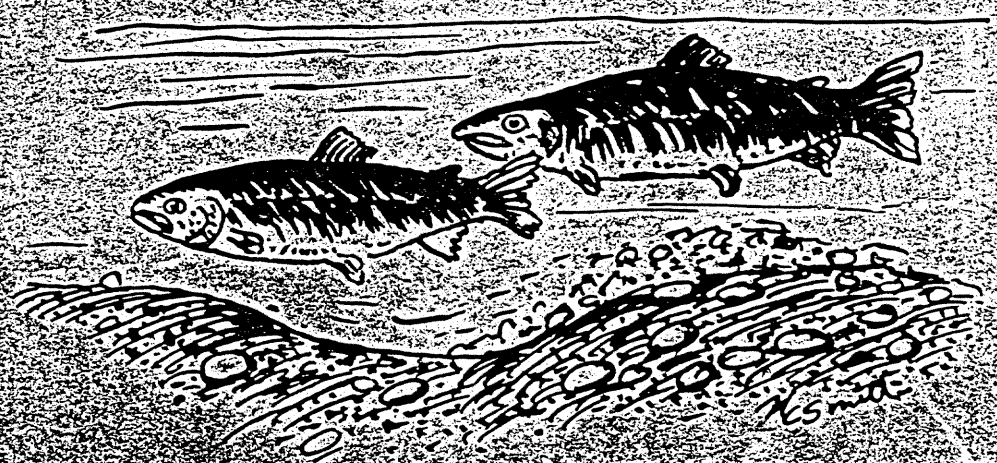
C. J. Campbell

Basin Investigations

NORTH COAST BASIN



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

A Report with Recommendations to the
OREGON STATE WATER RESOURCES BOARD

By

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Basin Investigations Section

FEDERAL AID TO FISH RESTORATION
Progress Report
Fisheries Stream Flow Requirements
Project F-69-R-5, Job Number 3

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INTRODUCTION

This report describes the water requirements of fish and wildlife in the North Coast Basin, outlines the procedures used for defining these requirements, and submits minimum perennial flow regimen necessary for maintaining reasonable levels of fish and wildlife production in the basin. Similar reports have been submitted to the State Water Resources Board since 1961 for nine other Oregon drainage basins.

Field studies relevant to this report were initiated in the spring of 1965 and terminated in the fall of 1966. Most of the investigations were conducted during the months of June through September of 1965 and 1966.

Personnel contributing to the study were aquatic biologist, James M. Hutchison, Gregory J. Hattan, and the authors. Consulting and documentary assistance were provided by Oregon State Game Commission district biologists, Wernald H. Christianson, Warren M. Knispel, and William E. Hosford, and personnel of the Fish Commission of Oregon, United States Geological Survey, and Oregon State Water Resources Board.

FISH RESOURCES OF THE NORTH COAST BASIN

Fish Populations

Salmon and steelhead are the most important game fish in the North Coast Basin. More than three times as much angler effort was expended on salmon and steelhead trout angling in 1965 than on any other group of fish. Four of nine species of anadromous fish found in the North Coast have basin-wide distribution. The four most common species are the winter steelhead trout, coho salmon, fall chinook salmon, and sea-run cutthroat trout. Summer steelhead trout, spring chinook salmon, chum salmon, pink salmon, and sturgeon are less widespread, but are well established in certain stream systems in the basin (Plate 1). Various index counts are regularly made on salmon and steelhead to evaluate their population levels (Tables 1, 2, 3, and 4). Shad and eulechon (smelt) migrate through the Columbia River but do not inhabit tributary streams.

Resident trout are indigenous to nearly all streams in the North Coast Basin. The majority of trout stocked in the lakes and streams of the basin are cutthroat, but plantings of rainbow are common in lakes (Appendix VI). Most cutthroat are anadromous, spending part of their life cycle in saltwater and returning to "cradle" streams as adults, 11 to 19 inches in length.

Table 1. Spring chinook salmon counts in the Wilson, Trask and Nestucca Rivers, 1962 and 1964 through 1967 1/

River	Year	Number of pools examined	Number of chinook counted
Wilson	1962 2/	17	152
	1964	4	110
	1965	10	11
	1966	8	21
	1967	10	8
Trask	1962 2/	20	526 3/
	1964	10	224
	1965	16	131 4/
	1966	12	40
	1967	19	86
Nestucca	1964	10	59
	1965	12	62
	1966	8	39
	1967	20	15

1/ Data obtained by skin and SCUBA diving.
2/ Source: Fish Commission of Oregon.
3/ Includes chinook salmon in pool below the F.C.O. Trask River Hatchery.
4/ Does not include the chinook salmon (300+) in the pool below the F.C.O. Trask River Hatchery.

Table 2. Three Rivers trap counts, 1961-64

Year	Months	Coho	Chinook	Steelhead
1960-61	Nov-Feb.	143	2	117
1961-62	Oct-Mar.	262	24	116
1962-63	Oct-Apr.	368	21	90
1963-64	Oct-Apr.	368	34	22 1/

1/ An unknown number of steelhead passed upstream uncounted when a segment of the trap washed out during high water.

Table 3. Chinook salmon spawning surveys, Nehalem River, 1960-67

Species	Year	Miles surveyed	Fish per mile	Total fish 1/
Fall chinook	1961	4	61.8	247 (19)
	1962	4	43.8	175 (27)
	1963	5	51.4	257 (50)
	1964	5	50.0	250 (26)
	1965	5	44.8	224 (56)
	1966	5	38.8	194 (19)
	1967	5	34.8	174 (16)
Summer chinook	1961	12	5.6	67 (6)
	1963	12	3.4	41 (10)
	1964	12	9.3	111 (7)
	1965	12	8.8	106 (7)
	1966	12	3.3	36 (6)
	1967	No survey made		

1/ Figures in parenthesis indicate jack salmon which are also included in the total.

Table 4. Coho salmon spawning surveys, 1961-67

Stream	Year	Miles surveyed	Fish per mile	Total fish 1/
Nehalem R.	1961	12.5	32.2	403 (23)
	1962	11.5	22.2	265 (34)
	1963	15.0	16.4	246 (10)
	1964	15.0	32.8	493 (34)
	1965	13.8	24.3	336 (19)
	1966	13.8	17.8	245 (26)
	1967	13.8	26.3	364 (37)
Necanicum	1961	4.75	20.4	97 (6)
	1962	4.25	18.1	77 (8)
	1963	4.25	12.0	51 (3)
	1964	4.25	31.3	133 (14)
	1965	4.25	13.4	57 (9)
	1966	4.25	25.6	109 (9)
	1967	4.25	4.0	17

1/ Figures in parenthesis indicate jack salmon which are also included in totals.

Perch, sunfish, crappie, bass, and bullhead are the warm-water game fish species of the North Coast Basin. All are common in backwater areas along the lower Columbia River, lowland lakes, and ponds along the coast (Table 5). Brown bullhead have been reported in the lower Necanicum River.

Table 5. Distribution of warm-water game fish in North Coast Basin lakes and ponds with public access

Lake	Surface acres	Location	Species present
Burkes Lake	6.3	West of Warrenton T.8 N., R.10 W., Sec. 21	Largemouth bass
Burnham Pond	3	Goble, N.W. of St. Helens, T.5 N. R.1 W., Sec. 8	Largemouth bass, bluegill
Cemetery Lake	10.3	South of Warrenton T.8N., R.10 W., Sec. 28	Yellow perch, white crappie, largemouth bass, bluegill
Coffenbury Lake	50	West of Warrenton T.8 N., R.10 W., Sec. 17, 18, 20	Yellow perch, brown bullhead
Crabapple Lake	22	West of Warrenton T.8 N., R.10 W., Sec. 20	Largemouth bass, yellow perch
Crescent Lake	7	Manhattan T.2 N., R.10 W., Sec. 29	Largemouth bass
Cullaby Lake	200	North of Gearhart T.7 N., R.10 W., Sec. 15, 22, 23	White crappie, black crappie, yellow perch, brown bullhead, largemouth bass
Lytle Lake	59	North of Rockaway T.2 N., R.10 W., Sec. 29, 32	Largemouth bass
Marie Lake	0.6	Twin Rocks T.1 N., R.10 W., Sec. 5	Largemouth bass, pumpkinseed sunfish
Smith Lake	40	North of Garibaldi T.1 N., R.10 W., Sec.18	Largemouth bass, brown bullhead
Smith Lake	41	South of Warrenton T.8 N., R.10 W., Sec. 28, 33	Largemouth bass, yellow perch, bluegill, white crappie, black crappie, warmouth
Spring Lake	11	North of Garibaldi T.1 N., R.10 W., Sec. 5, 8	Largemouth bass, black crappie

Table 5 (continued)

Lake	Surface acres	Location	Species present
Stanley Lake	7	Gearhart T.6 N., R.10 W., Sec.15	Brown bullhead
Sunset Lake	107	North of Gearhart T.7 N., R.10 W., Sec. 9, 16, 21	Yellow perch, largemouth bass, brown bullhead
West Lake	32	North of Gearhart T.7 N., R.10 W., Sec.22	Brown bullhead, yellow perch, largemouth bass

Lingcod, greenling, surfperch, rockfish, and flounder are nongame marine fish that support a popular sport fishery in the bays and coastal areas. Dungeness crabs and several species of clams and oysters are also economically important fauna of the North Coast Basin.

Fifteen species of undesirable or "rough" fish are found in the waters of the basin, the majority occurring in the lower Columbia River and its tributaries (Table 6). Ocean tributaries in the basin south to, and including the Nehalem drainage, contain suckers, lamprey, sculpin, and stickleback. Dace, sculpin, and stickleback are the only species of rough fish present in the Tillamook Subbasin. Where rough fish have become well established, they compete with game fish for food and space.

Table 6. Distribution of nongame fish in the North Coast Basin

Species	General distribution
Carp	Columbia River and lower reaches of its tributaries
Chiselmouth	Columbia River and tributaries
Chub	Columbia River and tributaries
Sculpin	Common throughout the basin
Dace	Columbia River and tributaries. Limited distribution in the Nestucca River system
Goldfish	Columbia River. Suspected in lower reaches of Columbia River tributaries
Lamprey	Columbia and Nehalem Subbasin streams
Peamouth	Columbia River and tributaries
Shiners	Columbia River and tributaries
Squawfish	Columbia River and tributaries
Stickleback	Nestucca River. Suspected in tidal areas of other coastal streams. Columbia River and tributaries
Suckers	In most Columbia and Nehalem Subbasin streams. Absent in Tillamook Subbasin
Tench	Columbia River. Suspected in lower reaches of Columbia River tributaries
Troutperch	Columbia River. Suspected in lower reaches of Columbia River tributaries

Economic and Aesthetic Values

Sport fisheries

The sport fisheries of the North Coast Basin are as varied as any other basin in the state (Table 7). The magnitude of the combined effort on these fisheries is indicated in Figure 1. Although not as popular as in some other parts of Oregon, the lake and stream trout fisheries are intensively managed and could withstand considerably more angling pressure than they now receive. Approximately 200,000 trout are stocked annually into 30 streams and 12 lakes by the Oregon State Game Commission (Appendix VI). The basin supports much of the most popular and productive salmon and steelhead angling in the state. More than 40,000 days were spent angling for marine fish such as lingcod, surfperch, rockfish, flounder, and greenling in 1965. Columbia River sloughs and several inland lakes provide a significant fishery on warm-water game fish.

Table 7. Angler trips and catch by species in the North Coast Basin in 1965 1/

Species	Angler trips	Catch
Salmon unidentified	276,051	128,345
Coho	34,374	89,404
Chinook	4,922	13,709
Jack salmon	20,275	17,785
Steelhead	144,804	93,100
Trout	152,143	267,075
Warm-water game fish	40,800	108,269
Nongame marine fish	44,592	173,879
Totals	717,961	891,566

1/ Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Effort in Oregon in 1965".

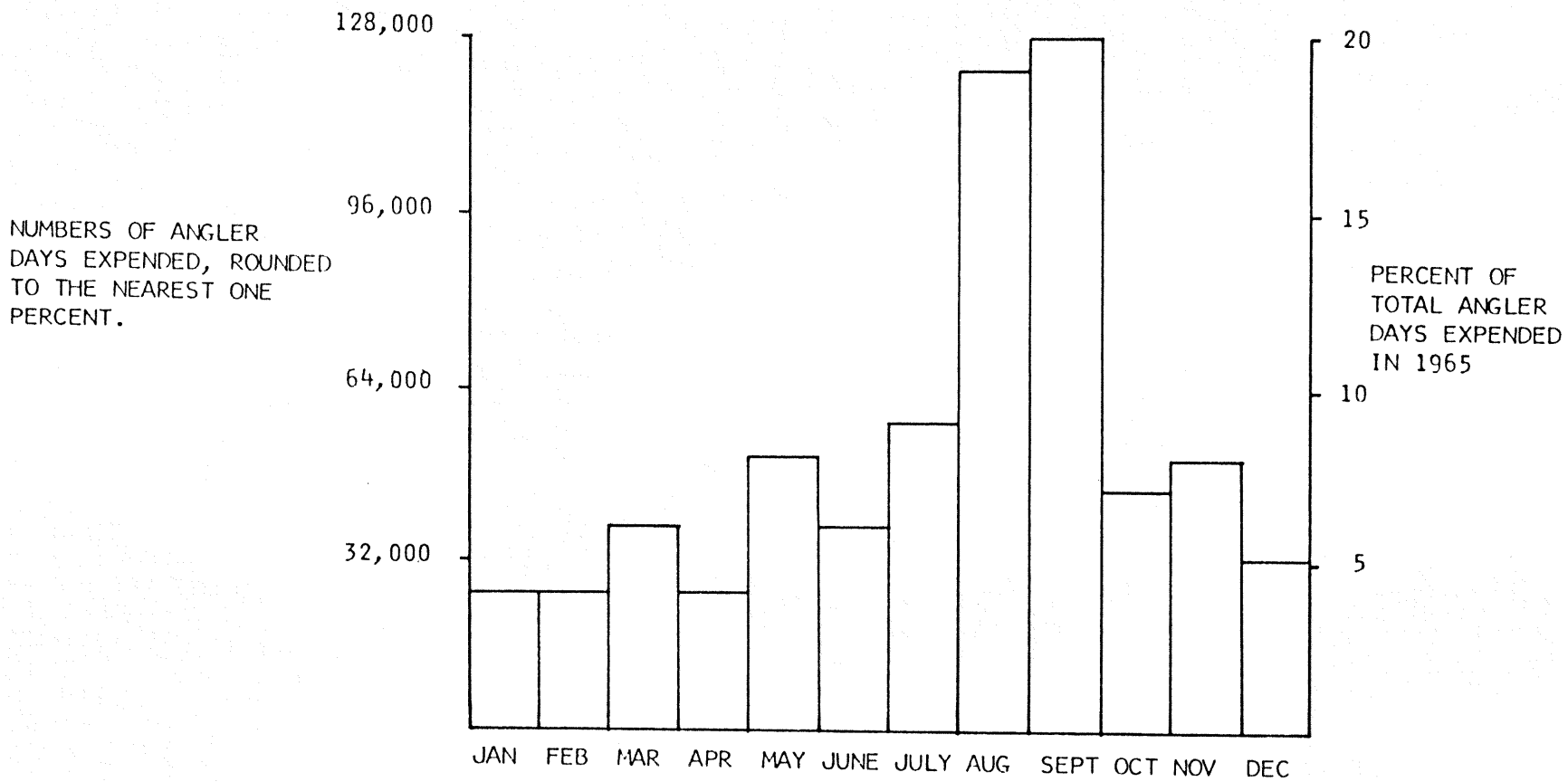


FIGURE 1. ANGLER TRIPS EXPENDED ON ALL SPORT FISH IN THE NORTH COAST BASIN IN 1965.

Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Efforts in Oregon in 1965."

The catch and angler effort expended on salmon and steelhead in the North Coast Basin is impressive (Tables 7, 8, and 9). Nearly one-half million fisherman days were spent in the basin on salmon and steelhead in 1965 (Figure 2).

Table 8. Salmon and steelhead sport catch in certain North Coast Basin streams in 1965 and 1966 1/

Stream	Catch			
	1965		1966	
	salmon	steelhead	salmon	steelhead
Columbia River 2/	42,728	14,400	40,057	22,199
Big Creek	445	1,993	983	5,082
Clatskanie	81	257	200	375
Gnat Creek	3/	219	4	502
Lewis & Clark R.	42	242	30	285
Youngs River	15	16	51	21
Klaskanine	591	273	886	912
Kilchis River	169	300	592	703
Miami River	73	180	85	226
Necanicum River	257	703	196	821
Nehalem River	6,597	3,279	4,818	4,724
Salmonberry R.	34	85	12	174
Neskowin Creek	19	73	77	230
Nestucca River	3,825	7,058	4,218	12,507
Tillamook River	142	38	68	166
Trask River	2,769	2,665	3,232	4,230
Wilson River	1,306	11,128	1,781	17,887
Totals	59,093	42,909	57,290	71,044
Combined totals	102,002		128,334	

1/ From Oregon State Game Commission salmon and steelhead punchcard records.
2/ Includes all river below Bonneville Dam.
3/ No catch reported.

Table 9. Columbia River and ocean sport fishery, 1946-66 1/ 2/

Year	Boat trips	Number of anglers	Number of chinook	Number of coho	Total salmon	Catch per angler trip	Period for which catch was estimated
1946	14,900	40,400	23,400	2,600	26,000	0.64	8/24 - 9/7
1947	13,600	39,000	12,800	3,200	16,000	0.41	8/24 - 9/1
1948	15,600	47,500	12,000	3,000	15,000	0.32	8/24 - 9/5
1949	13,900	40,500	11,200	2,800	14,000	0.35	8/24 - 9/4
1950	15,000	40,000	16,600	2,300	18,900	0.47	8/24 - 9/2
1951	17,200	48,500	7,200	1,900	9,100	0.19	8/24 - 9/3
1952	11,800	34,000	11,000	4,000	15,000	0.44	8/24 - 9/1
1953	18,500	50,700	14,700	8,000	22,700	0.45	8/10 - 9/15
1954	15,700	55,000	12,500	16,000	28,500	0.52	8/1 - 9/15
1955	20,000	64,300	12,500	15,200	27,700	0.43	8/1 - 9/15
1956	20,000	78,000	34,000	50,000	84,000	1.08	8/1 - 9/15
1957	14,600	54,000	18,500	38,700	57,200	1.06	7/3 - 9/15
1958	19,000	66,000	25,000	39,600	64,600	0.98	6/1 - 9/15
1959	19,200	75,000	23,400	50,000	73,400	0.98	6/1 - 9/30
1960	21,000	78,000	37,700	34,600	72,300	0.93	6/30 - 9/30
1961	29,600	89,800	20,500	85,500	106,000	1.18	6/11 - 9/30
1962	30,500	116,400	29,900	118,900	148,800	1.28	6/7 - 9/15
1963	30,600	117,800	32,600	116,200	148,800	1.26	6/10 - 9/22
1964	27,800	113,100	28,100	134,100	162,200	1.43	6/15 - 9/20
1965	36,500	152,600	53,200	251,800	305,000	2.00	6/21 - 9/26
1966	41,400	163,900	71,400	187,800	259,200	1.58	6/1 - 9/30

1/ Fishery includes Columbia River downstream from Bonneville Dam and ocean fishery off the mouth of the Columbia River.

2/ Not included are an estimated 420 pink salmon in 1963, and 660 in 1965.

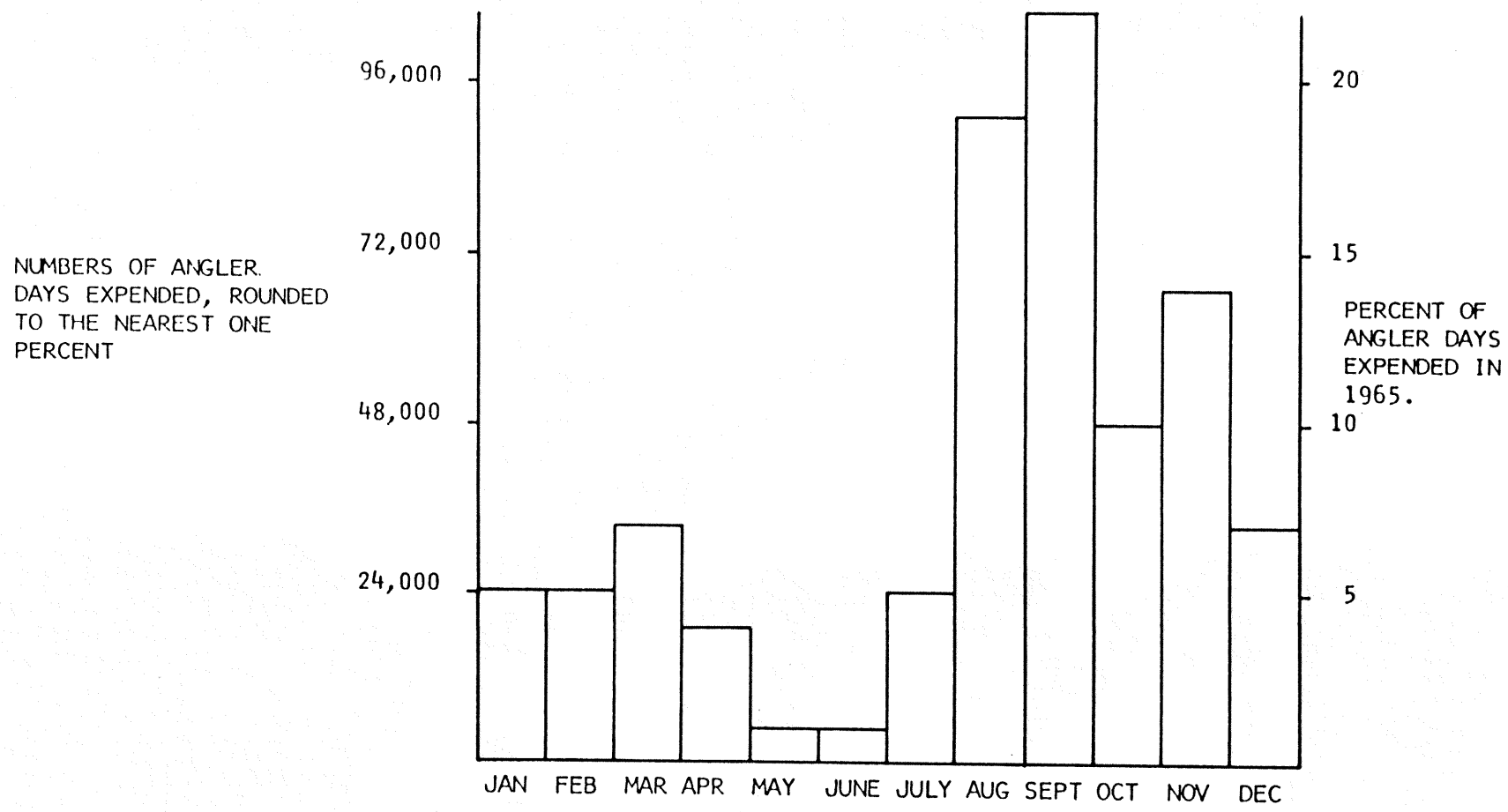


FIGURE 2. ANGLER TRIPS EXPENDED ON SALMON AND STEELHEAD IN THE NORTH COAST BASIN IN 1965. EXCLUDES NONRESIDENT ANGLING ON THE COLUMBIA RIVER.

Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Efforts in Oregon in 1965."

The trout fishery of the North Coast Basin supported more than 150,000 angler days (Tables 7 and 10). Although not comparable to the basin's large salmon and steelhead fishery, there is potential for a sizable increase in the trout fishery if stream discharges are not excessively depleted and streamside habitat is left undisturbed.

Angling for warm-water game fish in the basin is relatively localized, but accounted for more than 40,000 angler days and 108,000 fish in the creel in 1965 (Tables 7 and 11). Most of the angler effort and catch takes place in the lower Columbia River sloughs.

Because of the variety and availability of nongame marine fish, they make an important contribution to the North Coast sport fisheries. These marine fish are caught by anglers in the bays and along the jetties and beaches. A survey of 1965 angler use tabulated nearly 45,000 angler trips expended to catch approximately 174,000 marine fish (Tables 7 and 12). In addition, many hours are spent in pursuit of Dungeness crabs and several species of clams. The Fish Commission of Oregon manages and regulates the harvest of these popular animals.

Table 10. Angler trips by month for trout in the North Coast Basin in 1965 1/ 2/

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Number	0	0	3,431	3,594	34,399	25,419	27,487	31,702	16,379	2,195	7,092	445	152,143
Percent	0	0	2	2	23	17	18	21	11	1	5	0	100

1/ Trout classification includes anadromous or sea-run cutthroat trout.

2/ Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Effort in Oregon in 1965."

Table 11. Angler trips by month for warm-water game fish in the North Coast Basin in 1965 1/

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Number	0	0	1,345	886	5,807	9,909	7,256	546	15,051	0	0	0	40,800
Percent	0	0	3	2	14	25	18	1	37	0	0	0	100

1/ Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Effort in Oregon in 1965."

Table 12. Angler trips by month for marine nongame fish in the North Coast Basin in 1965 1/ 2/

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Number	879	0	6,864	1,352	14,298	4,052	6,784	7,140	3,193	30	0	0	44,592
Percent	2	0	16	3	32	9	15	16	7	0	0	0	100

1/ Lingcod, greenling, surfperch, rockfish, flounder and some other fish are considered as marine nongame fish.

2/ Source: Calvin, Lyle D. and Thomas D. Burnett, "Survey of Angling Effort in Oregon in 1965".

From a philosophical viewpoint, sportsmen and other conservationists place special emphasis on the aesthetic values relative to the fish resources of a region. Although little is probably known of the psychological benefits imparted to people by the presence of unspoiled streams and thriving fish populations, they do exist. Fishermen comprise a minority of the people who enjoy these psychological benefits; therefore, the pollution of a stream or the destruction of a fish population concerns not only anglers but a large segment of the public. In short, the annual three million dollar price estimated for the North Coast Basin steelhead and salmon fisheries might be conservative if they had to be replaced by resources of equal recreational and therapeutic value. If these fisheries were permitted to depreciate through the influence of pollution, stream flow depletions and careless watershed destruction, the cost of restoring the resource would exceed the cost of preventing the loss of stream habitat through proper management of water and watershed.

Commercial Fisheries

Commercial fish landings at Astoria, Nehalem, Tillamook, Netarts and Pacific City annually exceed 20,000,000 pounds (Table 13). Chinook and coho salmon landings in the North Coast between 1960 and 1964 annually averaged 651,000 pounds. Lesser catches of chum, pink and sockeye salmon and steelhead are also taken. The most significant fishery, that on bottom fish, harvests principally rockfish, flatfish and sablefish.

Salmon, steelhead, shad, smelt and sturgeon are caught with gill nets in the Columbia River. Salmon are also taken on troll in the ocean. Bottom fish are harvested the entire year, principally by otter trawl along the continental shelf and other coastal areas. Several techniques are employed to harvest the various species of shellfish.

Other than the lower Columbia River, Tillamook Bay is the only Oregon bay not closed to commercial fishing by legislative action. It is presently closed to commercial fishing by regulation, but may be opened at any time at the discretion of the Fish Commission.

Mainly because of the expanded fishery on bottom fish, made possible by new markets for these fish and modernized processing methods, commercial fisheries of the North Coast Basin have increased by about 17 percent during a recent 10-year period.

Table 13. Commercial fish landings of the North Coast Basin, 1960-64 1/

	Bottom fish	Tuna	Crab	Shrimp	Coho	Chinook	Total
Average landings, pounds	17,985,000	4,639,000	1,657,000	649,000	523,000	128,000	25,581,000
Percent of average landings	70	18	6.5	3	2	0.5	100
Percent of average annual Oregon catch landed in North Coast Basin	62	72	29	24	22	12	--

1/ Substantial commercial landings of shad, smelt and sturgeon are also made. The 1964 Oregon landings of these species totaled 1,317,000 pounds.

Characteristics of North Coast Basin Streams

Water availability

Water supplies in the North Coast Basin are generally adequate for current fish and wildlife populations. Water shortages are typically limited to three months of the year (July, August, September). For more than six months each year flows in most streams exceed the level required for optimum utilization of spawning and rearing areas for fish production. Peak flows occur in December, January, and February.

Of the four principal river systems in the North Coast Basin, (Nehalem, Wilson, Trask, and Nestucca) the Nehalem drainage experiences the most critical water shortages during the summer (Figure 3). A comparison of mean summer (July-September) discharges per unit of drainage area reveals this point. For the summer period of 1965 the values were 0.16 cfs per square mile drainage area for the Nehalem River system, 0.58 for the Trask, 0.52 for the Wilson and 0.43 cfs per square mile for the Nestucca (Table 14). It was also the Nehalem River system where the adverse effects of low stream flows on fish life (See Appendix IV-Biological Requirements) were most evident. Conversely, the fish life in streams which discharge into Tillamook Bay are least troubled by inadequate summer minimum flows which may also partly explain why the spring chinook salmon are more successfully established in the Trask and Wilson River systems.

Figure 3. Nehalem River at river mile 91.0, discharge 1.7 cfs, August 9, 1966.

Table 14. Comparison of summer mean discharges of the Nehalem, Nestucca, Trask, and Wilson Rivers in 1965 with those of a prior duration 1/

River	Gage location (river mile)	Drainage area (square miles)	Mean discharge (July-Sept) 1965	Mean discharge (July-Sept)
Nehalem	13.5	667	108 cfs	197 cfs (1946-65)
Nestucca	13.5	180	76	2/
Trask	10.4	145	84	122 (1951-55) (1961-65)
Wilson	9.4	161	84	141 (1946-65)

1/ Source: U.S. Geological Survey.
2/ Gage installed in 1964.

Anadromous fish in the Lower Columbia tributaries spawn about a month earlier than fish elsewhere in the basin and therefore encounter more difficulty in their early fall migrations. The 1949 legislative withdrawal of the Clatskanie River and its tributaries, Klaskanine River and its tributaries, Lewis and Clark River, and Big Creek from any future legal appropriations other than for fish life, was a significant step toward perpetuating runs in these streams. The protection of all existing unappropriated water during the late summer and early fall in the remaining Columbia Subbasin streams is likewise needed to maintain the present resource.

Withdrawals which create significant flow deficiencies during the natural low flow period include: A municipal diversion on the Upper South Fork Necanicum River, an industrial diversion on Coal Creek (Kilchis River tributary), municipal withdrawals on Youngs River and Lewis and Clark River, miscellaneous withdrawals on Beaver Creek (Columbia River tributary), and irrigation and municipal withdrawals in the Tillamook River system.

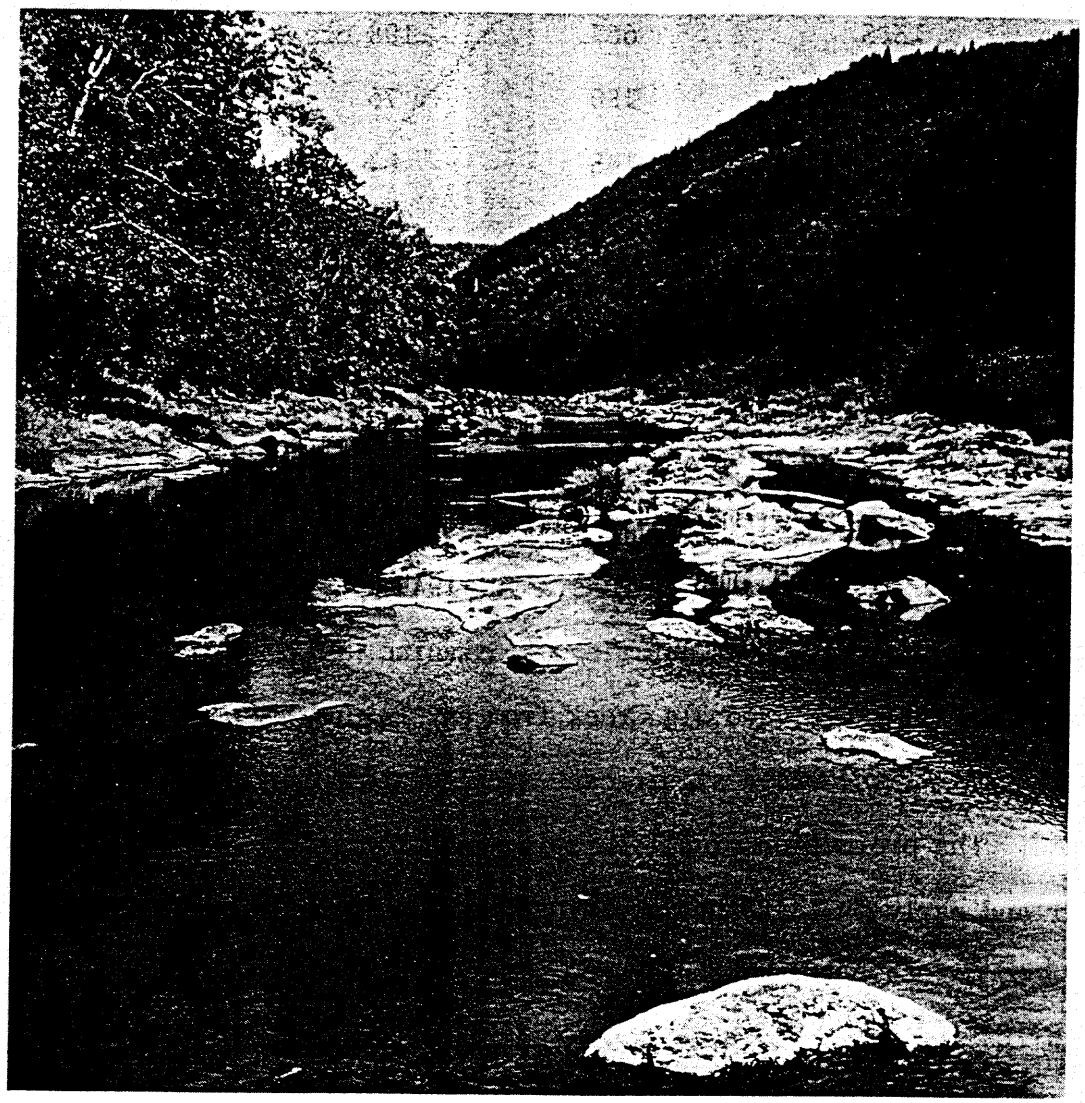


Figure 4. Nehalem River at river mile 20.0, typical low gradient, bedrock pool area where water temperatures frequently become excessive for fish life during the summer, August 1966.

Water quality

In general, the quality of water in North Coast Basin streams is excellent for fish production. Most water quality problems associated with fish life relate to domestic and industrial pollution, siltation, or temperature. Few incidences have been reported of fish kills resulting from either domestic or industrial effluents.

Silt in the streams results from either natural erosion or man-caused disturbances such as road construction and gravel removal. The addition of silt is most critical during periods of low flow because much of it may be deposited on gravel bars important for spawning and rearing of fish. The blanket of silt and sand has a smothering effect on fish eggs which incubate in the gravel. It is also harmful to aquatic insects which provide food for fish.

High water temperatures add another burden to fish life. Temperatures exceeding 65 F begin to have certain critical effects on fish. Foremost of these is an increase in the metabolic rate resulting in an increased need for dissolved oxygen. This condition is compounded by the decreased ability of water to hold dissolved oxygen as the temperature increases. Another significant effect is the more frequent occurrence of disease at higher temperatures. Under natural low flow conditions during the summer, many of the streams in the North Coast Basin exceed 65 F. In most streams, these high temperatures are only temporary and many fish can seek relief in the cooler tributaries; but in some, excessive water temperatures persist throughout much of the summer. Because of the proportionately lower summer flows in the Nehalem River system, water temperatures attain levels more critical to fish than in most other North Coast drainage systems (Figure 4). Water temperatures approaching 80 F have

been recorded in the Nehalem River (Appendix 3). Here and in most streams in the basin, any further flow depletions during the months of July, August, and September may result in increasingly higher stream temperatures with greater impacts on fish life.

Barriers

Barriers to fish passage, in the form of log jams, water falls, cascades and dams, preclude the use of large sections of many streams for fish production. The most common type of barrier is the log jam. The Oregon State Game Commission and Fish Commission of Oregon, with the financial assistance of certain other land management agencies, expend considerable time and revenue annually for removing jams. Most impassable log jams occur in the headwaters of a stream system where logging is most extensive. The combination of careless stream-side logging and high winter flows are responsible for the formation of most jams.

There are several falls in the basin which block anadromous fish from potentially productive stream areas (Table 15 and Figure 5). A few falls have been laddered or made passable where economically feasible.

Table 15. Status of falls and dams affecting anadromous fish

Stream	Type of barrier	Location	Passage status
Beaver Creek	Falls	River mile 4.8	Impassable
Lewis & Clark River	"	" " 21.5	"
" " "	Dam	" " 16.5	Marginal
Carcus Cr. (Clatskanie R)	Falls	1-2 mi. above mouth	Impassable
Youngs River	"	River mile 9.2	"
S. Fk. Necanicum R.	Dam	" " 1.2	Marginal
N. Fk. Necanicum R.	"	0.2 mi. above mouth	"
W.Fk. Elk Cr. (Pacific)	Falls	Approx. 1.0 mi above mouth	Impassable
W.Fk. Elk Cr. (Pacific)	"	Approx. 0.5 mi. above mouth	"
Miami River	"	River mile 12.2	Marginal
Little N.Fk. Wilson R.	Steep gradient	" " 6.5	"
Jordan Cr. (Wilson R.)	Falls	" " 6.0 (Approx)	Impassable
S.Fk. Wilson River	"	" " 2.0	Marginal
Drift Cr. (Wilson R.)	"	" " 0.3	Impassable
Trask R., Middle Fk.	"	" " 2.0	"
" "	"	" " 3.0	"
" "	"	" " 3.8	"
Bark Shanty Cr. (Trask R.)	"	" " 1.2	"
" "	"	" " 2.7	Unknown
Munson Cr. (Tillamook R.)	"	" " 2.3	Impassable
Three Rivers (Nestucca R)	"	" " 9.0	"

Table 15 (continued)

Stream	Type of barrier	Location	Passage status
Cedar Cr. (Nestucca R.)	Dam	River mile 0.3	Impassable 1/
Clarence Cr. " "	Falls	" " 1.0	"
Slick Rock Cr. (Nestucca R.)	"	" " 1.1	"
Bible Cr. (Nestucca R.)	"	" " 1.0	"
Testament Cr. " "	"	Unknown	"
Elk Cr. (Nestucca R.)	"	River mile 2.8	Marginal
Nestucca R.	"	" " 40.7	"
" "	Steep gradient	" " 46.7	Impassable
Little Nestucca R.	Falls	" " 13.7	"
Louie Cr. (L. Nestucca R.)	"	Unknown	Marginal
Sand Cr.	"	2.0 mi. above Andy Cr.	Impassable
Jackson Cr.	Steep gradient	River mile 1.3	"

1/ The dam was made impassable to reduce the incidence of disease in water used at the fish hatchery downstream.

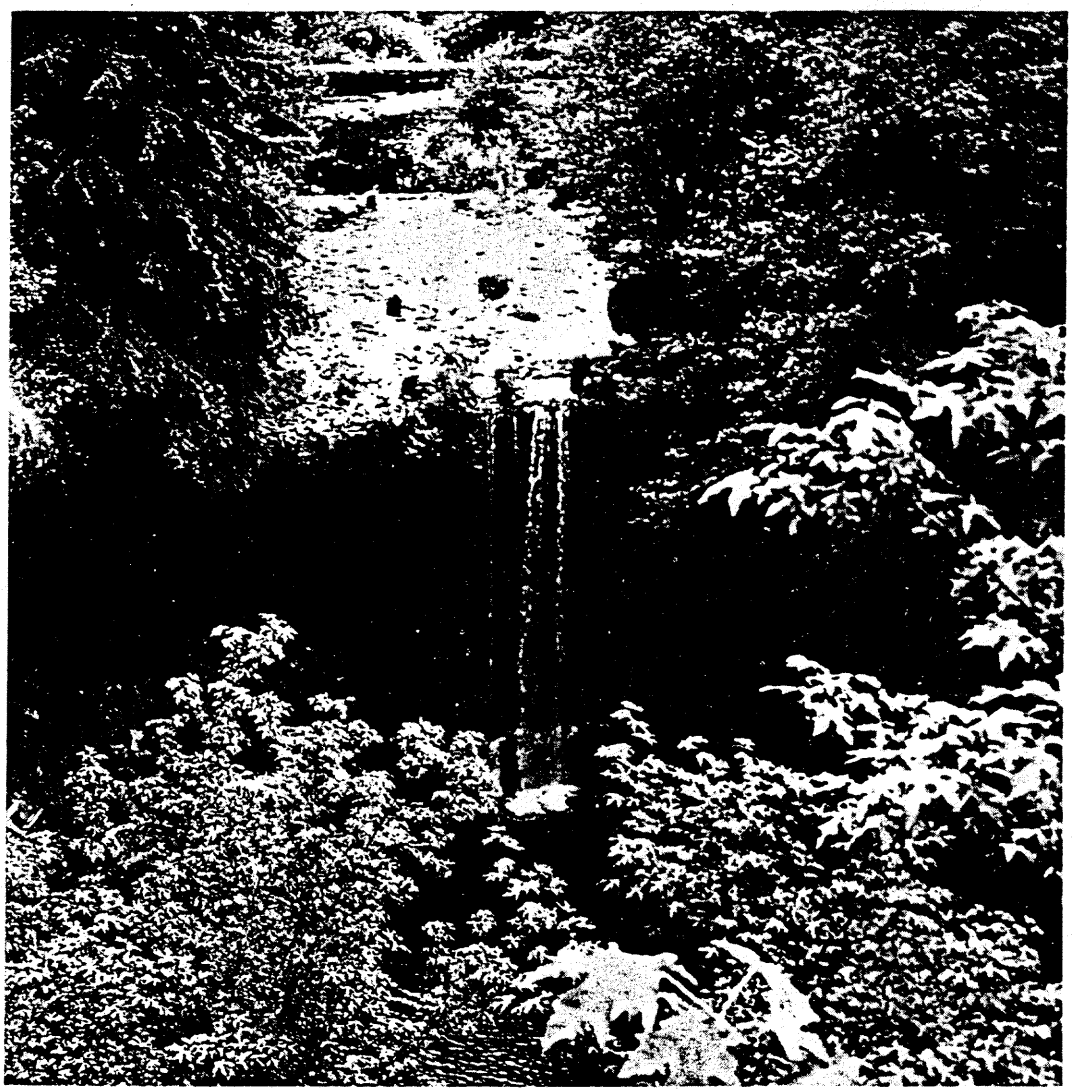


Fig. 5 Beaver Creek Falls at river mile 4.8 on Beaver Creek, tributary to Clatskanie Slough near Clatskanie, Oregon, August, 1966.

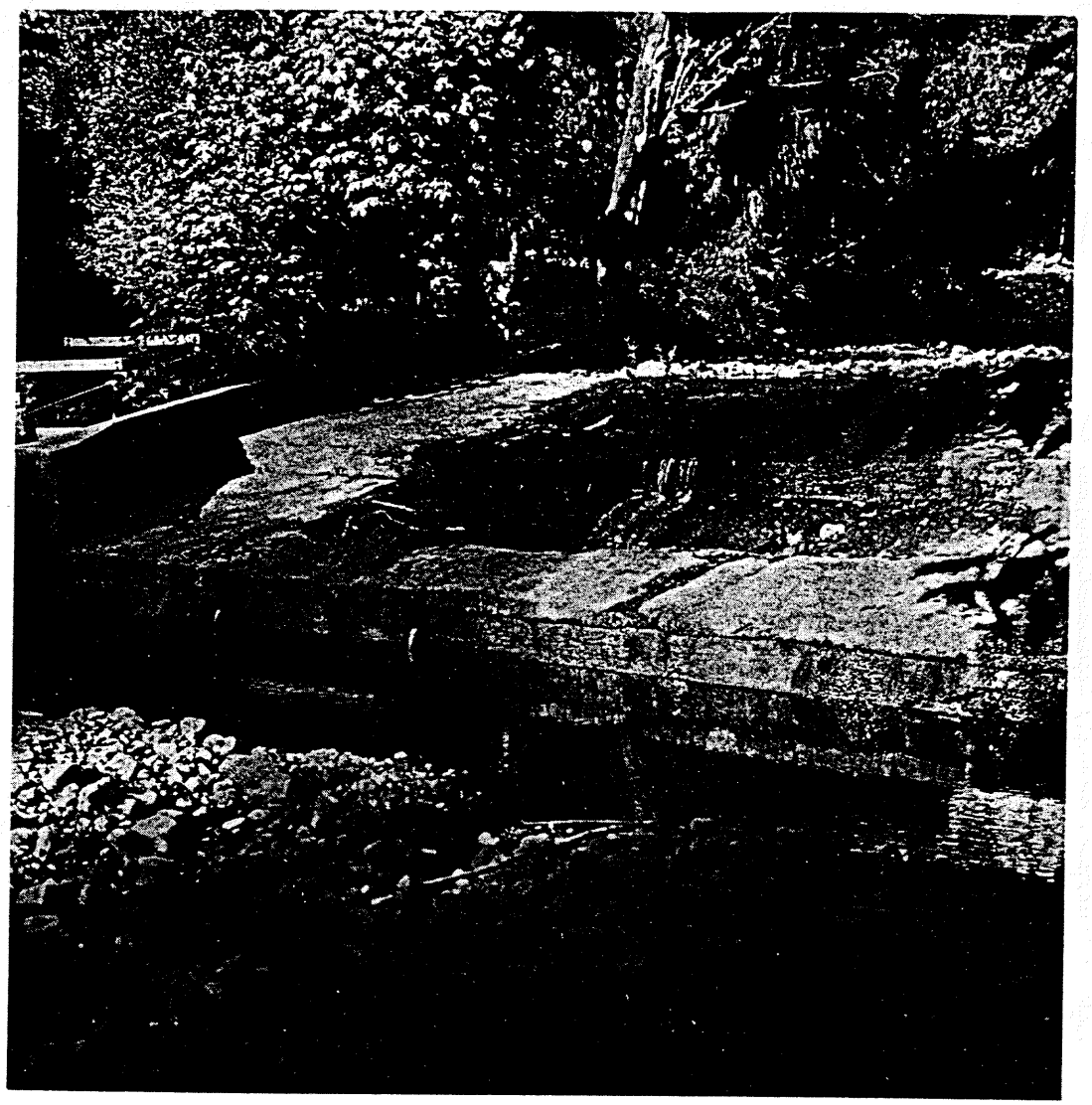


Fig. 6 Diversion dam and poorly constructed fish ladder near mouth of North Fork Necanicum River, August 1966. Approximately three quarters of flow was being diverted from stream.

