggs, fish stranded in pools when flow recedes, and fish abused by high velocities and turbidity. Damage to stream environment can be significant. Scoured streambeds, displaced gravel, and logjams are frequent products of flooding. Peak flows, however, can cleanse and renew gravel supplies vital to a productive stream.

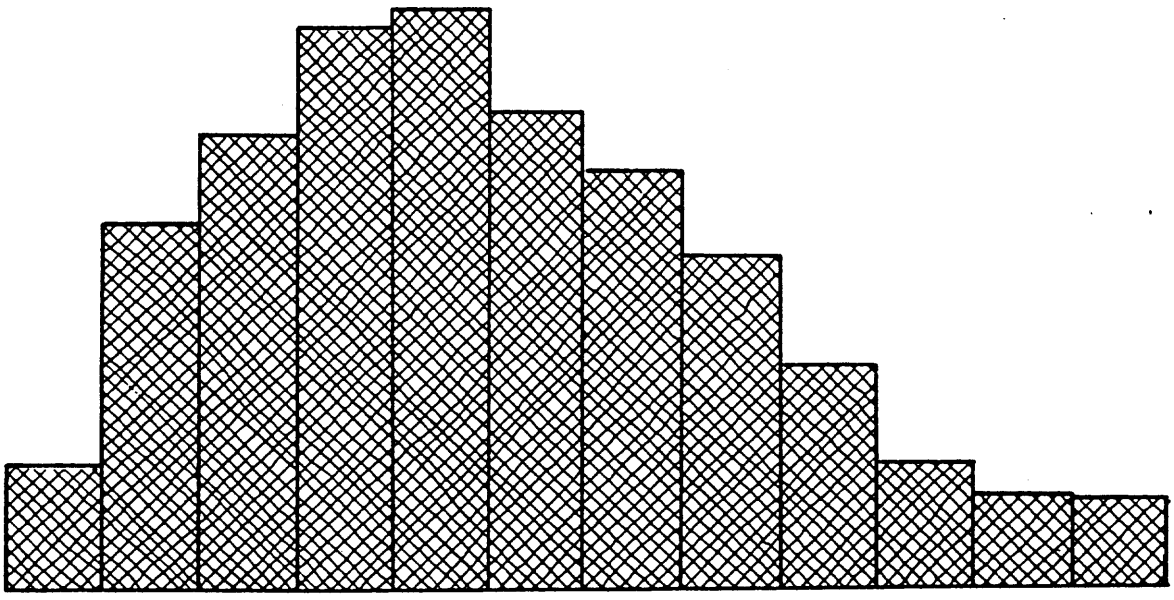


Fig. 3. Relative monthly discharge, North Umpqua River near the mouth, 1909-1960.

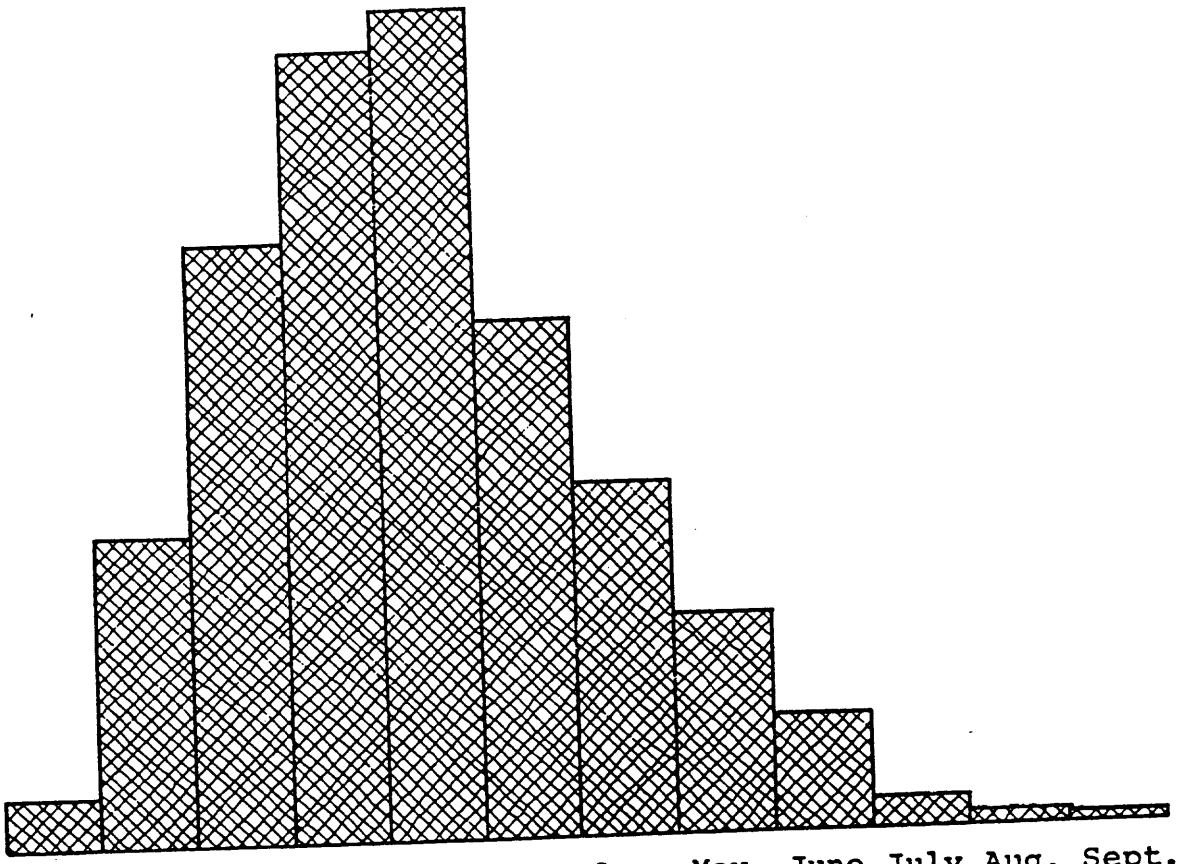
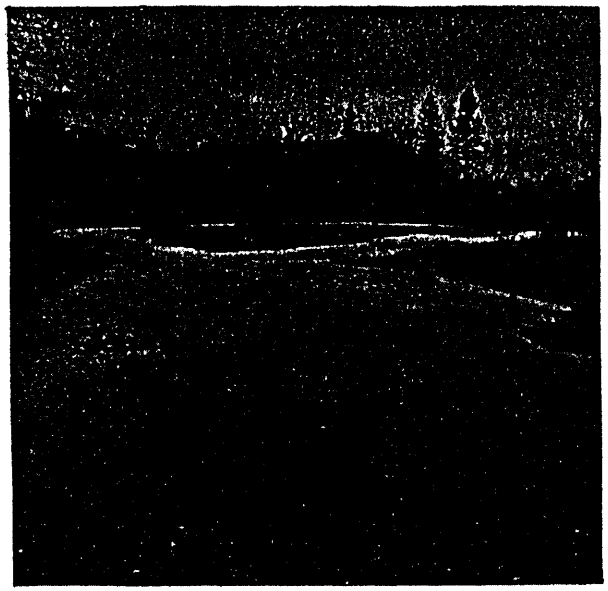


Fig. 4. Relative monthly discharge, South Umpqua River near Roseburg, 1906-1960.



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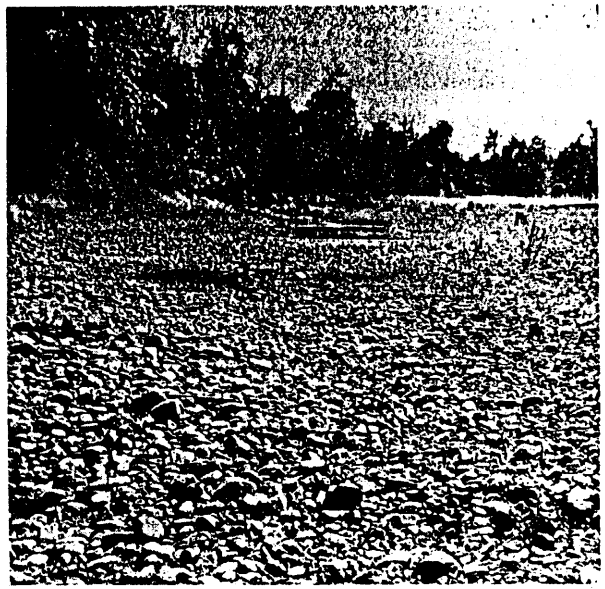


Intermittant

Fig. 5. Olalla Creek, one mile downstream from Tenmile Creek. (Approximate appearance of recommended minimum spawning (60 cfs) and rearing (15 cfs) flows. Flows encountered during the spring spawning period are as low as 15 cfs and are occasionally dry during the summer rearing period.)

Fig. 6. Lookingglass Creek at the mouth, August 5, 1968. (Low natural runoff complicated by numerous withdrawals for agricultural purposes has nearly eliminated the capacity of this 160 square mile stream system to rear salmonids.)

Water Quality

Domestic and industrial pollution, siltation, inadequate dissolved oxygen, and temperature extremes are the water quality problems most frequently affecting fish life. The severity of these problems can also relate to water quantity.

Many streams in municipal areas receive domestic and industrial effluents, the Roseburg area being most critical. Industrial pollutants are frequently associated with lumber mill operations. During low flow periods these pollutants have a more deleterious effect on fish due to lack of water for adequate dilution.

Road construction, logging, gravel removal operations, and natural erosion are the main causes of siltation. Heavy deposition of silt is more likely to occur on spawning beds and food producing areas when stream flows are low and unable to keep the particles in suspension (Biological Requirements). Siltation occurs throughout the basin with varying degrees of severity, but problem areas generally coincide with man's activities.

Water temperatures over 70 F commonly accompany low summer flows (Table 5, App. 3). High temperature seldom

Table 5. Miscellaneous maximum water temperatures, Umpqua Basin

Stream	Location	Temp. (F)
Umpqua River	Elkton	82
Elk Creek	Brush Creek	85
Calapooya Creek	Mile 10.4	86
N. Umpqua River	Mile 1.8	79
Litle River	Mile 6.6	77
Steamboat Creek	Mile 0.5	80
S. Umpqua River	Mile 25.0, Winston	94
"	Tiller	82
Deer Creek	Mile 3.0	81
Lookingglass Creek	Mile 0.8	90
Olalla Creek	Mile 11.7	84
Myrtle Creek	Mile 0.4	85
Cow Creek	Mile 6.7	85
" "	Mile 59, Whitehorse Cr.	81
W. Fork Cow Creek	Mile 1.5	78
Days Creek	Mile 1.3	79
Elk Creek	Dixon Creek	87
Jackson Creek	Chapman Creek	77

works as a single factor on fish. It generally aggravates others such as low dissolved oxygen concentration, incidence of disease, and competition from rough fish (Biological Requirements). Salmonids have the ability to withstand higher temperatures in streams with adequate flows than streams which become intermittent or potholed. In many streams, high temperature is temporary and fish may escape its effect by entering or gathering at mouths of cooler tributaries or spring areas. Additional withdrawals from these streams may result in temperatures intolerable to salmonids. Lookingglass, Elk, Cow, Calapooya, Myrtle, and Olalla Creeks, with low natural

flows and substantial irrigation demands are examples of streams where prolonged high temperature and its related problems limit salmonid production.

Excessively low temperatures may occur in some high elevation tributaries. However, their value for downstream temperature control exceeds their disadvantage of reduced productivity in headwater streams. Cold water delays hatching of eggs, slows fish growth, and reduces food production. North Umpqua River above Toketee Reservoir and Clearwater River, with mean annual temperatures of 42 and 41 F respectively, are streams which border upon the lower temperature limits for salmonid growth.

Barriers

The North Umpqua River system contains the only important man-made barriers to fish passage (Table 6). Soda Springs Dam located on the North Umpqua River at mile 70 is unladdered and marks the upper limit of anadromous fish runs. It is doubtful that this structure reduced anadromous fish production since a natural barrier in the same locality historically blocked salmon and steelhead runs. Winchester Dam at river mile 7 is the only major man-made barrier in the Umpqua Basin with fish

passage facilities. This structure, once used for power production, now creates a pool for recreation and esthetic values. The Oregon State Game Commission operates a fish ladder and counting station on the north end of Winchester Dam. Fish passage is good when the dam is properly maintained (Fig. 7).

There are few natural barriers and they have little influence upon fish runs when flows are adequate (Table 6). Smith River Falls, South Umpqua Falls, and Steamboat Falls are natural barriers which have been laddered to facilitate fish passage. Low flows seriously hinder fish passage over a cascade on Smith River at mile 29 (Fig. 8).

Logjams are problems on many small streams, especially those in the Coast Range. They are common in the Smith River system near logging activities and burned areas. The Oregon State Game Commission and Fish Commission of Oregon, with financial aid from other land management agencies, annually expend considerable effort to remove logjams.

Diversions for power production are limited to the North Umpqua River system above Soda Springs Dam. These diversions generally do not create water shortages for

Table 6. Status of falls and dams affecting anadromous fish, Umpqua Basin

Name and Location	Height	Passage Status
Rock slope on Smith R. at Buck Cr. (Fig. 7)	5'	Marginal at low flows
Smith R. Falls, mile 30	15'	Laddered, fair to good
N. Fk. Smith River Falls	80'	Impassable
Loon Lake Gorge, Mill Cr.	150' in 150 yds	Impassable
Camp Cr. Falls	25'	Impassable
Winchester Dam, N. Umpqua R. at mile 7	14'	Laddered, adequate passage at all flows
Soda Springs Dam, N. Umpqua R. at mile 70	114'	Impassable
Little River Falls, mile 15.0	15'	Impassable
Little Falls, Steamboat Cr., 0.5 mile above Canton Cr.	10'	Marginal
Steamboat Falls, Steamboat Cr., at Deep Cr.	40'	Laddered, fair to good
Canton Cr. Falls, mile 1.6	12'	Marginal
South Umpqua Falls, mile 96	30'	Laddered, fair to good
Cavitt Cr. Falls	15'	Marginal
Cow Cr. Falls	20'	Impassable
Coffee Cr. Falls	15'	Marginal
Canyon Cr. Falls	10'	Laddered, fair

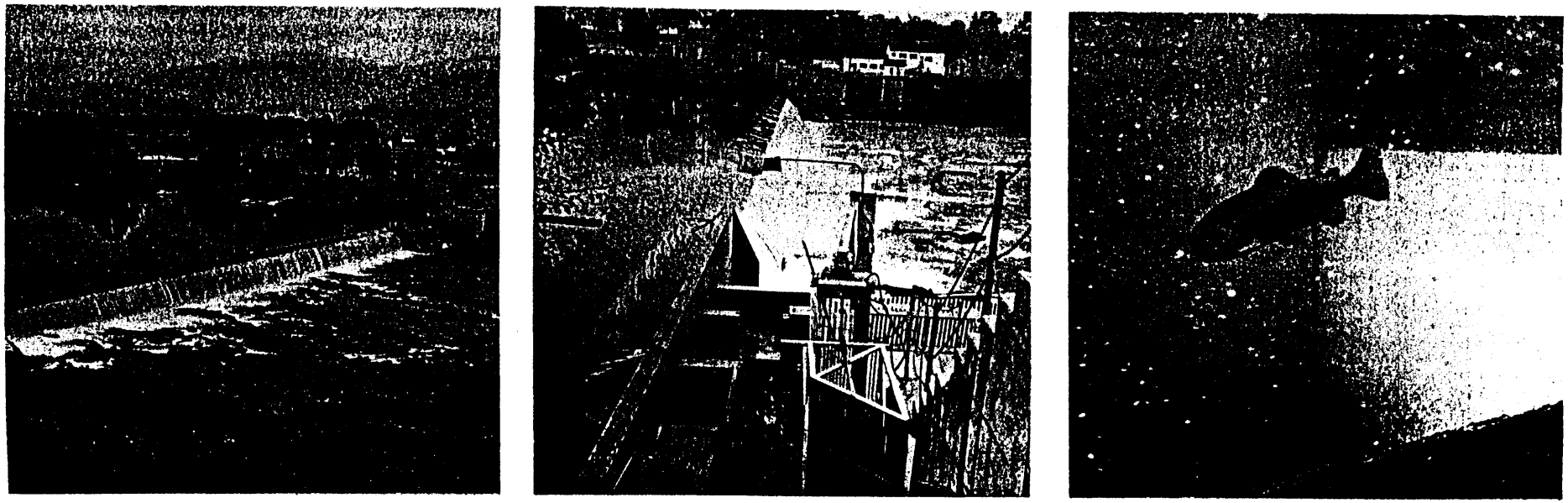


Fig. 7. Winchester Dam, fish ladder, and counting chamber on the North Umpqua River near Roseburg.

Fig. 8. Bedrock apron on Smith River at mile 29 impairs fish passage.

Fig. 9. North Umpqua River below Toketee Reservoir. (Diversions for power production leave the section of river between Toketee Reservoir and Fish Creek with insufficient flow to maintain a minimum desirable fish population.)

fish life. One exception is the three mile section of the North Umpqua River, from Toketee Dam to Fish Creek, which would require additional flow to maintain a desirable fish population (Fig. 9).

Illegal Harvest

Spring chinook salmon and summer steelhead are the species most affected by illegal harvest. Also, commercial fishing for shad and striped bass take some spring chinook in gill nets in the lower Umpqua River. Summer steelhead and spring chinook are taken from resting pools with dynamite, snagging gear, and other illegal methods.

Non-game Fish

Rough fish are common in most streams having low, warm summer flows. They detrimentally affect salmonids by competing for food and living space. Additional water withdrawn from these streams would compound the problem by reducing the quantity and quality of stream habitat for salmonids (Biological Requirements).

Spawning Gravel

Smith River is most noticeably deficient of spawning gravel. Tributaries in this system, however contain

some excellent gravel and provide most of the spawning area. Chinook salmon populations could be greatly enhanced if suitable gravel were available in Smith River. North Umpqua River, likewise, would be more productive for fish life with more spawning gravel. Gravel throughout the remainder of the basin is generally sufficient to provide for an acceptable degree of spawning.

STREAM FLOW STUDY

The investigation of stream flow requirements of fish and wildlife in the Umpqua Basin was made in 1968. Since ORS 536.310 (7) directs the Board to consider "The maintenance of minimum perennial stream flows sufficient to support aquatic life...", minimum flows have been recommended which will support a reasonable level of fish production (App. 1). These flows, however, are substantially less productive for game fish than the stream course would potentially be capable of supporting. Although Umpqua Basin stream systems have high annual water yields, low flows of summer critically restrict natural fish production.

Optimum flow recommendations given in Appendix 2, even

though far lower than natural flows during the fall, winter, and spring seasons, are considerably higher than most natural stream flows during summer. Optimum flows are designed to achieve optimum productivity for fish life according to those aspects of their water requirements currently understood.

