THE FISH AND WILDLIFE RESOURCES OF THE POWDER BASIN AND THEIR WATER REQUIREMENTS

A Report with Recommendations to the

OREGON STATE WATER RESOURCES BOARD

By

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INTRODUCTION

This report describes field investigations relevant to the water requirements of fish and wildlife resources of the Powder Basin. Preliminary findings and recommendations that are presented here were submitted to the Oregon State Water Resources Board in December 1965. The information will enable the Board to consider the needs of these resources in a comprehensive water use program to be developed for the basin. This report includes general descriptions of the basin's fish and wildlife resources, factors influencing these resources including management, and aspects of the stream flow investigations. The appendixes contain recommendations for minimum stream flows, momentary stream flow and temperature measurements, thermograph records, fish stocking information, and game fish distribution data.

Field studies of this basin were initiated in May, 1965 and continued through October. Studies were again conducted in August, 1966. Stream flow recommendations are based substantially on data collected during these investigations.

Field work was conducted primarily by Kenneth E. Thompson and Gregory J. Hattan, aquatic biologists, and by student trainee, Ronald L. Lindland. The wildlife section was prepared by Warren W. Aney, game biologist. Several other Game Commission biologists cooperated with various aspects of the studies.

FISH RESOURCES OF THE POWDER BASIN

Inventory and Distribution

Distributions of trout and warm-water game fish, and the former distribution of anadromous fish are shown on the appended maps. The largest trout populations occur in those higher elevation streams and lakes which maintain adequate flows of good quality water throughout the year. A notable exception is Unity Reservoir, a lower elevation impoundment where planted trout often experience favorable water conditions. Frequently these fish move down Burnt River for some distance below the reservoir and provide a good fishery. Rainbow are the most plentiful trout in the basin, with brook trout common in certain headwater lakes and streams. Whitefish and other species of trout are occasionally found in some streams.

Warm-water game fish are established in a few reservoirs and in the lower portions of the Burnt and Powder River systems. These species, particularly channel catfish, commonly enter these two rivers from Brownlee Reservoir. The reservoir itself supports far greater warm-water game fish populations and associated angling pressure than any other water in the basin.

Several kinds of rough fish are abundant in most middle and low elevation streams and in the reservoirs. These fish are more adaptable than salmonids to the warm, turbid flows which prevail in many streams.

Factors Affecting Fish Resources

Biological Requirements for Trout

The biological requirements discussed here are for trout which spend all or part of their lives in fresh water streams. These fish are referred to as "resident" trout. A stream must present certain physical characteristics and

provide water of adequate quantity and quality in order to support a population of fish.

Spawning Requirements

Trout must have gravel for spawning. Gravel used normally ranges between one-eighth inch and two inches in diameter; however, large trout will choose gravel up to three or four inches in diameter. Gravel must be relatively free of fines and silt which tend to compact the streambed. Excessive fines and silt create adverse conditions for eggs and fry in the gravel by impeding intergravel flows and thus reducing supplies of available dissolved oxygen. The clogged interspaces also inhibit the escapement of fry from the gravel. Adequate depth of gravel is necessary for construction of a redd, or nest, by the female fish. Redd depths vary from an average of approximately 0.4 of a foot.

Suitable water temperatures for spawning range from about 42 to 55 F. Temperatures outside these limits cause excessive losses of viable eggs.

Eggs from most stream spawning trout hatch in about two months and the fry emerge from the gravel two weeks later. This is controlled primarily by the prevailing water temperatures.

The dissolved oxygen requirements for eggs and alevins in the gravel are higher (8 ppm) than for fish that have emerged from the gravel (5 ppm). These higher requirements by eggs and alevins are provided by having good permeability and rate of intergravel flow which are influenced by gravel size and interspaces and stream gradient.

Oregon State Game Commission personnel and other fishery workers have made numerous measurements of steelhead redds. Steelhead and stream spawning trout require similar conditions in which to spawn. From the results of these studies, water depth and velocity criteria have been selected for proper spawning conditions.

Minimum water depth for spawning steelhead is considered to be 0.6 foot. Most stream systems have resident trout that approach the size of steelhead; therefore, somewhat similar spawning depths are required. Proper water velocities for spawning range between 1.0 and 2.5 feet per second as measured 0.4 foot from the bottom.

Rearing

Resident trout spend all of their life in fresh water. When habitat is desirable and competition not excessive, they will not move long distances, although they may migrate many miles to find suitable spawning conditions. Under ideal conditions resident trout may live eight years or longer and attain weights of over ten pounds. One of the most critical times during their rearing is the period of low flow. The lowest flows are therefore commonly referred to as "rearing" flows. They usually occur during the summer and fall but may be during the winter and spring in streams below dams that are impounding water. To support the fish during this period, the stream must contain sufficient flow to provide food, shelter and a suitable medium in which to live.

Food

Food of trout consists primarily of aquatic insects. However, larger trout also ingest other food items that may be available, such as crayfish and other fish. Production of most 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 also to avoid some of the causes of physiological upsets known as stress.

Suitable Medium

A suitable medium in which to live refers primarily to water quality. Good rearing water is high in dissolved oxygen (above 5 ppm), temperature 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. In addition, water loses its capacity to hold dissolved oxygen as its temperature increases, yet the metabolic rate and resultant oxygen requirement of cold-blooded animals increases at higher temperatures. This causes a condition of greater need with a reduced supply. The incidence of disease also increases with rising temperature. Water that is far from neutral, either acid or alkaline, interferes with the physiology of fish. 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 drive fish from streams, impair health and result in actual mortalities.

Adequate summer stream flows play a vital part in meeting each of the three basic requirements. Without an adequate flow any or all of the conditions may not be satisfied, and the elimination of but one necessary factor can be sufficient to have a definite limiting effect upon a fish population.

Passage

Trout that spend all or part of their life in streams either rear in streams and migrate to headwater areas to spawn or live in lakes and migrate to streams to spawn. In either case, they are affected by passage conditions. They must

have adequate stream flow to make these spawning runs. As upstream migrants, trout must have a portion of the stream cross-section with sufficient depth so their passage will not be impeded. Much remains to be learned of these requirements which may vary from one situation to another. Tentatively, a depth of 0.6 foot is recommended for desirable passage conditions.

Trout need adequate stream depths for normal intra-stream movement. Riffles are extensively used for feeding areas and for movement between pools. Minimum depth requirements over riffle areas vary with the size of the stream and the trout inhabiting it. On the smallest streams, a minimum depth of only 0.1 foot in a portion of the channel may be adequate. In larger streams which typically support bigger trout, minimum depths up to 0.6 foot may be required. Recommendations for minimum flows are based on these depth measurements plus a knowledge of the trout populations.

Problems and Developments

Low, warm flows in summer months are most instrumental in depleting trout populations in many streams. These conditions have mainly resulted from large diversions for irrigation. The common lack of proper stream environment for the native salmonids is apparent from the discharge and temperature data listed in Appendix 2. Appendixes 3, 4, and 5 contain temperature data obtained in 1965 with two recording thermometers in Burnt River and one in Powder River.

High turbidities have been widespread for several decades. Extreme siltation resulting from mining activities has severely affected the fish spawning and rearing capabilities of Powder River, Burnt River, and other streams. Although most mining operations that created heavy silt loads were terminated prior to 1960, recovery of fish habitat will take many years if left to natural processes. Rehabilitation can be accelerated materially if better stream flows are provided

and other corrective measures applied. Complete recovery is difficult on the critically damaged sections such as dredge tailing areas or stream beds which are completely silted in and cemented. But, Oregon State Game Commission exploratory efforts in the John Day Basin demonstrate these can be improved, especially if suitable stream flows are available.

Gold dredges, used in the basin until the 1950's, destroyed bottom materials important for spawning and food production. They also contributed to siltation by disrupting the stream banks, thus allowing erosion. One placer mining operation in upper North Fork Burnt River continues to cause extreme siltation in that stream.