Existing man-made dams in the basin are relatively minor (Figure 6); although some proposed structures would have a serious effect on fish and wildlife, if constructed. Some beaver dams create barriers to fish movement during medium and low flow periods, but most are removed by high water or are otherwise made passable.

Improperly installed road culverts or culverts altered by high water often create impassable or marginal passage conditions (Figures 7 and 8). After prolonged effort on the part of the fish and game departments, road construction agencies have become more cognizant of the importance of properly designed culverts suitable for fish passage, this problem is becoming less common.

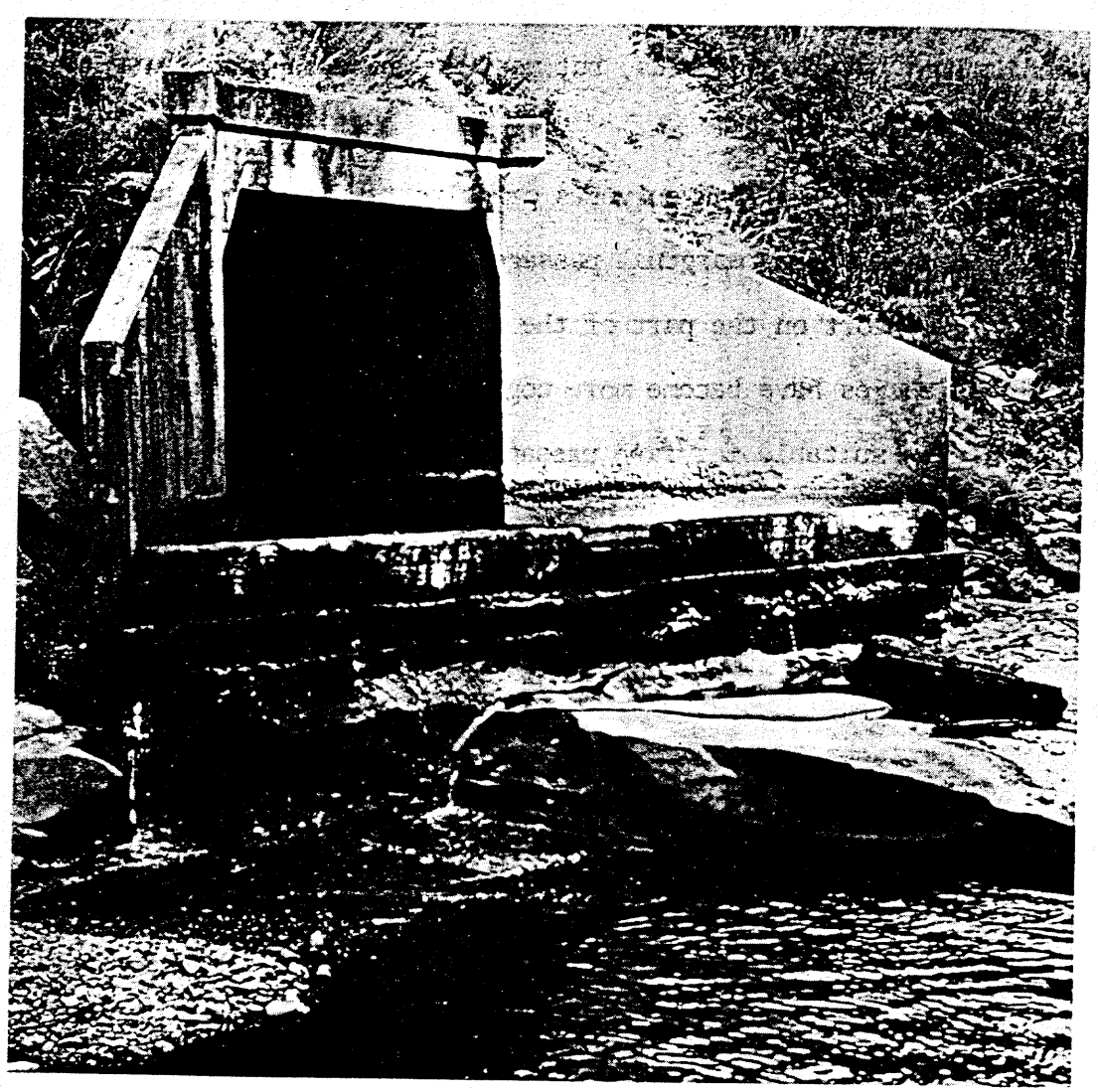


Fig. 7 Culvert at the mouth of Killam Creek on the Tillamook River is poorly designed and impassable to fish at low flows, August 1966.

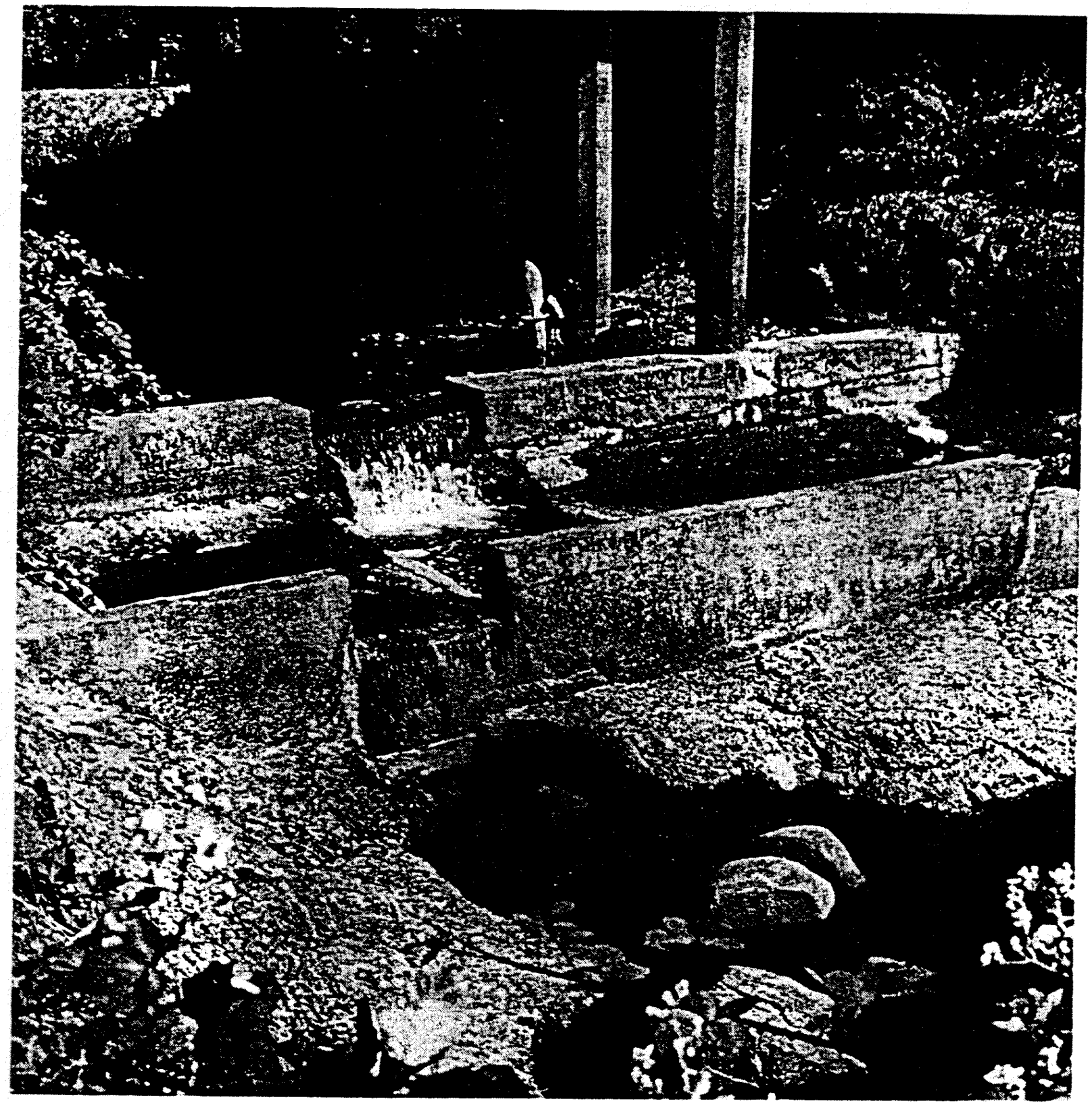


Fig. 8 Culvert at the mouth of Fawcet Creek on the Tillamook River, August 1966. High flows have eroded under bottom step making it impassable to fish at low flows.

Management and Research

To help maintain and perpetuate fishery resource of the North Coast Basin, conservation agencies have employed several professional fishery management and research biologists who devote all or part of their time to this effort. The Oregon State Game Commission maintains three full-time biologists, stationed at Tillamook, Seaside and Deer Island, whose responsibilities are to gather factual information concerning the area's game fish resources and their recreational uses.

The Fish Commission of Oregon conducts similar investigations on the basin's salmon, shellfish, and nongame marine fish.

The Research Division of the Oregon State Game Commission has been using the Wilson River as one of the key streams in its investigations of winter steelhead. An intensified program was performed to determine the size, age, and condition of fish and time of stocking that produce the best returns of hatchery reared stocks. These efforts have resulted in larger runs of steelhead and led to liberalized bag limits and extension of open waters available to the angler.

The Fish and Game Commissions operate six fish hatcheries in the basin. The Fish Commission manages four, which are located on Big Creek, North Fork Nehalem River, and Klaskanine River, each rearing salmon and steelhead, and one on Trask River, which rears salmon exclusively. The two Game Commission hatcheries on Gnat Creek and Cedar Creek raise salmon, steelhead, and trout. Fish reared at these facilities are stocked principally in the North Coast Basin.

STREAM FLOW STUDY

Studies designed to ascertain minimum stream flow requirements of fish in North Coast Basin streams were conducted during the summers of 1965 and 1966. The product of these studies are submitted in the form of minimum discharge recommendations by semi-monthly periods in Appendix I. The primary intent of the recommendations is to serve as a guide for protecting stream flows from excessive appropriation. These are designed to maintain and perpetuate native fish populations presently in the basin. Enhancement is not a consideration in these recommendations. If flows greater than the recommended minimums can be provided in any stream, such provision should be encouraged since it will benefit fish life.

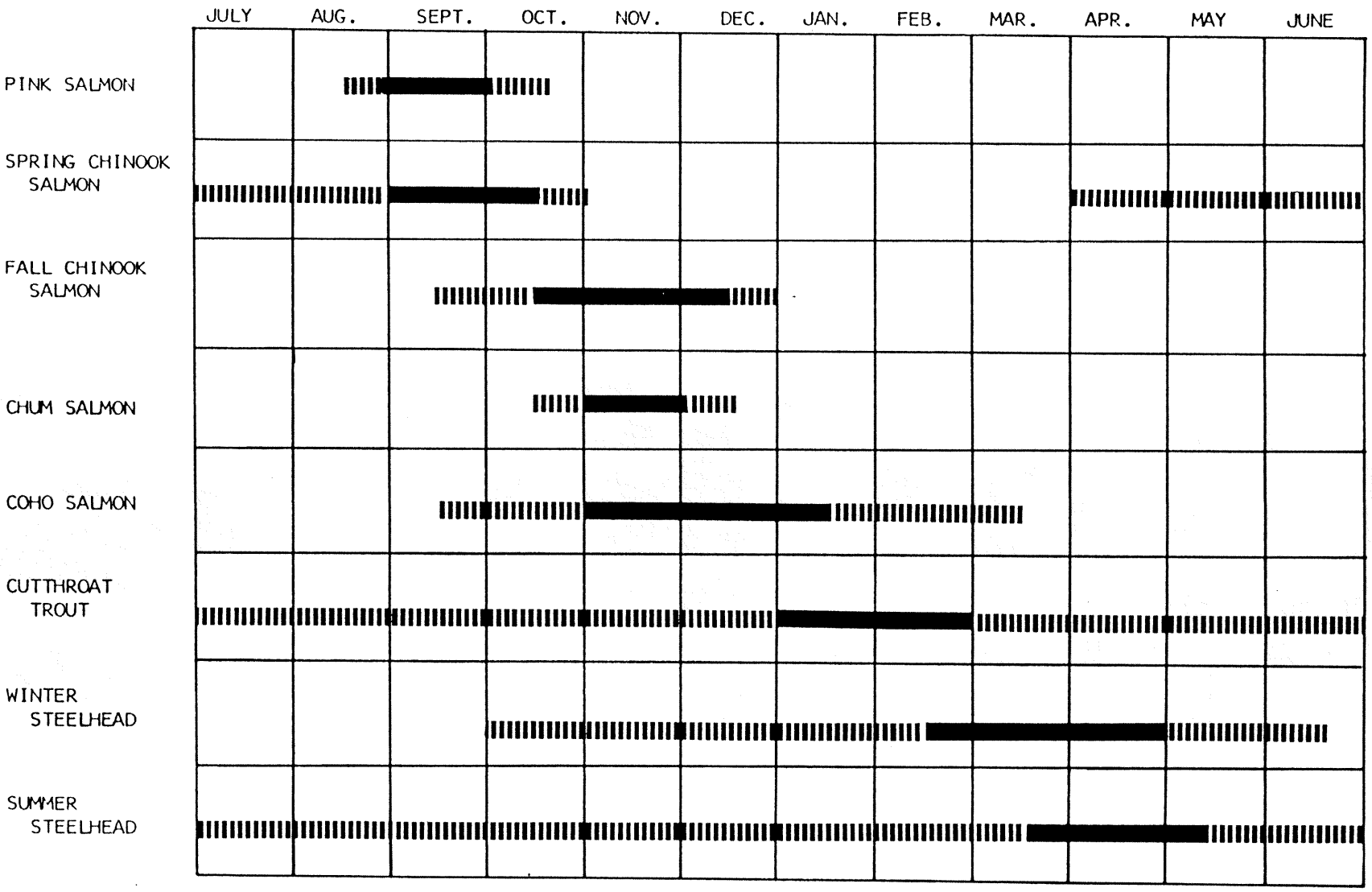
Discharge measurements were used as one of the guides for determining flow regimens submitted in Appendix I. Discharge information was compiled during the study by Oregon State Game Commission's Basin Investigations personnel (Appendix II) and by U. S. Geological Survey stream gaging stations. A tabulation of the mean summer flows during the past 10 to 20 years indicates that 1965 summer stream flows were 60 to 70 percent of average (Table 14). U. S. Geological Survey gaging records for the summer of 1966 and the periodical measurements of the Oregon State Game Commission Survey Crew (Appendix II) indicate that the 1966 runoff was slightly higher than in 1965, though less than average.

Methods for determining the rates recommended in Appendix I were the same as those used in the nine basins studied previously. The recommended flows are based on the biological requirements of fish (Appendix V) and water availability or existing flows. Each recommended flow provides an average condition

over gravel bars that meets the minimum depth and velocity requirements of fish.

Spring and fall chinook salmon are the largest salmonids in the basin, and thus have the greatest transportation and spawning flow requirements. Because summer steelhead and spring chinook salmon reside in streams during the summer prior to spawning, their dependency on minimum summer flows exceeds that of any of the other game fish in the basin. Stream flow requirements for spawning and passage of coho, chum, and pink salmon, and steelhead and sea-run cutthroat trout are similar (Appendix V). Seasonal stream flow requirements for all anadromous fish in the basin were developed from Figure 9 on spawning periodicity. Because natural selection has adjusted the life histories of fish to natural stream discharge patterns, recommendations developed in Appendix I are necessarily keyed to these patterns. Although nothing conclusive can be said of the relationship of the recommended flows with angling, the minimums submitted here are believed to be considerably below optimum for this purpose.

FIGURE 9. PERIODICITY CHART SHOWING WHEN ADULT ANADROMOUS FISH ARE PRESENT OR SPAWNING IN NORTH COAST BASIN STREAMS. DOTTED LINES INDICATE PRESENCE OF ADULTS IN THE STREAMS AND SOLID LINES INDICATE PERIODS OF HEAVIEST SPAWNING. SPAWNING BEGINS APPROXIMATELY ONE MONTH EARLIER IN COLUMBIA RIVER TRIBUTARIES.



GAME RESOURCES OF THE NORTH COAST BASIN

General

Because of the availability, distribution, and quality of Oregon's coastal fresh water supplies, wildlife numbers and distribution are not limited by water shortages as in some other parts of the state. Diversions, impoundments, and excessive consumptive use could cause local water shortages, particularly during late summer. Flooding of habitat by reservoirs and water pollution by domestic and industrial effluents are potential hazards to wildlife.

Among many management techniques regular index counts are made on most of the basin's game animals to evaluate population status and determine surpluses for hunting (Tables 17, 19, 20 and 21).

Big Game

More hunter-days are expended on black-tailed deer than any other game animal in the North Coast Basin (Table 16). The Tillamook Burn and extensive logging have made vast areas of the basin more productive for deer by removing the overstory and allowing the growth of forage plants. This has made the North Coast Basin one of the best areas in the state for black-tailed deer.

Table 16. Deer harvest, North Coast Basin

	1964	1965	1966	1967
Estimated no. of hunters	19,116	19,325	17,021	16,700
Estimated total deer kill	9,198	6,946	6,626	6,210
Estimated total hunter-days	110,130	104,139	97,203	87,730

Table 17. Black-tailed deer population trends

Big game mgmt. unit	Sample route miles traveled	Deer observed per mile traveled 1962	1963	1964	1965	1966
Clatsop	106	2.4	2.7	2.6	2.4	2.2
Nestucca	92	1.5	2.0	2.5	2.2	1.7
Trask	111	3.4	3.2	4.3	2.2	3.5
Wilson	39	2.3	3.2	3.2	3.1	2.7
Weighted means		2.5	2.7	3.2	2.4	2.5

Roosevelt elk are relatively plentiful in the basin. The 1964 harvest exceeded 2,700 animals (Table 18), when 12,000 sportsmen, expending several times that many hunter-days, hunted elk in the basin. The habitat preference of elk is similar to deer, thus they too have benefited from the removal of dense forest canopy. Like the other important game species, their population dynamics are under constant surveillance by the biologists. Among other measures, population trend counts (Table 19) are made annually on elk. These indices of animal numbers are used to adjust the regulations governing their harvest.

Table 18. Elk harvest, North Coast Basin

	1964	1965	1966	1967
Estimated number of hunters	12,287	11,397	9,954	9,870
Estimated total elk kill	2,728	1,806	1,456	1,493

Table 19. Roosevelt elk population trends

Big game mgmt. unit	Sample route miles traveled	Elk observed per mile traveled 1962	1963	1964	1965	1966
Clatsop	47	10.6	12.0	14.9	16.0	17.0
Nestucca	20	0.5	5.4	6.5	7.8	4.7
Trask	27	2.3	3.5	3.2	1.3	1.5
Wilson	29	8.2	6.2	9.5	13.0	12.5
Weighted mean		6.6	7.7	9.7	10.7	10.5

Upland Game

Five species of upland game birds occupy the North Coast Basin. Two species, the band-tailed pigeon and mourning dove, are migratory. Resident game birds include the blue grouse, ruffed grouse, and mountain quail; all utilize forest habitat primarily. Production and population trend counts are taken each year on grouse and quail to help ascertain proper harvest regulations (Table 20). More hunting pressure is exerted on doves and pigeons than on grouse and quail.

Table 20. Grouse and mountain quail population trends, North Coast Basin

Species	Miles traveled	Birds per mile 1962	1963	1964	1965	1966
Blue grouse	124	0.22	0.17	0.12	0.13	0.15
Ruffed grouse	124	0.06	0.05	0.11	0.10	0.14
Mountain quail	124	0.35	0.49	0.25	0.17	0.06

Waterfowl

Of the basin's wildlife, the 19 species of waterfowl which spend all or part of each year in this area are most dependent on water supplies. Water

shortages and pollution are the most important water related limitations affecting waterfowl. These are especially important to the birds, particularly ducks, during their fall and winter concentration (Table 21). Most water developments, unless for consumptive uses, do not create problems for waterfowl. Contrary to the interests of most wildlife, shallow impoundments, where they complement or enhance existing habitat, are beneficial to ducks, geese and certain other water birds. A few species, such as the wood duck, commonly nest in the basin. Major winter waterfowl concentration and hunting areas are on the lower Columbia River, Sand Lake, and Youngs, Nehalem, Tillamook and Netarts Bays.

Table 21. Annual winter waterfowl inventory, North Coast Basin

Species	1963	1964	1965	1966	1967	Mean
Mallard	350	593	2,781	528	1,131	1,077
American widgeon	3,102	4,004	8,433	1,003	2,773	3,863
Green wing teal	84	80	31	73	1,323	318
Shoveler	0	1,186	3	11	38	246
Pintail	1,353	2,927	2,828	638	1,179	1,785
Redhead	9	19	5	14	19	13
Canvasback	495	600	475	713	681	593
Scaup	492	594	511	456	875	586
Ring-necked	85	47	13	27	35	41
Goldeneye	49	47	32	96	46	54
Bufflehead	454	477	384	429	391	427
Ruddy duck	615	476	255	973	626	589
Merganser	165	307	152	251	254	226

Table 21 (continued)

Species	1963	1964	1965	1966	1967	Mean
Scoter	147	139	24	319	268	121
Harlequin	0	17	11	0	0	6
Snow goose	0	0	160	0	0	32
White-fronted goose	0	0	0	3	0	1
Canada goose	40	360	300	6	0	141
Lesser Canada goose	0	0	0	0	200	40
Cackling goose	0	10	0	0	0	2
Black brant	410	1,416	1,108	667	1,296	979
Whistling swan	671	994	861	820	539	777
Coot	437	408	738	917	767	655

Furbearers

Beaver, muskrat, mink and otter are the four most valuable furbearers in the basin. Eight other species are commonly trapped (Table 22). Total annual revenue from the harvest of the basin's furbearers, based on green pelt value, ranges from nearly $16,000 to more than $23,000. Furbearers rely extensively on water for their existence. Proper water quantities, as well as quality, are important. Probably the most destructive water problems are floods and pollution, each condition capable of causing losses or driving the animals from a stream.