Recommended stream flows are principally designed to accommodate the environmental requirements of salmon and steelhead because these fish receive primary management emphasis by Oregon's fishery agencies. Summer flow requirements of anadromous and resident salmonids are essentially the same, but anadromous fish have higher flow requirements during the migration and spawning seasons.

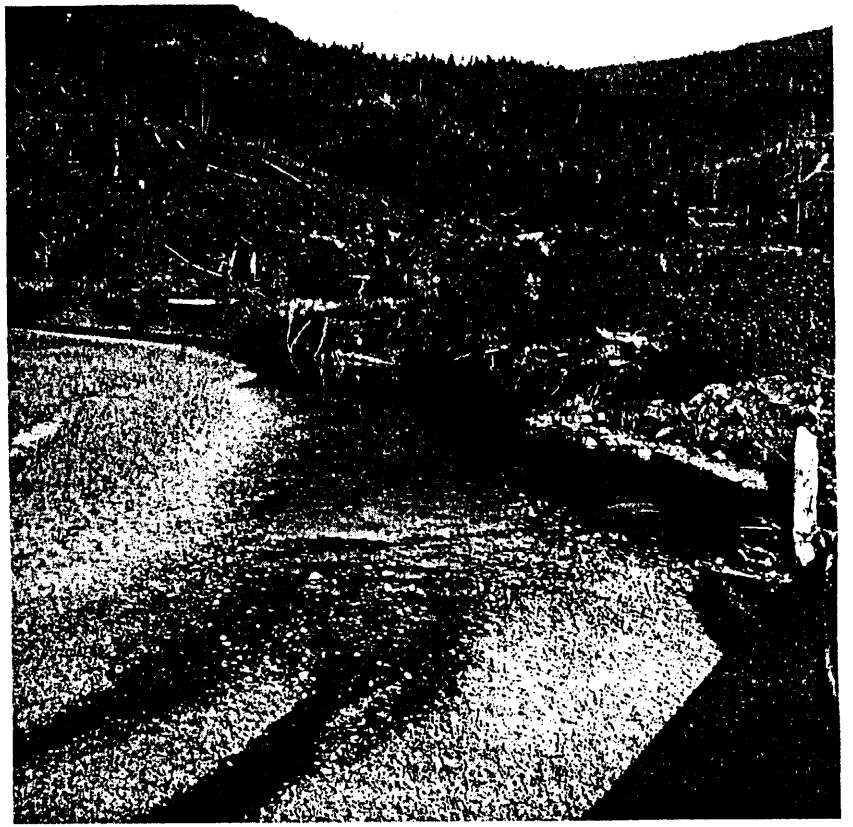
Recommended flow regimens in Appendices 1 and 2, although based on all the biological requirements understood, do not consider some significant effects of natural stream flows. High flows are generally believed necessary to stimulate upstream migration of adult salmon and steelhead, to remove silt which settles into spawning gravels during low discharge periods, and to help maintain a proper freshwater-saltwater balance in estuaries. But, because these occurrences are not thoroughly understood, natural peak flow regimen during

the fall and winter have not been recommended at this time.

Measurements of late spring and early fall stream flows provided the information to formulate flow recommendations for fish migration, spawning, and egg incubation. Data obtained during the summer low-flow period were used to help develop rearing flow recommendations (Figs. 10-13).

Spawning flow recommendations were developed from data obtained at cross-sections located on gravel bars representative of those used by spawning fish (Fig. 14). Measurements of stream width, with flow meeting minimum depth and minimum and maximum velocity requirements of fish were taken at various flows. Standard depth and velocity criteria were applied to assure recommendations commensurate with biological requirements. The resulting relationships were then graphed and recommended flows determined (Fig. 15). Optimum spawning flows yield the greatest amount of gravel usable for spawning, while minimum spawning flows approximate maximum efficient use of the water for fish. Flows recommended for passage of adult fish migrating to spawning beds are minimum flows for physical movement. Flows needed to stimulate upstream movement may be considerably greater.

91 cfs, May 2, 1968



21 cfs, August 30, 1968

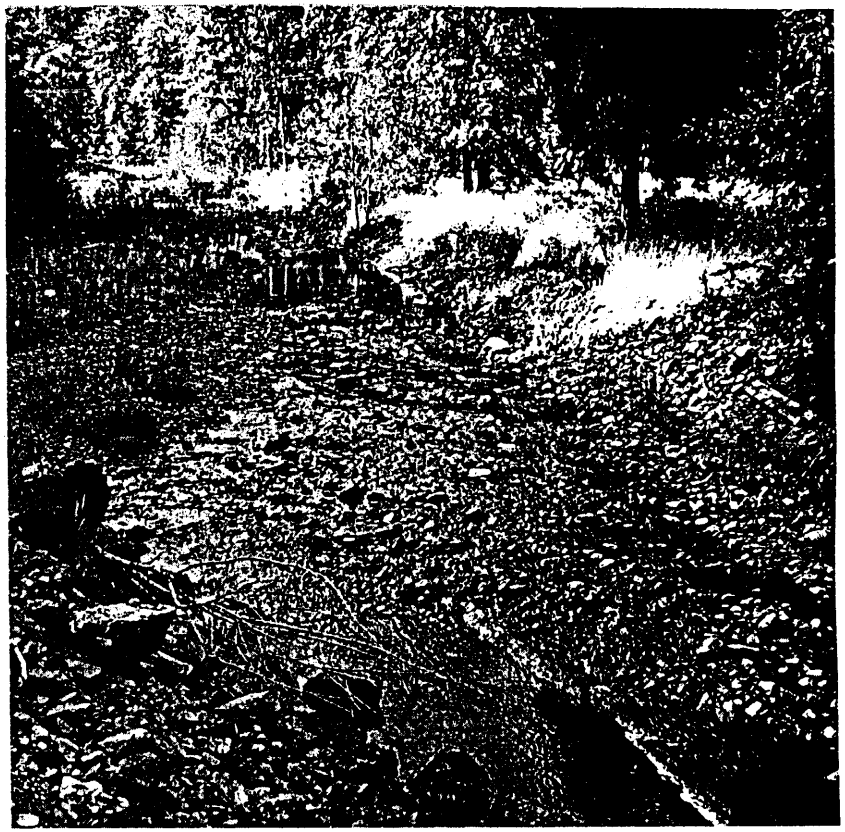
Fig. 10. Approximate appearance of recommended minimum spawning (80 cfs) and rearing (30 cfs) flows in Rock Creek near the mouth.

30 cfs, May 2, 1968

6.5 cfs, August 30, 1968

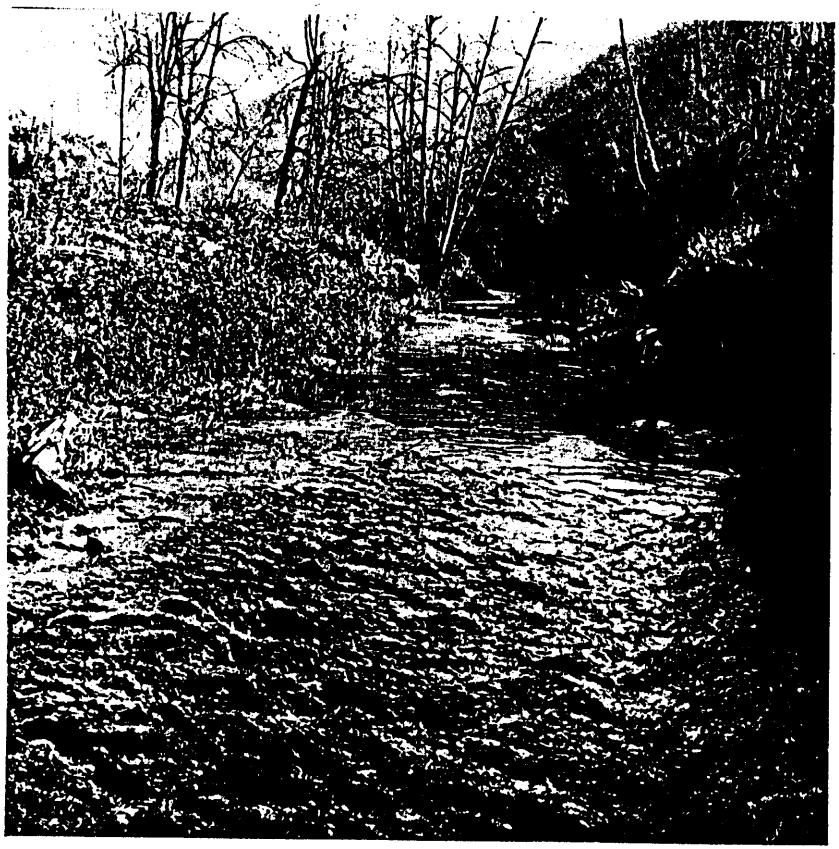
Fig. 11. Approximate appearance of recommended minimum spawning (40 cfs) and rearing (8 cfs) flows in East Fork Rock Creek, 0.2 mile above the mouth.

24 cfs, October 23, 1968



3.3 cfs, July 24, 1968

Fig. 12. Approximate appearance of recommended minimum spawning (25 cfs) and rearing (3 cfs) flows in Hinkle Creek near the mouth.



21 cfs, October 24, 1968

3.5 cfs, October 1, 1968

Fig. 13. Approximate appearance of recommended minimum spawning (28 cfs) and rearing (3 cfs) flows in South Fork Sister Creek, 1.5 miles above the mouth.

Fig. 14. Location of typical cross-section used to determine spawning flow recommendations.

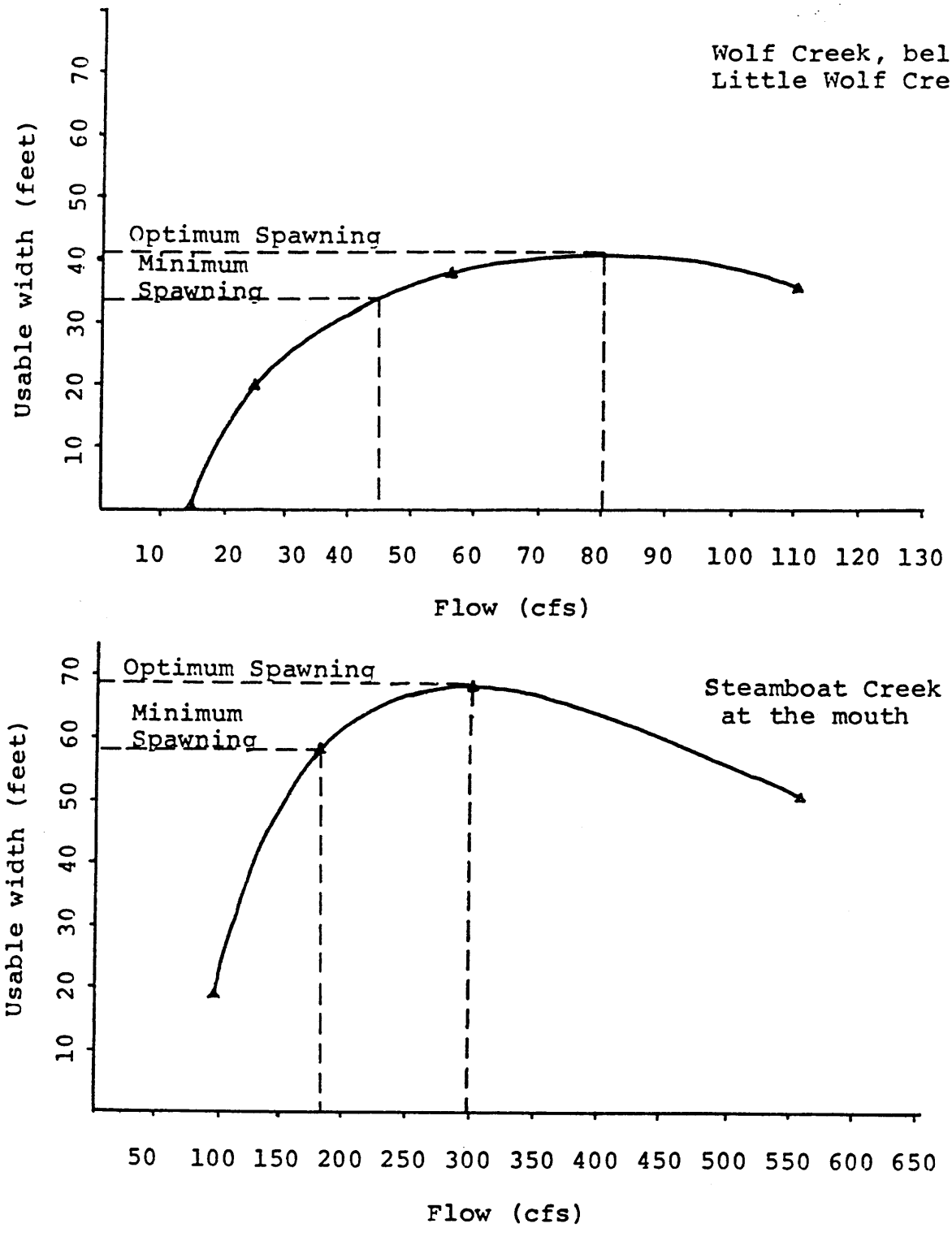
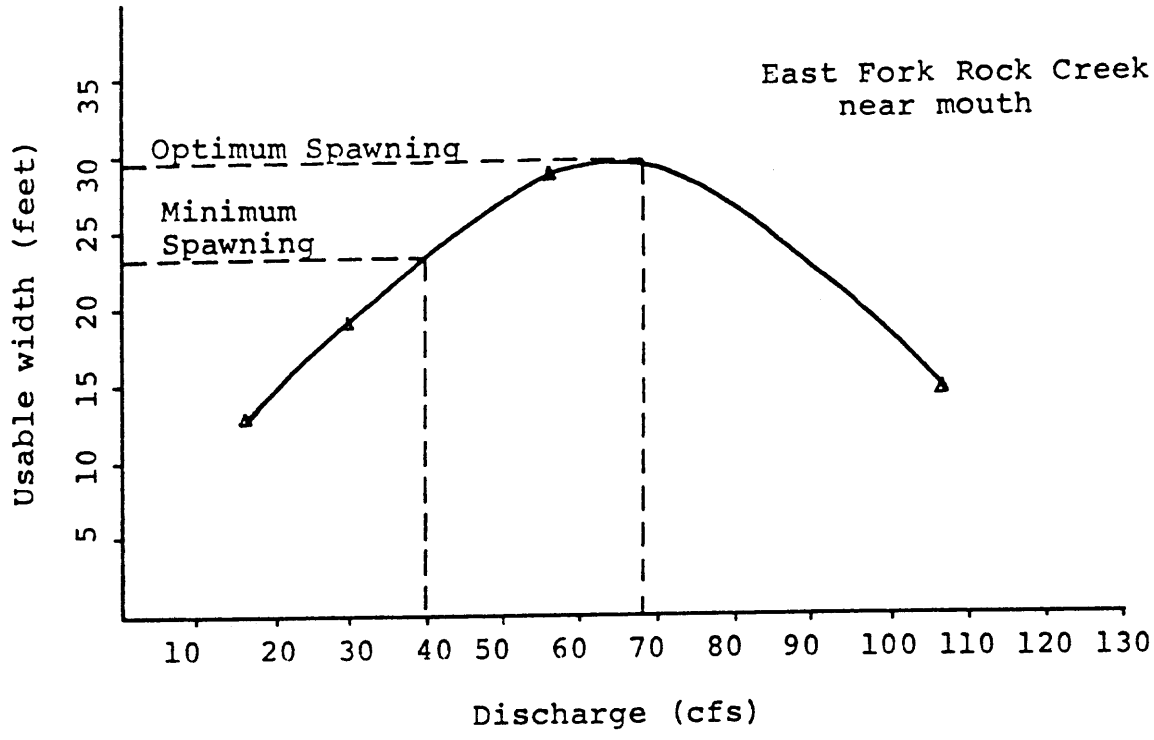


Fig. 15. Graphs illustrating method used to determine spawning flow recommendations for coho salmon and steelhead. Stream discharge versus width usable for spawning.



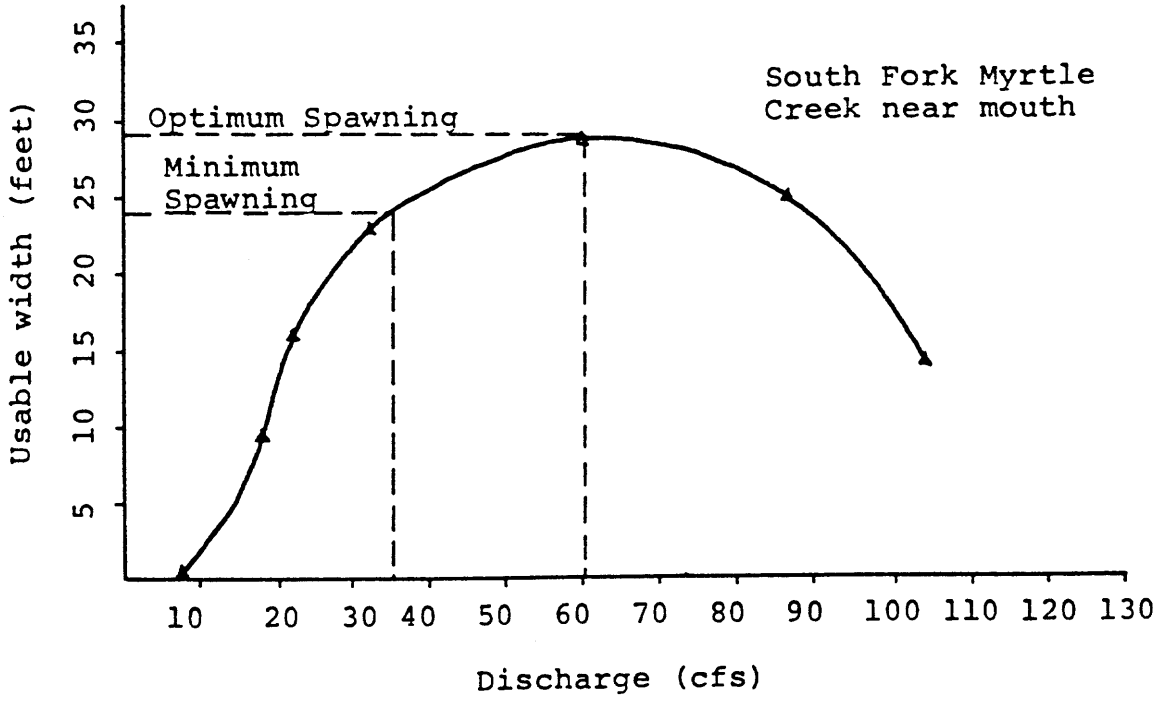


Fig. 15. Continued

Flows recommended for the rearing period are designed to provide suitable food, shelter, and water quality conditions (Biological Requirements, pages 12 - 17). Another important consideration is intra-stream movements. Riffles are used extensively as feeding areas and for movement between pools. Minimum depth requirements over riffles vary with the size of fish inhabiting the stream. On small streams, a minimum depth of 0.1 foot over the riffle may be adequate. Larger streams, which typically hold larger fish, require minimum depths up to 0.8 foot.