Anadromous fish, which had survived depletions in water quantity and quality, were eliminated from the basin by construction of unladdered dams. Erection of Thief Valley Dam on the Powder River in 1931, and Unity Dam on Burnt River in 1937, blocked steelhead trout and spring chinook salmon from many miles of excellent upstream habitat. In recent years, fish passage problems associated with several large Snake River projects have resulted in the elimination of anadromous fish runs to the Powder Basin. The remnants of these runs are now trapped at Hell's Canyon Dam and held for artificial propagation or transported to suitable streams outside the Basin.

Fishery Management Activities

Of the Game Commission's management activities in the basin, the more important are fish stocking, habitat improvement, habitat inventories, determination of fish population status, and inventories of angler effort and catch.

Several thousand trout are planted in the basin yearly. Timing, locations, and numbers stocked depend largely upon availability of adequate water supplies. Table 6 lists fish liberations in the Powder Basin for the 1960-1964 period.

Chemical control of rough fish is undertaken whenever their numbers increase to the point where angling for desirable species is seriously reduced. An extensive program of screening irrigation ditches was maintained for the protection of trout and juvenile anadromous fish in the Eagle and Pine Creek drainages. But, this program was recently abandoned as unjustifiable since salmon and steelhead were blocked from these streams by Hells Canyon Dam. Lake and stream surveys are conducted periodically in order to keep abreast of habitat status. Fish sizes, condition, relative population densities, and species composition are sampled by creel census or direct collections with nets or shockers. Catch data are gathered by checking creels throughout the angling seasons. A realistic estimate of total angling effort and catch is not available; however, as it is in some waters of the state.

STREAM FLOW STUDY

The recommended minimums are based primarily on the biological requirements of the fish present and follow seasonal stream discharge patterns to which the life cycles of salmonids have become adapted. Flow measurements were made periodically during the study and streams were examined near U.S. Geological Survey gaging stations (Appendix 2). From this information, flows were selected that provided the minimum desirable conditions capable of maintaining the trout populations. The recommendations for minimum flows in the basin are listed in Appendix 1.

The flow recommendations are intended to maintain resident fish production or achieve a reasonable improvement of currently unsatisfactory production where water supply depletions or watershed abuses have reduced aquatic life below satisfactory levels. These recommended flows are not adequate to provide significant fishery benefits and are not intended to be used as guides for possible future

water development projects. If fishery enhancements are to be assumed by any project, specific study of the affected area will be required to determine water needs and expected benefits.

The following eight stream areas are of greatest importance for current fish production and angling.

1. Eagle Creek drainage above Little Eagle Creek.
2. North Powder River and Anthony Creek drainage above their confluence.
3. South Fork Burnt River.
4. North Fork Burnt River.
5. Power River upstream from Baker, including its tributaries Cracker and and Deer Creeks, and McCully Fork.
6. Pine Creek drainage (Snake River tributary).
7. Wolf Creek and Clear Creek drainages above their confluence.
8. Upper Pine and Rock Creek drainage (Power River tributaries).

If acceptable minimum flows in these areas cannot be integrated into the Board's forthcoming water use program, programming is urged which will protect existing flows from excessive future appropriation. Protection is also recommended for all high elevation lakes providing trout angling.

Other stream areas have substantial habitat potential, but the present lack of acceptable flows prevent existence of desirable fish life. Little or no water is released from Unity and Thief Valley Reservoirs during most fall and winter filling periods. Guarantees of certain releases during these periods, even if relatively small, would greatly increase the fish production capabilities of the river sections below both reservoirs.

Even from the fish management standpoint, water regulation is complex. There are serious conflicts in the possible use for available water. In some cases the

maintenance of adequate minimum pools in certain reservoirs is more important than maintaining stream flows below those impoundments.

Over the years it has been impossible to realistically manage a fishery in Thief Valley Reservoir. Periodically, excellent angling has been provided at Unity Reservoir as a result of the occasional combination of greater than normal carry-over of stored water and the control of coarse fish populations. The desirable minimum pool level for realistic fish management in these impoundments is 7,000 acre-feet in Unity and 2,000 acre-feet in Thief Valley Reservoir. A minimum pool of 12,000 to 15,000 acre-feet was recommended for the Mason Dam Project to assure a good trout fishery, however, a volume of only 5,000 acre-feet was authorized.

WILDLIFE RESOURCES OF THE POWDER BASIN

Each year the wildlife resources of the Powder Basin provide about four percent of the deer hunting, about five percent of the elk hunting, and one percent of the fur harvest in Oregon. This represents 7,600 deer hunters spending 38,770 recreation days to harvest 4,640 mule deer, 2,800 elk hunters killing 735 Rocky Mountain elk, and 650 fur pelts with a market value of $1,770 for the latest seasons on record. In addition to this, there are significant populations of chukar partridge, ring-necked pheasant, and valley and mountain quail. All evidence indicates that recreational hunting on these resources is increasing in importance. The basin's streams also provide nesting and wintering grounds for waterfowl.

Maintenance of adequate furbearer populations, particularly beaver, muskrat, otter, and mink requires a year-round supply of clean water in the streams and marshes to furnish food, water, and shelter. These same requirements are needed for nesting and wintering waterfowl.

Upland game distribution in this part of the state is rigidly controlled by the availability of water and cover. Any reduction in water supplies will have immediate and long-range effects on upland game populations by eliminating drinking water and by the eventual decadence of water-side vegetation.

Big game species also require a daily source of fresh water; thus, limited water supplies can effectively restrict the desirable levels and distribution of deer and elk herds.

Developments that cause wide fluctuations in stream discharge or impoundment levels, or that severely reduce stream flows will diminish game numbers and distribution. The stabilization of stream flows, the efficient distribution of water, and the maintenance of dependable and clean water supplies will be of much benefit to the valuable wildlife resources.

A P P E N D I X E S

Appendix I. Recommended minimum flows for resident game fish, Powder Basin 1/

Stream	Feb.		March thru May	June		July		Aug. thru Jan.	Location
Burnt River	20	30	40	40	30	20		20	USGS Gage 13-2730 (Unity Dam)
" "	25	40	50	50	40	25		25	USGS Gage 13-2742 (Bridgeport)
" "	25	40	50	50	40	25		25	USGS Gage 13-2750 (Huntington) to mouth
East Fk. Camp Cr.	2	4	6	6	4	2		2	Mouth (Tributary to Burnt R.)
West Fk. Camp Cr.	3	5	8	8	5	3		3	Mouth
N.Fk. Burnt R.	5	10	20	20	15	10	5	5	1.0 mi. above Patrick Creek
" " "	6	12	25	25	20	12	6	6	USGS Gage 13-2693
" " "	6	12	25	25	20	12	6	6	Mouth
Camp Cr.	1	2	3	3	2	1		1	Mouth
S.Fk. Burnt R.	7	10	15	15	12	7		7	Just above Elk Creek
" " "	10	15	20	20	15	10		10	USGS Gage 13-2708
" " "	4	6	10	10	8	6	4	4	Mouth
Elk Creek	10	15	20	20	15	10		10	Mouth
Pine Creek	20	25	30	30	25	20		20	0.8 mi. below Tunnel Creek
" "	40	50	65	65	50	40		40	Just above Long Branch Creek
" "	60	80	100	100	80	60		60	Mouth
Clear Creek	15	20	25	25	20	15		15	3.5 mi. below Meadow Creek
" "	15	23	30	30	23	15		15	Mouth
East Pine Creek	6	10	16	16	10	6		6	0.5 mi. above Beecher Creek
" " "	6	10	16	16	10	6		6	Mouth
North Pine Creek	3	6	10	10	6	3		3	Just above Duck Creek
" " "	20	30	45	45	30	20		20	Mouth
Duck Creek	3	6	10	10	6	3		3	Mouth
Lake Fk. Creek	2	5	8	8	5	2		2	Just above Elk Creek
" " "	7	15	25	25	15	7		7	Mouth
Elk Creek	3	6	10	10	6	3		3	Mouth
Little Elk Creek	2	4	6	6	4	2		2	Mouth
Powder River	25	30	40	40	30	25		25	USGS Gage 13-2755 (Salisbury)
" "	25	30	40	40	30	25		25	1.5 mi. below Sutton Creek
" "	25	30	40	40	30	25		25	5 mi. below Muddy Creek
" "	25	30	40	40	30	25		25	Just above North Powder River
" "	25	30	40	40	30	25		25	Entering Thief Valley Reservoir

1/ Listed flows are primarily for trout production, but would also accommodate warm-water game fish and provide fair angling conditions. The volumes relate to natural flow conditions and are, therefore, not necessarily the flows which would be recommended below future impoundments.