Table 22. Fur trapping, Clatsop, Columbia and Tillamook Counties 1/

Species	1963-64		1964-65		1965-66	
	Harvest	Value	Harvest	Value	Harvest	Value
Beaver	1,049	$11,067	1,269	$10,076	1,145	$13,626
Muskrat	2,263	2,512	1,727	1,692	2,654	3,291
Mink	320	2,659	269	2,055	316	2,316
Otter	57	1,191	59	1,281	70	1,714
Raccoon	291	471	166	241	344	795
Nutria	277	349	7	9	321	642
Bobcat	26	137	53	306	38	535
Coyote	62	191	40	175	40	257
Oppossum	124	48	70	21	124	58
Fox	2	7	0	0	9	36
Weasel	10	3	11	5	22	9
Skunk	0	0	1	1	21	23
Totals	4,481	$18,635	3,672	$15,862	5,104	$23,302

1/ These figures represent more than 90 percent of all licensed trapping in Clatsop, Columbia and Tillamook Counties. Some additional trapping took place by children under 14 years of age who were not required to obtain a license or file a report of their catch.

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APPENDIX

Appendix I. Recommended minimum flows for fish life, North Coast Basin

Stream	Location	Dec-Apr.	May	June	July	August	Sept.	Oct.	Nov.
Miscellaneous Columbia River Tributaries									
Bear Creek	0.7 mi. above mouth	15	10	7	5	3 2	10 15	15	15
Beaver Creek	1.8 mi. above Stewart Cr.	30	15	7	5	4	4	4 8	15 30
Big Creek	1.1 mi. above mouth	50	40	30	25	20	30 50	50	50
Clatskanie River	1.1 mi. below Perkin Cr.	60	40	20	15	8	30 60	60	60
Carcus Creek *	Mouth	10	7	4	2	1	1	5 10	10
(Klaskanine River)									
N.Fk. Klaskanine R.	Mouth	40	25	15	10	5	30 40	40	40
S.Fk. Klaskanine R.	Mouth	40	25	15	10	5	30 40	40	40
Lewis & Clark River	River mile 10.8	45	30	20	15	6	30 45	45	45
Plympton Creek	0.3 mi. above mouth	20	15	10	7	4	15 20	20	20
Young's River	0.1 mi. below Young's Falls	40	30	20	15	7	20 40	40	40
Kilchis River	0.2 mi. below Mapes Creek	75	50	50	50 35	25	50	75	75
Clear Creek	Mouth	30	15	5	3	2	2 15	30	30
Coal Creek	Mouth	8	8	2	1	1	1	6 8	8
Little S.Fk. Kilchis R.	Mouth	50	30 20	15	10	5	5	20 50	50
North Fk. Kilchis R.	Mouth	50	30 20	15	12	6	6	20 50	50
South Fk. Kilchis R.	Mouth	40	30 20	12	8	5	5	15 40	40
Miami River	0.2 mi. above Moss Creek	80	50	30	20	15	15 50	80	80
Miami River *	River mile 7.0	50	30	20	14	8	8 30	50	50
Moss Creek	Mouth	25	15 6	2	2	1	1	15 25	25
Peterson Creek	Mouth	12	3	2	2	1	1	8 12	12
Prouty Creek	Mouth	12	2	1	1	0.5	0.5	8 12	12
Miscellaneous Ocean Tributaries									
Arch Cape Creek	Head of tidewater	25	15	8	6	4	4 18	25	25

Appendix I (continued)

Stream	Location	Dec-Apr.	May	June	July	August	Sept.	Oct.	Nov.
(Elk Creek)									
N.Fk. Elk Creek	Mouth	25	9	5	4	3	3	15 25	25
West Fk. Elk Creek	Mouth	25	11	7	5	5	4	15 25	25
Neskowin Creek	1.1 mi. above mouth	40	20	12	8	6	5 30	40	40
Sand Creek	0.3 mi. above Jewell Cr.	30	15 8	4	3	2	2 20	30	30
Short Sand Creek	0.6 mi. above mouth	20	3	2	2	2	2 15	20	20
Necanicum River	0.7 mi. above Circle Cr.	75	50	35	20	20	20 50	75	75
" "	Just above Bergsvik Cr.	20	15 10	5	3	3	3	12 20	20
Bergsvik Creek	Mouth	15	10 6	4	2	2	2	10 15	15
Klootchie Creek	Mouth	15	10 6	4	3	2	2	12 15	15
N.Fk. Necanicum R.	Mouth to mile 0.4	15	12 8	5	3	2	2	8 15	15
S.Fk. Necanicum R.	Mouth	15	12 8	5	3	2	2	8 15	15
Nehalem River	USGS gage 14-3010	400	300	200	200	200	240	400	400
" "	0.4 mi. above Humbug Cr.	200	150	150	100	50	100	200	200
" "	Just above Rock Creek	50	30	20	12	4	4	30 50	50
" "	Just above Wolf Creek	30	15	10	6	3	3	15 30	30
Anderson Creek	Mouth	20	10 5	3	3	2 1	1	8 15	20
Beaver Creek (R.M.66.0)	Mouth	10	6 4	2	2	0.5	0.5	2 5	5
Buster Creek *	Mouth	30	20 15	10	4	2	2	20 30	30
Cook Creek	Mouth	60	40	30	20	12	12	40 60	60
Cow Creek	0.6 mi. above mouth	15	7	3	2	1	1	8 15	15
Cronin Creek	Mouth	40	25 12	8	5	3	3	25 40	40
Deep Creek *	Mouth	15	10 5	3	2	1	1	10 15	15
East Fk. Nehalem R.	Mouth	15	10	5	3	1	1	3 10	10
Fishhawk Creek (R.M.65.7)	Mouth	25	15	8	6	4	4	15 25	25
Foley Creek	1.0 mi. above mouth	50	35 25	18	12	9	7	30 50	50

Appendix I (continued)

Stream	Location	Dec-Apr.	May		June		July	August	Sept.		Oct.		Nov.
Humbug Creek	1.2 mi. above mouth	60	40	25	15		10	3	3		40	60	60
S.Fk. Humbug Creek	Mouth	25	15		8	4	2	2	2		15	25	25
W.Fk. Humbug Creek	Mouth	40	25		15	6	3	3	3		30	40	40
Lost Creek	Mouth	20	15	8	6		3	2	2		10	20	20
N.Fk. Nehalem River	0.6 mi. below Grassy Creek	150	100	70	50		30	20	20	80	150		150
" " " "	Just above Gods Valley Cr.	70	50		30		20	15	15	40	70		70
Gods Valley Creek	Mouth	40	20	10	5		3	2	2		20	40	40
Soapstone Creek	Mouth	60	40	20	10		6	4	4		40	60	60
Northrup Creek	Mouth	20	15	8	5		3	2	2		10	20	20
Oak Ranch Creek	Mouth	15	10	5	3		2	1	1		10	15	15
Peterson Creek	Mouth	15	7	3	1.5		1	1	1		10	15	15
Quartz Creek *	Mouth	30	20	10	6		4	2	2		20	30	30
Rock Creek	Mouth	80	50		30		20	20	20	50	80		80
Roy Creek	Mouth	15	6	2	0.5		0.5	0.5	1		10	15	15
Salmonberry River	Mouth	70	50		40		30	25	25	50	70		70
Spruce Run Creek	Mouth	20	10	5	3		1	1	2		10	20	20
Walker Creek	Just above Fishhawk Creek	30	20	15	10		5	2	2		20	30	30
Fishhawk Creek	Just above Walker Creek	30	20	15	10		4	1	2		20	30	30
Wolf Creek	Mouth	20	15	10	6		3	1	1		10	20	20
Nestucca River	USGS gage 14-3036	320	320		240		70	70	150		320		320
" "	0.5 mi. below Bear Creek	150	150		60		60	60	60	100	150		150
" "	USGS gage 14-3029	8	8	6	4		3	2	2		3		8
Bays Creek	Mouth	20	20	10	5		4	3	3		12	20	20
Bear Creek (Beaver Creek)	Mouth	20	20	15	7		6	3	3		15	20	20
Bear Creek	Mouth	8	8	8	2		2	1	1		6	8	8

Appendix I (continued)

Stream	Location	Dec-Apr.	May		June	July	August	Sept.		Oct.		Nov.
East Beaver Creek	Mouth	50	50	30	16	12	8		8	40	50	50
West Beaver Creek	Mouth	18	18	10	6	2	2		2	15	18	18
Bible Creek	Mouth	15	15	6	2	2	2		2	10	15	15
Clarence Creek	Mouth	15	15	6	2	1	1		1	10	15	15
Clear Creek	Mouth	20	20	8	4	3	2		2	12	20	20
Elk Creek	Mouth	20	20	12	8	4	4		4	15	20	20
Farmer Creek	Mouth	25	25	12	6	4	4		4	15	25	25
Little Nestucca River	0.1 mi. below Fall Creek	75	75	50	30	20	20		50	75		75
" " "	Just above Louie Creek	30	30	20	10	4	4	4	20	30		30
Bear Creek *	Mouth	15	15	6	3	2	1		1	10	15	15
Fall Creek	Mouth	10	10	6	3	2	1		1	8	10	10
Louie Creek	Mouth	15	15	6	3	2	1		1	10	15	15
S.Fk. Little Nestucca R.	"	18	18	10	7	5	3		3	12	18	18
Moon Creek	Just above East Creek	30	30	20	20	5	3		20	30		30
East Creek	Just above Moon Creek	35	35	20	10	7	4		3	25	35	35
Niagara Creek	Mouth	30	30	25	25	5	3		20	30		30
Powder Creek	Mouth	20	20	10	5	3	2	2	10	20		20
Slick Rock Creek	Mouth	15	15	6	3	2	1		1	10	15	15
Testament Creek	Mouth	15	15	8	4	3	3		3	12	15	15
Three Rivers	Mouth	70	70	50	40	25	15	15	40	70		70
" "	Just above Alder Creek	40	40	20	12	8	6	6	25	40		40
Alder Creek	Mouth	25	25	10	5	4	3		3	15	25	25
Wolfe Creek	Mouth	10	10	6	3	3	2		2	8	10	10
Tillamook River	Just above Bewley Creek	80	50		50	25	8		50	80		80
Bewley Creek	Mouth	15	10	6	3	2	2	2	15	15		15
Fawcet Creek	Mouth	25	15	10	6	3	2		2	15	25	25

Appendix I (continued)

Stream	Location	Dec-Apr.	May	June	July	August	Sept.	Oct.	Nov.
Killam Creek	Mouth	15	10	5	2	1	1 10	15	15
Munson Creek	Mouth	20	12 6	3	2	1	1	10 20	20
Simmons Creek	Mouth	20	13 8	4	3	1	1	15 20	20
Trask River	USGS gage 14-3025	300	300	220	70	70	150	300	300
Green Creek *	Mouth	8	5 2	0.5	0.5	0.5	0.5	1 5	8
N.Fk. Trask River	Mouth	90	70	70	50	35	50	90	90
Bark Shanty Creek	Mouth	18	12	8	6	4	4	14 18	18
Clear Creek	Mouth	25	15	15	6	4	15	25	25
Mid. Fk. of North Fk. Trask River	Just above N.Fk. of N.Fk. Trask River	50	30	30	25	16	30	50	50
N.Fk. of North Fork Trask River	Mouth	35	20	12	8	5	5	25 35	35
S.Fk. Trask River	Mouth	60	40	40	40	30	40	60	60
E.Fk. of South Fork Trask River	Mouth	40	30	30	20	15	25	40	40
Edwards Creek	Mouth	30	20	20	8	4	15	30	30
Wilson River	USGS gage 14-3015	320	320	240	70	70	200	320	320
Cedar Creek	Mouth	30	20	12	10	8	5	18 30	30
Devils Lake Fork	Mouth	40	30	30	10	6	20	40	40
Elk Creek	Mouth	30	15	5	4	4	3	20 30	30
Fall Creek	Mouth	10	7	5	3	2	2	6 10	10
Jordan Creek	Mouth	35	20	20	15	10	20	35	35
Little N.Fk. Wilson R.	Mouth	70	45	30	20	10	20 40	70	70
N.Fk. Wilson River	Mouth	45	30	30	20	12	25	45	45
S.Fk. Wilson River	Mouth	40	30	30	10	5	20	40	40

* Part of recommended discharge regimen were extrapolated by correlating known discharge volumes with flow requirements of neighboring streams of similar size.

Appendix II. Miscellaneous flow and temperature measurements, North Coast Basin streams, 1965-1966

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Columbia R. Tribs.							
Bear Cr.	6-10-65	11:30 AM	54	61	11.1*	0.7 mi. above mouth	
" "	7-16-65	12:00 Noon	59	62	26*	"	
" "	9-16-65	12:35 PM	53	63	2.5*	"	
" "	4-28-66	7:15 PM	53	52	13*	"	
" "	6-7-66	4:25 PM	57	61	9.3*	"	
" "	7-6-66	12:10 PM	57	59	6.8*	"	
" "	8-8-66	2:45 PM	64	70	3.2*	"	
" "	9-14-66	2:10 PM	57	60	1.9*	"	Recent rain
" "	11-7-66	12:45 PM	45	-	7.3*	"	
Beaver Cr.	7-16-65	2:30 PM	65	68	2.2	1.4 mi. upstream from Inglis, Oregon	
" "	9-16-65	10:50 AM	52	59	1.9	"	
" "	4-28-66	4:35 PM	56	63	2.1*	"	
" "	6-7-66	1:10 PM	57	58	7.0*	"	
" "	7-6-66	10:45 AM	57	58	5.0*	"	
" "	8-8-66	1:05 PM	62	73	2.1*	"	
" "	9-14-66	11:10 AM	55	56	3.6*	"	Recent rain
" "	11-7-66	11:00 AM	43	-	4.0*	"	
Big Cr.	6-10-65	12:00 Noon	53	61	59*	1.1 mi. upstream from mouth	
" "	7-16-65	12:25 PM	59	62	25.9*	"	
" "	9-16-65	12:20 PM	53	62	22.5*	"	
" "	4-28-66	7:00 PM	50	53	84*	"	
" "	6-7-66	4:10 PM	55	60	52*	"	
" "	7-6-66	11:55 AM	53	58	31.4*	"	
" "	8-8-66	2:30 PM	62	71	24.3*	"	
" "	9-14-66	1:45 PM	54	60	22.6*	"	Recent rain
" "	11-7-66	12:00 PM	44	-	32.0*	"	

* Measured flow, others are estimated.

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Clatskanie R.	6-10-65	1:15 PM	59	65	27	1.2 mi. downstream from Keystone Creek	
"	7-16-65	2:00 PM	65	66	17*	"	
"	9-16-65	11:20 AM	54	60	15.2*	"	
"	4-28-66	5:10 PM	53	63	59*	"	
"	6-7-66	1:45 PM	56	58	26*	0.2 mi. below Keystone Cr.	
"	7-6-66	11:00 AM	57	60	18.0*	"	
"	8-8-66	1:30 PM	63	74	9.1*	"	
"	9-14-66	11:40 AM	57	56	10.8*	"	Recent rain
Carcus Cr.	9-14-66	12:20 PM	55	56	1.0*	0.3 mi. above mouth	Recent rain
(Klaskanine R.)							
N.Fk. Klaskanine	6-10-65	8:45 AM	56	58	25*	Mouth	
" "	7-16-65	11:05 AM	61	61	6.4*	"	
" "	8-26-65	6:15 PM	65	68	6.2*	"	
" "	9-16-65	2:50 PM	56	64	12.1*	"	
" "	4-29-66	8:55 AM	48	54	43*	"	
" "	6-7-66	5:35 PM	58	59	20*	"	
" "	7-6-66	1:05 PM	57	61	11.4*	"	
" "	8-8-66	3:45 PM	67	73	3.2*	"	
" "	9-14-66	3:20 PM	58	64	3.7*	"	Recent rain
S.Fk. Klaskanine	6-10-65	9:00 AM	56	58	27*	Mouth	
" "	7-16-65	11:15 AM	61	61	8.9*	"	
" "	8-26-65	6:25 PM	64	68	5.7*	"	
" "	9-16-65	2:35 PM	57	64	10.9*	"	
" "	4-29-66	9:00 AM	47	54	35*	"	
" "	6-7-66	5:20 PM	58	59	22*	"	
" "	7-6-66	1:00 PM	56	61	12.7*	"	
" "	8-8-66	3:35 PM	66	73	5.2*	"	
" "	9-14-66	3:10 PM	58	64	4.1*	"	Recent rain

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Lewis & Clark R.	6-10-65	10:10 AM	57	60	64*	River mile 10.8	
" "	7-16-65	9:30 AM	59	58	7.0	"	
" "	7-16-65	10:15 AM	63	58	13.5*	"	
" "	8-26-65	5:30 PM	69	69	10.6*	"	
" "	9-16-65	1:50 PM	58	64	25	"	
" "	4-29-66	10:15 AM	49	55	76	"	
" "	6-7-66	6:15 PM	60	56	29*	"	
" "	7-6-66	1:50 PM	59	60	25.3*	"	
" "	8-8-66	4:30 PM	70	72	7.5*	"	
" "	9-14-66	4:15 PM	61	64	6.5*	"	Recent rain
Plympton Cr.	6-10-65	12:30 PM	53	64	17.4*	0.3 mi. above mouth	
"	7-16-65	1:00 PM	61	64	6.4*	"	
"	9-16-65	11:45 AM	51	61	6.3*	"	
"	4-28-66	5:30 PM	49	54	17.6*	"	
"	6-7-66	2:40 PM	54	58	14.6*	"	
"	7-6-66	11:25 AM	53	60	10.6*	"	
"	8-8-66	2:00 PM	59	70	4.6*	"	
"	9-14-66	1:15 PM	54	60	4.7*	"	Recent rain
"	11-7-66	11:30 AM	44	-	8.5*	"	
Young's R.	6-10-65	9:30 AM	57	60	35	Mile 8.9, 0.1 mi. below Young's Falls	
"	7-16-65	10:45 AM	62	59	9.0*	"	
"	8-26-65	6:00 AM	65	68	6.5*	"	
"	9-16-65	2:20 PM	56	64	14.5*	"	
"	4-29-66	9:30 AM	48	54	40*	"	
"	6-7-66	5:55 PM	59	58	20.4*	"	
"	7-6-66	1:20 PM	58	60	19.7*	"	
"	8-8-66	4:00 PM	67	74	6.8*	"	
"	9-14-66	3:50 PM	59	65	4.3*	"	Recent rain

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Kilchis R.	8-26-64	10:45 AM	58	58	103*	1/4 mi. downstream from Mapes Creek	
"	6-17-65	7:30 PM	56	54	75*	"	
"	7-13-65	10:40 AM	60	65	42.5*	"	
"	8-26-65	8:35 AM	60	59	28.8*	"	
"	9-17-65	9:35 AM	51	46	35*	"	
"	6-10-66	9:00 AM	58	56	90*	"	
"	7-12-66	9:35 AM	57	52	57*	"	
"	8-10-66	9:45 AM	61	64	26.7*	"	
"	9-16-66	10:40 AM	58	62	27.2*	"	Recent rain
Clear Cr.	6-17-65	6:10 PM	54	55	5.2*	Mouth	
"	7-13-65	10:50 AM	56	65	3.1*	"	
"	8-26-65	8:45 AM	57	59	1.2*	"	
"	9-17-65	9:50 AM	50	47	1.7*	"	
"	3-25-66	11:30 AM	48	62	42*	"	
"	6-10-66	7:45 AM	54	55	10.3*	"	
"	7-12-66	9:50 AM	54	53	4.7*	"	
"	8-10-66	10:00 AM	57	63	2.1*	"	
"	9-16-66	11:00 AM	56	64	1.7*	"	Recent rain
Coal Cr.	6-17-65	5:40 PM	60	55	0.4	Mouth	Numerous coho juveniles observed
"	7-13-65	10:20 AM	62	63	0.1	"	"
"	8-26-65	11:00 AM	-	-	-	"	Dry to 300 yds. above mouth, flow 0.1 cfs.
"	9-17-65	9:20 AM	48	46	0.2	"	
"	3-25-66	11:00 AM	48	60	9.0*	"	Several juvenile coho & steelhead observed
"	6-10-66	9:15 AM	55	56	1.0	"	
"	8-10-66	9:35 AM	-	63	Dry	"	
Little South Fk.	6-17-65	7:00 PM	56	55	21*	Mouth	
"	7-13-65	12:15 PM	59	73	10.7*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Little South Fk.	8-26-65	9:00 AM	59	59	7.0*	Mouth	
" "	9-17-65	10:00 AM	50	48	7.5*	"	
" "	3-25-65	11:50 AM	49	63	126*	"	
" "	6-10-66	7:55 AM	55	55	17.0*	"	
" "	7-12-66	10:05 AM	55	54	11.8*	"	
" "	8-10-66	10:15 AM	60	65	4.8*	"	
" "	9-16-66	11:15 AM	56	64	6.1*	"	Recent rain
N.Fk. Kilchis R.	6-17-65	6:25 PM	57	56	18.2*	Mouth	
" "	7-13-65	11:30 AM	61	72	9.2*	"	
" "	8-26-65	9:30 AM	62	60	5.7*	"	
" "	9-17-65	11:35 AM	52	54	6.6*	"	
" "	3-25-66	12:55 AM	49	65	170	"	
" "	6-10-66	8:25 AM	58	55	16.5*	"	
" "	7-12-66	10:30 AM	60	56	17.9*	"	
" "	8-10-66	10:35 AM	62	64	6.8*	"	
" "	9-16-66	11:35 AM	58	65	6.8*	"	Recent rain
S.Fk. Kilchis R.	6-17-65	6:35 PM	54	56	15.2*	Mouth	
" "	7-13-65	11:40 AM	57	72	7.4*	"	
" "	8-26-65	9:40 AM	58	60	5.0*	"	
" "	9-17-65	11:45 AM	50	54	5.7*	"	
" "	3-25-66	12:50 PM	49	65	130	"	Several juvenile salmonids observed at mouth
" "	6-10-66	8:30 AM	55	55	13.1*	"	
" "	7-12-66	10:35 AM	56	56	8.5*	"	
" "	8-10-66	10:45 AM	57	64	4.1*	"	
" "	9-16-66	11:45 AM	56	65	4.2*	"	Recent rain
Miami R.	8-26-64	9:30 AM	55	59	46*	200 yards upstream from Prouty Creek	
"	6-17-65	4:45 PM	55	56	42*	1/4 mi. upstream from Moss Creek	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Miami R.	7-13-65	9:50 AM	56	61	23*	1/4 mi. upstream from Moss Creek	
"	8-17-65	5:50 PM	63	75	18*	"	
"	9-17-65	12:30 PM	55	55	16.5*	"	
"	3-25-66	9:00 AM	45	48	315*	"	
"	6-9-66	12:40 PM	60	70	33*	"	
"	7-7-66	6:20 PM	59	67	30.7*	"	
"	8-10-66	9:15 AM	56	61	16.7*	"	
"	9-16-66	10:20 AM	56	60	13.7*	"	Recent rain
"	7-7-66	5:35 PM	57	70	18*	River Mile 7.0	
"	8-10-66	8:35 AM	57	60	8.0*	"	
"	9-16-66	9:45 AM	55	59	5.0*	"	Recent rain
Moss Cr.	6-17-65	3:35 PM	50	57	0.5*	Mouth	Intermittent flow in sections of lower 1.0 - 2.0 miles.
"	7-13-65	9:35 AM	53	60	2.0*	Mile 1.1	Dry in lower 1.1 mi.
"	8-17-65	5:10 PM	60	78	0.6	"	
"	9-17-65	1:00 PM	54	56	1.0	"	
"	3-25-66	9:30 AM	46	48	35*	Mouth	
"	6-9-66	12:30 PM	60	70	1.3	Mile 1.0	Dry in lower 0.8 mi. Coho juveniles seen at mile 1.0.
"	7-7-66	6:10 PM	56	68	5.7*	"	0.5 cfs between mouth & mile 0.4.
"	8-10-66	9:00 AM	55	60	1.0	"	Dry in lower 1.0 mi. many coho zeros seen.
"	9-16-66	10:20 AM	54	60	2.0	Mile 1.4	Lowermost flow at mi. 1.0, estimated at 0.5 cfs.
Peterson Cr.	6-17-65	4:30 PM	53	56	1.8*	0.2 mi. above mouth	
"	7-13-65	9:00 AM	52	58	0.8*	"	Numerous coho salmon juveniles observed at mile 0.2.