GAME RESOURCES

General

The Umpqua Basin, extending from the Cascade summit to the Pacific Coast, contains a wide variety of wildlife habitat and species. The spectrum of game animals in this predominently wooded watershed is most characterized by such species as black-tailed deer, ruffed grouse, silver-gray squirrel, band-tailed pigeon, and beaver. Numerous other species complement this list.

Water supplies are generally adequate. Only in certain areas, during certain periods, and for certain wildlife species could water be made more available or managed more wisely to benefit wildlife. For example, spring waterhole developments on south facing slopes in the South Umpqua and upper Smith River drainages would extend range utilization for several game and non-game species during summer months.

An inventory of game animals and an appraisal of their abundance follow.

Inventory, Distribution, and Water Requirements

Big game is the most important group of game animals within the basin represented by five species. In order of abundance, they are: black-tailed deer, Roosevelt elk, white-tailed deer, black bear, and cougar. Trend counts taken in recent years indicate relatively stable populations.

Since big game animals have minimal water requirements, problems are seldom related to inadequate water supplies; but are more commonly associated with man's activities. Deer and elk move to lower elevations during winter to escape deep snows. Large reservoirs which inundate

winter habitat along valley floors or traditional migration routes force deer and elk to remain at higher elevations where the effects of winter are more severe (Fig. 22).

Black-tailed deer are the most numerous and widely distributed big game animal. They are found throughout the basin, with heaviest populations in brushy areas adjacent to farmlands and logged or burned areas below 3,000 feet.

White-tailed deer, common in Central and Eastern United States, have only scattered populations in the Far West. The Umpqua Basin contains the largest herd of white-tails in Oregon. They are limited in range to an area about 12 miles wide and 20 miles long lying immediately east of Roseburg. A combination of strong competition for forage, frequent interbreeding with the dominant black-tailed deer, and depletion of habitat by land clearing practices has been detrimental to white-tailed deer.

The Umpqua Basin's largest elk herds are located around Loon Lake and Smith River in the Coast Range and in Kelsay Valley and Steamboat areas in the Cascades. These animals are clannish and seldom pioneer into new areas unless forced by adverse conditions or heavy

hunting pressure. Trapping and transplanting has increased elk productivity and range. Transplanting operations are probably responsible for the elk found in the Cascades near Lemolo Lake, original populations having been completely eliminated by commercial meat and hide hunters at the turn of the century.

The black bear is the only species of bear found in Oregon. It is the smallest of North American bears and generally considered the most able to adjust to pressures of civilization. Within the basin, bear populations are greatest in the upper Smith River drainage and at mid-elevations in the Cascades.

Cougars are primarily wilderness animals and the rarest of the basin's big game animals. Their population and range are decreasing. Because of this, cougar are hunted only on a restricted basis.

Upland game animals are an important segment of game resources. They include eight species: pheasant, valley quail, mountain quail, blue grouse, ruffed grouse, mourning dove, band-tailed pigeon, and silver gray squirrel. These animals reside in two distinct, but often closely intermingled habitat types. Pheasants,

valley quail, silver-gray squirrels, and mourning doves, are found primarily on or near agricultural lands. Grouse, mountain quail, and pigeons are mostly residents of wooded areas.

Land use patterns and weather are the factors most limiting upland game. Water requirements are minimal and seldom unfulfilled in the Umpqua Basin. Providing minimum stream flows and proper management of water is most important to valley-dwelling upland game species.

Furbearer populations are relatively static and will remain so unless land and water use practices are substantially altered. Several animals trapped for their fur are not legally classified as furbearers; however, because of their importance, they are discussed with this group. Furbearers thrive near water, but will not tolerate heavily polluted areas. Maintaining desirable summer stream flows and building small water impoundments would be beneficial. Present flow patterns cause a movement of certain animals from larger streams to smaller tributaries during the flood season to escape high waters, returning as waters recede.

The lack of attractive habitat limits waterfowl use. During the fall, migrating ducks concentrate on the

estuary and make some use of inland reservoirs and rivers. Early flocks of migrating widgeon, pintail, and coot are frequently observed on Lemolo and Diamond Lakes; however, birds seldom spend much time on these lakes.

Mallards, wood ducks, and mergansers nest along inland streams and ponds during spring and summer. Cascade lakes often hold breeding pairs of mallards, buffleheads, or Borrow's goldeneye.

The future of waterfowl depends upon land and water uses. If present practices are maintained, bird numbers will remain low and dependent on production from northern breeding areas. Much could be done to more properly manage water and land for waterfowl.

Miscellaneous wildlife species include a wide variety of birds and mammals generally recognized for their esthetic value. Because of their contribution to our environment and its liveability, ever greater emphasis is being placed on management and conservation of these wildlife forms. Water requirements of these animals are modest and amply fulfilled by existing supplies. Preservation of existing water quality and quantity will help insure healthy populations.

FISH AND WILDLIFE IMPORTANCE

Freshwater and Estuarine Fish

Harvest

Sport Sport fisheries occur on salmon, steelhead, trout, shad, striped bass, sturgeon, warm-water game fish, and several marine non-game species. Excellent angling opportunities are available all year (Table 7). Spring chinook and steelhead provide some of the most popular angling. A fishery on resident trout occurs on most streams and high lakes. Warm-water game fish are taken predominently in low-elevation lakes and ponds.

Steelhead account for a large portion of angler effort within the basin's streams (Table 8). The summer steelhead fishery begins in June on the Umpqua and North Umpqua Rivers, peaks in July, August, and September, and tapers off in October (Table 7). Fishing is currently restricted to use of artificial flies above Rock Creek on the North Umpqua. Fly fishing for summer steelhead, however, is popular throughout the North Umpqua system open to fishing. The summer steelhead fishery is limited to the Umpqua and North Umpqua Rivers because other areas lack the excellent summer water

supply needed to hold these fish.

Winter steelhead becomes the angler's main attraction in November through March (Table 7). Several thousand fish are harvested annually in the five streams open to winter steelhead angling. The most successful angling on the lower Umpqua River system is in November through January. Fishing is best in the North and South Umpqua Rivers about one month later.

Table 7. Peak angling periods for Umpqua Basin sport fisheries

Species	Umpqua River RM 0 - 30	Umpqua River RM 30-111	North Umpqua River RM 0 - 35	North Umpqua River RM 35 - 70	South Umpqua River RM 0 - 50	South Umpqua River RM 50 - 80	Smith River
Summer steelhead	---	Jul.-Sep.	Aug.-Oct.	Aug.-Nov.	---	---	---
Winter steelhead	Nov.-Dec.	Dec.-Jan.	Jan.-Feb.	Jan.-Mar.	Dec.-Feb.	Jan.-Mar.	Dec.-Jan.
Spring chinook	Apr.-May	May	May-June	---	---	---	---
Fall chinook	Sep.-Oct.	Oct.	Oct.	---	Oct.	Oct.	Sep.-Oct.
Coho	Sep.-Nov.	Oct.	Oct.	---	Oct.	Oct.	Sep.-Oct.
Sea-run cutthroat	Aug.-Nov.	Sep.-Nov.	Sep.-Dec.	---	Oct.-Dec.	---	Sep.-Oct.
Resident trout	---	---	May-Sep.	May-Sep.	---	May-Sep.	May
Shad and striped bass	Mar.-May	May-June	---	---	May	---	Apr.-Sep.
Sturgeon	Apr.-Sep.	---	---	---	---	---	---

Table 8. Estimated annual harvest, angler-days, and gross expenditures for steelhead, Umpqua Basin 1/

Stream	Harvest	Angler-days	Gross expenditures
Umpqua River	8,000	32,000	$ 592,000
N. Umpqua River	6,000	24,000	444,000
S. Umpqua River	1,000	4,000	74,000
Smith River	1,300	5,200	96,200
N. Fk. Smith River	200	800	14,800
Totals	16,500	66,000	$1,221,000

1/ Source: Oregon State Game Commission (App. 9).

Table 9. Umpqua Basin spring chinook fishery, 1958-1967 1/

Year	Catch	Hours per fish	Percent of run harvested
1958	515	71	11
1959	758	53	18
1960	408	59	10
1961	547	46	10
1962	1,227	26	17
1963	1,141	21	10
1964	1,407	28	16
1965	2,647	27	19
1966	2,220	65	24
1967	2,000	56	19

1/ Source: Oregon State Game Commission.

The sport fishery on fall chinook and coho salmon starts in June on the ocean and late in August on the lower Umpqua River (Tables 7, 10 & 11). The most productive river fishing occurs during October and drops off in November. Coho and fall chinook fisheries on the North and South Umpqua Rivers occur three weeks to a month later.

A limited sport fishery occurs on sea-run cutthroat trout as they enter freshwater during late summer and early fall. Harvest data indicate that annually about 12,500 angler-days are spent in harvesting 5,000 fish, with a gross expenditure by cutthroat fishermen of $231,250. Popular fishing waters include Umpqua, South Umpqua, and Smith Rivers. Many cutthroat taken in the Umpqua and North Umpqua Rivers are inadvertently taken by summer steelhead anglers. The lack of interest in this fishery is not a reflection of its potential; but, primarily the result of other more productive and appealing fisheries occurring at the same time.

Another growing fishery is the April, May, and June fishery on shad (Tables 7 and 12). Fish are taken as far up the South Umpqua as Dillard and in the North Umpqua to Winchester.

Table 10. Winchester Bay salmon fishery, 1958-1970 1/

Year	Catch		Salmon per angler-day
	Chinook	Coho	
1958	4,232	10,779	0.76
1959	2,788	8,297	0.61
1960	2,414	6,590	0.47
1961	3,903	23,769	0.79
1962	2,631	44,413	1.01
1963	3,908	42,266	0.99
1964	5,455	46,933	0.98
1965	4,008	54,644	1.38
1966	6,441	49,254	1.05
1967	4,794	44,257	1.10
1968	3,262	74,474	1.36
1969	4,451	58,303	1.04
1970	4,009	45,620	1.17

1/ Source: Oregon State Game Commission.

Approximately 5,000 striped bass are caught annually from lower Umpqua and Smith Rivers (Table 12, Fig. 20). Best bass fishing occurs from April through September (Table 7).

Sturgeon support a fishery on the lower Umpqua River (Table 12). Best angling occurs in January and February and again from June through August. During these periods, an average of 25 sport boats per day fish for sturgeon.

Table 11. Estimated annual sport harvest, angler-days, and gross expenditures for salmon, Umpqua Basin 1/

	Harvest	Angler-days	Gross expenditures
Ocean	57,500	50,000	$4,255,000
Estuary	3,000	7,500	222,000
Streams	15,600	62,400	1,154,400
Umpqua River	13,000	52,000	962,000
North Umpqua R.	2,000	8,000	148,000
South Umpqua R.	100	400	7,400
Smith R.	500	2,000	37,000
Grand Total	76,100	119,900	$5,631,400

1/ Source: Oregon State Game Commission (App. 9).

Table 12. Estimated annual sport harvest, angler-days, and gross expenditures for bay fish, shad, striped bass, and sturgeon, Umpqua Basin 1/

Species	Harvest	Angler-days	Gross expenditures
Bay fish	60,000	10,000	$ 60,000
Shad	2,750	1,500	27,750
Striped bass	5,000	12,000	222,000
Sturgeon	600	2,000	12,000
Totals	68,350	25,500	$321,750

1/ Source: Oregon State Game Commission (App. 9).

Rainbow, cutthroat, brook, and brown trout, and kokanee support important sport fisheries during the spring, early summer, and early fall (Tables 7 and 13). The most productive fishing occurs in the spring and fall when streams and lakes are cool. Best fishing in the extreme headwaters of the North Umpqua River, however, generally does not occur until late May or June after the cold waters of spring runoff begin to warm.

Table 13. Estimated annual harvest, angler-days, and gross expenditures for resident salmonids and warm-water game fish, Umpqua Basin 1/

	Harvest	Angler-days	Gross expenditures
Resident salmonids	432,800	160,000	$ 960,000
Warm-water game fish	23,800	12,500	75,000
Totals	456,600	172,500	$1,035,000

1/ Source: Oregon State Game Commission (App. 9).

Rainbow and cutthroat trout can be caught nearly anywhere in the Umpqua River system. One of the most important trout fisheries occurs on the North Umpqua River (Table 14). Only the cold headwater streams of the upper North Umpqua preclude all but brook trout. Rainbow are stocked in several streams and lakes where they do not naturally occur.

Table 14. North Umpqua River trout fishery

Year	Total Catch	Hour per fish	Catch Composition					
			Hatchery rainbow	Steelhead (6-8 inches)	Juvenile chinook	Resident trout		
						Ct.	Rb	Br.
1958	30,200	1.3	19,450	9,242	---	551	870	87
1959	32,361	1.2	24,253	7,566	93	279	153	17
1960	43,784	1.3	36,878	6,106	40	447	299	14
1961	44,699	1.2	38,964	5,306	---	243	93	93
1962	41,345	1.4	33,649	6,854	---	332	421	56
1963	32,364	1.3	26,696	4,920	---	353	335	60
1964 1/	32,640	1.2	25,120	6,850	---	194	255	221

1/ Intensive creel sampling that gives comparable data was discontinued after 1964.

Brown trout reside throughout most of the North Umpqua River. Because they are much more difficult to catch than other trout, brown trout are considered more of a trophy fish.

Kokanee stocked in Lemolo and Hemlock Lakes provide an attractive addition to the basin's sport fishing opportunities.

Bullhead, largemouth bass, crappie, and bluegill support a small fishery in the lower Umpqua River and certain lakes, ponds, and reservoirs (Tables 7 and 13). Even though the fishing season on warm-water game fish is open year around, most fish are caught early in the summer.

Marine non-game fish support a moderate fishery in the lower Umpqua River and Winchester Bay (Table 12). Samples of catch composition revealed 40% herring, 24% sea perch, 20% surf smelt, 10% rock fish, 5% lingcod, and 1% miscellaneous species.

In total, Umpqua Basin sport anglers annually expend over 395,000 angler days in pursuit of bay and game fishes, with an annual gross expenditure of about $8,500,000. No universally accepted method exists to

convert gross angler expenditures to total value to the economy.

An enlarged populace enjoying more leisure time will create an increase in future angling pressure. The sale of angling licenses is predicted to increase 50% by 1980 and possibly as much as 350% by 2000. Stream flow levels are vital not only for maintaining desirable fish populations, but also to provide proper water conditions for recreational angling. Therefore, the Oregon Game Commission has developed flow recommendations designed to provide proper water levels for present and future recreational demands on the more popular Umpqua Basin streams (App. 4).

Commercial The Umpqua Basin annually provides about 128,000 salmon to the commercial fishery (includes hatchery contribution). These fish are taken in the ocean from San Francisco to Alaska and the catch is made up of about 59% coho and 41% chinook. The average annual value of these fish to fishermen is estimated at $750,000. No satisfactory method exists to convert this first wholesale value to total value to the economy. However, discussions with industry suggest a two-fold increase in fishermen value would be a reasonable approximation.

Troll fishermen operating from Winchester Bay landed 611,940 pounds of salmon in 1970, primarily coho and chinook, with a value to the fishermen of about $330,000.

Commercial fishermen operating in Winchester Bay harvested 394,000 pounds of shad, 35,000 pounds of striped bass, 250 pounds of sturgeon, and 10,600 pounds of clams in 1970, with a total value to fishermen of about $60,000.

Estuary

The Umpqua estuary is a rich body of water, partly because of the intermixing nutrients from the stream and ocean. Several important fish species, such as herring, need estuaries for successful spawning. Estuaries with their peculiar saline balance are crucial to the survival of young salmon and steelhead, by providing them an opportunity to adjust to full seawater conditions. Likewise, estuaries play an important part in the adjustment of adults to freshwater. Most of Oregon's important bottom fishes are dependent on estuaries during some part of their life.

Estuaries provide much commercial and recreational value to man. Many are heavily utilized for sport fishing,

clamming, and crabbing. Angler use and gross expenditure data for Winchester Bay are given in Table 12. Commercial fishing values are presented on pages 55 and 56.

Estuaries are very complex ecological systems where freshwater and saltwater mix. This delicate balance between fresh and saltwater is just beginning to be understood. We do not have the knowledge to predict the consequences if the balance between fresh and saltwater is upset by impairing the supply of freshwater flows into estuaries.

Wildlife

Hunters annually expend considerable time and money in pursuit of game animals (Table 15). Deer hunting is popular among Umpqua Basin sportsmen (Table 16). Hunter effort and success depends heavily on weather conditions. The best hunting occurs in the fall following a mild winter when survival is high. A preseason rain followed by mild weather produces ideal hunting conditions. Most of the range of white-tails lies on private land, therefore access for the average hunter is limited.

Table 15. Estimated hunting and trapping data, Umpqua Basin, 1970 1/

	Harvest	Hunter-days	Gross expenditures
Big Game			
Deer	6,170	82,345	$1,655,134
Elk	263	10,270	273,182
	6,433	92,615	$1,928,316
Upland Game	24,820	24,600	$ 147,600
Waterfowl	8,480	8,190	65,520
Furbearers	1,976	---	18,383 2/
Totals	41,709	125,405 3/	$2,159,819

1/ Source: Oregon State Game Commission (App. 9).

2/ Cash value to trappers.

3/ Excludes effort for furbearers.

Hunting pressure on elk has remained reasonably stable during recent years (Table 17).

The sport value of upland game is high and hunting pressure significant (Table 18). Productive pheasant habitat is limited and much of it closed to the average hunter. The Oregon State Game Commission has negotiated with selected landowners to provide for more public hunting with annual game farm bird releases maintaining

Table 16. Deer harvest, Umpqua Basin, 1966-1970 1/

Year	Hunters	Harvest	Hunter-days	Gross expenditure
1966	12,919	7,347	80,460	$ 1,617,246
1967	13,932	8,832	83,484	1,678,028
1968	13,474	9,653	79,728	1,602,533
1969	13,620	5,638	82,730	1,662,873
1970	13,070	6,170	82,345	1,655,134

1/ Source: Oregon State Game Commission annual hunter questionnaire (App. 9).

Table 17. Elk harvest, Umpqua Basin, 1966-1970 1/

Year	Hunters	Harvest	Hunter-days	Gross expenditures
1966	1,475	187	8,004	$ 212,906
1967	1,471	191	6,462	171,889
1968	1,664	303	7,583	201,708
1969	1,770	167	6,868	182,689
1970	1,947	263	10,270	273,182

1/ Source: Oregon State Game Commission annual hunter questionnaire (App. 9).