Appendix I (continued)

Stream	Feb.		March thru May	June		July	Aug. thru Jan.	Location
Powder R. (continued)	50	60	70	70	60	50	50	Just below Thief Valley Dam
" "	60	70	80	80	70	60	60	0.5 mi. above Goose Creek
" "	60	70	80	80	70	60	60	USGS Gage 13-2867 (Richland) to mouth
Big Creek	3	5	9	9	5	3	3	USGS Gage 0.1 mi. below Lick Creek
Cracker Creek	9	15	20	20	15	12	9	Mouth
Daley Creek	2	2	3	3	2	2	2	Mouth
Deer Creek	6	10	15	15	10	8	6	Just above Alder Creek
" "	6	10	15	15	10	8	6	Just above Smith Creek
Eagle Creek	20	30	50	50		30	20	Just above W. Fk. Eagle Creek
" "	30	50	60	60		50	30	Just above E. Fk. Eagle Creek
" "	60	70	80	80		70	60	USGS Gage 13-2882
" "	60	70	80	80		70	60	Mouth
E.Fk. Eagle Cr.	30	50	60	60		50	30	Mouth
Little Eagle Cr.	2	5	11	11	5	2	2	Mouth
West Eagle Cr.	10	25	40	40	25	15	10	Mouth
Goose Creek	2	3	5	5	3	2	2	Mouth
McCully Fork Cr.	5	10	15	15	10	6	5	Mouth
N. Fk. Powder R.	8	15	25	25		15	10	8 Just above Antone Creek
" " " "	8	15	25	25		15	10	8 Just above Anthony Fk. Creek
" " " "	12	20	25	25		20	15	12 Mouth
Anthony Fk. Cr.	8	15	20	20		15	10	8 Just above Indian Cr.
" " "	10	18	25	25		18	12	10 Mouth
N.Fk. Anthony Fk.	4	7	12	12	9	7	4	Mouth
Antone Creek	4	6	10	10	8	6	4	Mouth
Dutch Flat Cr.	3	8	13	13	10	8	3	Mouth
Rock Creek	6	12	20	20	15	12	6	Power plant diversion head gate
" "	9	15	20	20	15	12	9	Mouth (Mile 9.6)
Wolf Creek	4	8	12	12	8	4	4	Just above Clear Creek
" "	4	8	12	12	8	4	4	Mouth
Clear Creek	2	4	7	7	4	2	2	Mouth

Appendix II Miscellaneous Flow and Temperature Measurements, Powder Basin 1965-1966

Stream	Date	Time 1/	Temp. °F. Water	Temp. °F. Air	Flow Cfs	Location	Remarks
Burnt R.	6-3-65	1:00 PM	63°	80°		USGS gage 13-2730	1,250 ft. below Unity
"	6-28-65	2:45 PM	64	65		"	" Dam
"	7-29-65	4:20 PM	67	92		"	"
"	9-7-65	5:20 PM	60	70		"	"
"	10-14-65	4:55 PM	51	58		"	"
"	8-24-66	11:10 PM	66	84	2.36 IG	"	"
"	6-3-65	12:00 noon	63	80		USGS gage 13-2742	Near Bridgeport
"	6-30-65	7:15 PM	64	67		"	"
"	7-29-65	3:40 PM	73	90		"	"
"	9-7-65	10:30 AM	56	69		"	"
"	10-14-65	1:50 PM	51	59		"	"
"	6-30-65	6:25 PM	67	70		USGS gage 13-2750	Near Huntington
"	7-29-65	3:05 PM	78	90		"	"
"	9-7-65	9:05 AM	67	60		"	"
"	10-14-65	9:15 AM	52	58		"	"
Camp Cr., W.Fk.	6-28-65	12:55 PM	56	66	11.3*	0.3 mi. below Whisky Cr.	
"	7-29-65	8:00 PM	56	68	7.5*	2.0 mi. below N.Fk. Camp Cr.	
"	8-30-65	1:45 PM	56	66	4.5*	"	
"	10-5-65	12:00 noon	52	58	2.7*	"	
"	8-24-66	12:10 PM	63	88	2.2*	"	
Camp Cr., E.Fk.	6-28-65	12:00 noon	56	64	6.4*	0.6 mi. above Forest Boundary	
"	7-29-65	7:20 PM	66	73	2.2*	"	
"	8-30-65	1:00 PM	53	69	3.4*	"	
"	10-5-65	12:40 PM	48	59	2.4*	"	
"	8-24-66	11:35 PM	59	85	1.0*	"	
N.Fk. Burnt R.	6-3-65	5:00 PM	63	79	23	1.0 mi. above Patrick	Clear
"	6-28-65	4:45 PM	63	68	23	" Cr.	Highly turbid
"	7-26-65	1:30 PM	67	81	12	"	"
"	8-30-65	5:15 PM	65	64	7.4*	"	"
"	10-5-65	4:00 PM	57	55	1.8*	"	Clear. Several trout observed
"	6-3-65	4:25 PM	67	78		USGS gage 13-2693	0.1 mi. above Petticoat Cr.
"	6-28-65	4:10 PM	67	68		"	Moderately turbid
"	7-26-65	2:45 PM	74	81		"	Slightly turbid
"	8-30-65	4:40 PM	65	62		"	Moderately turbid

1/ All are daylight saving time.
* Flow measured with a current meter (flows without asterisks are estimates).

Appendix II (continued)