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Peterson Cr.	8-17-65	5:25 PM	62	77	0.5	0.2 mi. above mouth	
"	9-17-65	1:10 PM	55	57	0.5	"	
"	3-25-66	9:45 AM	47	50	10.4*	Mouth	
"	6-9-66	12:05 PM	56	68	2.5*	"	
"	7-7-66	5:50 PM	56	68	3.1*	"	
"	8-10-66	8:45 AM	56	60	1.4*	"	
"	9-16-66	10:00 AM	55	60	2.0*	"	Recent rain
Prouty Cr.	6-17-65	4:15 PM	52	57	1.0	0.2 mi. above mouth	
"	7-13-65	9:15 AM	52	59	0.5*	"	
"	8-17-65	5:30 PM	60	77	0.3	"	
"	9-17-65	1:20 PM	54	57	0.5	"	
"	3-25-66	10:10 AM	47	53	8.0*	Mouth	
"	6-9-66	12:20 PM	-	68	0.5	0.3 mi. above mouth	Dry at mouth, 0.6 cfs 0.8 mi. above mouth.
"	9-16-66	10:10 AM	55	60	1.0	0.5 mi. above mouth	Dry in lower 0.5 mi. Recent rain
Miscellaneous Ocean Tribs.							
Arch Cape Cr.	6-9-65	6:20 PM	59	63	5.4*	0.2 mi. above mouth	
"	7-14-65	5:30 PM	64	68	2.5	"	
"	8-26-65	4:10 PM	62	70	5.0*	"	
"	9-16-65	5:50 PM	54	65	10.1*	"	
"	4-29-66	1:45 PM	51	65	14.6*	"	
"	6-8-66	9:00 AM	53	59	4.1*	"	
"	7-6-66	5:55 PM	55	56	13.3*	"	
"	9-15-66	6:45 PM	57	59	2.5*	"	Recent rain
"	11-7-66	4:45 PM	47	-	19.6*	"	
(Elk Cr.)							
N.Fk. Elk Cr.	6-9-65	7:00 AM	60	63	10.9*	Mouth	
"	7-14-65	6:00 PM	66	66	4.4*	"	
"	8-26-65	4:40 PM	66	70	4.3*	"	
"	9-16-65	5:25 PM	57	66	9.2*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
N.Fk. Elk Cr.	4-29-66	1:15 PM	51	64	22*	Mouth	
"	6-8-66	8:30 AM	55	57	6.6*	"	
"	7-6-66	6:15 PM	58	55	11.7*	"	
"	8-10-66	7:30 AM	62	57	3.2*	"	
"	9-15-66	7:15 PM	57	59	3.0*	"	Recent rain
W.Fk. Elk Cr.	6-9-65	6:45 PM	59	63	11.0*	Mouth	
"	7-14-65	6:15 PM	62	65	5.5*	"	
"	8-26-65	4:50 PM	63	70	6.3*	"	
"	9-16-65	5:15 PM	57	66	11.1*	"	
"	4-29-66	1:05 PM	51	64	24*	"	
"	6-8-66	8:40 AM	54	57	9.0*	"	
"	7-6-66	6:25 PM	58	55	18.9*	"	
"	8-10-66	7:25 AM	62	57	5.2*	"	
"	9-15-66	7:10 PM	56	59	3.7*	"	Recent rain
Neskowin Cr.	7-20-65	11:45 AM	58	62	10.0*	1.1 mi. above mouth	
"	8-16-65	11:50 AM	59	69	6.5*	"	
"	9-13-65	11:30 AM	58	65	4.5*	"	
"	6-14-66	9:40 AM	57	67	13.7*	"	
"	7-11-66	10:50 AM	60	63	12.7*	"	
"	8-15-66	11:35 AM	62	70	5.6*	"	
"	9-19-66	10:50 AM	53	63	8.0*	"	Recent rain
"	11-4-66	10:25 AM	48	46	42.2*	"	
Sand Cr.	6-18-65	10:00 AM	53	56	6.6*	1.0 mi. N.E. of Sand Lake	
"	7-12-65	12:50 PM	59	74	2.6*	"	
"	8-17-65	11:05 AM	58	66	1.1*	"	
"	9-14-65	10:10 AM	55	54	2.3*	"	
"	3-25-66	3:15 PM	50	64	52*	"	
"	6-14-66	12:00 Noon	60	74	4.9*	"	
"	7-11-66	11:30 AM	58	65	3.7*	"	
"	8-12-66	2:50 PM	59	82	0.9*	"	
"	9-19-66	1:05 PM	57	73	2.1*	"	Recent rain
"	11-4-66	11:25 AM	49	55	11.9*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Short Sand Cr.	6-9-65	6:00 PM	57	64	3.2*	0.6 mi. above mouth	
" "	7-14-65	5:15 PM	60	70	1.5	"	
" "	8-26-65	3:55 PM	61	70	1.7	"	
" "	9-16-65	6:00 PM	53	63	5.8*	"	
" "	4-29-66	2:00 PM	49	65	8.0*	"	
" "	6-8-66	9:15 AM	52	59	2.4*	"	
" "	7-6-66	5:40 PM	54	56	6.5*	"	
" "	8-10-66	7:55 AM	57	57	1.9*	"	
" "	9-15-66	6:35 PM	54	61	1.4*	"	Recent rain
" "	11-7-66	4:30 PM	46	-	15*	"	
Necanicum R.	6-9-65	8:45 AM	55	64	55*	River mile 6.0, 0.7 mi. above Circle Cr.	0.3 mi. above Hwy. #101 crossing
"	7-15-65	8:40 AM	65	60	21.4*	"	"
"	8-19-65	4:10 PM	63	64	20.4*	"	"
"	9-16-65	3:50 PM	59	65	32*	"	"
"	4-29-66	11:00 AM	49	57	86*	"	"
"	6-9-66	8:40 AM	58	60	43*	"	"
"	7-6-66	2:40 PM	59	63	35.5*	"	"
"	8-9-66	7:10 AM	64	57	13.4*	"	"
"	9-15-66	8:00 AM	57	56	8.7*	"	" (recent rain)
"	11-7-66	1:50 PM	47	-	107*	"	"
Necanicum R.	6-9-65	10:40 AM	52	67	6.1*	Just upstream from Bergsvik Cr.	
"	7-15-65	9:45 AM	57	60	3.0*	"	
"	8-19-65	3:05 PM	59	64	3.8*	"	
"	9-16-65	4:50 PM	54	66	3.8*	"	
"	4-29-66	12:15 PM	49	63	7.5*	"	
"	6-9-66	9:55 AM	52	57	4.9*	"	
"	7-6-66	3:40 PM	56	60	3.1*	"	
"	8-9-66	8:10 AM	58	61	1.6*	"	
"	9-15-66	9:10 AM	51	59	1.5*	"	Recent rain
Bergsvik Cr.	6-9-65	10:30 AM	52	67	5.7*	Mouth	
"	7-15-65	9:35 AM	59	60	1.8*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Bergsvik Cr.	8-19-65	3:00 PM	59	64	3.9*	Mouth	
"	9-16-65	4:45 PM	54	66	1.6*	"	
"	4-29-66	12:25 PM	49	63	14.5*	"	
"	6-9-66	9:50 AM	54	57	3.9*	"	
"	7-6-66	3:42 PM	56	60	3.0*	"	
"	8-9-66	8:15 AM	60	61	1.1*	"	
"	9-15-66	9:15 AM	52	59	0.7*	"	Recent rain
Kloochie Cr.	6-9-65	9:15 AM	53	64	4.8*	Mouth	
"	7-15-65	9:00 AM	62	60	1.7	"	
"	8-19-65	3:50 PM	60	64	3.9*	"	
"	9-16-65	4:05 PM	57	65	3.0*	"	
"	4-29-66	11:20 AM	49	59	10.8*	"	
"	6-9-66	9:00 AM	56	60	2.9*	"	
"	7-6-66	3:00 PM	56	61	3.6*	"	
"	8-9-66	7:25 AM	61	57	1.7*	"	
"	9-15-66	8:25 AM	52	56	1.3*	"	Recent rain
"	11-7-66	2:15 PM	47	-	13.9*	"	
N.Fk. Necanicum	6-9-65	10:00 AM	55	66	5.3*	0.3 mi. above mouth, above hatchery diversion	
"	7-15-65	9:25 AM	60	60	2.4*	"	
"	8-19-65	3:20 PM	60	64	4.9*	"	
"	9-16-65	4:35 PM	60	66	2.0	"	
"	4-29-66	12:00 Noon	52	62	10.6*	"	
"	6-9-66	9:35 AM	56	61	3.8*	"	Hatchery diversion flowing 1.3 cfs.
"	7-6-66	3:20 PM	59	60	4.2*	"	Hatchery diversion flowing 1.8 cfs.
"	8-9-66	7:55 AM	60	60	2.2*	"	Hatchery diversion flowing 1.7 cfs.
"	9-15-66	8:50 AM	53	58	1.6*	"	Hatchery diversion flowing 1.4 cfs. Recent rain.

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
S.Fk. Necanicum	6-9-65	9:30 AM	52	64	5.8*	Mouth	
"	7-15-65	9:10 AM	60	60	2.8*	"	
"	8-19-65	3:35 AM	60	64	1.3*	"	
"	9-16-65	4:25 PM	56	66	0.6	"	
"	4-29-66	11:40 AM	50	61	10.5*	"	
"	6-9-66	9:10 AM	54	61	4.2*	"	
"	7-6-66	3:10 PM	57	60	2.1*	"	
"	8-9-66	7:40 AM	60	58	0.7*	"	
"	9-15-66	8:35 AM	51	58	0.7*	"	Recent rain
Nehalem R.	6-9-65	12:00 Noon	-	67		USGS gage 14-3010	
"	7-14-65	5:05 PM	70	69		"	
"	8-26-65	2:15 PM	68	70		"	
"	9-15-65	9:50 AM	-	55		"	
"	6-8-66	9:45 AM	61	60		"	
"	7-7-66	3:35 PM	63	70		"	
"	8-9-66	2:50 PM	73	80		"	
"	9-15-66	5:20 PM	61	64		"	Recent rain
Nehalem R.	6-9-65	2:15 PM	65	74	176*	0.4 mi. upstream from Humbug Cr.	
"	7-14-65	1:55 PM	72	75	92*	"	
"	8-27-65	12:05 PM	66	72	56.5*	"	
"	9-15-65	1:15 PM	61	59	55*	"	
"	6-8-66	12:45 PM	63	72	190*	"	
"	7-7-66	2:10 PM	63	71	132*	"	
"	8-9-66	1:05 PM	73	78	33.4*	"	
"	9-15-66	4:00 PM	62	68	49.5*	"	Recent rain
"	11-8-66	12:10 PM	45	-	138	"	
Nehalem R.	6-9-65	2:25 PM	64	77	-	Just above confluence of Oak Ranch Creek	
"	7-15-65	12:20 PM	69	65	-	"	
"	8-19-65	11:05 AM	68	64	-	"	
"	9-15-65	3:30 PM	60	59	-	"	
"	6-8-66	3:45 PM	65	72	-	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Nehalem R.	7-7-66	11:30 AM	62	65	-	Just above confluence of Oak Ranch Cr.	
"	8-9-66	10:40 AM	67	71	-	"	
"	9-15-66	1:10 PM	59	67	-	"	Recent rain
Nehalem R.	6-9-65	4:00 PM	65	77	28.5*	200 yds. upstream from Rock Cr.	
"	7-15-65	2:00 PM	70	67	12.8*	"	
"	8-19-65	10:25 AM	66	64	4.8*	"	
"	9-15-65	4:10 PM	60	59	2.5*	"	
"	3-23-66	10:30 AM	40	48	250	"	
"	6-8-66	4:45 PM	65	72	24*	"	
"	7-7-66	12:35 PM	61	69	32.6*	"	
"	8-9-66	11:25 AM	67	72	1.7*	"	
"	9-15-66	2:25 PM	58	67	4.2*	"	Recent rain
"	11-8-66	3:20 PM	43	-	9.6*	"	
Nehalem R.	7-15-65	2:45 PM	65	68	4.5*	0.1 mi. upstream from Wolf Cr.	
"	9-15-65	5:15 PM	58	59	2.4*	"	
"	3-23-66	10:30 AM	40	48	198*	"	
"	8-19-65	2:15 PM	60	64	4.9*	"	
"	7-7-66	1:00 PM	57	70	7.4*	"	
"	8-9-66	12:00 Noon	60	75	2.2*	"	
"	9-15-66	2:50 PM	54	67	4.0*	"	Recent rain
"	11-8-66	4:00 PM	42	-	4.9*	"	
Anderson Cr.	6-9-65	10:45 AM	52	62	5.6*	Mouth	
"	6-8-66	10:00 AM	52	60	3.3*	"	
"	7-7-66	3:55 PM	55	70	2.8*	"	
"	8-9-66	3:20 PM	60	76	0.9*	"	
"	11-8-66	9:40 AM	45	-	7.2*	"	
Beaver Cr. (lower)	7-7-66	11:00 AM	56	65	1.8*	Mouth	
"	8-9-66	10:20 AM	-	70	0.1	"	
"	9-15-66	12:15 PM	-	62	0.5	"	Recent rain
"	11-8-66	2:20 PM	-	-	2	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Buster Cr.	9-15-66	10:50 AM	54	60	1.0*	Mouth	Recent rain
Cook Cr.	6-9-65	11:00 AM	53	65	53*	Mouth	
"	7-14-65	4:15 PM	63	73	20.2*	"	
"	8-26-65	1:50 PM	60	68	14.5*	"	
"	9-15-65	10:00 AM	56	55	18.9*	"	
"	3-24-66	3:25 PM	-	-	300	"	
"	6-8-66	10:15 AM	54	62	29.3*	"	
"	7-7-66	4:10 PM	59	70	32.7	"	
"	8-9-66	3:40 PM	64	76	11.4*	"	
"	9-15-66	5:55 PM	55	62	14.7*	"	Recent rain
"	11-8-66	10:20 AM	45	-	53*	"	
Cow Cr.	6-9-65	11:30 AM	58	70	2.8*	0.6 mi. above mouth	
"	7-15-65	10:25 AM	61	62	0.9*	"	
"	8-19-65	1:20 PM	60	64	0.8*	"	
"	9-15-65	1:30 PM	-	-	1	"	
"	3-23-66	1:15 PM	48	55	30*	"	
"	6-8-66	1:45 PM	62	72	3.5*	"	
"	7-7-66	9:00 AM	56	59	1.7*	"	
"	8-9-66	9:05 AM	61	64	0.7*	"	
"	9-15-66	10:35 AM	54	60	0.6*	"	Recent rain
"	11-8-66	1:05 PM	-	-	2	"	
Cronin Cr.	6-9-65	1:00 PM	55	71	13*	Mouth	
"	7-14-65	2:35 PM	60	75	5.2*	"	
"	3-24-66	2:10 PM	47	63	118*	"	
"	6-8-66	12:15 PM	56	71	7.2*	"	
"	7-7-66	2:55 PM	56	70	7.6*	"	
"	8-9-66	1:45 PM	59	78	2.4*	"	
"	9-15-66	4:40 PM	55	67	2.7*	"	Recent rain
"	11-8-66	11:30 AM	45	-	13.2*	"	
Deep Cr.	7-7-66	10:35 AM	57	64	2.0*	0.1 mi. above mouth	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Deer Cr.	9-15-66	12:50 PM	53	67	0.3	Mouth	Extensive logjam at mouth. Recent rain.
E.Fk. Nehalem R.	6-9-65	2:45 PM	62	77	6.5*	Mouth	
"	7-15-65	12:40 PM	65	65	1.8*	"	
"	8-19-65	10:50 AM	64	64	1.3*	"	
"	9-15-65	3:45 PM	57	59	0.9*	"	
"	3-23-66	-	-	-	200	"	
"	6-8-66	4:00 PM	63	71	5.4*	"	
"	7-7-66	11:40 AM	59	66	4.3*	"	
"	8-9-66	10:55 AM	63	72	0.7*	"	
"	9-15-66	1:20 PM	56	67	1.6*	"	Recent rain
"	11-8-66	2:55 PM	44	-	2.9*	"	
Fishhawk Cr.	6-9-65	1:40 PM	60	77	14.1*	0.2 mi. above mouth	Trib. at r.m. 65.8
"	7-15-65	11:45 AM	64	64	6.9*	"	
"	8-19-65	11:40 AM	64	64	2.6*	"	
"	9-15-65	3:05 PM	58	59	4.5*	"	
"	3-23-66	2:45 PM	-	-	125	"	
"	6-8-66	3:00 PM	61	74	11.2*	"	
"	7-7-66	10:55 AM	57	64	11.7*	"	
"	8-9-66	10:15 AM	62	69	3.7*	"	
"	9-15-66	12:10 PM	55	62	4.5*	"	Recent rain
"	11-8-66	2:15 PM	43	-	13.7*	"	
Foley Cr.	6-9-65	10:00 AM	54	60	26*	1.0 mi. above mouth	
"	7-14-65	5:00 PM	66	70	14.7*	"	
"	8-26-65	1:15 PM	60	65	14.2*	"	
"	9-15-65	8:30 AM	55	55	30.4*	"	
"	6-8-66	11:50 AM	61	68	17*	"	
"	7-7-66	5:05 PM	63	70	17.5*	"	
"	8-9-66	4:00 PM	70	78	8.6*	"	
"	9-15-66	6:10 PM	58	62	6.9*	"	Recent rain
"	11-8-66	8:45 AM	45	-	46*	"	
Humbug Cr.	6-9-65	2:50 PM	58	75	24*	1.2 mi. above mouth	
"	7-14-65	1:35 PM	65	74	5.9*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Humbug Cr.	8-27-65	11:40 AM	61	67	3.9	1.2 mi. above mouth	
"	9-15-65	12:45 PM	58	58	11*	"	
"	3-23-66	12:30 PM	43	52	277*	"	
"	6-8-66	1:10 PM	60	72	16.5*	"	
"	7-7-66	1:50 PM	59	70	10.7*	"	
"	8-9-66	12:45 PM	66	77	2.6*	"	
"	9-15-66	3:35 PM	57	68	2.7*	"	Recent rain
"	11-8-66	12:40 PM	45	-	41*	"	
E.Fk. Humbug	7-14-65	1:10 PM	62	74	1.7	Mouth	
"	9-15-65	12:30 PM	56	58	3.0	"	
"	7-7-66	8:15 AM	56	57	2.6*	"	
"	8-9-66	8:35 AM	62	64	0.8*	"	
"	9-15-66	9:35 AM	54	58	0.7*	"	Recent rain
W.Fk. Humbug	7-14-65	1:10 PM	60	74	3	Mouth	
"	9-15-65	12:35 PM	55	58	4	"	
"	7-7-66	8:30 AM	54	57	7.5*	"	
"	8-9-66	8:45 AM	60	64	2.2*	"	
"	9-15-66	9:45 AM	53	58	2.0*	"	Recent rain
Lost Cr.	6-9-65	11:35 AM	54	66	9*	Mouth	
"	7-14-65	3:50 PM	66	74	3*	"	
"	8-26-65	2:05 PM	62	69	2.6*	"	
"	9-15-65	10:10 AM	56	55	2.0*	"	
"	3-24-66	3:00 PM	51	63	88*	"	
"	6-8-66	10:35 AM	53	62	6.4*	"	
"	7-7-66	4:20 PM	61	73	5.4*	"	
"	8-9-66	3:00 PM	66	79	1.8*	"	
"	9-15-66	5:40 PM	57	63	2.8*	"	Recent rain
"	11-8-66	9:20 AM	44	-	9.5*	"	
N.Fk. Nehalem R.	6-9-65	5:15 PM	61	67	73*	0.6 mi. downstream from Grassy Cr.	
"	7-14-65	11:30 AM	62	66	29*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
N.Fk. Nehalem R.	8-26-65	12:45 PM	63	65	17.1*	0.6 mi. downstream from Grassy Cr.	
"	9-15-65	11:05 AM	57	57	36*	"	
"	6-8-66	11:25 AM	61	65	52*	"	
"	7-6-66	4:50 PM	59	58	49*	"	
"	8-9-66	4:25 PM	70	76	20.8*	"	
"	9-16-66	9:15 AM	56	58	19.8*	"	Recent rain
"	11-7-66	4:00 PM	46	-	141*	"	
N.Fk. Nehalem R.	6-9-65	4:30 PM	59	74	46*	Just upstream from Gods Valley Cr.	
"	7-14-65	12:00 Noon	60	72	18.8*	"	
"	8-27-65	10:30 AM	60	64	17.3*	"	
"	9-15-65	11:35 AM	56	57	26*	"	
"	6-8-66	10:45 AM	57	62	33*	"	
"	7-6-66	4:30 PM	57	59	21*	"	
"	8-9-66	4:50 PM	68	74	15.8*	"	
"	9-16-66	8:50 AM	56	54	13.6*	"	Recent rain
"	11-7-66	3:25 PM	46	-	63*	"	
Coal Cr.	6-9-65	5:30 PM	59	66	14.5*	0.3 mi. above mouth	
"	7-14-65	11:10 AM	59	63	6.3*	"	
Gods Valley Cr.	6-9-65	4:15 PM	62	74	8*	Mouth	
"	7-14-65	11:50 AM	65	71	1.3*	"	
"	8-27-65	10:20 AM	61	64	1.5*	"	
"	9-15-65	11:25 AM	59	57	3.0*	"	
"	3-24-66	5:05 PM	47	60	83*	"	
"	6-8-66	10:40 AM	62	62	4.1*	"	
"	7-6-66	4:20 PM	59	59	4.3*	"	
"	8-9-66	4:45 PM	74	74	0.8*	"	
"	9-16-66	8:40 AM	57	54	1.2*	"	Recent rain
"	11-7-66	3:15 PM	46	-	18.7*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Soapstone Cr.	6-9-65	4:00 PM	57	76	11.9*	Mouth	
"	7-14-65	12:30 PM	61	73	4.7*	"	
"	8-27-65	10:45 AM	58	65	4.4*	"	
"	9-15-65	12:00 Noon	56	58	7.5*	"	
"	3-24-66	5:30 PM	46	60	114*	"	
"	6-8-66	10:20 AM	57	59	7.1*	"	
"	7-6-66	4:05 PM	57	60	7.5*	"	
"	8-9-66	5:05 PM	66	72	2.6*	"	
"	9-16-66	8:25 AM	56	54	2.3*	"	Recent rain
"	11-7-66	2:45 PM	46	-	33*	"	
Northrup Cr.	6-9-65	12:45 PM	59	77	7.1*	0.2 mi. above mouth	
"	7-15-65	11:20 AM	63	63	2.4*	"	
"	8-19-65	12:20 PM	62	64	1.7*	"	
"	9-15-65	2:40 PM	57	59	2.3*	"	
"	3-23-66	2:20 PM	-	-	100	"	
"	6-8-66	2:35 PM	60	74	5.5*	"	
"	7-7-66	10:05 AM	57	62	4.1*	"	
"	8-9-66	9:50 AM	61	66	1.0*	"	
"	9-15-66	11:45 AM	54	61	1.2*	"	Recent rain
"	11-8-66	1:50 PM	43	-	5.2*	"	
Oak Ranch Cr.	6-9-65	2:15 PM	57	77	2.8*	Mouth	
"	7-15-65	12:15 PM	59	65	1.4*	"	
"	8-19-65	11:00 AM	60	64	1.0*	"	
"	9-15-65	3:25 PM	56	59	1.0*	"	
"	3-23-66	3:20 PM	46	58	58*	"	
"	6-8-66	3:45 PM	58	72	3.0*	"	
"	7-7-66	11:25 AM	55	65	2.5*	"	
"	8-9-66	10:35 AM	58	71	1.1*	"	
"	9-15-66	1:05 PM	53	67	1.3*	"	Recent rain
"	11-8-66	2:40 PM	44	-	1.8*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Peterson Cr.	6-9-65	10:30 AM	51	60	1.5	0.3 mi. above mouth	
"	7-14-65	4:40 PM	57	73	0.3	"	
"	8-26-65	1:25 PM	57	66	0.3	"	
"	7-7-66	4:30 PM	-	72	0.5	"	
"	9-15-66	6:00 PM	-	62	0.1	"	Recent rain
"	11-8-66	9:00 AM	-	-	1.8	"	
Quartz Cr.	9-15-66	10:15 AM	51	59	3.0*	0.3 mi. upstream from mouth	Recent rain
Rock Cr.	6-9-65	3:30 PM	62	77	26.5*	Mouth	
"	7-15-65	1:25 PM	68	66	19.4*	"	
"	8-19-65	10:10 AM	67	64	8.7*	"	
"	9-15-65	4:00 PM	60	59	9.8*	"	
"	3-23-66	-	-	-	250	"	
"	6-8-66	4:15 PM	65	71	47*	"	
"	7-7-66	12:05 PM	60	66	17.4*	"	
"	8-9-66	11:15 AM	67	72	11.6*	"	
"	9-15-66	2:00 PM	58	66	12.2*	"	Recent rain
"	11-8-66	3:10 PM	43	-	27*	"	
Roy Cr.	8-26-65	1:20 PM	-	-	Dry	0.1 mi. above mouth	
"	6-8-66	9:30 AM	54	59	0.2	"	
"	7-7-66	4:35 PM	-	72		"	No flow
"	8-9-66	3:50 PM	-	78		"	No flow
"	9-15-66	6:05 PM	-	62		"	No flow
"	11-8-66	8:55 AM	-	-	1.0	"	
Salmonberry R.	6-9-65	12:15 PM	58	68	97*	0.1 mi. above mouth	
"	7-14-65	3:15 PM	69	75	38*	"	
"	8-26-65	12:45 PM	62	70	25.8*	"	
"	9-15-65	9:30 AM	57	55	33*	"	
"	6-8-66	11:45 AM	59	68	63*	"	
"	7-7-66	3:15 PM	60	68	52.5*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Salmonberry R.	8-9-66	2:00 PM	70	78	25*	0.1 mi. above mouth	
"	9-15-66	5:00 PM	57	65	27.2*	"	Recent rain
"	11-8-66	11:00 AM	45	46	59*	"	
Spruce Run Cr.	6-9-65	1:40 PM	55	73	4.2*	Mouth	
"	7-14-65	2:20 PM	58	75	0.8	"	
"	3-24-66	11:50 AM	45	59	43*	"	
"	7-7-66	2:30 PM	54	71	2.7*	"	
"	8-9-66	1:25 PM	60	76	0.4*	"	
"	9-15-66	4:15 PM	54	67	1.4*	"	Recent rain
"	11-8-66	11:45 AM	44	-	5.0*	"	
Walker Cr.	6-9-65	12:00 Noon	56	74	18*	Just above confluence of Fishhawk Cr.	
"	7-15-65	10:45 AM	63	63	4.2*	"	
"	8-19-65	12:40 PM	62	64	1.7*	"	
"	9-15-65	2:10 PM	57	59	1.7*	"	
"	3-23-66	1:40 PM	44	56	232*	"	
"	6-8-66	2:10 PM	58	72	15.6*	"	
"	7-7-66	9:40 AM	57	60	7.5*	"	
"	8-9-66	9:20 AM	63	66	1.8*	"	
"	9-15-66	11:15 AM	56	60	1.8*	"	Recent rain
"	11-8-66	1:25 PM	42	-	9.0*	"	
Fishhawk Cr.	6-9-65	12:15 PM	55	74	14.7*	Just above confluence of Walker Cr.	
"	7-15-65	10:50 AM	62	63	3.4*	"	
"	8-19-65	12:50 PM	62	64	1.1*	"	
"	9-15-65	2:20 PM	57	59	2.3*	"	
"	3-23-66	2:45 PM	-	-	125	"	
"	6-8-66	2:15 PM	58	72	13.1*	"	
"	7-7-66	9:50 AM	56	60	5.7*	"	
"	8-9-66	9:30 AM	61	66	1.3*	"	
"	9-15-66	11:20 AM	53	60	1.0*	"	Recent rain
"	11-8-66	1:30 PM	42	-	18.3*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Wolf Cr.	6-9-65	4:30 PM	58	76	8.8*	0.3 mi. above mouth	
"	7-15-65	3:00 PM	63	68	3.6*	"	
"	8-19-65	2:00 PM	60	64	1.4*	"	
"	9-15-65	4:55 PM	56	59	1.2*	"	
"	3-23-66	10:30 AM	40	50	136*	"	
"	6-8-66	5:25 PM	59	70	7.4*	"	
"	7-7-66	1:15 PM	56	70	3.3*	"	
"	8-9-66	12:10 PM	60	75	1.0*	"	
"	9-15-66	3:00 PM	54	67	1.7*	"	Recent rain
"	11-8-66	3:50 PM	40	-	2.0*	"	
Nestucca R.	8-26-64	5:55 PM	61	-	116*	80 yds. upstream from Farmer Cr.	
Nestucca R.	6-14-66	10:35 AM	61	70		USGS gage 14-3036	
"	7-11-66	2:00 PM	63	72		"	
"	8-12-66	1:55 PM	67	83		"	
"	9-20-66	1:10 PM	60	80		"	Recent rain
Nestucca R.	6-18-65	3:25 PM	54	52	54*	0.5 mi. downstream from Bear Cr.	
"	4-20-65	-	49	56	165*	"	
"	7-20-65	3:45 PM	59	64	38.6*	"	
"	8-16-65	3:30 PM	68	81	21.3	"	
"	9-13-65	2:55 PM	59	68	18.4*	"	
"	6-14-66	5:30 PM	67	70	68*	"	
"	7-11-66	5:10 PM	61	71	35.3*	"	
"	8-12-66	11:50 AM	58	74	20.5*	"	
"	9-20-66	10:25 AM	51	60	21.3*	"	Recent rain
Nestucca R.	6-18-65	4:20 PM	53	53		USGS gage 14-3029	
"	7-20-65	4:30 PM	57	64		"	
"	8-16-65	4:25 PM	62	82		"	
"	6-14-66	6:45 PM	62	65		"	
"	7-11-66	5:45 PM	60	68		"	
"	8-12-66	10:55 AM	55	70		"	
"	9-20-66	9:30 AM	50	56		"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Bays Cr.	6-18-65	1:10 PM	52	56	4.9*	0.2 mi. above mouth	
"	7-20-65	1:20 PM	55	62	4.5*	"	
"	8-16-65	1:25 PM	59	72	4.3*	"	
"	9-13-65	1:25 PM	56	68	2.8*	"	
"	4-8-66	11:45 AM	50	51	21*	"	
"	6-14-66	3:00 PM	60	78	6.6*	"	
"	7-11-66	3:00 PM	58	72	4.6*	"	
"	8-12-66	1:30 PM	57	82	2.8*	"	
"	9-20-66	12:35 PM	54	74	2.2*	"	Recent rain
Bear Cr.	6-18-65	3:40 PM	51	53	7.3*	Mouth	
"	7-20-65	4:00 PM	56	64	5.9*	"	
"	8-16-65	3:45 PM	63	82	3.7*	"	
"	9-13-65	3:05 PM	56	68	2.9*		
"	4-8-66	1:45 PM	48	53	23*	"	
"	6-14-66	5:50 PM	60	70	8.6*	"	
"	7-11-66	5:20 PM	57	72	6.0*	"	
"	8-12-66	11:40 AM	55	74	3.1*	"	
"	9-20-66	10:20 AM	51	60	3.1*	"	Recent rain
(Beaver Cr.)							
Bear Cr.	6-18-65	10:25 AM	52	57	3*	Mouth	
"	7-12-65	12:15 PM	59	74	1.0*	"	
"	8-16-65	1:00 PM	61	71	0.8	"	
"	9-13-65	1:00 PM	58	67	0.9	"	
"	4-8-66	11:00 AM	50	51	7.2*	"	
"	6-14-66	11:35 AM	60	73	2.3	"	
"	7-11-66	1:20 AM	62	70	1.7*	"	
"	9-19-66	2:55 AM	57	75	0.7*	"	Recent rain
E. Beaver Cr.	6-18-65	10:40 AM	52	57	23.5*	Mouth	
"	7-12-65	12:05 PM	58	74	14.4*	"	
"	8-16-65	12:45 PM	61	70	11.2*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
E. Beaver Cr.	9-13-65	12:45 PM	57	67	6.7*	Mouth	
"	4-8-66	10:45 AM	49	50	57*	"	
"	6-14-66	11:20 AM	58	73	18.7*	"	
"	7-11-66	1:40 PM	61	70	14.5*	"	
"	8-12-66	2:30 PM	63	82	8.2*	"	
"	9-19-66	12:45 PM	57	71	13*	"	Recent rain
"	11-4-66	2:30 PM	50	65	36*	"	
W. Beaver Cr.	6-18-65	10:45 AM	52	55	6*	Mouth	
"	7-12-65	12:10 PM	62	74	1.3	"	
"	8-16-65	12:50 PM	63	70	0.8	"	
"	9-13-65	12:55 PM	59	67	0.8	"	
"	4-8-66	10:35 AM	51	50	17.2*	"	
"	6-14-66	11:10 AM	61	73	7.0*	"	
"	7-11-66	1:30 PM	61	70	2.7*	"	
"	8-12-66	2:30 PM	62	82	0.6*	"	
"	9-19-66	12:40 PM	57	71	3.4*	"	Recent rain
Bible Cr.	6-14-66	4:50 PM	-	76	2.5	Mouth	
"	7-11-66	4:45 PM	-	74	2.0	"	
"	8-12-66	12:10 PM	-	76	1.2	"	
"	9-20-66	10:55 AM	51	60	1.9*	"	Recent rain
Clarence Cr.	6-18-65	2:20 PM	51	52	2.0*	Mouth	
"	7-20-65	3:25 PM	57	65	0.7*	"	
"	8-16-65	2:50 PM	59	79	0.5	"	
"	9-13-65	11:50 AM	56	65	0.8	"	
"	4-18-66	1:05 PM	48	53	11*	"	
"	6-14-66	4:25 PM	58	77	2.9*	"	
"	7-11-66	4:25 PM	57	73	1.8*	"	
"	8-12-66	12:35 PM	55	78	1.0*	"	
"	9-20-66	11:20 AM	52	64	0.7*	"	Recent rain