Table 18. Upland game harvest, Umpqua Basin, 1969-1970 1/

Species	1969 Hunters	1969 Harvest	1969 Hunter-days	1969 Gross expenditure	1970 Hunters	1970 Harvest	1970 Hunter-days	1970 Gross expenditure
Pheasant	1,560	3,000	6,440	$ 38,640	1,320	2,260	5,380	$ 32,280
Quail	980	4,250	3,390	20,340	860	4,920	4,570	27,420
Grouse	1,070	2,920	3,410	20,460	1,140	4,190	4,370	26,220
Band-tailed pigeon	830	5,970	2,900	17,400	900	6,420	3,080	18,480
Mourning dove	580	3,120	2,090	12,540	350	2,590	2,040	12,240
Silver-gray squirrel	660	3,500	3,480	20,880	830	4,440	5,160	30,960
Total	5,680	22,760	21,710	$130,260	5,400	24,820	24,600	$147,600

1/ Oregon State Game Commisson annual hunter questionnaire (App. 9).

quality hunting on these areas. Best pheasant hunting is near the communities of Umpqua and Sutherlin.

Valley quail and mourning dove are frequently taken by hunters in pursuit of other game, primarily pheasant. The communities of Sutherlin, Kellogg, and Canyonville are centers of the most productive valley quail and dove hunting.

Grouse and mountain quail seldom attain the population density of most upland game. Mountain quail reach their best populations in the Coast Range with areas around Hubbard and Weatherly Creeks being highly productive. Grouse hunting is most productive near older clear cuts at mid-elevations in the Cascades.

Mineral springs, wild berry patches scattered throughout the Coast Range and Cascade Ranges, and tide flats provide some excellent band-tailed pigeon shooting. The persistence of these birds to obtain mineral water may result in overharvest.

The Umpqua Basin ranks among top Oregon areas in harvest of silver-gray squirrels. Most hunting pressure is expended along low elevation streams or adjacent to

mast crops. The Garden Valley area is the basin's most popular silver-gray squirrel hunting area.

Hunting pressure for waterfowl is light (Table 15). A limited amount of jump shooting occurs along streams and some decoy shooting is done on the estuary.

Miscellaneous unprotected wildlife such as coyotes, bobcats, rabbits, ground squirrels and crows are receiving increased attention by hunters. This hunting effort is not monitored but is substantial, especially on and bordering agricultural lands.

Trapping pressure for furbearers has remained stable during recent years and no change is foreseen unless fur prices change sharply. During the past few years sixteen species have been trapped (Table 19). Additional furbearers which may exist are wolverine, badger, and fisher. The beaver has been the trapper's mainstay, but the river otter consistently brings the highest price per pelt. Skunk and raccoon are the most abundant.

Recreation and Esthetics

The Umpqua Basin annually provides millions of recreation days. One indication of the intensity of this use is

Table 19. Fur trapping in Douglas County, 1966-1967 through 1969-1970 1/

Species	No. of trappers 70 1966-1967 Harvest	Value	No. of trappers 45 1967-1968 Harvest	Value	No. of trappers 41 1968-1969 Harvest	Value	No. of trappers 47 1969-1970 Harvest	Value
Beaver	1,139	$13,212.40	803	$10,679.90	952	$14,384.72	1,358	$15,739.22
Otter	17	332.69	19	366.70	33	831.93	26	680.42
Mink	65	365.30	16	86.56	23	190.44	20	106.20
Muskrat	313	266.05	103	66.95	68	61.88	275	277.75
Raccoon	116	214.60	38	76.38	72	281.52	168	514.08
Marten	1	6.07	---	---	--	---	---	---
Skunk	14	14.98	4	2.24	3	2.73	25	27.25
Civet cat	13	17.03	1	1.26	6	8.52	2	2.30
Weasel	3	1.65	---	---	--	---	---	---
Gray fox	2	2.60	2	3.00	8	18.16	5	14.40
Red fox	1	3.07	---	---	2	9.26	---	---
Bobcat	2	17.84	8	116.24	11	189.31	45	663.75
Coyote	11	34.65	3	8.58	10	68.20	49	354.76
Nutria	1	1.15	---	---	6	9.78	2	3.02
Opossum	--	---	---	---	--	---	1	.32
Ring-tailed cat	--	---	---	---	1	1.25	---	---
Totals	1,698	$14,490.08	997	$11,407.81	1,195	$16,057.70	1,976	$18,383.47

1/ A smaller, unreported harvest is made by unlicensed juvenile trappers.

provided by statistics furnished by the Oregon State Highway Department, Douglas County, U. S. Forest Service, and Bureau of Land Management which show that state, county, and federal parks and waysides in the basin received over 1,000,000 day-visitors in fiscal year 1969-1970. Many of these visits are directly related to fish and wildlife or water-based recreation. Thus, adequate stream flows and lake levels which contribute significantly to the esthetic appeal of the area must be protected to assure these values (App. 5).

Summary

The Umpqua Basin presently receives $8,465,400 in annual gross expenditures by sport anglers seeking anadromous salmonids, shad, striped bass, sturgeon, resident trout, warm-water game fish and bay fish. Salmon produced in the basin contribute about $750,000 to commercial fishermen and are also taken by sport anglers from other coastal ports. Commercial value of shad, striped bass, sturgeon, and clams harvested within the basin approached $60,000 in 1970. In addition, gross expenditures for hunting and revenues from furbearer trapping exceeded $2,159,000 in 1970.

Another consideration is the use for other types of recreation for which adequate stream flows have esthetic

importance.

Demand for use of fish and wildlife resources will continue to increase. A comprehensive minimum flow program will protect the basin's fish and wildlife resources and water-connected recreation.

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A P P E N D I C E S

Appendix 1. Recommended minimum stream flows for fish life, Umpqua Basin 1/ 2/ 3/

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Umpqua River	USGS Gage #14-3229	1,000	1,000	1,000	750	750	750	1,000	1,000	1,000
Smith River	USGS Gage #14-3231	180	150	100	50	50	50/150	200	200	180
Smith River	Below Yellow Creek	90	60	40	20	20	20/40	60	90	90
Smith River	Above S.Fk. Smith River	30	20	15	4	4	4/15	15	30	30
Noel Creek	Mouth	12	10	4	2	1	1	3/8	12	12
N.Fk. Smith River	Mouth	70	50	30	15	15	15/60	90	90	70
Johnson Creek	Mouth	15	10	5	2	1	1	5/10	15	15
Georgia Creek	Mouth	12	10	4	2	1	1	4/8	12	12
Spencer Creek	Mouth	35	20	10	2	2	2	10/20	35	35
Buck Creek	Mouth	12	8	4	2	1	1	6/15	15	15
Johnson Creek	Mouth	24	15	5	2	2	2	5/15	24	24
Vincent Creek	Mouth	30	20	10	3	3	3	10/20	30	30
W.Fk. Smith River	Mouth	40	30	15	6	6	15/30	50	50	40
Sister Creek	Mouth	40	25	10	5	5	5	15/25	40	40
N.Fk. Sister Creek	Mouth	25	15	8	4	2	2	15	25	25
S.Fk. Sister Creek	Mouth	28	20	10	5	3	3	15	28	28
Big Creek	Mouth	20	12	5	3	1	1	5/12	20	20
Halfway Creek	Mouth	20	12	5	2	2	2	5/12	20	20
Cleghorn Creek	Mouth	20	12	5	2	2	2	6/12	20	20
Yellow Creek	Mouth	15	10	5	2	1	1	5/10	15	15
S. Fk. Smith River	Mouth	25	15	6	4	2	2	6/15	25	25
Schofield Creek	Head of tidewater	20	12	5	2	2	2	5/12	20	20
Dean Creek	Head of tidewater	20	12	5	2	2	2	5/12	20	20
Johnson Creek	Mouth	10	6	4	2	1	1	3/7	10	10
Mill Creek	Head of tidewater	100	70	40	20	20	40/70	130	130	100
Camp Creek	Mouth	35	20	15	8	5	10/20	45	45	35
Weatherly Creek	Mouth	20	15	8	4	2	2	8/15	20	20

Appendix 1. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Paradise Creek	Mouth	30	20	12	5	3	3	12/40	40	40
Little Paradise Creek	Mouth	12	10	6	2	2	2	6/10	12	12
Elk Creek	Above Brush Creek	110	80	50	30	30	30	50/80	110	110
Elk Creek	Above Pass Creek	70	50	30	10	10	10	30/50	70	70
Big Tom Folley Creek	Mouth	30	20	10	3	3	3	10/20	30	30
Brush Creek	Mouth	30	20	10	3	3	3	10/20	30	30
Brush Creek	Above Thistleburn Creek	25	15	8	2	2	2	8/15	25	25
Thistleburn Creek	Mouth	6	4	2	1	1	1	2/4	6	6
Jack Creek	Mouth	10	7	4	1	1	1	4/7	10	10
Hardscrabble Creek	Mouth	15	10	5	1	1	1	5/10	15	15
Billy Creek	Mouth	25	15	5	3	3	3	5/15	25	25
Pass Creek	Below Pheasant Creek	40	25	10	6	6	6	10/25	40	40
Pheasant Creek	Mouth	12	8	4	2	1	1	4/8	12	12
Yoncalla Creek	Mouth	15	10	4	2	1	1	4/10	15	15
Mehl Creek	Mouth	15	10	5	1	1	1	5/10	15	15
Yellow Creek	Mouth	30	20	12	4	4	4	12/20	30	30
Wolf Creek	Mouth	45	30	15	4	4	4	15/30	45	45
Hubbard Creek	Mouth	25	15	8	4	4	4	8/15	25	25
Calapooya Creek	Mouth	100	70	40	30	30	30	40/70	100	100
Calapooya Creek	Below Gassy Creek	70	50	30	20	20	20	30/50	70	70
Williams Creek	Mouth	25	15	7	1	1	1	7/15	25	25
Cabin Creek	Mouth	10	6	4	1	1	1	4/6	10	10
Oldham Creek	Mouth	20	10	6	3	3	3	5	10	15
Gassy Creek	Mouth	20	15	6	2	2	2	6/15	20	20
Hinkle Creek	Mouth	25	15	8	3	3	3	8/15	25	25
N. Umpqua River	Mouth	800	800	600	600	600	800	800	800	800

Appendix 1. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
N. Umpqua River	Above Little River	600	600	400	400	400	600	600	600	600
N. Umpqua River	Above Steamboat Creek	400	400	300	300	300	400	400	400	400
N. Umpqua River	Above Toketee Reservoir	200	150	150	100	100	100	200	200	200
Sutherlin Creek	Mouth	23	15	6	2	2	2	6/15	23	23
Little River	Mouth	150	100	60	40	40	40	40/80	150	150
Little River	Above Emile Creek	60	45	30	15	15	15	30/45	60	60
Cavitt Creek	Mouth	45	30	15	8	8	8	15/30	45	45
Emile Creek	Mouth	20	10	6	2	2	2	6	10	15
Rock Creek	Mouth	80	60	40	30	30	40/90	90	90	80
Rock Creek	Above E.Fk. Rock Creek	45	25	15	10	10	25/55	55	50	45
E.Fk. Rock Creek	Mouth	40	20	12	8	8	20/45	45	40	40
Honey Creek	Mouth	7	4	4	1	1	1	4	7	7
Susan Creek	Mouth	7	4	4	2	2	2	4	7	7
Williams Creek	Mouth	10	7	4	2	2	2	5	10	10
Steamboat Creek	Mouth	180	150	75	50	50	125/200	200	180	180
Steamboat Creek	Above Canton Creek	130	100	60	40	40	40	60	90	90
Steamboat Creek	Above Big Bend Creek	90	50	30	15	15	15	30	50	50
Canton Creek	Mouth	90	50	30	15	15	15	30	50	50
Canton Creek	Above Pass Creek	30	20	10	5	5	5	10	20	20
Pass Creek	Mouth	30	20	10	5	5	5	10	20	20
Steelhead Creek	Mouth	25	15	8	3	3	3	8	15	15
Big Bend Creek	Mouth	30	20	15	8	8	8	15	20	20
Cedar Creek	Mouth	25	15	6	3	3	3	6	15	15
Limpy Creek	Mouth	20	12	8	5	5	5	12	20	20
Limpy Creek	Above Panther Creek	15	10	6	4	4	4	10	15	15
Panther Creek	Mouth	8	6	4	2	2	2	6	8	8

Appendix 1. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Calf Creek	Mouth	33	20	12	4	4	4	12/20	33	33
Copeland Creek	Mouth	40	25	15	7	7	7	15/25	40	40
Boulder Creek	Mouth	35	25	12	6	6	6	12/25	35	35
Fish Creek	Mouth	60	40	20	15	15	15	20/40	60	60
Clearwater River	Mouth	50	40	40	30	30	30	50	50	50
S. Umpqua River	Mouth	350	275	225	180	180	225/300	400	400	350
S. Umpqua River	Above Cow Creek	250	180	140	110	110	150/225	300	300	250
S. Umpqua River	Above Elk Creek	180	150	100	80	80	150/200	200	180	180
Deer Creek	Mouth	30	20	10	4	4	4	10/20	30	30
N.Fk. Deer Creek	Mouth	15	12	6	2	2	2	6/12	15	15
S.Fk. Deer Creek	Mouth	25	15	10	3	3	3	10/15	25	25
Roberts Creek	Mouth	30	15	8	2	2	2	8/15	30	30
Lookingglass Creek	Mouth	90	60	40	20	20	20	40/60	90	90
Lookingglass Creek	Above Olalla Creek	25	15	6	2	2	2	6/15	25	25
Olalla Creek	Mouth	75	60	40	20	20	20	40/50	75	75
Olalla Creek	Below Tenmile Creek	60	40	25	15	15	15	25/40	60	60
Olalla Creek	USGS Gage #14-3112	45	30	15	7	7	7	15/30	15	15
Tenmile Creek	Mouth	40	25	12	5	5	5	12/25	45	45
Tenmile Creek	Above Shields Creek	30	20	10	3	3	3	10/20	30	30
Shields Creek	Mouth	18	10	5	2	2	2	5/10	18	18
Berry Creek	Mouth	20	12	6	2	2	2	6/12	20	20
Kent Creek	Mouth	15	10	4	1	1	1	4/10	15	15
Rice Creek	Mouth	18	12	5	2	2	2	5/12	18	18
Willis Creek	Mouth	16	12	5	2	2	2	5/12	16	16
Myrtle Creek	Mouth	50	35	20	10	10	10	20/35	50	50
N. Myrtle Creek	Mouth	35	20	10	6	6	6	10/20	35	35

Appendix 1. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
S. Myrtle Creek	Mouth	35	20	10	5	5	5	10/20	35	35
Cow Creek	Below W.Fk. Cow Creek	135	100	70	50	50	50/100	150	150	135
Cow Creek	Above Riffle Creek	90	60	40	30	30	30/60	100	100	90
Cow Creek	Below Windy Creek	70	50	35	20	20	20	35/50	70	70
Cow Creek	USGS Gage #14-3090	60	40	20	10	10	10	20/40	60	60
W.Fk. Cow Creek	Mouth	60	40	20	12	12	12	20/40	60	60
Middle Creek	Mouth	45	30	15	5	5	5	15/30	45	45
Riffle Creek	Mouth	25	18	8	3	3	3	8/18	25	25
Windy Creek	Mouth	25	18	8	3	3	3	8/18	25	25
Quines Creek	Mouth	25	18	8	3	3	3	8/18	25	25
Starvout Creek	Mouth	17	12	5	3	1	1	5/12	17	17
Whitehorse Creek	Mouth	20	15	7	3	1	1	7/15	20	20
Canyon Creek	Mouth	30	20	10	4	4	4	10/20	30	30
O'Shea Creek	Mouth	15	12	5	3	1	1	5/12	15	15
Days Creek	Mouth	30	20	10	6	4	4	10/20	30	30
Coffee Creek	Mouth	20	15	8	4	2	2	8/15	20	20
Elk Creek	USGS Gage #14-3085	55	35	15	7	7	7	15/35	55	55
Jackson Creek	USGS Gage #14-3077	100	70	40	25	25	60/120	120	100	100
Jackson Creek	Above Squaw Creek	50	35	20	10	10	10	20/35	50	50
Beaver Creek	Mouth	20	15	8	4	4	4	8	15	15
Squaw Creek	Mouth	20	15	8	4	4	4	8	15	15
Deadman Creek	Mouth	30	20	12	5	5	5	12/20	30	30
Boulder Creek	Mouth	35	20	12	5	5	5	12/20	35	35
Buckeye Creek	Mouth	25	15	8	3	3	3	8	15	15
Quartz Creek	Mouth	30	20	10	4	4	4	10	20	20
Black Rock Creek	Mouth	45	30	15	6	6	6	15	30	30

Appendix 1. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Castle Rock Creek	Above Black Rock Creek	45	30	15	8	8	20/55	55	45	45
Fish Lake Creek	Mouth	25	15	8	3	3	3	8	15	15

1/ Flow are expressed in cubic feet per second.

2/ To benefit aquatic life, the flows should arrive at the specified location and continue to the mouth of the stream or to the next point for which a different flow is recommended.

3/ Recommended minimum flows are designed to provide instream conditions capable of maintaining a minimum desirable level of natural production. No consideration is given to the requirements of estuaries to to beneficial impacts of winter freshets.