Stream	Date	Time 1/	Temp. °F Water	Air	Flow Cfs	Location	Remarks
N.Fk. Burnt R.	10-5-65	3:25 PM	55	56		USGS gage 13-2693	Clear
"	8-24-66	10:40 PM	--	--	0.2	"	0.1 mi. above Petticoat Cr.
"	6-3-65	4:00 PM	69	83	25	50 ft. below China Cr. (lower)	
"	6-28-65	3:55 PM	75	70	2.6*	"	
"	7-29-65	5:00 PM	87	93	0.2	"	
"	8-30-65	4:25 PM	68	69	5.4*	"	Mod. turbid
"	10-5-65	3:15 PM	60	60	1.9*	"	Clear
"	8-24-66	10:50 AM	63	83	0.1	"	
Camp Cr.	6-3-65	4:45 PM	73	78	4	0.3 mi. above mouth	N.Fk. Burnt R. trib.
"	6-28-65	4:25 PM	70	72	0.9*	"	
"	7-26-65	2:30 PM	81	81	0.1	"	
"	8-30-65	4:55 PM	70	62	0.4	"	
"	10-5-65	3:40 PM	62	55	0.1	"	
"	8-24-66	10:30 PM	--	83	Dry	"	
S.Fk. Burnt R.	6-28-65	1:55 PM	55	65	14*	100 ft. above Elk Cr.	
"	7-29-65	5:55 PM	56	80	12.2*	"	
"	8-30-65	2:45 PM	51	65	10.8*	"	
"	10-5-65	2:05 PM	47	53	10.8*	"	
"	8-24-66	1:05 PM	56	90	9.1*	"	
"	6-3-65	3:00 PM	58	80		USGS gage 13-2708	300 ft. above Barney Cr.
"	6-28-65	1:30 PM	56	66		"	"
"	7-29-65	5:40 PM	60	82		"	"
"	8-30-65	2:25 PM	52	66		"	"
"	10-5-65	1:50 PM	48	55		"	"
"	8-24-66	1:20 PM	58	90	1.04 IG	"	
"	6-3-65	3:30 PM	61	81	28	Mouth	
"	6-28-65	3:30 PM	70	70	5.8*	"	
"	7-29-65	4:40 PM	78	92	0.9*	"	
"	8-30-65	3:50 PM	63	71	2.5*	"	
"	10-5-65	2:45 PM	57	63	13.2*	"	
"	8-24-66	1:55 PM	68	92	1.2	"	
Elk Cr.	6-28-65	2:05 PM	56	65	19.2*	Mouth	
"	7-29-65	6:00 PM	58	80	19.8*	"	
"	8-30-65	3:00 PM	51	65	17.5*	"	
"	10-5-65	2:15 PM	49	53	15.8*	"	
"	8-24-66	1:10 PM	58	90	10.2*	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
Pine Cr.	6-1-65	5:20 PM	47	68	350	0.8 mi. below Tunnel Cr.	Above highest irrigation diversion (Moore Ditch)
"	6-28-65	9:55 AM	46	66	200	"	
"	7-27-65	4:30 PM	62	75	111*	"	
"	9-6-65	1:55 PM	51	60	40*	"	
"	10-6-65	8:55 AM	42	53	29*	"	
"	6-30-65	10:20 AM	51	68	193*	2.0 mi. above Clear Cr.	
"	7-27-65	11:55 AM	69	80	12.8*	"	
"	9-6-65	12:20 PM	60	70	3.8*	"	
"	10-6-65	10:05 AM	50	55	7.2*	"	
"	6-30-65	11:50 AM	57	72	300-400	100 ft. above mouth of N. Pine	
"	7-27-65	2:00 PM	76	83	50	"	
"	9-6-65	10:50 AM	55	64	30	"	
"	10-6-65	10:40 AM	53	58	15	"	
"	8-23-66	2:55 PM	75	97	14	"	
"	7-27-65	12:40 PM	74	87	98*	Mouth	
"	9-6-65	11:00 AM	56	68	78*	"	
"	10-6-65	12:05 PM	55	63	65*	"	
"	8-23-66	4:15 PM	77	101	29.2*	"	
Clear Cr. 2/	6-1-65	5:45 PM	46	66	120	3.5 mi. below Meadow Cr.	Above highest irrigation diversion 2/
"	6-30-65	3:00 PM	54	74	85	"	
"	7-27-65	4:55 PM	63	74	32*	"	
"	9-6-65	1:20 PM	52	68	21*	"	
"	10-6-65	9:20 AM	43	48	23*	"	
"	8-23-66	1:05 PM	60	89	11*	"	
"	6-30-65	10:45 AM	56	69	50*	1.2 mi. above mouth	
"	7-27-65	3:50 PM	76	84	2.9*	"	Many small rough fish observed
"	9-6-65	12:10 PM	62	70	6.1*	"	
"	10-6-65	10:15 AM	54	56	4.0*	"	
"	8-23-66	2:05 PM	--	--	2.0	"	
E. Pine Cr.	6-1-65	6:10 PM	50	65	90	0.5 mi. above Beecher Cr.	Slightly turbid
"	6-30-65	2:40 PM	58	66	16*	"	
"	7-27-65	5:20 PM	72	75	7.5*	"	
"	9-6-65	12:50 PM	55	67	6.2*	"	
"	10-6-65	9:40 AM	44	55	7.5*	"	

2/ Regulated releases are made from Clear Creek Reservoir in the headwaters.

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
E. Pine Cr.	8-23-66	1:35 PM	65	89	2.8*	0.5 mi. above Beecher Cr.	
"	6-30-65	11:10 AM	60	70	4.9*	1.5 mi. above mouth	
"	7-27-65	3:45 PM	77	84	0.8*	"	
"	9-6-65	12:05 PM	58	70	4.0	"	
"	10-6-65	10:20 AM	50	56	2.5	"	
"	8-23-66	2:15 PM	--	--	3.1*	"	
Fish Cr.	6-30-65	2:15 PM	66	66	0.1	7.0 mi. above mouth	
"	6-30-65	1:45 PM	69	68	0.7	Mouth	
N. Pine Cr. 3/	7-27-65	3:00 PM	68	82	3.0	200 ft. above mouth of Duck Cr.	
"	9-6-65	10:10 AM	44	60	2.0	"	
"	10-6-65	11:10 AM	45	57	1.7*	"	
"	8-23-66	3:35 PM	--	--	0.5	"	
"	6-30-65	1:20 PM	57	61	19*	200 ft. above mouth of Lake Fk. Cr.	
"	6-1-65	7:20 PM	51	58	300	100 ft. above mouth of Little Elk Cr.	
"	6-30-65	11:35 AM	55	70	145*	Mouth	
"	7-27-65	1:50 PM	75	83	35*	"	
"	9-6-65	10:45 AM	56	64	24*	"	
"	10-6-65	10:35 AM	53	58	15.4*	"	
"	8-23-66	2:45 PM	64	97	9.0*	"	
Duck Cr.	7-27-65	3:05 AM	64	82	7.0*	Mouth	
"	9-6-65	10:00 AM	45	60	3.6*	"	
"	10-6-65	11:05 AM	45	57	2.5*	"	
"	8-23-66	3:30 PM	60	93	0.8	"	
Lake Fk. Cr.	9-6-65	8:45 AM	47	50	2.0*	50 ft. above Elk Cr.	
"	6-30-65	12:20 PM	50	60	133*	Mouth	
"	7-27-65	2:30 PM	67	82	22*	"	
"	9-6-65	9:30 AM	48	59	7.6*	"	
"	10-6-65	11:25 AM	48	58	8.8*	"	
"	8-23-66	3:10 PM	65	95	5.9*	"	
Elk Cr.	9-6-65	9:00 AM	44	50	5.7*	Mouth	
Little Elk Cr.	6-1-65	7:20 PM	57	58	5	Mouth	
"	6-30-65	12:05 PM	61	61	2.6*	"	
"	9-6-65	10:30 AM	55	60	1.2*	"	
"	10-6-65	11:40 AM	50	60	0.9*	"	
"	8-23-66	3:00 PM	--	97	0.4	"	

3/ No diversions above mouth of Lake Fork Creek.