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Clear Cr.	6-22-65	11:45 AM	54	66	3.2*	0.2 mi. above mouth	
"	7-20-65	12:15 PM	56	62	2.9*	"	
"	8-16-65	12:15 PM	59	69	2.0*	"	
"	9-13-65	2:25 PM	54	69	0.6	"	
"	5-4-66	1:00 PM	52	57	6.6*	"	
"	6-15-66	11:05 AM	57	80	4.1*	"	
"	7-11-66	10:30 AM	56	63	3.0*	"	
"	8-15-66	11:10 AM	57	74	1.9*	"	
"	9-19-66	11:15 AM	55	67	2.2*	"	Recent rain
Elk Cr.	6-18-65	3:55 PM	51	53	9.4*	Mouth	
"	8-16-65	3:55 PM	63	82	4.9*	"	
"	9-13-65	3:15 PM	57	68	4.1*	"	
"	4-8-66	2:00 PM	47	53	24*	"	
"	6-14-66	6:05 PM	62	68	12.3*	"	
"	7-11-66	5:30 PM	58	70	4.9*	"	
"	8-12-66	11:30 AM	58	72	4.6*	"	
"	9-20-66	10:05 AM	51	59	4.5*	"	Recent rain
Farmer Cr.	6-18-65	11:20 AM	53	56	6*	Mouth	
"	7-12-65	11:40 AM	59	73	5.3*	"	
"	8-17-65	10:45 AM	58	65	3.9*	"	
"	9-13-65	12:35 PM	57	66	3.9*	"	
"	3-25-66	3:45 PM	50	64	45*	"	
"	6-14-66	10:20 AM	57	68	9*	"	
"	7-11-66	1:55 PM	58	71	5*	"	
"	8-12-66	2:10 PM	61	82	3.6*	"	
"	9-20-66	1:15 PM	59	80	3.2*	"	Recent rain
"	11-4-66	2:55 PM	51	62	14.8*	"	
Little Nestucca R.	6-22-65	12:15 PM	55	62	38*	200 yds. below Fall Cr.	
"	7-20-65	11:15 AM	57	62	18.8*	"	
"	8-16-65	11:30 AM	61	68	22*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Little Nestucca	9-13-65	11:10 AM	57	64	15.9*	200 yds. below Fall Cr.	
"	5-4-66	12:10 PM	53	55	83*	"	
"	6-15-66	10:45 AM	61	75	46*	"	
"	7-12-66	4:30 PM	59	60	35*	"	
"	8-15-66	12:05 PM	59	72	17*	"	
"	9-19-66	10:15 AM	53	60	21*	"	Recent rain
Little Nestucca	7-20-65	9:45 AM	56	60	2.5	150 yds. above Louie Cr.	
"	8-16-65	10:30 AM	60	66	3.2*	"	
"	9-13-65	10:20 AM	56	60	2.6*	"	
"	5-4-66	11:00 AM	51	54	21*	"	
"	6-15-66	9:30 AM	56	63	10.5*	"	
"	7-12-66	5:25 PM	60	58	4.1*	"	
"	8-15-66	10:05 AM	58	60	3.5*	"	
"	9-19-66	9:20 AM	52	56	4.5*	"	Recent rain
"	11-4-66	9:15 AM	45	42	16.8*	"	
Bear Cr.	6-15-66	10:15 AM	57	68	3.1*	Mouth	
"	11-4-66	9:45 AM	43	43	8.4*	150 yds. above mouth	
Fall Cr.	6-22-65	11:15 AM	55	62	4.6	Mouth	
"	7-20-65	10:55 AM	55	61	1.7*	"	
"	8-16-65	11:15 AM	57	68	1.5*	"	
"	9-13-65	11:00 AM	54	63	1.2	"	
"	5-4-66	12:20 PM	52	55	8.9*	"	
"	6-15-66	10:30 AM	57	73	3.7*	"	
"	7-12-66	4:40 PM	56	60	3.0*	"	
"	8-15-66	12:10 PM	56	72	1.4*	"	
"	9-19-66	10:25 AM	51	60	2.1*	"	Recent rain
Louie Cr.	6-22-65	1:40 PM	54	66	2.8*	Mouth	
"	7-20-65	10:05 AM	56	60	1.9*	"	
"	8-16-65	10:45 AM	59	66	0.9*	"	
"	9-13-65	10:30 AM	56	60	0.8*	"	

Appendix II (Continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Louie Cr.	5-4-66	10:45 AM	49	53	6.5*	Mouth	
"	6-15-66	9:15 AM	55	62	3.3*	"	
"	7-12-66	5:15 PM	60	58	1.8*	"	
"	8-15-66	10:00 AM	56	60	0.7*	"	
"	9-19-66	9:30 AM	51	56	1.0*	"	Recent rain
S.Fk. Little Nestucca R.	6-22-65	2:30 PM	56	66	7*	Mouth	
"	7-20-65	10:30 AM	55	60	4.7*	"	
"	8-16-65	11:00 AM	58	68	3.5*	"	
"	9-13-65	10:45 AM	54	62	2.6*	"	
"	5-4-66	11:45 AM	50	52	13*	"	
"	6-15-66	9:55 AM	55	67	12.8*	"	
"	7-12-66	5:00 PM	56	60	9.3*	"	
"	8-15-66	12:30 PM	57	72	4.2*	"	
"	9-19-66	9:50 AM	51	57	4.9*	"	Recent rain
Moon Cr.	6-18-65	1:25 PM	53	55	9.4*	Just above confluence with East Cr.	
"	7-20-65	1:35 PM	58	62	3.9*	"	
"	8-16-65	1:40 PM	64	74	4.0*	"	
"	9-13-65	1:40 PM	58	68	2.4*	"	
"	4-8-66	12:05 PM	49	52	28*	"	
"	6-14-66	3:30 PM	62	77	11.7*	"	
"	7-11-66	3:30 PM	60	73	7.2*	"	
"	8-12-66	1:15 PM	60	80	3.5*	"	
"	9-20-66	12:00 Noon	55	70	2.9*	"	Recent rain
East Cr.	6-18-65	1:30 PM	53	55	12.6*	Just upstream from Moon Cr.	
"	7-20-65	1:45 PM	57	62	8.0*	"	
"	8-16-65	1:50 PM	61	74	4.1*	"	
"	9-13-65	1:45 PM	57	68	3.2*	"	
"	4-8-66	12:20 PM	49	52	45*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
East Cr.	6-14-66	3:20 PM	63	78	14*	Just upstream from Moon Cr.	
"	7-11-66	3:20 PM	60	73	8.8*	"	
"	8-12-66	1:10 PM	58	80	5.7*	"	
"	9-20-66	11:50 AM	53	69	3.0*	"	Recent rain
Niagara Cr.	6-18-65	2:10 PM	53	55	9.3*	Mouth	
"	7-20-65	3:00 PM	59	65	4.6*	"	
"	8-16-65	2:30 PM	68	78	2.2	"	
"	9-13-65	2:15 PM	56	69	1.6	"	
"	4-8-66	12:55 PM	48	53	37*	"	
"	6-14-66	4:10 PM	65	77	6.6*	"	
"	7-11-66	4:10 PM	63	73	4.0*	"	
"	8-12-66	12:40 PM	65	78	2.2*	"	
"	9-20-66	11:25 AM	57	66	2.0*	"	Recent rain
Powder Cr.	6-18-65	1:45 PM	52	55	5.8*	Mouth	
"	7-20-65	2:45 PM	57	64	2.5*	"	
"	8-16-65	2:20 PM	62	77	0.9	"	
"	9-13-65	2:05 PM	56	69	1.0	"	
"	4-8-66	12:40 PM	48	52	23*	"	
"	6-14-66	3:50 PM	61	77	6.4*	"	
"	7-11-66	3:50 PM	60	74	3.1*	"	
"	8-12-66	12:50 PM	58	79	2.1*	"	
"	9-20-66	11:35 AM	53	68	1.7*	"	Recent rain
Slick Rock Cr.	6-18-65	2:45 PM	51	56	2.7*	Mouth	
"	7-20-65	3:35 PM	56	65	2.2*	"	
"	8-16-65	3:05 PM	60	80	0.7*	"	
"	9-13-65	2:30 PM	56	69	0.6	"	
"	4-8-66	1:15 PM	48	53	12*	"	
"	6-14-66	4:40 PM	62	77	3.0*	"	
"	7-11-66	4:35 PM	57	74	2.1*	"	
"	8-12-66	12:25 PM	55	78	1.3*	"	
"	9-20-66	11:05 AM	52	62	1.0*	"	Recent rain