Appendix 2. Recommended optimum stream flows for fish life, Umpqua Basin 1/ 2/ 3/

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Umpqua River	USGS Gage #14-3229	1700	1700	1700	1000	1000	1000	1700	1700	1700
Smith River	USGS Gage #14-3231	300	180	120	120	120	120/180	300	300	300
Smith River	Below Yellow Creek	150	90	60	60	60	60	90	150	150
Smith River	Above S.Fk. Smith R.	50	30	20	20	20	20	30	50	50
Noel Creek	Mouth	20	12	8	8	8	8	8/12	20	20
N.Fk. Smith River	Mouth	130	70	47	47	47	47/70	130	130	130
Johnson Creek	Mouth	25	15	10	10	10	10	10/15	25	25
Georgia Creek	Mouth	20	12	8	8	8	8	8/12	20	20
Spencer Creek	Mouth	60	35	23	23	23	23	23/35	60	60
Buck Creek	Mouth	20	12	8	8	8	8	12/20	20	20
Johnson Creek	Mouth	40	24	16	16	16	16	16/24	40	40
Vincent Creek	Mouth	46	30	20	20	20	20	20/30	46	46
W. Fk. Smith River	Mouth	68	40	26	26	26	26/40	68	68	68
Sister Creek	Mouth	68	40	26	26	26	26	26/40	68	68
N. Fk. Sister Creek	Mouth	42	25	17	17	17	17	17/25	42	42
S. Fk. Sister Creek	Mouth	48	28	19	19	19	19	19/28	48	48
Big Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Halfway Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Cleghorn Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Yellow Creek	Mouth	25	15	10	10	10	10	10/15	25	25
S. Fk. Smith River	Mouth	42	25	17	17	17	17	17/25	42	42
Schofield Creek	Head of tidewater	34	20	13	13	13	13	13/20	34	34
Dean Creek	Head of tidewater	34	20	13	13	13	13	13/20	34	34
Johnson Creek	Mouth	17	10	7	7	7	7	7/10	17	17
Mill Creek	Head of tidewater	170	100	67	67	67	67/100	170	170	170
Camp Creek	Mouth	60	35	23	23	23	23/35	60	60	60

Appendix 2. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Weatherly Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Paradise Creek	Mouth	51	30	20	20	20	20	30/51	51	51
Little Paradise Creek	Mouth	20	12	8	8	8	8	8/12	20	20
Elk Creek	Above Brush Creek	187	110	74	74	74	74	74/110	187	187
Elk Creek	Above Pass Creek	120	70	47	47	47	47	47/70	120	120
Big Tom Foley Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Brush Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Brush Creek	Above Thistleburn Creek	42	25	17	17	17	17	17/25	42	42
Thistleburn Creek	Mouth	10	6	4	4	4	4	4/6	10	10
Jack Creek	Mouth	17	10	7	7	7	7	7/10	17	17
Hardscrabble Creek	Mouth	25	15	10	10	10	10	10/15	25	25
Billy Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Pass Creek	Below Pheasant Creek	68	40	27	27	27	27	27/40	68	68
Pheasant Creek	Mouth	20	12	8	8	8	8	8/12	20	20
Yoncalla Creek	Mouth	25	15	10	10	10	10	10/15	25	25
Mehl Creek	Mouth	25	15	10	10	10	10	10/15	25	25
Yellow Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Wolf Creek	Mouth	80	45	30	30	30	30	30/45	80	80
Hubbard Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Calapooya Creek	Mouth	170	100	67	67	67	67	67/100	170	170
Calapooya Creek	Below Gassy Creek	120	70	47	47	47	47	47/70	120	120
Williams Creek	Mouth	30	25	16	16	16	16	16/25	30	30
Cabin Creek	Mouth	17	10	7	7	7	7	7/10	17	17
Oldham Creek	Mouth	34	20	13	13	13	13	13	13	20
Gassy Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Hinkle Creek	Mouth	45	25	17	17	17	17	17/25	45	45
North Umpqua River	Mouth	1350	1350	1350	1350	1350	1350	1350	1350	1350

Appendix 2. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
North Umpqua River	Above Little River	1020	1020	1020	1020	1020	1020	1020	1020	1020
North Umpqua River	Above Steamboat Creek	680	680	680	680	680	680	680	680	680
North Umpqua River	Above Toketee Reservoir	340	200	200	150	150	150	340	340	340
Sutherlin Creek	Mouth	39	23	15	15	15	15	15/23	39	39
Little River	Mouth	255	150	100	100	100	100	100/150	255	255
Little River	Above Emile Creek	102	60	40	40	40	40	40/60	102	102
Cavitt Creek	Mouth	76	45	30	30	30	30	30/45	76	76
Emile Creek	Mouth	34	20	13	13	13	13	13	13	20
Rock Creek	Mouth	136	80	53	53	53	80/136	136	136	136
Rock Creek	Above E. Fk. Rock Creek	76	45	30	30	30	45/76	76	76	76
E. Fk. Rock Creek	Mouth	68	40	27	27	27	40/68	68	68	68
Honey Creek	Mouth	12	9	6	6	6	6	6/9	12	12
Susan Creek	Mouth	12	9	6	6	6	6	6/9	12	12
Williams Creek	Mouth	17	10	7	7	7	7	7/10	17	17
Steamboat Creek	Mouth	300	180	120	120	120	180/300	300	300	300
Steamboat Creek	Above Canton Creek	220	130	87	87	87	87	87	130	130
Steamboat Creek	Above Big Bend Creek	150	90	60	60	60	60	60	90	90
Canton Creek	Mouth	150	90	60	60	60	60	60	90	90
Canton Creek	Above Pass Creek	51	30	20	20	20	20	20	30	30
Pass Creek	Mouth	51	30	20	20	20	20	20	30	30
Steelhead Creek	Mouth	42	25	17	17	17	17	17	25	25
Big Bend Creek	Mouth	51	30	20	20	20	20	20	30	30
Cedar Creek	Mouth	42	25	17	17	17	17	17	25	25
Limpy Creek	Mouth	34	20	13	13	13	13	20	34	34
Limpy Creek	Above Panther Creek	25	15	10	10	10	10	15	25	25
Panther Creek	Mouth	14	8	5	5	5	5	8	14	14

Appendix 2. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Calf Creek	Mouth	56	33	22	22	22	22	22/33	56	56
Copeland Creek	Mouth	68	40	27	27	27	27	27/40	68	68
Boulder Creek	Mouth	60	35	24	24	24	24	24/35	60	60
Fish Creek	Mouth	102	60	40	40	40	40	40/60	102	102
Clearwater River	Mouth	85	50	33	33	33	33	85	85	85
South Umpqua River	Mouth	595	350	235	235	235	235/350	595	595	595
South Umpqua River	Above Cow Creek	425	250	168	168	168	168/250	425	425	425
South Umpqua River	Above Elk Creek	305	180	120	120	120	180/305	305	305	305
Deer Creek	Mouth	85	30	20	20	20	20	20/30	85	85
N. Fk. Deer Creek	Mouth	25	15	10	10	10	10	10/15	25	25
S. Fk. Deer Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Roberts Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Lookingglass Creek	Mouth	153	90	60	60	60	60	60/90	153	153
Lookingglass Creek	Above Olalla Creek	42	25	17	17	17	17	17/25	42	42
Olalla Creek	Mouth	130	75	50	50	50	50	50/75	130	130
Olalla Creek	Below Tenmile Creek	102	60	40	40	40	40	40/60	102	102
Olalla Creek	USGS Gage #14-3112	76	45	30	30	30	30	30/45	76	76
Tenmile Creek	Mouth	68	40	27	27	27	27	27/40	68	68
Tenmile Creek	Above Shields Creek	51	30	20	20	20	20	20/30	51	51
Shields Creek	Mouth	31	18	12	12	12	12	12/18	31	31
Berry Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Kent Creek	Mouth	26	15	10	10	10	10	10/15	26	26
Rice Creek	Mouth	31	18	12	12	12	12	12/18	31	31
Willis Creek	Mouth	27	16	11	11	11	11	11/16	27	27
Myrtle Creek	Mouth	85	50	33	33	33	33	33/50	85	85
N. Myrtle Creek	Mouth	60	35	24	24	24	24	24/35	60	60
S. Myrtle Creek	Mouth	60	35	24	24	24	24	24/35	60	60

Appendix 2. (continued)

Stream	Location	Jan-Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Cow Creek	Below W. Fk. Cow Creek	225	135	90	90	90	90/135	225	225	225
Cow Creek	Above Riffle Creek	150	90	60	60	60	60/90	150	150	150
Cow Creek	Below Windy Creek	120	70	47	47	47	47	47/70	120	120
Cow Creek	USGS Gage #14-3090	102	60	40	40	40	40	40/60	102	102
W. Fk. Cow Creek	Mouth	102	60	40	40	40	40	40/60	102	102
Middle Creek	Mouth	77	45	30	30	30	30	30/45	77	77
Riffle Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Windy Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Quines Creek	Mouth	42	25	17	17	17	17	17/25	42	42
Starvout Creek	Mouth	29	17	11	11	11	11	11/17	29	29
Whitehorse Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Canyon Creek	Mouth	51	30	20	20	20	20	20/30	51	51
O'Shea Creek	Mouth	25	15	10	10	10	10	10/15	25	25
Days Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Coffee Creek	Mouth	34	20	13	13	13	13	13/20	34	34
Elk Creek	USGS Gage #14-3085	94	55	37	37	37	37	37/55	94	94
Jackson Creek	USGS Gage #14-3077	170	100	67	67	67	100/170	170	170	170
Jackson Creek	Above Squaw Creek	85	50	33	33	33	33	33/50	85	85
Beaver Creek	Mouth	34	20	13	13	13	13	13	20	20
Squaw Creek	Mouth	34	20	13	13	13	13	13	20	20
Deadman Creek	Mouth	51	30	20	20	20	20	20/30	51	51
Boulder Creek	Mouth	60	35	24	24	24	24	24/35	60	60
Buckeye Creek	Mouth	42	25	17	17	17	17	17	25	25
Quartz Creek	Mouth	51	30	20	20	20	20	20	30	30
Black Rock Creek	Mouth	76	45	30	30	30	30	30	45	45
Castle Rock Creek	Above Black Rock Creek	76	45	30	30	30	45/76	76	76	76
Fish Lake Creek	Mouth	42	25	17	17	17	17	17	25	25

1/ Flows are expressed in cubic feet per second.

2/ Recommended flows should arrive at the point of recommendation and continue to the mouth or to the next point for which a different flow is recommended.

3/ Recommended optimum flows are designed to provide instream conditions capable of maintaining optimum levels of natural production. No consideration is given to the requirements of estuaries or to beneficial impacts of winter freshets.

Appendix 3. Miscellaneous flow and temperature measurements, Umpqua Basin, 1967-1968

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Umpqua River	USGS Gage #14-3229	5-3-67	12:00 (N)	54	60	7,930*
		7-25-67	10:15 AM	--	--	1,140*
		8-24-67	11:30 AM	--	--	882*
		10-24-67	1:00 PM	--	--	1,880*
		4-24-68	3:20 PM	--	--	3,160*
		5-20-68	12:35 PM	--	59	2,460*
		6-24-68	11:55 AM	--	75	1,380*
		7-24-68	12:00 (N)	--	--	1,000*
		8-29-68	12:10 PM	67	68	1,550*
		9-30-68	1:10 PM	--	66	1,160*
		10-23-68	1:50 PM	--	--	3,980*
Smith River	USGS Gage #14-3231	5-3-67	11:00 AM	53	58	440*
		6-27-67	11:45 AM	73	--	30*
		7-25-67	11:10 AM	--	--	24*
		8-24-67	10:25 AM	--	--	10*
		10-24-67	10:30 AM	53	--	175*
		4-25-68	11:00 AM	--	--	164*
		5-21-68	8:45 AM	58	54	123*
		6-25-68	9:00 AM	69	61	102*
		7-25-68	10:10 AM	66	60	20*
		8-30-68	10:30 AM	64	75	105*
		10-1-68	10:00 AM	58	58	41*
		10-24-68	10:35 AM	--	--	322*
Smith River	Below Yellow Creek	4-25-68	3:50 PM	--	--	33
		5-21-68	12:00 (N)	58	59	23
		6-25-68	12:40 PM	69	80	12
		7-25-68	1:50 PM	70	73	4.4
		8-30-68	2:10 PM	64	86	12
		10-1-68	1:30 PM	58	65	5.0
		10-24-68	2:50 PM	53	--	39
		10-30-68	3:00 PM	52	49	119
		11-8-68	11:15 AM	51	--	319

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Smith River	Above S.Fk. Smith R.	8-30-68	2:50 PM	70	86	2.3
		10-1-68	2:05 PM	62	--	2*
		10-24-68	3:15 PM	--	--	6*
		10-30-68	2:30 PM	51	--	38
Noel Creek	0.3 mi. above mouth	4-25-68	8:35 AM	47	--	5.4
		5-21-68	8:00 AM	51	52	5*
		7-25-68	8:30 AM	59	58	1*
		8-30-68	8:30 AM	55	--	5.1
		10-1-68	8:30 AM	54	48	1.9
		10-24-68	8:45 AM	51	49	20
N.Fk. Smith River	0.4 mi. above Georgia Cr.	4-25-68	9:45 AM	47	56	89
		5-20-68	3:55 PM	57	59	66
		6-24-68	3:30 PM	73	82	47
		7-25-68	9:35 AM	63	61	15
		8-30-68	9:40 AM	58	--	128
		10-1-68	9:15 AM	55	--	42
		10-24-68	9:50 AM	51	50	307
Johnson Creek	0.1 mi. above mouth	4-25-68	9:00 AM	57	48	2.7
		5-20-68	4:30 PM	56	58	2.7
		6-24-68	3:15 PM	72	79	1.0
		7-25-68	8:50 AM	60	60	0.2*
		8-30-68	8:40 AM	56	--	3.9
		10-1-68	9:00 AM	54	49	0.7
		10-24-68	9:05 AM	51	50	11
Georgia Creek	Mouth	4-25-68	9:20 AM	47	--	1.5
		5-20-68	4:15 PM	52	58	2.0
		6-24-68	3:50 PM	62	82	0.6
		7-25-68	9:10 AM	57	60	0.3*
		8-30-68	8:45 AM	56	65	1.4
		10-1-68	9:05 AM	54	--	0.5
		10-24-68	9:20 AM	51	--	4.2

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Spencer Creek	0.1 mi. above mouth	4-25-68	10:40 AM	49	--	6.8
		5-21-68	8:35 AM	52	53	9.4
		6-25-68	8:45 AM	62	60	1.8
		7-25-68	10:00 AM	59	60	0.4*
		8-30-68	10:00 AM	58	--	9.1
		10-1-68	9:45 AM	54	58	2.7
		10-24-68	10:15 AM	51	--	26
Buck Creek	Mouth	4-25-68	11:10 AM	50	--	3.0
		5-21-68	9:00 AM	52	54	2.1
		6-25-68	9:10 AM	61	64	0.9
		7-25-68	10:20 AM	60	61	0.3*
		8-30-68	10:40 AM	59	76	1.6
		10-1-68	10:10 AM	55	--	0.7
		10-24-68	10:45 AM	52	56	10
Johnson Creek	1.3 mi. above mouth	4-25-68	11:50 AM	49	--	4.1
		5-21-68	9:15 AM	51	53	5.0
		6-25-68	9:30 AM	61	60	1.2
		7-25-68	10:55 AM	60	61	0.3*
		8-30-68	11:00 AM	56	--	6.3
		10-1-68	10:45 AM	54	--	2.4
		10-24-68	11:30 AM	52	--	17
Vincent Creek	Mouth	4-25-68	12:20 PM	50	53	26
		5-21-68	9:40 AM	53	53	14
		6-25-68	9:45 AM	63	63	3.7
		7-25-68	11:00 AM	61	60	1.5
		8-30-68	11:30 AM	60	77	6.3
		10-1-68	11:00 AM	54	60	2.5
		10-24-68	12:00 (N)	52	--	36

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
W.Fk. Smith River	0.2 mi. above mouth	4-25-68	1:05 PM	--	--	33
		5-21-68	10:00 AM	54	55	23
		6-25-68	10:00 AM	63	65	10
		7-25-68	11:25 AM	61	61	5.7
		8-30-68	11:40 AM	60	--	26
		10-1-68	11:10 AM	56	--	8.9
		10-24-68	12:45 PM	52	--	89
N.Fk. Sister Creek	0.5 mi. above mouth	4-25-68	1:40 PM	53	--	9.3
		5-21-68	10:25 AM	53	58	8.5
		6-25-68	10:25 AM	63	68	2.4
		7-25-68	11:45 AM	61	65	0.6*
		8-30-68	12:15 PM	60	--	5.0
		10-1-68	11:30 AM	56	66	2.3
		10-24-68	1:10 PM	57	--	20
S.Fk. Sister Creek	1.5 mi. above mouth	4-25-68	2:00 PM	53	--	6.3
		5-21-68	10:40 AM	56	56	5.6
		6-25-68	10:50 AM	71	70	2.7
		7-25-68	11:55 AM	65	65	1.5*
		8-30-68	12:40 PM	72	86	6.0
		10-1-68	11:45 AM	60	66	3.5
		10-24-68	1:20 PM	57	--	21
Big Creek	0.1 mi. above mouth	4-25-68	2:35 PM	54	--	5.8
		5-21-68	11:05 AM	56	58	3.7
		6-25-68	11:15 AM	65	74	0.6
		7-25-68	12:25 PM	61	69	0.2*
		8-30-68	1:00 PM	64	--	2.6
		10-1-68	12:30 PM	57	64	0.7
		10-24-68	1:50 PM	55	65	14
Halfway Creek	Mouth	4-25-68	3:05 PM	52	--	5.8
		5-21-68	11:30 AM	52	58	3.9
		6-25-68	11:35 AM	59	62	2.4

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Halfway Creek (cont.)	Mouth	7-25-68	1:10 PM	61	69	1.5
		8-30-68	1:30 PM	60	86	2.3
		10-1-68	1:00 PM	53	--	2.4
		10-24-68	2:15 PM	52	--	6.1
		10-30-68	3:45 PM	51	49	35
		11-8-68	11:00 AM	51	--	134
Cleghorn Creek	0.1 mi. above mouth	4-25-68	3:35 PM	54	--	2.6
		5-21-68	11:45 AM	54	58	2.1
		6-25-68	11:55 AM	62	71	1.4
		7-25-68	1:40 PM	61	73	0.1*
		8-30-68	1:50 PM	60	86	1.8
		10-1-68	1:15 PM	53	64	0.5
		10-24-68	2:35 PM	51	--	4.3
		10-30-68	3:20 PM	51	49	29
		11-8-68	10:30 AM	51	--	73
Yellow Creek	Mouth	4-25-68	4:20 PM	56	--	1.2
		5-21-68	12:10 PM	56	59	1.7
		6-25-68	12:50 PM	64	85	0.5
		7-25-68	2:00 PM	61	73	0.3*
		8-30-68	2:30 PM	64	--	2.1
		10-1-68	1:40 PM	56	--	0.6
		10-24-68	3:00 PM	55	--	3.0*
		10-30-68	2:50 PM	52	49	19
S.Fk. Smith River	0.5 mi. above mouth	4-25-68	4:20 PM	59	--	2.4
		5-21-68	12:35 PM	55	60	5.5
		6-25-68	1:05 PM	66	85	1.0
		7-25-68	2:15 PM	64	73	0.3*
		8-30-68	2:45 PM	66	--	1.5
		10-1-68	2:00 PM	58	65	0.4
		10-24-68	3:10 PM	58	--	4*
		10-30-68	2:20 PM	51	49	48

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Schofield Creek	100 yds. below Wind Cr.	4-24-68	6:00 PM	--	--	20
		5-20-68	2:25 PM	60	59	12*
		6-24-68	1:35 PM	60	78	5.0*
		7-24-68	4:15 PM	--	61	1.0
		8-29-68	5:15 PM	59	75	24*
		9-30-68	3:00 PM	56	--	4.7
		10-23-68	3:50 PM	53	--	70*
Dean Creek	0.2 mi. above Johnson Creek	4-24-68	5:30 PM	57	--	5.7
		5-20-68	2:00 PM	59	59	5.0
		6-24-68	1:15 PM	69	76	2.0
		7-24-68	3:55 PM	64	64	0.4*
		8-29-68	4:50 PM	67	75	11
		9-30-68	2:30 PM	58	60	1.7
		10-23-68	3:25 PM	56	--	25
Johnson Creek	0.2 mi. above mouth	4-24-68	5:20 PM	54	--	2.5
		5-20-68	2:05 PM	60	59	0.9
		6-24-68	1:10 PM	71	76	0.6
		7-24-68	3:40 PM	62	64	0.2*
		8-29-68	4:30 PM	64	80	3.3
		9-30-68	2:20 PM	57	--	0.8
		10-23-68	3:10 PM	54	--	7.6
Mill Creek	2.5 mi. above mouth	4-24-68	4:50 PM	57	--	140
		5-20-68	1:40 PM	61	60	74
		6-24-68	12:20 PM	70	76	46
		7-24-68	2:50 PM	68	64	15*
		8-29-68	4:00 PM	70	70	59
		9-30-68	1:30 PM	62	--	31