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
Powder River	7-26-65	5:50 PM	74	74		USGS gage 13-2755	Salisbury gage.
"	9-1-65	9:30 AM	57	74		"	
"	6-2-65	10:15 AM	51	74	200-250	1.5 mi. below Sutton	Baker. Moderately
"	6-29-65	10:00 AM	57	66	-	" Cr.	turbid.
"	7-29-65	8:30 AM	65	72	28*	"	
"	9-4-65	8:15 AM	52	46	21*	"	
"	10-13-65	5:15 PM	56	60	7.2*	"	
"	8-23-66	8:15 AM	58	67	0.8	"	
"	7-29-65	1:25 PM	74	94	37*	5 mi. below Muddy Cr.	
"	6-2-65	2:30 PM	65	75	300-400	200 ft. above mouth of N. Powder R.	Highly turbid.
"	6-29-65	5:10 PM	64	76	190	"	
"	7-29-65	11:10 AM	71	78	37*	"	
"	9-4-65	2:30 PM	62	73	60*	"	
"	10-13-65	10:05 AM	51	56	32*	"	
"	6-2-65	12:15 PM	59	75	--	300 yds. below Thief Valley Dam	Slightly turbid.
"	6-29-65	4:15 PM	60	75	300	"	
"	7-29-65	12:00 noon	70	86	119*	"	
"	9-4-65	12:00 noon	66	76	49*	"	
"	10-13-65	11:00 AM	58	62	117*	"	
"	8-22-66	1:10 PM	63	79	1.9	"	
"	6-2-65	9:55 AM	59	74	--	0.5 mi. above Goose Cr.	Moderately turbid.
"	6-30-65	5:00 PM	68	74	--	"	
"	7-27-65	8:50 AM	65	66	71*	"	Moderately turbid.
"	9-6-65	4:50 AM (?)	63	63	104*	"	
"	10-6-65	7:00 AM	53	42	130*	"	
"	8-23-66	5:45 PM	--	88	7.6*	"	
"	6-2-65	9:15 AM	61	70		USGS gage 13-2867	Near Richland.
"	6-30-65	4:20 PM	71	75		"	"
"	7-27-65	9:40 AM	70	66		"	"
"	9-6-65	3:00 PM	67	73		"	Moderately turbid.
"	8-23-66	5:20 PM	79	88	IG 0.75	"	Near Richland.
Big Cr.	6-1-65	1:15 PM	57	65		USGS gage 13-2859	0.1 mi. below Lick Cr.
"	6-29-65	6:30 PM	58	66		"	
"	7-28-65	12:05 PM	65	79		"	
"	9-5-65	10:00 AM	49	59		"	
"	10-6-65	3:25 PM	56	61		"	
"	8-23-66	8:50 PM	53	70	0.7	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
Cracker Cr.	6-28-65	5:40 PM	52	66	100*	0.6 mi. above mouth	
"	7-26-65	3:45 PM	64	76	29*	"	
"	8-31-65	8:30 AM	46	47	18.5*	"	
"	10-5-65	4:45 PM	51	53	9*	"	
"	8-24-66	9:30 AM	56	73	3.8*	"	
Daley Cr.	6-2-65	8:50 AM	55	69	3.6*	0.3 mi. above Brownlee Pool	
"	6-30-65	3:50 PM	66	74	1.2*	"	
"	7-27-65	10:05 PM	63	68	2.9*	"	
"	9-5-65	3:00 PM	62	76	1.8*	"	
"	10-6-65	7:45 AM	51	51	1.1*	"	
Deer Cr.	6-29-65	8:35 AM	47	56	28*	0.2 mi. above Alder Cr.	
"	7-26-65	4:50 PM	62	70	12.4*	"	
"	8-31-65	8:55 AM	46	47	7.3*	"	
"	10-5-65	5:15 PM	51	53	5.1*	"	
"	8-24-66	8:55 AM	55	68	4.2*	0.2 mi. above Alder Cr.	
"	6-29-65	8:00 AM	49	56	16*	200 yds. above Smith Cr.	
"	7-26-65	5:20 PM	67	65	0.9*	"	
"	8-31-65	9:30 AM	49	57	1.5*	"	
"	10-5-65	5:30 PM	55	55	1.5*	"	
"	8-24-66	9:10 AM	58	70	0.3	"	
Eagle Cr.	6-1-65	2:15 PM	45	66	250	100 yds. above W. Fk. Eagle Cr.	
"	6-29-65	8:00 PM	51	56	--	100 ft. above E. Fk. Eagle Cr.	
"	7-28-65	8:50 AM	54	67	100	"	
"	9-5-65	12:10 PM	49	56	80	"	
"	10-6-65	2:10 PM	50	56	40	"	
"	8-23-66	10:10 AM	55	78	28.2*	"	
"	6-30-65	8:50 AM	47	59		USGS gage 13-2882	0.5 mi. above Skull Cr.
"	7-27-65	6:45 PM	64	76		"	
"	9-5-65	1:40 PM	50	60		"	
"	10-6-65	1:10 PM	49	62		"	
"	8-23-66	12:05 PM	--	--	IG 0.81	"	0.5 mi. above Skull Cr.
"	7-27-65	6:20 PM	68	80	128*	1.0 mi. above mouth	
"	9-5-65	2:10 PM	64	76	12.9*	"	
"	10-6-65	7:58 AM	51	51	3.5	"	
"	8-23-66	5:10 PM	78	88	4.5	"	
E.Fk. Eagle Cr.	6-1-65	2:45 PM	49	69	400	Mouth	Moderately turbid
"	6-29-65	8:00 PM	47	56	350	"	
"	7-28-65	8:50 AM	49	67	175	"	

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Cfs	Location	Remarks
E.Fk. Eagle Cr.	9-5-65	12:05 PM	49	56	99*	Mouth	
"	10-6-65	2:05 PM	52	56	62*	"	
"	8-23-66	10:00 AM	49	77	79.6*	"	
Little Eagle Cr.	6-1-65	3:40 PM	51	70	70	Mouth	Moderately turbid
"	6-20-65	8:40 PM	50	59	10.9*	"	
"	7-27-65	7:00 PM	68	75	3.1*	"	
"	9-5-65	1:30 PM	54	60	2.4*	"	
"	10-6-65	1:20 PM	54	61	2.2*	"	
"	8-23-66	11:25 AM	57	87	5.9*	"	
W. Eagle Cr.	6-1-65	1:50 PM	45	65	180	Mouth	
"	6-29-65	7:30 PM	49	57	125	"	
"	7-28-65	9:30 AM	52	64	19.3*	"	
"	9-5-65	11:30 AM	47	61	13.6*	"	
"	10-6-65	2:40 PM	54	60	1.8*	"	
"	8-23-66	9:35 AM	53	75	2.6*	"	
Phillips Ditch	6-1-65				10	Road crossing approx. 6 mi. below head gate	
"	6-29-65	7:15 PM	53	62	19.2*	"	
"	7-28-65	10:00 AM	54	68	23*	"	Slightly turbid
"	9-5-65	10:40 AM	46	55	5.6*	"	Clear
"	10-6-65	2:50 PM	48	59	22*	"	"
"	8-23-66	9:15 AM	51	74	11.9*	"	
Goose Cr.	6-2-65	9:40 AM	54	74	1.6*	Mouth	
"	6-30-65	4:50 PM	64	73	4.6*	"	
"	7-27-65	9:10 AM	61	66	6.0*	"	
"	9-6-65	4:40 PM	60	63	4.3*	"	
"	10-6-65	7:05 PM	50	42	6.6*	"	
McCully Fk. Cr.	6-28-65	6:05 PM	52	64	36.7*	1.0 mi. above mouth	
"	7-26-65	3:50 PM	65	76	7.5*	"	
"	8-31-65	8:10 AM	45	38	4.5*	"	
"	10-5-65	4:50 PM	52	51	4.6*	"	
"	8-24-66	9:45 AM	54	74	0.1	"	
N.Fk. Powder R.	6-2-65	6:05 PM	47	75	240	0.4 mi. below Antone Cr.	Slightly turbid
"	6-29-65	1:30 PM	49	65	160	100 ft. above Antone Cr.	
"	7-28-65	7:20 PM	60	65	26*	"	
"	9-4-65	6:00 PM	53	62	14.8*	"	
"	10-13-65	3:00 PM	51	54	7.0*	"	
"	6-2-65	5:45 PM	--	76	150*	50 ft. above Anthony Fk.	Slightly turbid