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Testament Cr.	6-18-65	3:00 PM	51	52	4	Mouth	
"	7-20-65	3:40 PM	56	65	3.4	"	
"	8-16-65	3:15 PM	60	80	2.8	"	
"	9-13-65	2:40 PM	54	69	2.2	"	
"	4-8-66	1:30 PM	47	53	19*	"	
"	6-14-66	5:05 PM	60	74	6.5*	"	
"	7-11-65	4:55 PM	57	73	4.3*	"	
"	8-12-66	12:02 PM	56	78	2.0*	"	
"	9-20-66	10:40 AM	52	60	2.4*	"	Recent rain
Three Rivers	6-22-65	11:30 AM	54	65	52*	Mouth	
"	7-12-65	11:25 AM	58	71	34.1*	"	
"	8-17-65	10:30 AM	59	65	18.3*	"	
"	9-13-65	12:05 PM	58	66	17.6*	"	
"	4-8-66	10:00 AM	48	50	168*	"	
"	6-15-66	12:15 PM	63	85	49.3*	"	
"	7-11-66	10:15 AM	56	62	37*	"	
"	8-15-66	11:00 AM	59	74	22.1*	"	
"	9-19-66	11:30 AM	55	68	21	"	Recent rain
"	11-4-66	3:10 PM	49	60	67	"	
Three Rivers	6-22-65	10:15 AM	50	60	11.8	Just upstream from Alder Cr.	
"	7-12-65	11:00 AM	54	70	7.5	"	
"	8-17-65	10:05 AM	56	65	5.8	"	
"	9-14-65	9:40 AM	55	54	7.0	"	
"	4-8-66	9:30 AM	47	49	50	"	
"	6-15-66	1:00 PM	60	86	23*	"	
"	7-11-66	9:55 AM	53	62	13.9*	"	
"	8-15-66	10:35 AM	56	70	6.1*	"	
"	9-19-66	3:35 PM	56	76	10.0*	"	Recent rain
"	11-4-66	3:50 PM	49	59	23.3*	"	
Alder Cr.	6-22-65	10:10 AM	51	60	6.9*	Mouth	
"	7-12-65	10:55 AM	55	70	5.7*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Alder Cr.	8-17-65	10:00 AM	57	65	3.7*	Mouth	
"	9-14-65	9:35 AM	55	54	3.9*	"	
"	4-8-66	9:20 AM	48	49	28*	"	
"	6-15-66	12:50 PM	61	86	4.7*	"	
"	7-11-66	9:45 AM	53	62	3.5*	"	
"	8-15-66	10:30 AM	55	70	3.1*	"	
"	9-19-66	3:20 PM	60	76	3.0*	"	Recent rain
"	11-4-66	3:45 PM	51	59	14.3*	"	
Wolfe Cr.	6-18-65	1:00 PM	54	56	3.8*	Mouth	
"	7-20-65	12:30 PM	57	62	3.0*	"	
"	8-16-65	1:15 PM	61	71	1.8*	"	
"	9-13-65	1:15 PM	58	67	1.7	"	
"	4-8-66	11:30 AM	50	51	8.2*	"	
"	6-14-66	2:40 PM	65	78	2.7*	"	
"	7-11-66	2:20 PM	63	72	2.3*	"	
"	8-12-66	1:40 PM	61	82	1.4*	"	
"	9-20-66	12:45 PM	57	75	1.2*	"	Recent rain
Tillamook R.	8-26-64	3:55 PM	61	-	44.5*	200 yds. upstream from Bewley Cr.	
"	6-18-65	8:40 AM	54	53	35*	"	
"	7-12-65	1:45 PM	68	74	19.1*	"	
"	8-17-65	12:00 Noon	63	67	4.4*	"	
"	9-14-65	11:05 AM	60	55	3.5*	"	
"	3-25-66	1:45 PM	50	63	300*	"	
"	6-14-66	1:30 PM	65	75	39*	"	
"	7-11-66	12:50 PM	62	68	29*	"	
"	8-11-66	3:20 PM	71	78	4.3*	"	
"	9-19-66	2:18 PM	62	75	24.4*	"	Recent rain
"	11-4-66	1:40 PM	50	70	75	"	
Bewley Cr.	6-18-65	8:50 AM	55	53	6.6*	Mouth	
"	7-12-65	1:55 PM	59	74	1.9*	"	
"	8-17-65	12:30 PM	61	68	1.2*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Bewley Cr.	9-14-65	11:15 AM	58	55	0.6	Mouth	
"	3-25-66	2:05 PM	-	-	20	"	
"	6-14-66	1:40 PM	62	75	3.1*	"	
"	7-11-66	1:00 PM	58	68	2.6*	"	
"	8-11-66	3:30 PM	60	78	1.1*	"	
"	9-19-66	2:30 PM	57	75	2.1*	"	Recent rain
"	11-4-66	2:00 PM	51	70	11.4*	"	
Fawcet Cr.	6-18-65	9:15 AM	52	54	5.8*	Mouth	
"	7-12-65	1:35 PM	63	74	2.3*	"	
"	8-17-65	11:40 AM	59	67	1.1*	"	
"	9-14-65	10:35 AM	58	54	0.8	"	
"	3-25-66	2:30 PM	51	64	47*	"	
"	6-14-66	1:10 PM	64	75	9.0*	"	
"	7-11-66	12:25 PM	61	68	8.2*	"	
"	8-11-66	4:00 PM	66	78	0.5*	"	
"	9-19-66	1:50 PM	58	75	10.0*	"	Recent rain
"	11-4-66	1:10 PM	51	70	16.5*	"	
Killam Cr.	6-18-65	9:00 AM	53	53	5.6*	Mouth	
"	7-12-65	2:10 PM	60	74	1.1*	"	
"	8-17-65	11:50 AM	58	67	0.5	"	
"	3-25-66	2:20 PM	-	-	24	"	
"	6-14-66	2:05 PM	61	77	7.3*	"	
"	7-11-66	12:40 PM	57	68	2.4*	"	
"	8-11-66	3:40 PM	62	76	0.1	"	
"	9-19-66	2:05 PM	56	75	2.6	"	Recent rain
"	11-4-66	1:25 PM	51	70	11.0*	"	
Munson Cr.	6-18-65	9:30 AM	53	54	2.8*	0.2 mi. above mouth	
"	7-12-65	1:15 PM	62	74	1.6*	"	
"	8-17-65	11:30 AM	58	66	0.8	"	
"	3-25-66	2:50 PM	50	64	19*	"	
"	6-14-66	12:45 PM	63	75	1.9*	"	
"	7-11-66	12:00 Noon	60	67	2.7*	"	

Appendix II (continued)

Stream	Date	Time	Temp °F. Water	Temp °F. Air	Flow cfs	Location	Remarks
Munson Cr.	8-11-66	4:15 PM	65	78	1.2*	0.2 mi. above mouth	
"	9-19-66	1:30 PM	61	75	1.5*	"	Recent rain
"	11-4-66	12:40 PM	51	70	5.3*	"	
Simmons Cr.	6-18-65	9:25 AM	52	54	3.7*	0.2 mi. above mouth	
"	7-12-65	1:30 PM	60	74	2.0*	"	
"	8-17-65	11:35 AM	57	67	0.7*	"	
"	3-25-66	2:40 PM	51	64	23*	"	
"	6-14-66	12:55 PM	61	74	6.8*	"	
"	7-11-66	12:10 PM	57	67	3.9*	"	
"	8-11-66	4:10 PM	62	78	1.0*	"	
"	9-19-66	1:40 PM	57	75	1.9*	"	Recent rain
"	11-4-66	1:00 PM	50	70	11.0*	"	
Trask R.	6-8-65	10:50 AM	58	54		USGS gage 14-3025	
"	7-12-65	2:35 PM	-	75		"	
"	9-20-66	1:50 PM	-	80		"	Recent rain
Green Cr.	6-8-65	10:45 AM	51	54	0.8	0.4 mi. above mouth	
"	7-12-65	6:45 PM	58	70	0.2	"	
"	8-17-65	4:45 PM	58	82	less than 0.1	"	
"	9-14-65	11:55 AM	57	56	0.3	"	
"	5-4-66	6:55 PM	-	57	1.2	"	
"	6-9-66	5:30 PM	56	66	0.5	"	
"	7-8-66	7:00 AM	52	53	0.6	"	
"	8-11-66	3:05 PM	56	85	0.3	"	
"	9-20-66	1:45 PM	54	80	0.6	"	Recent rain
N.Fk. Trask R.	6-8-65	1:15 PM	57	57	95*	0.5 mi. above mouth	
"	7-22-65	-	-	-	52	"	
"	8-17-65	2:45 PM	70	82	30*	"	
"	9-14-65	1:20 PM	60	58	49*	"	
"	5-4-66	5:15 PM	61	68	170	Mouth	
"	6-9-66	2:45 PM	58	74	67*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
N.Fk. Trask R.	7-8-66	10:15 AM	59	64	63*	Mouth	Rough measurement
"	8-11-66	12:40 PM	64	78	34*	"	
"	9-20-66	2:50 PM	62	80	30*	"	Recent rain
Bark Shanty Cr.	6-8-65	1:15 PM	53	58	16.3*	Mouth	
"	5-4-66	2:30 PM	57	64	17.5*	"	
"	6-9-66	3:20 PM	61	73	7.3*	"	
"	7-8-66	7:45 PM	52	54	7.6*	"	
"	8-11-66	1:05 PM	58	77	4.0*	"	
"	9-20-66	3:10 PM	57	80	3.5*	"	Recent rain
Clear Cr.	6-8-65	2:15 PM	56	58	9.3*	Mouth	
"	7-12-65	5:00 PM	64	75	4.5*	"	
"	8-17-65	3:45 PM	69	84	2.6*	"	
"	9-14-65	1:50 PM	60	59	1.9*	"	
"	5-4-66	4:35 PM	59	69	10*	"	
"	6-9-66	4:35 PM	62	71	6.1*	"	
"	7-8-66	8:50 AM	53	57	6.4*	"	
"	8-11-66	1:35 PM	65	79	2.4*	"	
"	9-20-66	3:35 PM	63	80	2.3*	"	Recent rain
M.Fk. of N.Fk. Trask R.	6-8-65	3:00 PM	59	62	48*	0.2 mi. upstream from mouth of N.Fk. of N.Fk.	
"	7-12-65	5:30 PM	68	75	26*	"	
"	8-17-65	4:00 PM	70	85	18.7*	"	
"	9-14-65	2:20 PM	59	59	15.4*	"	
"	5-4-66	3:30 PM	62	71	62*	"	
"	6-9-66	4:15 PM	62	72	35*	"	
"	7-8-66	8:30 AM	53	55	31.4*	"	
"	8-11-66	2:00 PM	63	81	17.5*	"	
"	9-20-66	4:00 PM	60	80	18.1*	"	Recent rain
N.Fk. of N.Fk. Trask R.	6-8-65	2:45 PM	58	60	17*	Mouth	
"	7-12-65	5:20 PM	66	75	8.1*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
N.Fk. of N.Fk. Trask R.	8-17-65	3:55 PM	70	85	6.2*	Mouth	
"	9-14-65	2:10 PM	60	59	5.1*	"	
"	5-4-66	4:10 PM	59	70	44*	"	
"	6-9-66	4:05 PM	63	73	12.9*	"	
"	7-8-66	8:40 AM	53	55	9.9*	"	
"	8-11-66	1:45 PM	64	81	4.8*	"	
"	9-20-66	3:50 PM	64	80	4.5*	"	Recent rain
S.Fk. Trask R.	6-8-65	12:45 PM	54	56	102*	0.2 mi. above mouth	
"	7-12-65	4:00 PM	65	75	44.8*	"	
"	8-17-65	2:10 PM	63	78	33.8*	"	
"	9-14-65	1:05 PM	57	58	34.7*	"	
"	5-4-66	5:50 PM	59	65	58*	150 yds. above E.Fk. of South Fk.	
"	6-9-66	2:30 PM	62	74	29*	"	
"	7-8-66	9:40 AM	53	63	35*	"	
"	8-11-66	12:10 PM	56	68	15*	"	
"	9-20-66	2:20 PM	58	80	13.5*	"	Recent rain
E.Fk. of S.Fk. Trask R.	6-8-65	11:45 AM	56	55	49*	0.2 mi. above mouth	
"	7-12-65	3:10 PM	65	75	29.6*	"	
"	8-17-65	1:45 PM	63	77	18.4*	"	
"	9-14-65	12:25 PM	58	57	15	"	
"	5-4-66	5:35 PM	61	67	52*	"	
"	6-9-66	2:20 PM	64	74	29*	"	
"	7-8-66	9:50 AM	55	63	23.7*	"	
"	8-11-66	12:20 PM	60	70	15*	"	
"	9-20-66	2:35 PM	60	80	11.2*	"	Recent rain
Edwards Cr.	6-8-65	11:30 AM	53	55	11.5*	Mouth	
"	7-12-65	3:25 PM	65	75	5.8*	"	
"	8-17-65	2:25 PM	66	80	2.9*	"	
"	9-14-65	12:35 PM	58	58	2.1*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
Edwards Cr.	5-4-66	6:00 PM	57	63	18*	Mouth	
"	6-9-66	2:10 PM	63	74	8.3*	"	
"	7-8-66	9:30 AM	53	62	8.9*	"	
"	8-11-66	12:00 Noon	60	68	4.0*	"	
"	9-20-66	2:10 PM	59	80	7.4*	"	Recent rain
Wilson R.	8-26-64	11:50 AM	64	60		USGS gage 14-3015	
"	6-8-65	5:50 PM	59	57		"	
"	5-5-66	11:20 AM	57	60		"	
"	9-16-66	1:00 PM	-	65		"	Recent rain
Cedar Cr.	6-17-65	2:05 PM	54	61	17.1*	0.1 mi. above mouth	
"	7-13-65	3:34 PM	66	77	10.6*	"	
"	8-18-65	3:50 PM	63	71	8.1*	"	
"	9-14-65	5:10 PM	57	56	5.2*	"	
"	5-5-66	12:50 PM	54	75	23*	"	
"	6-10-66	10:55 AM	54	57	15.3*	"	Recent moderate rainfall
"	7-8-66	11:50 AM	58	71	9.0*	"	
"	8-10-66	1:00 PM	61	70	7.0*	"	
"	9-16-66	2:10 PM	57	70	4.8*	"	Recent rain
Devil's Lake Fk.	6-17-65	11:45 AM	55	58	19.5*	0.3 mi. above mouth	
"	7-13-65	4:25 PM	66	77	9.9*	"	
"	8-18-65	4:45 PM	70	75	5.6*	"	
"	9-14-65	4:25 PM	57	57	6.2*	"	
"	5-5-66	3:15 PM	58	76	56*	"	
"	6-10-66	12:15 PM	56	62	21.4*	"	Recent moderate rainfall
"	7-8-66	1:00 PM	62	76	10.8*	"	
"	8-10-66	2:20 PM	66	79	5.2*	"	
"	9-16-66	3:15 PM	60	75	8.0*	"	Recent rain
Elk Cr.	6-8-65	12:15 PM	55	58	7.4*	0.2 mi. above mouth	
"	7-13-65	4:10 PM	68	77	4.5*	"	
"	8-18-65	4:25 PM	69	75	2.2*	"	
"	9-14-65	4:35 PM	58	57	1.0*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Air	Flow cfs	Location	Remarks
Elk Cr.	5-5-66	2:35 PM	54	76	27*	0.2 mi. above mouth	
"	6-10-66	12:05 PM	55	62	6.4*	"	Recent moderate rainfall
"	7-8-66	12:50 PM	58	75	4.0*	"	
"	8-10-66	2:10 PM	69	78	4.0	"	
"	9-16-66	3:00 PM	61	74	2.9*	"	Recent rain
Fall Cr.	6-8-65	5:30 PM	53	58	6	Mouth	
"	7-13-65	2:10 PM	57	73	2	"	
"	8-18-65	3:05 PM	58	67	1.5	"	
"	5-5-66	11:40 AM	-	61	7*	"	
"	6-10-66	10:15 AM	52	58	5.3*	"	Recent moderate rainfall
"	7-8-66	11:20 AM	57	68	2.9*	"	
"	9-16-66	1:10 PM	54	65	1.5*	"	Recent rain
Jordan Cr.	6-8-65	4:50 PM	56	58	40*	Mouth	
"	7-13-65	2:30 PM	65	74	18.4*	"	
"	8-18-65	3:30 PM	67	69	10.1*	"	
"	9-14-65	3:25 PM	58	59	10.2*	"	
"	5-5-66	12:15 PM	56	69	48*	"	
"	6-10-66	10:30 AM	57	58	26.6*	"	Recent moderate rainfall
"	7-8-66	11:30 AM	58	69	22.6*	"	
"	8-10-66	12:40 PM	62	70	10.9*	"	
"	9-16-66	1:25 PM	57	68	10.0*	"	Recent rain
Little North Fk.	6-8-65	6:00 PM	54	57	54*	0.3 mi. above mouth	
"	7-13-65	1:45 PM	66	73	17.3*	"	
"	8-18-65	2:45 PM	61	67	13.7*	"	
"	5-5-66	11:00 AM	-	-	47*	"	
"	6-10-66	9:55 AM	56	57	46*	"	Recent moderate rainfall
"	7-8-66	11:00 AM	59	65	25.7*	"	
"	8-10-66	12:15 PM	63	65	10.8*	"	
"	9-16-66	12:50 PM	58	65	10.0*	"	Recent rain

Appendix II (continued)

Stream	Date	Time	Temp. °F. Water	Temp. °F. Air	Flow cfs	Location	Remarks
N.Fk. Wilson R.	6-17-65	2:30 PM	57	65	35*	0.5 mi. above mouth	
"	7-13-65	3:10 PM	66	75	19.2*	"	
"	8-18-65	4:15 PM	68	75	13.9*	"	
"	9-14-65	4:00 PM	59	59	11.8*	"	
"	5-5-66	2:15 PM	57	75	61*	"	
"	6-10-66	11:10 AM	56	58	22.2*	"	Recent moderate rainfall
"	7-8-66	12:10 PM	59	73	24.7*	"	
"	8-10-66	1:25 PM	66	75	13.5*	"	
"	9-16-66	2:25 PM	59	73	11.1*	"	Recent rain
S.Fk. Wilson R.	6-17-65	12:35 PM	55	61	17*	0.3 mi. above mouth	
"	7-13-65	4:00 PM	69	77	7.9*	"	
"	8-18-65	4:35 PM	70	75	3.5*	"	
"	9-14-65	4:45 PM	58	57	4.7*	"	
"	5-5-66	2:50 PM	58	76	43*	"	
"	6-10-66	11:55 AM	55	61	21*	"	Recent moderate rainfall
"	7-8-66	12:40 PM	63	75	11.8*	"	
"	8-10-66	2:00 PM	68	78	6.1*	"	
"	9-16-66	2:40 PM	60	74	5.2*	"	Recent rain

Appendix III. Miscellaneous water and air temperature records for streams of the North Coast Basin

Type of instrument Recording thermometers Stream or impoundment Necanicum River Location One-half mile above tidewater at Necanicum Park on right bank. Dates covered 5-18-65 through 10-26-65 Source OSGC

	May				June				July				August			
	Water		Air		Water		Air		Water		Air		Water		Air	
Day	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1					64	52			61	57	61	52	64	60	62	55
2					59	55			59	56	58	52	60	58	59	57
3					58	55			60	57	58	51	62	57	60	56
4					61	54			61	57	60	52	66	60	64	54
5					63	57			60	56	54	51	68	62	68	54
6					65	58			61	56	62	50	69	61	68	50
7					63	57			60	58	58	54	68	62	62	52
8					61	56			59	57	58	52	64	62	60	55
9					60	54			58	56	57	51	69	61	67	55
10					60	54			58	56	56	52	70	63	67	55
11									62	56	62	52	68	63	64	55
12									64	59	63	54	62	60	58	54
13									65	58	66	50	-	-	-	-
14									67	61	64	54	64	-	67	-
15									67	63	63	53	62	60	63	55
16									63	61	60	53	64	59	64	57
17									65	60	61	50	66	60	65	55
18	57	-							65	59	62	48	61	59	59	55
19	54	51							64	59	61	47	59	57	59	57
20	53	50							61	60	57	54	60	56	63	56
21	52	50							62	58	59	51	62	58	64	56
22	51	50							63	59	60	53	62	60	62	57
23	52	49							66	59	69	53	62	59	66	56
24	55	49							67	60	66	50	63	58	67	55
25	58	50			-	-	-	-	65	61	62	55	61	57	63	53
26	58	52			56	53	54	48	61	58	58	53	63	59	64	55
27	60	54			59	51	65	43	62	57	65	48	62	57	63	51
28	60	54			62	55	69	48	64	56	66	46	60	55	61	49
29	57	54			59	58	60	53	66	58	67	52	61	54	61	46
30	59	53			62	55	66	48	65	60	64	54	63	54	72	44
31	57	53							65	58	63	51	64	55	73	48
Ave.	55.9	51.5			60.8	54.9	62.8	48.0	62.8	58.2	61.3	51.5	63.6	58.8	63.8	53.7

Appendix III (continued)

Type of instrument Recording thermometers Stream or impoundment Necanicum River Location One-half mile above tidewater at Necanicum Park on right bank. Dates covered 5-18-65 through 10-26-65 Source OSGC

	September				October			
	Water		Air		Water		Air	
Day	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	65	57	63	54				
2	61	59	59	54				
3	63	57	62	51				
4	63	59	60	51				
5	62	58	60	50				
6	65	56	71	47				
7	64	55	65	46				
8	62	59	57	51	59	56	63	51
9	61	59	57	54	59	56	59	47
10	61	58	58	52	57	54	58	45
11	60	58	55	53	57	55	56	53
12	62	58	60	52	56	55	54	52
13	61	58	57	52	58	56	58	51
14	60	59	56	54	57	54	53	49
15	60	58	55	51	52	50	53	44
16	60	56	61	45	51	49	50	41
17	57	53	58	41	55	51	57	56
18	59	52	63	41	52	51	53	47
19	60	53	61	42	53	50	57	50
20	60	54	62	45	56	52	60	48
21	57	56	55	53	55	51	67	46
22	63	56	66	51	54	51	65	48
23	65	57	75	49	55	50	67	46
24	65	56	75	48	56	52	65	49
25	60	57	59	49	55	52	64	50
26					54	52	61	47
27								
28								
29								
30								
31								
Ave.	61.4	56.7	61.2	49.4	55.3	52.5	58.9	48.4

Appendix III (continued)

Type of instrument Recording thermometer Stream or impoundment Nehalem River Location Two hundred yards above Cook Creek on right bank near USGS gage 14-3010. Dates covered 5-18-65 through 10-26-65 Source OSGC

Day	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.	September Max.	September Min.	October Max.	October Min.
1			62	53	-	-	71	69	67	62	66	54
2			65	54	65	62	70	68	66	64	63	55
3			62	54	67	59	68	67	66	62	62	59
4			60	52	64	60	70	65	67	58	59	57
5			62	56	67	58	74	62	67	62	60	58
6			60	56	68	59	74	64	67	58	62	60
7			60	54	75	64	69	64	67	56	60	54
8			60	58	70	68	70	65	62	56	54	51
9			64	59	68	65	71	66	62	61	52	48
10			65	58	62	59	72	66	67	61	58	51
11			62	58	64	61	74	69	64	61	58	57
12			60	55	63	59	71	67	65	62	59	57
13			58	54	66	58	71	67	62	59	60	58
14			58	56	64	58	74	67	63	61	65	57
15			-	56	70	64	75	67	62	60	63	60
16			-	-	72	68	75	65	59	53	61	57
17			-	-	74	64	72	65	59	51	55	51
18	58	-	-	-	70	66	70	67	61	51	52	49
19	55	54	-	-	68	62	70	69	61	53	-	-
20	55	53	-	-	68	62	70	68	65	54	59	-
21	56	52	-	-	67	66	71	68	62	59	58	51
22	55	53	63	-	68	65	72	67	69	61	58	51
23	54	52	64	60	72	65	70	67	71	61	58	51
24	55	52	62	56	78	65	71	67	72	60	58	52
25	57	52	61	56	74	68	70	67	67	59	59	52
26	62	50	61	59	70	68	69	66	63	62	57	52
27	58	54	63	54	68	66	66	63	62	57		
28	60	54	67	57	69	62	66	61	61	55		
29	58	56	68	60	77	60	66	58	63	59		
30	57	55	70	60	72	67	69	57	64	55		
31	56	54			74	67	69	59				
Ave.	56.9	53.2	62.4	54.0	69.3	63.3	70.6	65.3	64.4	58.4	59.0	54.2

Remarks: Readings of the instrument were somewhat inconsistent with hand thermometer readings. Compensations were made but extreme accuracy is questionable (probably always within two degrees.)