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Camp Creek	2.4 mi. above mouth	4-24-68	3:45 PM	55	53	23
		5-20-68	1:10 PM	59	59	18
		6-24-68	12:35 PM	68	80	7.7
		7-24-68	3:00 PM	65	64	2.4
		8-29-68	3:15 PM	66	71	10
		9-30-68	1:45 PM	57	64	5.2
		10-23-68	2:30 PM	53	--	28
Weatherly Creek	Mouth	4-24-68	3:05 PM	55	63	11
		5-20-68	12:25 PM	57	58	5.7
		6-24-68	11:40 AM	64	72	1.8
		7-24-68	2:15 PM	64	72	0.3
		8-29-68	2:30 PM	65	77	3.7
		9-30-68	1:00 PM	58	64	0.8
		10-23-68	1:45 PM	54	56	11
		10-30-68	12:05 PM	52	--	35
Paradise Creek	0.2 mi. above mouth	4-24-68	2:40 PM	55	--	13
		5-20-68	12:05 PM	58	58	6.7
		6-24-68	11:25 AM	65	70	4.6
		7-24-68	1:50 PM	67	70	1.2
		8-29-68	2:10 PM	65	70	5.0
		9-30-68	12:45 PM	57	--	1.4
		10-23-68	1:20 PM	54	56	9.5
		10-30-68	11:45 AM	52	--	44
		11-20-68	11:45 AM	51	54	40
Little Paradise Cr.	0.1 mi. above mouth	5-20-68	11:50 AM	56	60	2.5
		6-24-68	11:10 AM	67	76	1.0
		7-24-68	1:40 PM	65	70	0.5
		8-29-68	2:00 PM	63	70	0.9
		9-30-68	12:30 PM	56	--	0.6
		10-30-68	11:30 AM	51	--	6.1

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Elk Creek	0.1 mi. above Brush Cr.	4-26-68	4:00 PM	56	--	100
		5-22-68	2:10 PM	60	56	114
		6-26-68	2:00 PM	82	83	15
		7-25-68	4:15 PM	85	80	0.2*
		9-5-68	10:20 AM	68	68	13
		10-1-68	4:30 PM	65	--	23
		10-25-68	10:00 AM	55	--	91
Elk Creek	Above Pass Creek	5-22-68	12:50 PM	59	65	46
		9-5-68	9:40 AM	64	62	7.0
		10-1-68	3:15 PM	63	70	6.5
		10-24-68	3:50 PM	55	65	48
		10-31-68	12:30 PM	50	--	200*
Elk Creek	USGS Gage #14-3220	4-26-68	1:50 PM	54	57	55*
		6-26-68	3:00 PM	77	84	6.5*
		7-25-68	3:10 PM	75	80	1.5*
Big Tom Folley Creek	100 yds. above mouth	4-26-68	4:20 PM	56	--	9.3
		5-22-68	2:30 PM	59	55	8.3
		6-26-68	2:30 PM	76	83	2.4
		7-25-68	4:30 PM	76	82	1.0
		9-5-68	11:00 AM	63	74	1.6
		10-1-68	4:45 PM	62	65	1.6
		10-25-68	10:20 AM	53	--	9.1
		10-31-68	11:45 AM	50	--	51
Brush Creek	0.2 mi. above mouth	5-22-68	1:55 PM	59	56	6.2
		9-5-68	10:50 AM	64	70	1.0*
		10-1-68	4:15 PM	61	65	0.9
		10-25-68	9:45 AM	53	--	6.0*
		10-31-68	11:15 AM	49	--	31
		11-20-68	11:15 AM	51	54	25

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Brush Creek	Above Thistleburn Cr.	4-26-68	3:40 PM	56	--	8.9
		6-26-68	1:45 PM	74	83	2.0
		7-25-68	4:00 PM	66	80	0.2*
		9-5-68	10:35 AM	60	68	0.8*
		10-1-68	4:00 PM	58	--	0.4*
		10-31-68	10:40 AM	49	--	22
Thistleburn Creek	Mouth	4-26-68	3:30 PM	54	64	1.4
		6-26-68	1:30 PM	66	83	0.5*
		7-25-68	4:00 PM	64	80	0.1*
		9-5-68	10:35 AM	61	68	0.3*
		10-1-68	4:00 PM	56	--	0.1*
		10-31-68	10:30 AM	49	--	6.5
Jack Creek	Mouth	4-26-68	3:05 PM	54	63	1.4
		5-22-68	1:30 PM	55	58	1.1
		6-26-68	1:10 PM	67	80	0.3*
		7-25-68	3:45 PM	66	80	0.1*
		9-5-68	10:05 AM	61	64	0.3*
		10-1-68	3:50 PM	59	--	0.2*
		10-25-68	9:25 AM	--	--	1.5*
		10-31-68	12:05 PM	50	--	5.1
		11-20-68	10:35 AM	51	54	10
Hardscrabble Creek	Mouth	4-26-68	2:50 PM	54	62	2.2
		5-22-68	1:20 PM	56	56	1.2
		6-26-68	1:00 PM	71	78	0.4*
		7-25-68	3:40 PM	--	80	Intermittent
		9-5-68	10:00 AM	61	64	Less than 0.1*
		10-1-68	3:45 PM	60	70	0.2*
		10-25-68	9:20 AM	52	--	1.5*
		10-31-68	10:30 AM	50	--	8.6
		11-20-68	10:25 AM	51	54	17

Appendix 3. (continued

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Billy Creek	0.1 mi. above mouth	4-26-68	2:35 PM	55	62	11
		5-22-68	1:05 PM	57	66	7.4
		6-26-68	12:50 PM	70	78	2.0
		7-25-68	3:20 PM	78	80	0.1*
		9-5-68	9:50 AM	66	64	0.3*
		10-1-68	3:30 PM	61	70	1.2
		10-25-68	9:15 AM	52	63	9.1
		10-31-68	10:00 AM	49	--	32
		11-20-68	10:15 AM	51	--	40
Pass Creek	Mouth	4-26-68	1:35 PM	53	55	31
		5-22-68	12:40 PM	57	63	30
		6-26-68	12:35 PM	70	78	6.8
		7-25-68	3:30 PM	71	80	1.0*
		9-5-68	9:35 AM	66	62	2.6
		10-1-68	3:10 PM	60	68	4.3
		10-24-68	4:00 PM	55	65	22
		10-31-68	12:30 PM	49	--	82
Pheasant Creek	2.5 mi. above mouth	4-26-68	1:00 PM	52	55	2.1
		5-22-68	12:10 PM	54	59	2.5
		6-26-68	12:15 PM	63	78	0.6*
		7-25-68	5:10 PM	69	81	0.1*
		9-5-68	9:15 AM	57	60	0.2*
		10-1-68	2:50 PM	57	--	0.2*
		10-25-68	9:00 AM	52	--	1.0*
		10-31-68	9:40 AM	49	--	5.7
		11-20-68	9:45 AM	50	52	6.8
Yoncalla Creek	1.5 mi. above mouth	4-26-68	2:10 PM	55	60	8.1
		5-22-68	3:00 PM	59	56	5.5
		6-26-68	3:10 PM	71	84	0.1*
		7-25-68	3:05 PM	67	80	0.1*
		9-5-68	11:35 AM	64	75	0.3*
		10-1-68	5:00 PM	60	--	0.1*
		10-24-68	4:15 PM	57	63	7.5

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Mehl Creek	0.5 mi. above mouth	4-24-68	1:55 PM	54	62	4.8
		5-20-68	11:10 AM	57	61	2.9
		6-24-68	10:25 AM	63	69	1.2
		7-24-68	12:40 PM	68	75	0.2*
		8-29-68	12:50 PM	64	68	1.4
		9-30-68	11:30 AM	58	--	0.5
		10-23-68	12:10 PM	54	56	3.0
		10-30-68	10:50 AM	51	--	18
Yellow Creek	Mouth	4-24-68	1:15 PM	53	60	11
		5-20-68	10:45 AM	58	60	14
		6-24-68	9:50 AM	63	66	4.8
		7-24-68	12:20 PM	67	72	2.1
		8-29-68	12:30 PM	64	68	3.2
		9-30-68	11:15 AM	58	--	1.3
		10-23-68	12:00 (N)	--	--	9.0*
		10-30-68	10:15 AM	51	--	27
		11-20-68	1:20 PM	51	54	30
Wolf Creek	0.1 mi. below Little Wolf Cr.	4-24-68	11:50 AM	51	58	26
		5-20-68	10:00 AM	55	58	15
		6-24-68	9:20 AM	61	60	4.3
		7-24-68	11:25 AM	68	70	1.3
		8-29-68	11:45 AM	62	63	2.9
		9-30-68	10:45 AM	58	--	2.0
		10-30-68	9:35 AM	50	--	112
		11-20-68	2:10 PM	51	55	56
Hubbard Creek	0.1 mi. above mouth	4-24-68	11:00 AM	48	56	11
		5-20-68	9:20 AM	56	56	11
		6-24-68	8:35 AM	62	60	4.8
		7-24-68	10:45 AM	64	64	1.3
		8-29-68	11:10 AM	63	63	2.1
		9-30-68	10:00 AM	58	--	1.0
		10-23-68	10:55 AM	--	--	5.0*
		10-30-68	9:00 AM	51	47	33

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Calapooya Creek	0.3 mi. below Williams Creek	4-26-68	8:20 AM	49	53	106*
		5-13-68	--	--	--	54
		5-22-68	8:45 AM	58	52	146
		6-7-68	--	--	--	89
		6-26-68	8:25 AM	73	65	34
		7-24-68	10:05 AM	68	62	15
		8-29-68	10:45 AM	66	61	51
		9-30-68	9:50 AM	60	58	30
		10-25-68	11:00 AM	53	--	105
		11-5-68	12:50 PM	51	47	205
Calapooya Creek	0.2 mi. below Gassy Cr.	4-26-68	11:00 AM	50	55	79
		5-22-68	10:00 AM	51	54	133
		6-7-68	--	--	--	80
		6-26-68	9:55 AM	67	73	38
		7-24-68	8:45 AM	62	59	19
		8-29-68	9:20 AM	60	59	43
		9-30-68	8:30 AM	56	57	30
		10-23-68	9:40 AM	48	45	144
		11-5-68	12:00 (N)	49	45	182
Calapooya Creek	1.5 mi. above Hinkle Creek	5-16-68	--	50	55	26
		6-7-68	--	--	--	53
		11-5-68	11:30 AM	49	44	107
Williams Creek	Mouth	4-26-68	8:45 AM	52	54	4.7
		5-22-68	9:00 AM	54	52	1.5
		6-26-68	9:00 AM	67	67	0.1*
		7-24-68	10:20 AM	--	62	Intermittent
		8-29-68	10:35 AM	--	61	Intermittent
		9-30-68	9:45 AM	--	58	Intermittent
		10-23-68	10:20 AM	52	50	0.6*
		11-10-68	2:40 PM	--	--	52
		11-13-68	12:45 PM	50	--	97
		11-15-68	2:50 PM	49	--	39
		11-20-68	8:50 AM	50	50	23

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Cabin Creek	3.0 mi. above mouth	4-26-68	9:35 AM	52	55	3.7
		5-22-68	11:00 AM	57	59	2.0*
		6-26-68	11:15 AM	77	77	0.1*
		7-25-68	5:40 PM	--	78	Less than 0.1*
		10-1-68	5:30 PM	--	64	Less than 0.1*
		10-31-68	1:00 PM	49	--	2.4
		11-20-68	9:10 AM	50	52	33
Oldham Creek	1.5 mi. above Bachelor Creek	4-26-68	10:10 AM	53	56	5.5
		5-22-68	9:30 AM	56	53	11
		6-26-68	9:20 AM	69	74	1.0
		7-24-68	9:45 AM	63	62	Less than 0.1*
		8-29-68	10:20 AM	61	62	1.9
		9-30-68	9:30 AM	57	57	0.6
		10-23-68	10:10 AM	51	47	5.3
		11-20-68	3:00 PM	49	55	34
Gassy Creek	Mouth	4-26-68	11:20 AM	52	54	4.1
		5-22-68	10:15 AM	54	56	3.9
		6-26-68	10:10 AM	67	75	0.8
		7-24-68	9:00 AM	60	60	0.1*
		8-29-68	9:30 AM	59	59	1.3
		9-30-68	8:40 AM	54	57	0.4*
		10-23-68	8:40 AM	47	42	11
		11-5-68	2:30 PM	51	--	18
Hinkle Creek	Mouth	4-26-68	11:40 AM	50	54	16
		5-22-68	10:30 AM	53	57	19
		6-26-68	10:30 AM	68	75	6.2
		7-24-68	9:15 AM	60	60	3.3
		8-29-68	9:45 AM	59	59	5.4
		9-30-68	9:00 AM	54	57	3.4
		10-23-68	9:00 AM	47	42	24
		11-5-68	2:50 PM	49	--	45

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
N. Umpqua River	Mouth	7-17-68	3:30 PM	69	80	950
		7-31-68	10:00 AM	74	75	864
		8-9-68	--	--	--	868
		10-14-68	9:30 AM	50	--	1,650*
N. Umpqua River	0.5 mi. below Wright Creek	7-16-68	2:30 PM	56	--	856
N. Umpqua River	Below Steamboat Creek	5-2-68	10:45 AM	48	--	
		5-28-68	9:50 AM	52	56	
		6-29-68	12:30 PM	59	60	
		7-30-68	12:10 PM	65	88	
		10-3-68	11:15 AM	50	70	
N. Umpqua River	Above Panther Creek	7-16-68	--	56	--	611
		7-30-68	11:50 AM	61	78	630
		9-4-68	2:40 PM	68	78	630
		10-3-68	11:15 AM	48	63	600*
N. Umpqua River	0.1 mi. above Toketee Res.	5-28-68	2:40 PM	50	67	500*
		6-29-68	9:30 AM	49	48	700*
		7-30-68	9:35 AM	52	62	700*
		9-4-68	1:35 PM	52	78	700*
		10-3-68	9:45 AM	46	44	700*
		10-23-68	--	--	--	600*
Sutherlin Creek	0.1 mi. above mouth	5-1-68	2:00 PM	58	66	2.7
		5-27-68	12:30 PM	69	70	1.7
		6-28-68	4:15 PM	70	--	Less than 0.1*
		7-27-68	5:00 PM	--	85	Intermittent
		9-5-68	12:45 PM	--	77	Intermittent
		10-30-68	8:25 AM	53	46	13

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Little River	Below Cavitt Creek	7-1-68	8:55 AM	61	57	59
		7-30-68	5:00 PM	78	90	35*
		8-27-68	4:00 PM	62	63	63
		10-3-68	5:20 PM	57	--	33
		10-25-68	2:10 PM	52	--	171
Little River	Above Emile Creek	5-1-68	4:15 PM	55	--	53
		5-27-68	2:15 PM	54	70	150*
		7-1-68	10:00 AM	59	66	25
		7-30-68	5:35 PM	76	90	18
		8-27-68	3:25 PM	60	61	29
		10-3-68	5:05 PM	55	--	15
Cavitt Creek	0.2 mi. above mouth	5-1-68	3:35 PM	57	68	26
		5-27-68	1:40 PM	57	70	66
		7-1-68	9:30 AM	59	57	19
		7-30-68	5:05 PM	76	90	6.1
		8-27-68	2:55 PM	63	63	29
		10-3-68	4:45 PM	58	66	7.0*
Emile Creek	Mouth	5-1-68	4:00 PM	52	--	10
		5-27-68	2:05 PM	53	70	25
		7-1-68	9:55 AM	56	66	4.5
		7-30-68	5:40 PM	73	90	0.8*
		8-27-68	4:00 PM	57	61	7.8
		10-3-68	5:00 PM	56	--	2.4
Rock Creek	Just above Conley Cr.	5-2-68	10:00 AM	48	--	91
		5-27-68	3:00 PM	57	74	300
		6-29-68	4:20 PM	63	65	54
		7-30-68	3:55 PM	78	89	20
		9-4-68	5:30 PM	72	78	26
		10-3-68	3:45 PM	61	65	26
		11-6-68	--	--	--	500*

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Rock Creek	2.0 mi. above E.Fk. Rock Cr.	5-2-68	9:40 AM	44	52	43
		5-27-68	4:15 PM	53	70	158
		6-29-68	4:50 PM	58	62	26
		7-30-68	4:10 PM	76	89	13
		9-4-68	5:50 PM	71	78	20
		10-3-68	4:05 PM	58	66	12
		11-7-68	--	50	--	187
E.Fk. Rock Creek	0.3 mi. above mouth	5-2-68	9:15 AM	47	52	30
		5-27-68	3:55 PM	59	75	56
		6-29-68	4:40 PM	62	62	16
		7-30-68	4:20 PM	80	91	6.5
		9-4-68	5:40 PM	73	78	9.7
		10-3-68	4:00 PM	62	65	9.9
		11-7-68	--	52	--	113
Honey Creek	Mouth	5-2-68	6:00 PM	60	--	1.7
		5-28-68	3:40 PM	55	67	7.5
		6-29-68	3:45 PM	60	62	1.3
		7-30-68	3:35 PM	--	91	Less than 0.1*
		9-4-68	5:10 PM	65	80	0.3*
		10-3-68	3:30 PM	56	--	0.3*
Susan Creek	Mouth	5-2-68	10:25 AM	47	--	3.2
		5-28-68	9:35 AM	53	57	5.4
		6-29-68	3:35 PM	57	62	2.0
		7-20-68	3:25 PM	67	91	1.5*
		9-4-68	5:05 PM	64	80	1.5*
		10-3-68	3:15 PM	56	65	1.2
Williams Creek	Mouth	10-21-68	11:45 AM	48	48	9.2
Steamboat Creek	0.1 mi. above mouth	10-21-68	12:00 (N)	48	48	560
		10-25-68	3:30 PM	50	--	185
		10-28-68	4:30 PM	50	--	95
		11-6-68	2:40 PM	46	--	300