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
N.Fk. Powder R.	6-29-65	1:50 PM	52	65	137*	50 ft. above Anthony Fk.	
"	7-28-65	2:35 PM	68	76	11.3*	"	
"	9-4-65	3:25 PM	57	70	7.7*	"	
"	10-13-65	1:10 PM	52	68	1.6*	"	
"	8-22-66	4:10 PM	--	--	Nearly dry	"	
Anthony Fk. Cr.	6-2-65	4:45 PM	47	78	100*	100 yds. above Indian Cr.	
"	7-28-65	4:00 PM	57	65	22*	"	
"	9-4-65	4:25 PM	49	62	11.1*	"	
"	10-13-65	2:25 PM	47	53	9.6*	"	
"	6-2-65	5:45 PM	52	76	130*	Mouth	Moderately turbid.
"	6-29-65	1:45 PM	55	65	46*	"	
"	7-28-65	2:30 PM	67	76	23*	"	
"	9-4-65	3:15 PM	54	70	28*	"	
"	10-13-65	1:00 PM	50	68	15*	"	
"	8-22-66	4:00 PM	64	80	6.1*	"	
"	7-28-65	5:30 PM	62	65	3.5	Anthony Lake outlet	
N.Fk. Anthony Fk. Cr.	6-2-65	4:20 PM	48	78	48*	0.5 mi. above mouth	Slightly turbid.
"	7-28-65	3:25 PM	60	66	9.7*	"	
"	9-4-65	4:05 PM	49	66	7.6*	"	
"	10-13-65	1:50 PM	47	53	5.5*	"	
Antone Cr.	6-2-65	5:15 PM	45	76	70	100 yds. above Little Antone Cr.	L. Antone Cr. flowing 2 cfs.
"	6-29-65	1:00 PM	46	65	32	"	L. Antone Cr. flowing 1.5 cfs.
"	7-28-65	7:05 PM	57	66	7.6*	Mouth	
"	9-4-65	5:55 PM	49	62	6.9*	"	
"	10-13-65	3:10 PM	47	54	4.8*	"	
"	8-22-66	3:30 PM	57	80	2.5	Mouth	
Dutch Flat Cr.	6-29-65	12:25 PM	47	64	24*	2.0 mi. above mouth	
"	7-28-65	6:50 PM	57	66	12.5*	"	
"	9-4-65	5:00 PM	49	62	5.7*	"	
"	10-13-65	3:25 PM	47	54	2.7*	"	
"	8-22-66	2:24 PM	57	80	3.0*	"	
Rock Cr.	6-2-65	7:15 PM	44	65	125	1.5 mi. below Killamacue Cr.	Below Power Plant Diversion
"	6-29-65	11:10 AM	45	61	140	"	"

Appendix II (continued)

Stream	Date	Time	Temp. °F Water	Air	Flow Cfs	Location	Remarks
Rock Cr.	7-29-65	9:30 AM	52	69	25*	1.5 mi. below Killamacue Cr.	Below Power Plant Diversion
"	9-3-65	5:45 PM	50	53	2.8*	"	"
"	10-13-65	4:00 PM	49	55	0.8	"	"
"	6-2-65	-	--	--	15	0.8 mi. above mouth	
"	6-29-65	10:40 AM	50	76	50	"	
"	7-29-65	8:55 AM	60	74	3.0*	"	
"	9-3-65	4:00 PM	64	62	3.8*	"	
"	10-13-65	4:45 PM	58	62	0.5	"	
"	8-22-66	6:20 PM	--	--	Dry	"	
Wolf Cr.	6-2-65	3:20 PM	56	78	58*	100 yds. above Clear Cr.	Slightly turbid
"	6-29-65	3:00 PM	60	68	19.4*	"	
"	7-29-65	10:20 AM	61	68	4.7*	"	
"	9-2-65	7:15 PM	57	58	5.0*	"	
"	10-13-65	9:10 AM	46	53	2.7*	"	
"	8-22-66	11:10 AM	57	76	1.4	"	
"	6-2-65	1:45 PM	51	75	32*	0.3 mi. above mouth	
"	6-29-65	5:30 PM	70	74	1.6*	"	
"	7-29-65	10:45 AM	68	78	0.3	"	
"	9-4-65	1:55 PM	58	70	1.9*	"	
"	10-13-65	9:40 AM	50	56	2.8*	"	
"	8-22-66	11:40 AM	--	77	Nearly dry	"	
Clear Cr.	6-2-65	3:10 PM	58	75	9.0*	Mouth	
"	6-29-65	2:50 PM	62	68	1.9*	"	
"	7-29-65	10:15 AM	61	68	0.7*	"	
"	9-2-65	7:30 PM	57	58	0.8*	"	
"	10-13-65	9:15 AM	47	53	0.4	"	
"	8-22-66	11:05 AM	66	76	0.1	"	

Appendix III. Water and Air Temperatures (°F), Burnt River, below Bridgeport, 1965

Type of Instrument Recording Thermometer (Partlow) Stream or Impoundment Burnt R. Location USGS gage 13-2742. 6.5 miles below Bridgeport Dates covered May 12, 1965 - Sept. 27, 1965 Source OSGC - Basins Section

	May				June				July			
	Water		Air		Water		Air		Water		Air	
Day	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1					64	60	72	32	65	61	81	41
2					65	60	83	34	65	61	81	38
3					64	60	80	37	65	62	80	39
4					69	58	82	32	66	62	79	38
5					72	59	85	45	69	63	91	37
6					73	62	86	-	71	64	94	38
7					71	61	85	45	70	66	92	46
8					70	61	76	40	68	66	83	43
9					71	62	76	35	66	63	80	34
10					70	60	94	40	65	63	75	42
11					68	61	85	39	64	61	63	36
12	61	-	78	-	65	60	69	40	67	59	82	31
13	60	58	73	42	63	57	66	30	68	59	86	32
14	60	57	74	34	59	56	46	34	72	60	96	35
15	60	57	70	30	59	55	54	33	74	64	93	45
16	60	58	65	30	58	55	55	37	75	64	98	41
17	58	55	68	21	62	56	60	39	73	67	86	53
18	60	54	71	20	64	59	70	39	73	66	86	46
19	58	56	59	30	66	59	75	35	72	65	86	38
20	59	55	61	28	69	61	86	36	66	64	69	41
21	59	58	51	36	66	62	76	38	65	61	63	40
22	58	56	44	33	67	63	85	38	66	59	77	28
23	56	55	44	30	65	63	81	41	69	59	89	32
24	57	55	54	30	65	62	73	41	69	61	92	35
25	59	55	66	28	64	61	66	42	70	63	94	38
26	59	57	72	34	62	60	64	37	69	65	84	49
27	62	57	79	30	62	57	72	26	70	64	91	44
28	63	59	82	34	63	57	71	28	70	64	95	44
29	64	61	81	40	64	59	76	36	71	64	90	45
30	63	60	66	31	64	61	72	38	70	64	91	43
31	63	60	71	33					72	63	94	42
Aver.	60.0	57.0	66.5	32.2	65.5	59.6	74.0	36.8	68.9	62.8	85.2	39.8

Appendix III (continued)

Type of Instrument Recording Thermometer (Partlow) Stream or Impoundment Burnt R. Location USGS gage 13-2742. 6.5 miles below Bridgeport Dates covered May 12, 1965 - Sept. 27, 1965 Source OSGC - Basins Section

	August				September			
	Water		Air		Water		Air	
Day	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	70	65	94	53	62	54	75	28
2	68	66	78	52	63	54	78	29
3	72	64	76	46	61	55	69	32
4	72	64	81	38	61	53	72	26
5	72	64	84	37	57	55	55	35
6	73	63	89	38	62	55	69	33
7	72	64	96	37	59	54	58	30
8	72	65	91	42	64	56	73	36
9	71	65	94	38	65	56	75	32
10	68	65	78	45	65	55	76	30
11	67	65	69	45	64	55	76	29
12	67	64	69	44	64	55	72	30
13	67	61	76	32	57	54	59	30
14	68	62	84	33	60	53	63	33
15	69	62	88	40	56	54	52	28
16	70	62	87	42	51	48	41	22
17	70	64	90	42	52	45	47	15
18	70	64	87	40	52	44	61	14
19	67	64	58	43	53	44	59	15
20	66	62	74	36	56	48	67	31
21	64	62	64	41	57	49	73	28
22	64	61	59	40	58	51	69	39
23	64	62	71	42	57	50	67	28
24	62	60	70	38	57	49	76	22
25	61	59	63	36	57	48	74	22
26	63	58	78	34	57	48	75	20
27	63	58	77	34	52	49	53	30
28	62	58	65	32				
29	62	56	68	28				
30	61	55	75	24				
31	62	53	79	25				
Aver.	67.1	61.8	77.8	38.6	58.5	51.4	66.1	27.7