Appendix III (continued)

Type of instrument Minimum-maximum thermometer Stream or impoundment Nestucca River Location Two hundred yards above Niagara Creek on left bank, river mile 29.7 Dates covered 5-19-65 through 9-13-65 Source OSGC

Day	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.	September Max.	September Min.
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13			57	45						
14									61	53
15										
16										
17							73	55		
18			64	48						
19	Installed									
20										
21					61	47				
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Ave.			60.5	46.5	61.0	47.0	73.0	55.0	61.0	53.0

Appendix III (continued)

Type of instrument Recording thermometer Stream or impoundment N. Fk. Trask R. Location Two hundred yards above Bark Shanty Cr. on left bank. Dates covered 5-19-65 to 10-15-65 Source OSGC

Day	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.	September Max.	September Min.	October Max.	October Min.
1			63	50	72	61	69	65	66	58	57	52
2			65	53	75	62	65	62	62	58	56	53
3			65	54	73	63	68	61	65	57	55	53
4			65	55	74	61	72	61	63	56	54	53
5			66	55	74	62	74	62	64	57	57	54
6			66	55	75	63	75	64	64	58	58	55
7			66	55	72	62	74	64	63	56	58	55
8			57	56	65	61	69	63	60	56	59	56
9			66	54	61	58	73	64	58	57	59	57
10			64	56	63	58	70	63	63	56	57	53
11			60	56	66	58	67	63	60	57	57	54
12			63	53	70	58	64	61	61	56	57	55
13			57	54	73	60	71	60	60	57	58	55
14			56	53	72	62	71	61	60	58	56	53
15			57	53	75	62	72	61	59	57	53	52
16			65	52	75	63	72	61	57	54		
17			60	55	73	62	72	63	57	52		
18			55	54	72	60	71	63	56	51		
19	53	-	66	53	68	58	65	62	56	51		
20	53	49	68	56	63	60	65	60	58	52		
21	54	50	68	57	66	59	68	61	57	55		
22	51	50	68	57	71	58	70	61	60	55		
23	52	48	68	58	73	60	67	61	59	55		
24	55	49	68	57	74	62	68	61	60	55		
25	59	50	61	57	69	63	64	60	58	55		
26	61	51	59	56	67	64	65	59	56	55		
27	62	52	65	53	73	61	63	59	-	-		
28	62	53	66	57	75	62	63	56	57	-		
29	57	53	72	60	75	65	63	55	58	54		
30	55	52	72	61	77	65	63	55	57	53		
31	55	51			74	67	65	56				
Ave.	56.1	50.7	63.7	55.2	71.1	61.3	68.3	60.9	59.8	55.4	56.7	54.0

Appendix III (continued)

Temperature (°F) of water, Nestucca River near Beaver, Oregon, October 1964 to September 1965 1/

Day	October		November		December		January		February		March		April		May		June		July		August		September	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1			52	52	48	48	43	43	46	45	43	43	47	47	52	50	58	52	67	64	70	65	63	60
2			52	52	48	48	43	43	45	45	43	43	47	45	50	49	62	55	69	63	65	63	63	62
3			52	51	48	47	43	43	45	45	43	43	48	46	49	49	61	58	68	63	65	62	62	60
4			52	52	47	47	43	43	46	45	43	43	48	48	49	49	62	57	70	63	68	62	62	58
5			52	50	47	47	43	43	46	45	43	43	48	48	49	48	62	58	70	64	70	63	62	60
6			50	48	47	46	43	43	45	44	43	43	48	46	48	46	62	58	70	64	70	64	63	59
7			48	48	46	46	44	43	45	45	43	43	46	46	50	48	62	58	69	65	69	65	62	58
8			48	48	46	46	44	44	45	45	43	43	47	46	52	49	60	56	65	62	68	65	62	60
9			48	48	47	46	44	44	45	45	44	43	48	47	56	52	62	55	63	59	70	65	60	59
10			48	48	47	46	44	44	45	44	44	44	48	48	56	52	62	58	61	59	70	66	62	58
11			48	48	46	45	44	44	44	44	44	44	49	47	57	53	61	58	64	59	68	66	62	61
12			48	46	45	44	44	44	45	44	44	44	50	49	57	54	59	54	68	61	66	64	61	58
13	57	55	46	44	44	44	44	44	45	45	44	44	50	50	56	53	58	55	69	63	67	62	60	59
14	56	56	45	44	44	44	44	44	45	44	44	44	50	49	55	52	56	54	71	65	69	63	59	59
15	56	55	45	44	44	44	44	44	44	44	44	44	50	50	55	53	56	55	70	66	70	64	59	59
16	55	53	44	44	44	40	44	44	44	43	44	43	50	50	53	52	59	54	71	65	69	65	59	58
17	53	51	44	44	40	37	44	44	44	43	43	43	50	50	53	51	59	58	71	66	69	65	58	54
18	51	50	44	44	37	37	44	44	44	44	43	42	50	50	55	52	58	55	69	63	68	65	56	54
19	52	51	44	43	38	37	44	44	44	44	42	42	50	50	54	53	61	54	68	63	65	63	56	54
20	52	51	43	42	39	38	44	44	44	43	42	42	50	50	53	52	65	59	66	63	63	62	56	54
21	52	51	42	42	43	39	44	44	43	43	43	42	50	50	52	51	65	60	67	61	65	62	56	56
22	52	51	43	42	44	43	44	44	43	43	44	43	50	49	52	51	65	59	68	61	67	64	61	56
23	51	51	46	43	44	44	44	44	43	43	45	44	50	50	51	50	63	60	72	63	67	64	62	58
24	51	51	48	46	45	44	44	44	43	42	45	44	50	50	50	50	64	58	71	66	67	64	62	59
25	51	51	48	48	45	45	45	44	42	42	44	43	53	50	55	50	61	59	71	66	66	64	62	59
26	51	48	48	46	45	45	46	45	43	42	43	43	56	52	57	52	60	56	67	64	64	63	60	59
27	48	48	46	46	45	44	46	46	43	43	44	43	56	54	58	54	62	55	66	60	65	62	59	58
28	50	48	46	46	44	43	46	46	43	43	44	44	55	54	59	55	65	58	69	61	64	60	58	58
29	51	50	46	46	43	43	46	46	-	-	44	44	54	52	58	55	69	62	69	64	63	58	58	58
30	52	51	48	46	43	42	46	46	-	-	46	44	54	52	55	54	69	64	70	66	64	58	58	55
31	52	52	-	-	43	42	46	46	-	-	47	46	-	-	54	53	-	-	71	66	63	57	-	-
Ave. Range			47	46	44	44	44	44	44	44	44	43	50	49	54	51	62	57	68	63	67	63	60	58

1/ Water temperature records furnished by U. S. Department of the Interior, Geological Survey, Water Resources Division.

Appendix III (continued)

Temperature (°F) of water, Trask River near Tillamook, October 1964 to September 1965 1/

Day	October		November		December		January		February		March		April		May		June		July		August		September	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	56	54	52	52	48	48	41	40	46	44	46	44	51	49	52	50	58	52	66	62	66	63	64	49
2	55	54	52	51	48	48	41	40	45	44	45	44	49	46	51	49	61	55	67	62	64	62	64	49
3	54	52	51	50	48	47	41	40	46	45	45	42	50	46	50	49	61	57	66	62	63	60	64	49
4	54	52	51	50	47	46	41	41	46	46	47	44	50	47	50	49	60	56	67	62	66	60	64	49
5	55	53	51	48	47	46	42	41	46	45	47	44	50	48	49	47	62	56	67	62	66	60	64	49
6	55	53	48	46	47	45	42	42	45	44	47	44	48	45	52	46	62	58	67	62	67	61	64	49
7	54	54	47	46	46	46	42	41	46	44	48	44	48	46	53	47	62	57	66	63	66	62	64	49
8	56	54	47	46	48	46	42	42	46	45	47	44	49	48	54	48	60	55	64	60	65	61	64	49
9	56	55	48	46	48	47	42	41	45	44	48	45	50	49	56	51	62	54	60	57	68	62	64	49
10	56	54	48	48	47	46	42	42	46	44	48	45	49	48	57	53	60	57	58	56	66	64	64	49
11	56	53	48	47	46	44	42	41	46	44	48	45	51	47	58	52	60	57	64	57	66	62	64	49
12	57	54	47	45	44	44	41	41	46	45	48	46	52	49	57	54	58	53	66	60	64	61	64	49
13	56	56	45	44	44	44	42	41	46	46	47	44	52	50	57	53	57	54	67	61	66	60	64	49
14	56	56	45	44	44	44	43	42	46	44	47	43	53	49	56	51	54	53			67	61	64	49
15	56	54	44	42	44	43	44	43	45	44	48	45	53	51	54	52	55	54			66	61	64	49
16	54	52	42	42	43	37	44	43	46	45	48	46	52	50	53	51	60	53			66	62	64	49
17	52	50	43	42	37	36	43	42	48	46	46	45	51	49	54	50	59	55			66	62	64	49
18	50	49	43	42	38	36	43	42	48	46	46	43	51	49	55	50	55	54			66	62	64	49
19	50	49	42	41	39	38	44	43	47	47	45	42	51	50	55	52	60	53			62	62	64	49
20	50	49	41	41	41	39	45	44	47	46	48	44	51	50	52	50	63	57			62	60	64	49
21	50	49	41	41	43	41	45	44	46	44	49	47	51	49	54	50	62	58					64	49
22	50	49	45	41	46	43	44	43	45	44	49	48	52	49	53	50	61	56					64	49
23	49	48	47	45	46	45	44	43	45	44	49	47	51	49	50	49	59	57					64	49
24	50	49	48	47	45	45	44	42	46	44	48	44	54	51	52	50							64	49
25	50	48	47	47	45	45	43	42	47	44	46	44	56	52	56	50							64	49
26	48	46	47	45	45	44	45	43	47	46	47	45	58	54	57	52							64	49
27	47	46	45	45	44	43	45	45	47	45	47	45	58	54	58	54							64	49
28	50	47	46	45	43	42	46	45	45	44	47	46	56	54	58	54							64	49
29	51	50	47	46	42	41	47	46	-	-	49	47	56	52	58	54			68	62			64	49
30	52	51	48	47	41	40	48	47	-	-	51	48	54	52	55	54			69	63			64	49
31	52	52	-	-	40	40	47	46	-	-	51	50	-	-	54	51	-	-	68	64				
Ave. Range	53	51	47	45	44	43	43	43	46	45	47	45	52	49	54	51								

Note: Temp. inlet out of water or nearly out of water June 24-30, July 14-28, August 21 to September 30.
1/ Water temperature records furnished by U. S. Department of the Interior, Geological Survey, Water Resources Division.

Appendix IV. Monthly maximum, mean, and minimum water temperatures for years of record on some streams in the North Coast Basin 1/

Stream			Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Location
Clatskanie R.	1950-54	Mean	51	45	43	42	42	43	47	54	57	62	62	58	2 miles below
		Max.-Min.	59 41	52 33	49 35	48 35	48 37	50 38	56 39	65 46	71 49	75 52	73 53	66 49	Carcus Cr.
Gnat Cr.	1960-62	Mean	48	43	43	42	44	43	46	48	53	55	56	53	2 miles above
		Max.-Min.	54 43	50 38	46 36	46 34	48 35	48 37	50 42	56 45	58 48	61 50	59 52	59 50	Big Noise Cr.
Big Cr.	1950-55	Mean	51	47	45	43	43	43	46	50	52	56	56	54	0.3 mile below
		Max.-Min.	56 46	53 39	48 38	48 37	47 38	47 37	51 41	55 43	61 47	61 50	62 51	60 47	Mill City Cr.
Young's R.	1947-58	Mean	51	46	44	43	45	45	48	52	55	61	61	56	
		Max.-Min.	60 42	52 37	50 38	49 34	51 32	50 35	57 43	64 44	67 44	70 47	69 49	65 47	River Mile 9.4
North Fork Klaskanine R.	1950-55	Mean	51	46	45	43	43	43	47	50	54	57	58	56	2 miles above N.
		Max.-Min.	59 43	52 34	48 34	48 37	48 36	49 35	53 41	60 42	65 46	65 51	65 51	66 47	Fk. of N. Fk.
Nehalem R.	1947-62	Mean	53	45	44	44	44	44	48	55	61	66	67	62	0.2 mile above
		Max.-Min.	66 44	52 36	54 37	50 35	50 34	49 34	57 43	69 47	76 48	78 48	77 58	73 51	Cook Cr.
Wilson R.	1947-62	Mean	53	46	44	44	44	45	49	54	58	64	65	61	1 mile above
		Max.-Min.	63 43	53 38	52 39	50 36	50 35	50 36	57 42	68 46	74 45	76 47	75 56	72 50	Little North Fork
Trask R.	1947-62	Mean	54	47	45	43	45	45	48	53	59	64	64	61	0.6 mile above
		Max.-Min.	62 45	54 39	51 39	50 34	51 35	50 35	57 42	63 44	69 47	76 50	73 58	69 52	Gold Cr.
Cedar Cr.	1943-62	Mean	50	46	45	43	44	45	48	50	51	54	54	53	
		Max.-Min.	57 41	53 35	50 36	49 34	49 38	53 38	56 42	57 43	60 41	62 47	60 47	60 44	Mouth

1/ Temperature records furnished by spot observations and temperature correlation adjustments by U. S. Geological Survey and miscellaneous records of the Oregon State Game Commission. Data was compiled by the U. S. Department of the Interior, Geological Survey and recorded in their publication entitled "Compilation of Water-Temperature Data for Oregon Streams", 1964.

Appendix V. Biological requirements of fish

A stream must present certain physical characteristics and provide water of adequate quantity and quality in order to support a population of fish. The requirements for salmon and steelhead are reviewed in this appendix. 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. Since production of food organisms is highest in riffles, best production of fish is achieved with a balanced combination of riffles and pools. The gradient of a stream in combination with the flow governs the ratio between riffles and pools. In a reach of a given gradient, a discharge that creates a strong flowing riffle situation would not be suitable for a quiet-water fish. On the other hand, a small flow that reduces the stream to a series of pools, virtually eliminates habitat for the riffle dwellers. Therefore, 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. For salmon and steelhead, gravel should range between 1/4 inch and 6 inches in diameter with extremes in sizes being least desirable. Chinook salmon normally select slightly larger gravel than do coho and steelhead, while anadromous cutthroat and resident trout choose the 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 in the gravel by causing low intragravel

flows which in turn result in decreased supplies of dissolved oxygen for respiration. Large amounts of fine material can also reduce survival of fry because it fills the gravel interstices thus blocking their emergence route out of the spawning bed. Adequate depth of gravel is necessary for construction of a redd or nest by the female fish. Chinook salmon dig slightly deeper redds than do the coho salmon and steelhead. Redd depths may vary from approximately 6 to 15 inches.

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

The dissolved oxygen requirement for egg survival in the gravel 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 the three species concerned. From the results of these studies, water depth and velocity criteria have been determined for proper spawning conditions. Minimum water depth for chinook salmon spawning is 0.8 foot, while coho salmon and steelhead require at least 0.6 foot. Proper velocities for spawning by all three species range between 1.0 and 2.5 feet per second as measured 0.4 foot from the bottom.

Rearing

The most critical time in the fresh water life of young salmonids is the period of low flow during the summer. Depending on the species, up to 3 years is spent in fresh water before migrating to the ocean. To support the young

fish during this period, the stream must contain sufficient flow to provide food, shelter, and a suitable medium in which to live.

Food: Juvenile salmon and steelhead feed primarily on immature aquatic insects. Production of these organisms is confined almost entirely to riffle areas. The best producing riffles are those composed of large gravel or rubble. Clean, well-aerated water flowing over these areas is necessary for proper maintenance of 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 psychological stress.

Suitable medium: A suitable medium in which to live refers primarily to water quality requirements. Good rearing water is high in dissolved oxygen (above 5 ppm), with temperatures not exceeding 65 F for extended periods, low in turbidity, and not greatly acid or alkaline.

High water temperatures contribute to mortalities by simply exceeding the 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 the optimum for salmonids are often ideal for competing species of undesirable fish. The incidence of disease frequently increases with rising temperatures. Turbid waters generally cause greater damage to fish habitat than to fish themselves, primarily from the siltation of food-producing and spawning areas. Heavy silt loads, however, can injure the gills and other tender structures and

result in mortality. Water that is far from neutral, either acid or alkaline, interferes with the physiology of fish.

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

Passage

By definition, anadromous fish migrate between the ocean and fresh water. To complete this cycle, the fish must have adequate stream flow for passage. As upstream migrants, adult salmon and steelhead require a portion of the stream cross-section to have sufficient depth so passage will not be impeded. Minimum depths of 0.8 foot for chinook, and 0.6 foot for coho and steelhead are recommended as desirable passage conditions. Abrupt reduction in stream flow exceeding 1 cfs may cause some retardation of upstream passage.

The juvenile fish in fresh water must have enough water for intra-stream movement during their rearing period; a minimum stream depth of 0.1 - 0.2 foot is required throughout the year. Flows adequate to insure good survival of juveniles on their seaward migration are greater than those required for intra-stream movement, but this is usually no problem because the downstream migration normally takes place during seasons of higher flows.

Appendix VI. Oregon State Game Commission fish stocking in the North Coast Basin, 1961-65 1/ 2/

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Bear Cr.	St	F	64,188	23,998			15,000
" "	Co	F	50,003				
Bear Cr., W. Fk.	St	F				5,196	
Beaver Cr. (Nestucca)	Ct	L	500	400			
Beaver Cr., E. Fk.	Ct	L	202	602	1,400	502	496
Beaver Cr. (Columbia)	Ct	L	1,000	1,500	996	996	998
Big Cr.	St	F	33,451	21,891	15,000	14,993	
" "	Ct	L	4,000	399	4,999	2,896	2,497
Cedar Cr.	St	F	11,035	10,037			
" "	St	L			13,295		
Clatskanie R.	Ct	L	1,496	1,798	1,499	1,198	998
" "	St	F			25,004	30,926	89,845
Cook Cr.	Ct	L		1,323	1,500	501	502
Crooked Cr. (Nehalem)	St	F	2,503				
" " "	Ct	F		3,035			
Elk Cr.	Ct	L	1,002	1,200	1,199	500	502
Gnat Cr.	Co	F			19,992		
" "	St	F		23,429	24,996	41,802	38,517
Kilchis R.	Ct	L	2,205	3,024	3,450	1,900	2,297
" "	Ct	F		2,423			
Lewis & Clark R.	Co	F	44,695		60,719	57,045	88,293
" " "	Ct	L	5,026	4,013	3,799	2,999	1,998
" " "	St	F			32,111	24,953	59,744

Appendix VI (continued)

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Little Nestucca R.	Ct	L	2,003	2,000	3,102	2,898	1,700
" " "	Ct	F		4,463			
" " "	St	F				12,960	
Miami R.	Ct	L	1,706	1,898	2,298	1,502	1,700
Necanicum R.	Ct	L	21,317	20,258	26,496	18,878	20,697
" "	St	F		1,382		20,103	19,989
Nehalem R.	Ct	L	10,198	9,097	14,472	9,502	9,501
" "	St	F				50,883	56,917
Nehalem R., E. Fk.	St	F					14,990
" " " "	Ct	F		2,040			
Nehalem R., N. Fk.	Ct	L	4,015	3,016	4,001	3,849	4,001
" " " "	St	F				14,000	9,996
Neskowin Cr.	Ct	L	802	998	1,301	899	1,002
Nestucca R.	St	F	34,696	117,014	43,248	58,394	53,790
"	St	L					33,072
"	Ct	L	18,253	14,005	19,487	9,997	12,012
"	Ct	F		12,113			
"	Ch	F		18,581			
Pebble Cr. (Nehalem)	St	F	2,503				
" " "	Ct	F		3,034			
Plympton Cr.	Ct	F				1,347	
Rock Cr.	Ct	L	5,011	4,144	1,999	4,694	1,000

Appendix VI (continued)

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Rock Cr., N. Fk.	Ct	L					1,999
Salmon R.	Ct	L	10,002	9,000	6,498	3,002	1,999
" "	St	F				9,900	15,014
" "	St	L					4,739
Salmonberry R.	St	F		5,997			
Salmonberry R., N. Fk.	Ct	F			927		
" " " "	St	F		5,997			
Sand Cr.	Ct	L	701	800	1,197	701	499
Three Rivers	St	F	4,006		27,315	28,151	28,977
" "	Ct	L	2,199	1,900	3,679	1,801	1,198
" "	Ct	F		10,976	783		
Tillamook R.	Ct	L	1,701	2,002	3,298	1,201	2,000
" "	Ct	F		4,463			
Trask R.	Ct	L	5,264	5,000	8,638	4,511	7,394
" "	Ct	F		2,984			
" "	St	F					20,028
Trask R., N. Fk.	St	F					19,516
Trask R., S. Fk.	St	F					36,818
Watseco Cr.	St	L					9,100
Wilson R.	St	F	81,954	72,462	65,343	71,241	60,222
" "	Ct	F		4,462			
Wilson R., Devils Lk. Fk.	St	F		5,211			9,555

Appendix VI (continued)

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Wilson R., Little N. Fk.	St	F	16,996		5,991		
Wilson R., S. Fk.	St	F	7,998	9,000	17,702	15,564	28,808
Wilson R., Upper N. Fk.	St	F		8,998	17,510	25,300	
Young's R.	Ct	L	1,001	3,000	3,200	2,500	2,500
Battle Lk.	Ct	F			790		480
Blue Lk.	Ct	L		800	801		
Cape Meares Lk.	Ct	L			5,957		2,990
" " "	Ct	F			7,680		
" " "	Rb	F					100,064
Clear Lk.	Ct	F		999			
Coates Lk.	Ct	F	498				
Coffenbury Lk.	Ct	F	10,078				
" "	Ct	L	7,440	3,998	4,007	1,998	1,998
" "	Rb	L				1,099	
C.Z. Beaver Ponds	Ct	F	2,000				
Floeter Lk.	Ct	F		460		724	
Hebo Lk.	Ct	L	1,700	1,900	2,968	2,000	2,292
" "	Ct	F		1,998	1,008		
Jim George Lk.	Ct	F		102			

Appendix VI (continued)

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Kauppi Lk.	Rb	F					992
" "	Ct	F		1,018	1,020		
Kidders Butte Lk.	Ct	L		496			
Lindsey Lk.	Ct	F				362	
Lost Lk.	Ct	L	3,400	998	1,292	1,002	1,002
" "	Ct	F			4,644		
" "	St	F					970
Lytle Lk.	Ct	L	2,214	1,908	2,470	1,503	1,490
" "	Ct	F		15,672		996	
" "	Rb	L					802
Oak Ranch Ponds	Ct	F		458			
Poly Lk.	Ct	F			398		455
Quartz Lk., No. 1	Ct	L			500		
Scout Camp Lk.	Ct	L			500		
" " "	Ct	F				1,539	
Smith Lk.	Ct	L	2,000	1,500	3,075	1,700	1,001
" "	Ct	F		2,997		996	
" "	Rb	L					801
Soapstone Lk.	Ct	F			1,050		
South Lk.	Ct	F			4,022		1,057

Appendix VI (continued)

Stream system or lake	Species 3/	Size 4/	1961	1962	1963	1964	1965
Spring Lk.	Ct	L	2,300	1,798	2,436	1,798	998
" "	Ct	F		2,997		996	
" "	Rb	L					898
Sunset Lk.	Rb	L	523	500		977	
" "	Ct	F	25,109			2,999	
" "	Ct	L	6,086	4,999	5,001		3,005
Titus Lk.	Ct	F				181	
Unnamed Lk. (Soapstone Cr.)	Ct	F	564				
Unnamed Lk. (Fishhawk Area)	Ct	F	561				
Unnamed Lk. (Fishhawk Area)	Ct	F	282				

1/ Similar stocking rates were applied prior to 1961.

2/ Warm-water game fish liberations and adult salmon and steelhead transplants are not included.

3/ Species abbreviations: Ch, chinook salmon; Co, coho salmon; Ct, cutthroat trout; Rb, rainbow trout; St, steelhead trout.

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