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow (cfs)
Steamboat Creek	USGS Gage #14-3167	5-2-68	12:10 PM	50	64	186*
		5-28-68	10:00 AM	52	55	591*
		6-29-68	12:35 PM	60	60	96*
		7-30-68	12:45 PM	71	90	30*
		9-4-68	2:55 PM	68	78	64*
Steamboat Creek	0.1 mi. above Canton Cr.	7-30-68	3:00 PM	74	88	20*
		10-3-68	1:30 PM	52	81	43
		10-25-68	3:15 PM	50	--	160
		11-6-68	3:00 PM	45	--	249
Steamboat Creek	0.2 mi. above Big Bend Cr.	6-29-68	2:35 PM	60	58	27
		7-30-68	2:35 PM	74	92	7.7
		9-4-68	4:20 PM	68	75	15
		10-3-68	2:30 PM	54	64	14
		10-21-68	1:40 PM	47	49	219
		10-28-68	4:15 PM	49	--	34
		10-31-68	3:30 PM	48	--	137
		11-6-68	3:35 PM	45	--	86
Canton Creek	0.5 mi. above mouth	5-2-68	12:00 (N)	50	--	55
		5-28-68	11:05 AM	53	60	190
		6-29-68	12:45 PM	59	58	37
		7-30-68	1:40 PM	74	91	13*
		9-4-68	3:35 PM	70	78	17
		10-3-68	12:30 PM	56	--	23
		10-25-68	4:00 PM	48	--	66
		11-6-68	4:30 PM	45	--	112
Canton Creek	Above Pass Creek	5-2-68	11:15 AM	47	--	15
		5-28-68	10:25 AM	48	55	51
		6-29-68	1:25 PM	53	58	9.6
		7-30-68	1:15 PM	64	90	3.0*
		9-4-68	3:15 PM	61	78	4.0*
		10-3-68	12:45 PM	50	--	2.4

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Pass Creek	Mouth	5-2-68	11:30 AM	46	--	15
		5-28-68	10:35 AM	49	55	100*
		6-29-68	1:15 PM	56	58	16
		7-30-68	1:10 PM	67	90	2.5*
		9-4-68	3:15 PM	63	78	4.0*
		10-3-68	1:00 PM	53	80	2.5*
		10-21-68	3:15 PM	47	51	63
Steelhead Creek	0.1 mi. above mouth	5-2-68	12:40 PM	48	--	8.4
		5-28-68	11:40 AM	52	61	35
		6-29-68	2:10 PM	55	62	4.5
		7-30-68	1:55 PM	67	91	2.0*
		9-4-68	3:55 PM	64	78	5.0
		10-3-68	2:00 PM	54	76	3.1
		11-6-68	3:55 PM	45	--	24
Big Bend Creek	Mouth	5-2-68	1:00 PM	47	66	52
		5-28-68	11:55 AM	51	61	133
		6-29-68	2:25 PM	54	62	30
		7-30-68	2:15 PM	65	92	14
		9-4-68	4:15 PM	60	72	19
		10-3-68	2:15 PM	50	64	13
Cedar Creek	Mouth	5-2-68	1:15 PM	57	68	3.2
		5-28-68	12:05 PM	53	61	14
		6-29-68	2:50 PM	60	58	2.7
		7-30-68	2:40 PM	80	92	1.1
		9-4-68	4:30 PM	71	75	1.4
		10-3-68	2:35 PM	60	64	1.3
		10-21-68	1:50 PM	49	50	30
Limpy Creek	Just above Panther Cr.	5-2-68	2:35 PM	55	68	6.0
		5-28-68	1:15 PM	54	63	14
		6-29-68	11:35 AM	54	59	3.5

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Limpy Creek (cont.)	Just above Panther Cr.	7-30-68	11:20 AM	63	78	1.3
		9-4-68	2:35 PM	63	78	2.2
		10-3-68	11:30 AM	50	--	1.5
		10-31-68	4:20 PM	48	--	22*
Panther Creek	Mouth	5-2-68	2:20 PM	50	68	3.6
		5-28-68	1:05 PM	53	63	3.7
		6-29-68	11:30 AM	54	59	2.1
		7-30-68	11:15 AM	63	78	0.5*
		9-4-68	2:30 PM	61	78	0.8*
		10-3-68	11:30 AM	49	70	0.7
		10-31-68	4:10 PM	48	--	9.2
Calf Creek	0.1 mi. above mouth	5-2-68	2:50 PM	51	75	33
		5-28-68	1:35 PM	53	63	28
		6-29-68	11:15 AM	53	59	8.5
		7-30-68	11:00 AM	64	78	1.4
		9-4-68	2:25 PM	64	78	2.5*
		10-3-68	11:00 AM	49	--	2.0*
		11-6-68	2:20 PM	43	--	48
Copeland Creek	Mouth	5-2-68	3:05 PM	52	75	39
		5-28-68	1:55 PM	56	64	45
		6-29-68	11:00 AM	56	57	19
		7-30-68	10:50 AM	66	73	8.1
		9-4-68	2:10 PM	66	78	7.7
		10-3-68	10:50 AM	50	62	7.2
		11-6-68	2:00 PM	43	--	52
Boulder Creek	Mouth	5-2-68	3:35 PM	47	--	35
		5-28-68	2:00 PM	--	65	30*
		6-29-68	10:15 AM	53	50	16
		7-30-68	10:30 AM	--	70	2.0*
		9-4-68	2:05 PM	--	78	3.0*
		10-3-68	10:45 AM	--	62	2.0*

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Fish Creek	Mouth	5-28-68	2:10 PM	--	65	70*
		6-29-68	9:55 AM	--	48	35*
		7-30-68	10:20 AM	--	64	15*
		9-4-68	2:00 PM	--	78	12*
Clearwater River	Mouth	5-2-68	5:10 PM	45	--	135
		5-28-68	2:30 PM	50	67	115
		6-29-68	9:40 AM	43	48	104
		7-30-68	10:00 AM	49	62	320*
		9-4-68	1:45 PM	47	48	101
		10-3-68	10:00 AM	44	46	101
		10-28-68	--	--	--	70*
S. Umpqua River	0.1 mi. above Kent Cr.	7-9-68	11:30 AM	77	80	125
		7-26-68	3:05 PM	75	88	68
		9-3-68	4:45 PM	78	80	110
		10-2-68	4:00 PM	64	72	137
		10-22-68	4:20 PM	55	55	710
		10-29-68	9:15 AM	55	--	283
S. Umpqua River	0.5 mi. above Clark Branch Cr.	7-9-68	12:30 PM	77	85	122
		7-26-68	2:20 PM	75	87	70
		10-22-68	3:50 PM	54	55	672
		10-29-68	8:30 AM	54	--	263
S. Umpqua River	0.5 mi. above Packard Gulch Cr.	5-3-68	--	--	--	435
		5-17-68	--	--	--	242
		5-24-68	3:25 PM	59	56	502
		6-4-68	--	--	--	250
		6-28-68	2:45 PM	63	64	117
		7-3-68	--	--	--	120
		7-29-68	3:40 PM	85	94	55
		9-3-68	3:35 PM	74	84	82

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
S. Umpqua River (cont.)	0.5 mi. above Packard Gulch Cr.	10-2-68	2:15 PM	62	70	75
		10-15-68	--	51	--	180
		10-29-68	10:30 AM	54	--	138
		11-4-68	10:30 AM	47	45	462
S. Umpqua River	USGS Gage #14-3080	4-30-68	3:35 PM	56	60	332*
		5-24-68	2:30 PM	57	55	392*
		6-28-68	1:50 PM	68	59	95*
		7-29-68	2:20 PM	80	94	53*
		9-3-68	1:30 PM	71	82	60*
		10-2-68	12:30 PM	--	69	53*
		10-22-68	12:45 PM	--	52	270*
Deer Creek	0.2 mi. above mouth	4-29-68	10:40 AM	58	63	12
		5-23-68	9:00 AM	57	53	16
		6-27-68	8:30 AM	67	68	1.2
		7-26-68	9:10 AM	63	65	0.1*
		8-27-68	8:50 AM	64	63	2.8
		10-4-68	9:00 AM	55	--	1.5
		10-31-68	1:45 PM	54	--	19
		11-3-68	2:10 PM	50	--	25
		11-18-68	--	53	--	83
N.Fk. Deer Creek	Mouth	4-29-68	11:00 AM	55	64	2.3
		5-23-68	8:45 AM	55	52	3.8
		6-27-68	9:00 AM	65	68	0.4
		7-26-68	8:55 AM	62	64	0.5*
		8-27-68	8:30 AM	61	62	1.2
		10-4-68	8:30 AM	55	--	0.8
		10-31-68	2:15 PM	53	--	3.7
		11-3-68	2:45 PM	50	--	5.8
		11-7-68	--	54	--	14
		11-18-68	--	53	--	22

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
S.Fk. Deer Creek	Mouth	4-29-68	11:05 AM	56	64	7.9
		5-23-68	8:40 AM	57	52	8.3
		6-27-68	9:00 AM	67	68	1.4
		7-26-68	8:55 AM	65	64	0.4*
		8-27-68	8:30 AM	64	62	1.8
		10-4-68	8:30 AM	57	--	1.0
		10-31-68	2:00 PM	54	--	11
		11-3-68	2:35 PM	51	--	17
		11-7-68	--	54	--	23
		11-18-68	--	53	--	37
Roberts Creek	2 mi. above mouth	5-1-68	8:55 AM	52	48	1.3
		5-27-68	8:30 AM	59	55	1.0
		6-27-68	5:00 PM	68	--	Intermittent
		7-26-68	4:40 PM	--	90	Dry
		10-2-68	5:00 PM	--	70	Dry
		11-3-68	9:10 AM	48	--	1.0*
		11-10-68	10:55 AM	52	--	9.1
		11-12-68	10:00 AM	49	--	93
Lookingglass Creek	Mouth	5-1-68	9:30 AM	57	50	31
		5-27-68	9:05 AM	62	59	40
		6-27-68	4:20 PM	79	70	0.3
		7-26-68	4:30 PM	--	90	Intermittent
		8-28-68	12:40 PM	--	68	Dry
		10-2-68	4:50 PM	60	71	2.5*
		10-31-68	3:05 PM	--	--	70
		11-5-68	--	57	--	54
		11-18-68	--	52	--	198
Lookingglass Creek	Above Olalla Creek	5-1-68	1:05 PM	58	60	3.0
		5-27-68	11:30 AM	60	67	5.4
		6-27-68	4:00 PM	68	70	0.3*

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Lookingglass Cr. (cont.)	Above Olalla Creek	7-26-68	4:15 PM	73	89	Less than 0.1*
		8-28-68	1:15 PM	67	68	0.1*
		10-2-68	4:40 PM	64	70	0.1*
		10-31-68	4:15 PM	52	--	4.0*
		11-3-68	1:00 PM	48	--	8.0*
		11-18-68	1:55 PM	52	--	23
Olalla Creek	0.7 mi. above mouth	5-1-68	12:45 PM	62	59	23
		5-27-68	11:30 AM	64	66	26
		6-27-68	3:45 PM	74	70	1.5
		7-26-68	4:10 PM	--	89	Intermittent
		10-2-68	4:50 PM	64	70	1.2
		10-31-68	4:10 PM	52	--	55
		11-3-68	12:40 PM	49	--	95
		11-5-68	--	49	--	48
		11-18-68	--	48	--	145
Olalla Creek	1 mi. below Tenmile Cr.	5-13-68	--	--	--	15
		8-28-68	3:30 PM	73	70	3.5*
		10-2-68	4:30 PM	64	72	1.5*
		10-31-68	3:45 PM	52	--	56
		11-3-68	11:50 AM	48	--	101
		11-5-68	--	48	--	39
		11-18-68	--	52	--	132
Olalla Creek	0.5 mi. below Berry Cr.	5-13-68	--	--	--	6.8
		6-27-68	2:40 PM	75	70	2.2
		7-26-68	3:30 PM	80	88	0.3*
		8-28-68	3:10 PM	69	68	2.5*
		10-4-68	1:45 PM	59	--	1.0*
		11-3-68	10:00 AM	47	--	40
		11-5-68	--	48	--	22
		11-18-68	--	51	--	69

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Tenmile Creek	0.4 mi. below Shields Creek	5-1-68	11:10 AM	54	56	10
		5-27-68	10:40 AM	60	64	10
		6-27-68	3:20 PM	77	70	0.3*
		7-26-68	3:50 PM	83	89	0.1*
		10-4-68	2:05 PM	58	--	0.4*
		11-3-68	10:30 AM	47	--	31
		11-18-68	--	50	--	47
Tenmile Creek	0.5 mi. above Shields Creek	5-1-68	11:35 AM	56	56	6.5
		5-27-68	10:50 AM	60	64	7.6
		6-27-68	3:30 PM	72	70	0.2*
		7-26-68	3:55 PM	80	89	Less than 0.1*
		8-28-68	2:35 PM	69	68	2.0*
		10-4-68	2:10 PM	57	--	0.7*
		11-3-68	11:05 AM	47	--	28
		11-18-68	3:10 PM	52	--	31
Shields Creek	0.6 mi. above mouth	5-1-68	11:05 AM	52	55	1.2
		5-27-68	10:25 AM	58	62	1.2
		6-27-68	3:15 PM	69	70	0.1*
		7-26-68	3:45 PM	--	89	Intermittent
		8-5-68	--	--	--	Dry
		10-4-68	2:00 PM	60	--	Intermittent
		11-3-68	10:25 AM	47	--	7.8
		11-18-68	3:30 PM	52	--	11
Berry Creek	0.1 mi. above mouth	5-1-68	10:50 AM	53	--	2.9
		5-27-68	10:10 AM	60	60	3.0
		6-27-68	2:55 PM	73	--	Less than 0.1*
		8-5-68	--	--	--	Dry
		10-4-68	1:40 PM	58	--	0.2*
		11-3-68	9:45 AM	48	--	11
		11-18-68	4:00 PM	52	--	15

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Kent Creek	0.1 mi. above mouth	5-1-68	9:50 AM	51	50	1.2
		5-27-68	9:15 AM	56	59	0.4
		6-27-68	2:40 PM	--	70	Dry
		7-26-68	3:10 PM	--	88	Dry
		9-3-68	5:00 PM	--	80	Dry
		10-2-68	4:15 PM	--	72	Dry
		11-3-68	1:20 PM	48	--	1.0*
		11-10-68	11:15 AM	52	--	2.0*
		11-12-68	10:15 AM	50	42	20
Rice Creek	Mouth	5-1-68	10:00 AM	52	50	2.0
		5-27-68	9:25 AM	58	59	1.5
		6-27-68	2:30 PM	65	69	0.3*
		7-26-68	2:40 PM	--	87	Less than 0.1*
		9-3-68	4:25 PM	67	83	0.1*
		10-2-68	3:30 PM	57	72	0.3*
		11-3-68	1:25 PM	49	--	2.0*
		11-10-68	11:25 AM	53	--	7.6
		11-12-68	10:30 AM	50	42	44
Willis Creek	0.4 mi. above mouth	5-1-68	10:15 AM	52	51	2.0
		5-27-68	9:35 AM	59	60	1.7
		6-27-68	2:35 PM	65	69	0.1*
		7-26-68	2:45 PM	--	87	Less than 0.1*
		9-3-68	4:30 PM	--	83	0.1*
		10-2-68	3:40 PM	57	72	0.2*
		11-10-68	11:35 AM	54	--	13
N. Myrtle Creek	0.1 mi. above mouth	4-29-68	11:45 AM	58	67	16
		5-23-68	9:50 AM	56	52	18
		6-27-68	9:30 AM	65	68	2.6
		7-26-68	9:40 AM	63	67	1.0*
		8-27-68	9:30 AM	62	63	9.7
		10-4-68	9:15 AM	56	--	5.9
		10-22-68	3:15 PM	57	55	24
		11-19-68	--	50	--	63

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
S. Myrtle Creek	0.1 mi. above mouth	4-29-68	12:10 PM	59	69	11
		5-23-68	10:00 AM	56	52	19
		6-27-68	9:45 AM	65	68	1.2
		7-26-68	9:40 AM	--	67	Intermittent
		8-27-68	9:25 AM	63	63	7.4
		10-4-68	9:30 AM	55	--	5.4
		10-22-68	2:55 PM	54	55	22
		11-15-68	1:50 PM	47	--	104
Cow Creek	Just below Crawford Creek	5-23-68	2:00 PM	60	59	230
		6-27-68	1:00 PM	74	70	63
		7-26-68	1:10 PM	76	80	39
		8-27-68	1:50 PM	67	72	96
		10-4-68	12:20 PM	59	--	34
		10-31-68	2:20 PM	52	--	350*
		11-4-68	12:30 PM	49	47	403
Cow Creek	0.6 mi. above Smith Creek	6-5-68	--	--	--	111
		7-3-68	--	--	--	53
		10-15-68	--	51	--	330
Cow Creek	0.5 mi. above Riffle Creek	4-29-68	3:20 PM	64	81	134
		5-23-68	12:45 PM	58	57	86
		6-27-68	11:45 AM	73	68	23
		7-26-68	11:40 AM	71	70	7.7
		8-27-68	12:25 PM	64	66	40
		10-4-68	11:20 AM	56	55	21
		10-15-68	--	--	--	57
Cow Creek	0.1 mi. below Windy Creek	5-13-68	--	--	--	55
		6-5-68	--	--	--	40
		7-26-68	11:10 AM	69	70	3.2
		8-27-68	11:15 AM	69	62	26
		10-4-68	10:50 AM	58	55	11

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Cow Creek (cont.)	0.1 mi. below Windy Creek	10-31-68	12:50 PM	52	--	94
		11-1-68	--	52	--	70
		11-15-68	--	53	--	197
		11-19-68	3:30 PM	48	--	162
Cow Creek	USGS Gage #14-3090	4-29-68	5:10 PM	57	79	40*
		5-23-68	10:55 AM	54	51	29*
		6-27-68	10:40 AM	67	68	12*
		7-26-68	10:30 AM	65	68	10.0*
		8-27-68	10:30 AM	60	65	15*
		10-4-68	10:20 AM	54	52	9.5*
		10-31-68	11:20 AM	48	--	29*
W.Fk. Cow Creek	Mouth	6-27-68	12:20 PM	69	69	16
		7-26-68	12:25 PM	71	74	12
		8-27-68	1:00 PM	63	70	49
		10-4-68	11:45 AM	56	--	11
Middle Creek	Mouth	4-29-68	2:35 PM	59	80	16
		5-23-68	1:05 PM	55	54	24
		6-27-68	12:20 PM	67	69	5.8
		7-26-68	12:10 PM	65	74	4.3
		8-27-68	12:50 PM	61	66	8.5
		10-4-68	11:30 AM	54	--	4.3
		10-31-68	1:45 PM	50	--	27
		11-12-68	2:15 PM	48	--	240*
		11-19-68	3:00 PM	47	--	40
Riffle Creek	Mouth	4-29-68	2:50 PM	61	80	9.1
		5-23-68	1:00 PM	57	56	24
		6-27-68	12:00 (N)	67	68	3.2
		7-26-68	11:50 AM	67	70	2.6
		8-27-68	12:35 PM	61	66	6.3
		10-4-68	11:25 AM	54	--	2.0