Appendix IV. Water Temperatures (°F) Below Unity Dam, 1965

Type of Instrument Recording Thermometer (Weksler) Stream or Impoundment Burnt R. Location USGS gage 13-2730 just below Unity Dam Dates covered May 12, 1965 - Sept. 15, 1965 Source OSGC - Basins Section

Day	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.	September Max.	September Min.
1			56	51	61	59	69	64	66	62
2			56	51	63	58	67	60	68	62
3			57	51	63	58	67	62	67	63
4			55	52	65	58	68	61	65	60
5			55	50	65	60	67	60	64	60
6			58	51	65	60	67	60	65	60
7			56	51	66	60	65	60	65	61
8			58	53	67	61	66	60	64	60
9			59	53	68	61	67	62	64	59
10			58	53	66	61	67	62	64	59
11			59	53	62	59	66	61	65	59
12	51	47	59	55	64	58	68	62	64	60
13	51	47	58	53	63	57	68	63	65	60
14	51	48	59	54	64	58	67	61	63	60
15	51	47	61	55	66	59	68	63	60	57
16	51	47	61	55	68	60	69	62	60	56
17	52	48	59	56	67	60	69	63	59	55
18	52	49	61	57	66	61	69	63	59	54
19	52	49	63	57	71	63	69	63		
20	51	48	64	57	68	63	69	64		
21	51	48	66	60	66	62	68	61		
22	50	49	65	61	68	61	65	60		
23	50	49	65	59	68	61	66	63		
24	51	49	62	59	68	61	67	64		
25	52	49	63	59	69	62	67	63		
26	53	49	62	60	67	64	67	63		
27	54	49	62	58	69	63	68	63		
28	53	50	64	58	72	65	69	66		
29	54	50	64	59	71	64	68	64		
30	57	52	63	58	70	63	67	62		
31	56	51			70	64	66	61		
Aver.	52.1	48.8	60.3	55.3	66.6	60.8	67.4	62.1	63.7	59.3

Appendix V. Water and Air Temperatures (°F), Powder River, 1965

Type of Instrument Recording Thermometer (Partlow) Stream or Impoundment Powder R. Location River mile 90.5 (6.3 miles above N. Powder R.) Art Powell Ranch Dates covered May 12, 1965-Sept. 27, 1965 Source OSGC-Basins Section

	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					63	54	66	40	61	56	74	44	74	68	84	56
2					63	56	73	42	66	59	81	46	73	69	78	57
3					63	59	68	49	67	60	77	48	69	66	71	52
4					63	58	70	38	63	58	73	44	68	65	72	46
5					62	57	76	40	67	60	80	44	69	64	72	46
6					64	59	76	47	69	62	85	46	69	64	76	44
7					64	60	72	44	71	62	86	53	71	66	86	46
8					65	57	75	39	68	63	75	51	71	66	84	50
9					66	58	75	47	65	59	72	42	71	66	85	49
10					68	58	84	44	64	58	66	48	70	67	81	52
11					64	60	74	48	61	57	62	45	67	65	77	57
12	67	-	68	-	61	57	61	47	64	56	69	41	65	63	66	50
13	61	56	66	49	59	54	62	41	68	60	78	38	65	60	64	42
14	60	53	64	43	57	54	50	44	70	62	83	43	66	62	74	42
15	58	53	70	39	56	52	55	43	71	65	79	48	67	63	75	48
16	58	53	64	39	57	53	60	49	72	67	83	47	67	63	76	46
17	54	50	52	34	58	53	64	50	72	70	84	58	67	64	76	46
18	57	49	64	28	62	55	63	49	71	67	73	52	68	64	76	46
19	59	54	63	37	65	57	65	46	71	63	77	42	65	64	64	46
20	59	54	64	40	67	57	74	44	66	60	64	48	63	60	61	44
21	55	51	55	46	66	60	68	50	60	58	52	47	62	60	64	50
22	51	46	50	44	67	59	73	41	62	56	63	36	62	58	66	45
23	48	44	44	40	63	60	73	48	66	59	71	40	64	60	68	51
24	52	46	53	38	61	58	67	50	69	62	78	43	63	61	67	46
25	60	51	63	42	60	56	62	50	72	64	83	45	61	59	59	47
26	65	57	72	46	58	52	56	44	70	67	74	53	60	57	64	42
27	66	54	73	36	-	-	-	37	70	64	73	50	61	59	65	43
28	66	58	79	42	-	-	-	-	72	66	78	50	60	56	55	42
29	64	58	72	46	-	-	-	-	72	68	80	52	57	55	57	39
30	59	52	57	41	-	-	67	-	71	67	80	47	57	54	60	32
31	61	53	62	39					72	65	83	47	58	54	69	32
Aver.	59.0	52.2	62.8	40.5	63.3	56.7	67.7	44.9	67.8	61.9	75.4	46.4	65.4	62.0	70.7	46.2

Appendix V (continued)

Recording Thermometer
Type of Instrument (Partlow) Stream or Impoundment Powder R. Location River mile 90.5 (6.3 miles above N. Powder R.) Art Powell Ranch Dates covered May 12, 1965-Sept. 27, 1965 Source OSGC - Basins Section

September

	Water		Air	
Day	Max.	Min.	Max.	Min.
1	59	55	71	36
2	60	56	67	42
3	59	56	59	42
4	56	54	61	33
5	56	55	56	44
6	55	52	60	32
7	55	53	61	35
8	58	54	65	44
9	59	55	68	39
10	58	56	64	37
11	57	55	64	35
12	57	54	62	36
13	56	54	57	36
14	56	54	62	44
15	55	53	56	39
16	52	49	43	34
17	48	46	47	29
18	48	45	52	24
19	50	45	57	24
20	53	49	60	42
21	54	50	66	36
22	55	52	62	41
23	54	51	63	35
24	54	51	65	32
25	55	51	71	31
26	54	51	66	34
27	53	50	51	38
28				
29				
30				
31				
Aver.	55.0	52.1	60.6	36.1