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Riffle Creek (cont.)	Mouth	10-31-68	1:30 PM	50	--	12*
		11-12-68	2:00 PM	49	--	123
		11-19-68	2:45 PM	48	--	40
Windy Creek	Mouth	4-29-68	4:00 PM	64	82	10
		5-23-68	12:05 PM	55	53	10
		6-27-68	11:15 AM	63	68	1.0
		7-26-68	11:00 AM	63	70	0.6*
		8-27-68	11:00 AM	61	65	2.2
		10-4-68	10:45 AM	56	55	1.4
		10-31-68	12:40 PM	52	--	10*
		11-12-68	1:15 PM	49	--	84
		11-19-68	1:30 PM	51	--	22
Quines Creek	Mouth	4-29-68	4:30 PM	60	82	5.2
		5-23-68	11:20 AM	52	52	7.6
		6-27-68	10:55 AM	64	68	1.0*
		7-26-68	10:45 AM	--	69	Dry
		8-27-68	10:45 AM	62	65	1.0*
		10-4-68	10:30 AM	--	--	Dry
		10-31-68	11:35 AM	49	--	4.0*
		11-12-68	12:30 PM	47	--	48
Starvout Creek	Mouth	4-29-68	4:45 PM	61	80	2.8
		5-23-68	10:30 AM	52	50	2.9
		6-27-68	10:15 AM	--	68	Dry
		7-26-68	10:10 AM	--	68	Dry
		8-27-68	10:05 AM	59	64	0.6*
		10-4-68	10:00 AM	--	52	Dry
		10-31-68	11:00 AM	49	--	4.7
		11-12-68	11:45 AM	47	42	31

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Whitehorse Creek	Mouth	4-29-68	5:05 PM	59	79	3.7
		5-23-68	10:50 AM	52	50	3.0
		6-27-68	10:30 AM	62	68	0.9
		7-26-68	10:15 AM	61	68	0.4*
		8-27-68	10:15 AM	58	63	1.3
		10-4-68	10:10 AM	53	52	0.6
		10-31-68	11:15 AM	48	--	4.0*
		11-12-68	12:00 (N)	46	42	32
Canyon Creek	0.1 mi. above mouth	4-30-68	5:15 PM	61	--	12
		5-24-68	3:55 PM	56	56	15
		6-28-68	3:00 PM	63	64	4.0
		7-29-68	4:05 PM	81	92	1.0*
		9-3-68	3:55 PM	76	85	2.5*
		10-2-68	3:00 PM	64	72	3.0
		10-15-68	--	51	--	15
		11-12-68	3:20 PM	49	--	138
		11-15-68	--	50	--	40
		11-19-68	10:00 AM	52	--	25
O'Shea Creek	Mouth	4-30-68	5:05 PM	60	--	2.3
		5-24-68	3:45 PM	55	56	2.2
		6-28-68	2:55 PM	65	64	Less than 0.1*
		7-29-68	4:00 PM	--	93	Dry
		9-3-68	3:50 PM	--	84	Less than 0.1*
		10-2-68	2:45 PM	62	72	0.3*
		11-12-68	11:10 AM	49	--	21
Days Creek	0.1 mi. above mouth	4-30-68	4:45 PM	62	--	6.4
		5-24-68	3:10 PM	57	58	6.3
		6-28-68	2:35 PM	64	--	0.6
		7-29-68	3:20 PM	--	94	Intermittent
		9-3-68	3:15 PM	71	84	0.7
		10-2-68	2:00 PM	57	70	1.1

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Days Creek (cont.)	0.1 mi. above mouth	10-22-68	2:10 PM	56	55	8.2
		10-31-68	9:50 AM	50	--	4.1
		11-8-68	3:30 PM	52	--	112
		11-19-68	--	49	--	29
Coffee Creek	Mouth	4-30-68	4:10 PM	64	--	4.3
		5-24-68	2:45 PM	57	55	7.5
		6-28-68	2:10 PM	65	62	1.7
		7-29-68	3:10 PM	79	94	0.4*
		9-3-68	2:55 PM	69	80	1.1
		10-2-68	1:45 PM	56	70	1.0
		10-31-68	10:10 AM	48	--	4.5*
		11-8-68	3:10 PM	51	--	140*
		11-19-68	10:30 AM	47	--	28
Elk Creek	USGS Gage #14-3085	4-30-68	3:20 PM	64	58	14*
		5-24-68	2:15 PM	54	57	14*
	1 mi. below USGS #14-3085	6-28-68	2:00 PM	67	60	3.4
		7-29-68	2:55 PM	81	94	1.5*
		9-3-68	2:40 PM	69	82	2.8
	USGS Gage #14-3085	10-2-68	1:30 PM	57	70	0.8*
		10-22-68	1:35 PM	56	--	5.5*
		11-8-68	2:05 PM	51	--	108*
		11-19-68	11:00 AM	48	--	67*
Jackson Creek	USGS Gage #14-3077	4-30-68	1:15 PM	56	60	136*
		5-24-68	12:30 PM	52	56	160*
		6-28-68	12:15 PM	65	62	118*
		7-29-68	1:05 PM	73	89	18*
		9-3-68	12:35 PM	62	74	18*
		10-2-68	11:40 AM	53	64	18*
		10-22-68	12:30 PM	47	52	55*

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Jackson Creek	0.4 mi. above Squaw Creek	4-30-68	2:15 PM	52	59	60
		5-24-68	1:20 PM	50	56	84
		6-28-68	12:40 PM	58	60	11
		7-29-68	1:35 PM	70	87	7.5
		9-3-68	1:05 PM	59	72	7.9
		10-2-68	12:00 (N)	52	65	7.4
		10-22-68	12:05 PM	47	49	32
Beaver Creek	0.3 mi. above mouth	4-30-68	1:25 PM	56	60	10
		5-24-68	12:45 PM	54	57	8.6
		6-28-68	12:30 PM	63	61	2.4
		7-29-68	1:15 PM	72	90	1.0*
		9-3-68	12:45 PM	63	74	2.0*
		10-2-68	11:45 AM	54	64	1.0*
		10-22-68	11:20 AM	48	51	11
		11-8-68	2:45 PM	51	--	150*
		11-19-68	12:10 PM	45	--	64
Squaw Creek	Mouth	4-30-68	1:50 PM	49	49	61
		5-24-68	1:10 PM	46	56	64
		6-28-68	12:45 PM	57	60	12
		7-29-68	1:40 PM	67	87	5.2
		9-3-68	1:10 PM	60	72	6.4
		10-2-68	12:05 PM	53	65	7.1
		10-22-68	11:45 AM	45	49	20
Deadman Creek	Mouth	4-30-68	1:05 PM	56	60	19
		5-24-68	12:20 PM	55	56	26
		6-28-68	12:00 (N)	60	62	5.0
		7-29-68	12:50 PM	77	89	1.5*
		9-3-68	12:30 PM	67	74	3.3
		10-2-68	11:30 AM	57	62	2.5
		10-22-68	11:00 AM	48	50	23

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Boulder Creek	Mouth	4-30-68	12:35 PM	53	60	18
		5-24-68	11:50 AM	51	60	16
		6-28-68	11:40 AM	59	61	5.2
		7-29-68	12:30 PM	71	85	2.0*
		9-3-68	12:05 PM	62	73	3.6
		10-2-68	11:05 AM	55	60	2.5
		10-22-68	10:25 AM	47	48	31
Buckeye Creek	0.2 mi. above mouth	4-30-68	12:15 PM	52	60	6.0
		5-24-68	11:50 AM	51	60	7.0*
		6-28-68	11:25 AM	58	--	2.1
		7-29-68	12:10 PM	70	85	0.7*
		9-3-68	11:15 AM	60	67	1.0*
		10-2-68	10:50 AM	52	--	0.8
		10-22-68	9:50 AM	46	47	11
Quartz Creek	Mouth	4-30-68	11:45 AM	49	--	28
		5-24-68	11:15 AM	49	57	16
		6-28-68	11:05 AM	56	--	9.6
		7-29-68	11:45 AM	67	82	4.5
		9-3-68	11:30 AM	59	64	4.3
		10-2-68	10:35 AM	53	54	4.4
Black Rock Creek	Mouth	4-30-68	10:50 AM	48	49	65
		5-24-68	10:30 AM	46	55	53
		6-28-68	10:15 AM	52	56	13
		7-29-68	10:55 AM	65	72	5.2
		9-3-68	10:55 AM	58	60	9.7
		10-2-68	10:00 AM	52	46	11
Castle Rock Creek	0.2 mi. above mouth	4-30-68	10:20 AM	46	49	75
		5-24-68	10:00 AM	47	55	97
		6-28-68	10:00 AM	55	56	22
		7-29-68	10:40 AM	63	72	10
		9-3-68	10:45 AM	57	60	15
		10-2-68	9:50 AM	50	46	11

Appendix 3. (continued)

Stream	Location	Date	Time	Temp. °F. Water	Air	Flow (cfs)
Fish Lake Creek	0.5 mi. above mouth	4-30-68	11:20 AM	51	--	25
		5-24-68	10:50 AM	51	57	25
		6-28-68	10:45 AM	56	56	5.3
		7-29-68	11:25 AM	64	82	3.5
		9-3-68	11:10 AM	58	60	4.4
		10-2-68	10:10 AM	50	--	1.9

* Gaged or estimated flows, others were measured.

Appendix 4. Recommended angling flows for selected Umpqua Basin streams 1/ 2/

	April-September	October-March
Umpqua River	3,500	3,500
Smith River	100	400
North Umpqua River	1,500	1,500
South Umpqua River	1,200	1,200

1/ Flows are expressed in cubic feet per second.

2/ All flows are to reach the mouth of the stream.

Appendix 5. Sections of selected Umpqua Basin streams that should have flow protection because of their esthetic value

Stream	Area
Umpqua River	Entire
North Umpqua River	Entire
Steamboat Creek	Entire
South Umpqua River	Above Tiller
Cow Creek	Above Azalea

Appendix 6. Potential reservoir sites presently thought compatible with fishery resources, Umpqua Basin 1/

Stream	Location
Olalla Creek	T29S - R7W - S21
Cow Creek	T31S - R4W - S33
South Umpqua River	T30S - R4W - S16
North Myrtle Creek	T28S - R4W
South Myrtle Creek	T29S - R3W
Calapooya Creek	T24S - R3W
Elk Creek	T23S - R4W

1/ Detailed studies should be conducted to determine total impact to fish and wildlife before any of the above sites are considered for development.

Appendix 7. Oregon State Game Commission fish stocking in the Umpqua Basin, 1963-67 1/

Stream or Lake	Species 2/	Size 3/	1963	1964	1965	1966	1967
Black Rock Cr.	Rb	L					80
Buckeye Lake	BT	F		2,011		2,003	1,996
Calamut Lake	BT	F	2,021	2,011		2,003	1,996
Calapooya Creek	Rb	L	4,999	3,000		3,001	2,000
Calf Creek	StS	L					2,366
Camp Creek	Ct	F			1,129		
Canton Creek	StS	L					3,109
Cavitt Creek	Rb	L	330				240
" "	StW	F			20,485		
Cavitt Lake	Rb	F	1,045	1,012			
" "	Rb	L					400
Clearwater Res.	Rb	F	5,005	5,016			
Cliff Lake	Bt	F	2,525			2,003	1,996
Copeland Creek	StS	L					10,463
Cow Creek	Rb	L	4,995	4,000	4,002	3,993	4,000
Cultus Lake	Rb	L					200
Diamond Lake	Rb	F	499,981	499,744	500,420	400,126	420,061

Appendix 7. (continued)

Stream or Lake	Species 2/	Size 3/	1963	1964	1965	1966	1967
Emile Creek	Rb	F	291	1,008	952		
" "	Rb	L					1,000
Fish Lake	BT	F		5,017		9,902	5,010
" "	Rb	F		5,040			
French Branch Cr.	StW	F				15,097	
Hemlock Creek	StS	F				22,140	
" "	StS	L					200
" "	Rb	L					200
Hemlock Meadows	St	F		20,060			
" " Res.	StS	F			108,626	29,995	
" "	Rb	F					15,006
Horse Lake	Rb	F					4,743
Jackson Creek	Rb	L					2,004
Lake of the Woods	Rb	F	3,625	3,015	4,012		
" " "	Rb	L					2,995
Lemolo Reservoir	BT	F	50,256	50,321	100,050		
" "	K	F	93,433	95,550	89,822	88,540	100,185
" "	Rb	F	100,009	99,987	192,738	93,061	
" "	Rb	L					7,999
Linda Lake	Rb	F					3,275
Little River	Rb	F			5,848	25,092	
" "	Rb	L	5,997	2,996	3,002	2,998	3,838

Appendix 7. (continued)

Stream or Lake	Species 2/	Size 3/	1963	1964	1965	1966	1967
Little Twin Lake	BT	F	2,020				1,996
Loon Lake	Ct	L	4,000			1,824	
" "	Rb	L	9,999	8,002	8,002	6,002	8,003
Lucille Lake	BT	F	2,525	2,011		2,003	1,996
Maidu Lake	BT	F		3,006		2,995	2,994
N. Umpqua River	Ch	F		5,880		24,542	
" " "	Ct	L	10,014	10,100		19,987	20,085
" " "	St	L	124,157	115,867			
" " "	StS	L			29,872	100,159	93,288
" " "	StW	L			9,100	36,790	
" " "	Rb	L	74,955	67,600	63,674	53,004	53,981
Panther Creek	Rb	F		3,700			
Pass Creek	Rb	L					502
Plat I Reservoir	Rb	L					5,550
Rock Creek	Ch	F	4,348			2,975	165,472
" "	Ch	L	91,027	162,001	42,986	27,817	231,423
" "	Rb	F		7,292			
" "	StS	F			43,982		
" "	StW	F			35,779		
Skookum Lake	BT	F	3,030			2,995	1,996
Smith River	Rb	L				1,496	1,999
Soda Springs Res.	Rb	F	25,080	43,809	24,948	30,095	
" " "	Rb	L					1,001

Appendix 7. (continued)

Stream or Lake	Species 2/	Size 3/	1963	1964	1965	1966	1967
S. Umpqua River	Rb	L	34,856	24,978	21,180	15,988	24,994
Steamboat Creek	StS	L					30,100
Steelhead Creek	StS	F				2,492	
" "	StW	F				255	
Toketee Reservoir	Rb	F	75,078	75,016	100,627	55,135	
" "	Rb	L					3,000
Twin Lake	BT	F	2,525				1,996
Umpqua River	Ct	L			10,241		
" "	St	L		9,540			
" "	StS	L					7,900
Whistlers Bend Res.	Ch	F		49,050	63,442	58,866	
" " "	St	F	71,453				
White Creek	Rb	F	220				
Willow Creek Pond	Rb	F	547	1,009	5,232		
" " "	Rb	L					1,000
Wolfe Lake	BT	F				2,003	1,996

1/ Similar stocking rates were applied prior to 1963. Warm-water game fish liberation and adult salmon and steelhead transplants are not included.

2/ Species Abbreviations: BT, brook trout; Ch, chinook salmon; Ct, cutthroat trout; K, kokanee; Rb, rainbow trout, St, steelhead; Sts, steelhead (Summer); StW, steelhead (Winter).

3/ "F" - fry and/or fingerlings; "L" - yearling and/or legal sized.

Appendix 8. Lakes and reservoirs of the Umpqua Basin 1/

Name	Location			Surface Acres	Fish Species
	Township	Range	Section		
Beaver Lake	30S	1W	34	2	Rb
Buckeye Lake	29S	2E	12	7.5	BT
Calamut Lake	25S	5-1/2E	34	17	BT
Canyonville Pond	30S	5W	26	8.5	LB, BrB, BC
Cavitt Lake	28S	2W	11	4.0	Rb
Charline Lake	25S	5E	34	2	Too shallow
Clearwater #1 Forebay	26S	4E	35	17	Rb, BT, Br
Cliff Lake	29S	3E	7	5.5	BT
Cultus Lake	28S	2W	20	10	Rb
Diamond Lake	27 & 28 S	6E	32, 33, 6, 7, 8, 9, 21	2,993	Rb
Fish Creek Forebay	26S	31E	34		Rb
Fish Lake	29S	3E	5 & 6	90	BT, Rb
Ford's Pond	25S	6W	13 & 14		LB, BC, BrB, YP
Hemlock Meadows Reservoir	27S	1E	29	280	Rb
Horse Lake	28S	6E	17		Rb
Lake "O" Woods	27S	1E	17	4	Rb

Appendix 8. (continued)

Name	Location			Surface Acres	Fish Species
	Township	Range	Section		
Lemolo Reservoir	26S	5E	11, 13, 14, 24	475	BT, K, Rb, Br
Linda Lake	25-1/2S	6E	4	2	Rb
Little Twin Lake	27S	2E	9	10	BT
Loon Lake	23S	10W	2	269	WC, Ct, Rb, BrB, LB
Lucille Lake	27S	6-1/2E	4	9	BT
Maidu Lake	27S	6-1/2E	3	120	BT
Plat I Reservoir	25S	5W	14		Rb, Bq, BrB, Ct, Co, YP
Skookum Lake	28S	4E	3	15	BT
Stewart Park Pond	27S	6W	11	2	BC, LB
Soda Springs Reservoir	26S	3E	17	73.8	Rb, Br
Stump Lake	27S	5E	6	35	Rb, BT
Teal Lake	28S	6E	18	3	Rb
Toketee Reservoir	26S	3E	36	177.7	Rb, BT, Br, K
Twin Lake	27S	2E	9	14	BT
Wassen Lake	21S	9W	17	15	Ct
Whistlers Bend Reservoir	26S	4W	18	35	(Rearing Pond)

Appendix 8. (continued)

Name	Location			Surface Acres	Fish Species
	Township	Range	Section		
Willow Creek Pond	27S	1W	2	2	Rb
Wolf Lake	28S	3E	10	2	BT
Yellow Lake	20S	7W	29	10	Ct

1/ This list excludes a few small unsurveyed lakes.

Appendix 9. Values used in preparation of Tables 8, 11-13, and 15-18 and parts of the text

Daily gross expenditures by sportsmen 1/

Species	Expenditure per day
Sea-run cutthroat, shad, and striped bass	$ 18.50
Resident fish	6.00
Non-game marine fish	6.00
Sturgeon	6.00
Deer (black-tailed)	20.10
Elk (Roosevelt)	26.60
Small game	6.00
Waterfowl	8.00

Gross expenditure per animal harvested 1/

Species	Expenditure per animal harvested
Coho	$ 74.00
Chinook	74.00
Steelhead	74.00

1/ Source: Oregon State Game Commission

Appendix 9. (continued)

Ratios of commercial harvest to spawning escapement 2/

Species	Ratio
Coho	3 : 1
Chinook	3 : 1

Commercial fish values 2/

Species	Average Weight (lbs.)	Fisherman value per pound
Coho	8	$ 0.50
Chinook	12	0.70

2/ Source: Fish Commission of Oregon.

Appendix 10. Streams which should be protected from gravel removal

Stream	Reach of Stream
North Umpqua River system	Mouth to Soda Springs Dam
Smith River system	Entire
Umpqua River system	All tributaries below North and South Umpqua Rivers excluding Dean, Elk, and Calapooya Creeks