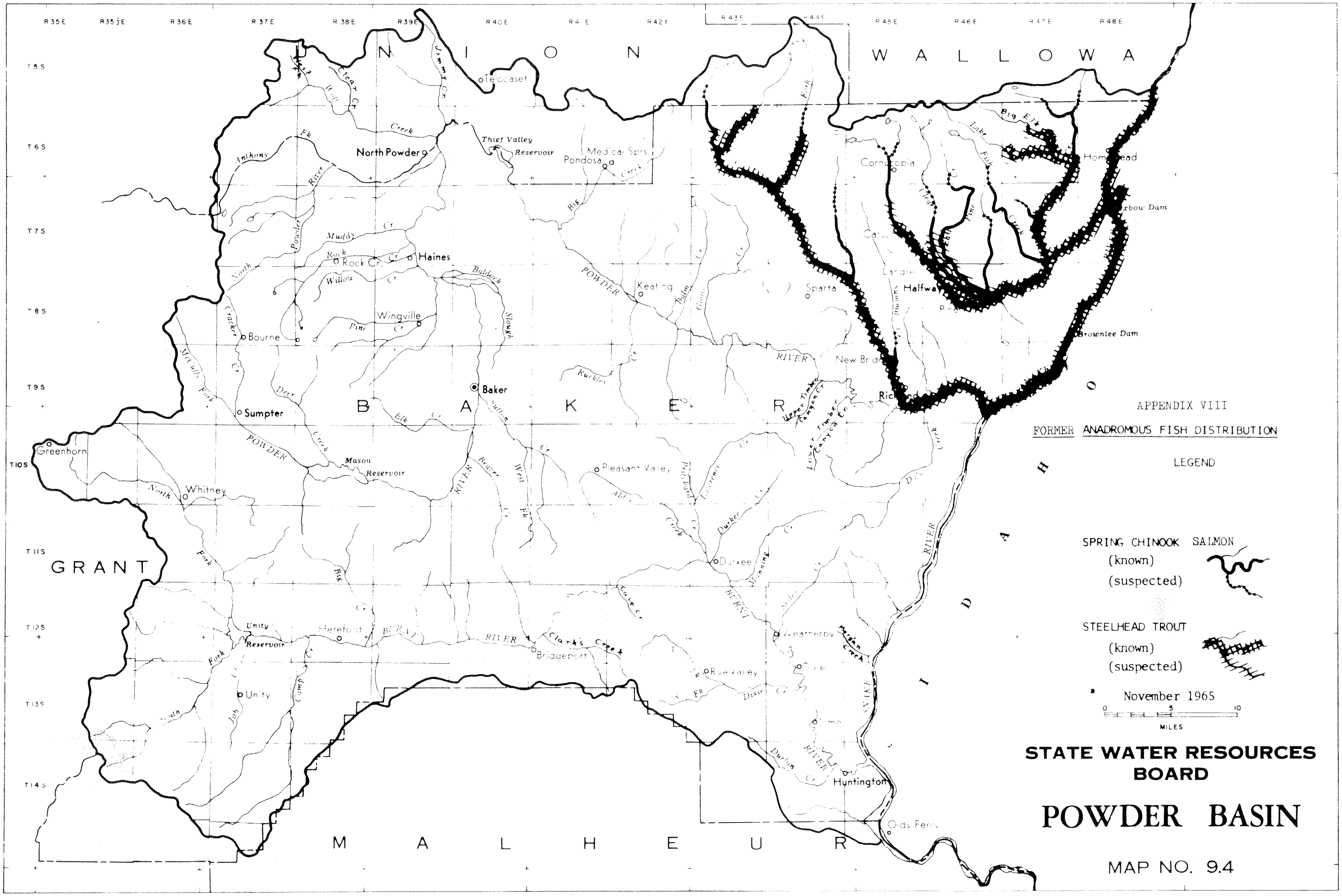
Appendix VI. Oregon State Game Commission Fish Releases in the Powder Basin, 1960-1964

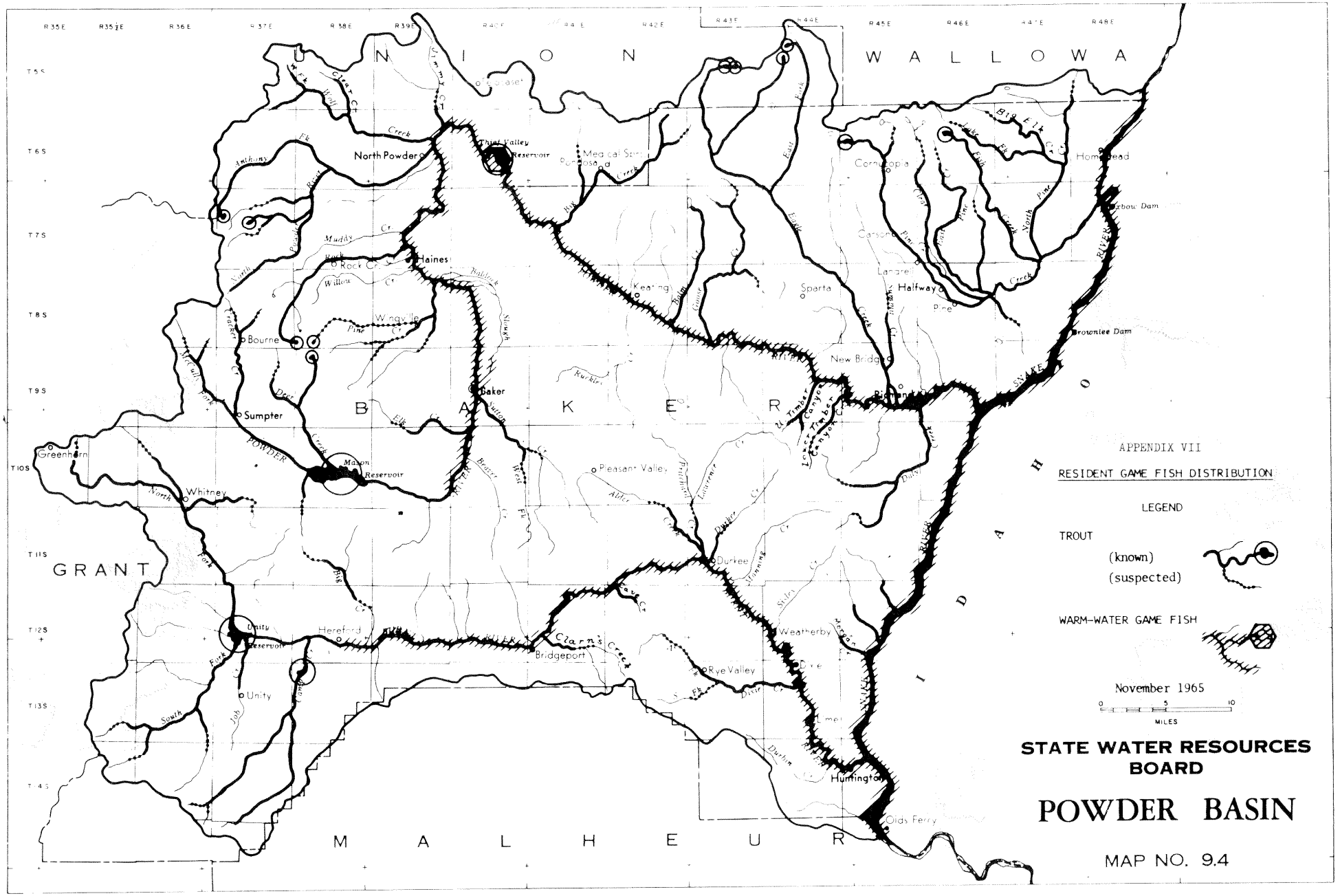
Stream	Species	Size	Numbers Stocked per Year 1960	1961	1962	1963	1964
Burnt River	Cutthroat	Fingerling	-	-	-	48,436	-
Burnt River, N. Fk.	"	"	-	-	-	26,274	-
"	Rainbow	"	-	-	-	22,048	12,985
Burnt River, S. Fk.	Brook T.	"	-	-	-	19,900	-
"	Rainbow	"	-	-	-	10,592	-
"	"	Legal	-	-	-	6,603	-
Eagle Cr. system	"	"	14,322	13,711	12,905	18,196	12,455
Pine Cr. system	"	"	6,668	7,692	7,797	8,007	8,002
Powder R. system 1/	"	"	12,337	39,526	8,595	11,987	12,374
Stream Total			33,327	60,929	29,297	172,043	45,816
Lake							
Anthony Lake	Rainbow	Legal	7,933	8,056	9,007	11,911	6,066
Baker Highway Ponds	"	"	3,098	1,499	-	-	-
Balm Creek Reservoir	"	"	4,094	4,006	4,003	3,440	-
"	"	Fingerling	9,950	10,065	9,860	10,000	10,003
Bear Lake	Cutthroat	"	-	1,770	-	-	-
"	Brook T.	"	-	-	-	3,420	-
Duck Lake	Brook T.	"	10,020	-	13,725	-	-
"	Rainbow	"	-	30,000	-	19,781	-
Eagle Lake	Brook T.	Finglering	14,010	9,984	-	5,130	-
Echo Lake	Cutthroat	"	-	2,300	-	-	-
Fish Lake	Rainbow	"	-	-	7,793	8,000	-
Haines Pond	"	"	-	1,940	2,973	2,041	4,105
"	"	Legal	-	3,808	4,002	3,913	4,006
Hardy Murray Reservoir	"	Fingerling	20,060	19,985	49,966	10,007	10,000
Heart Lake	"	"	10,030	-	4,800	-	3,000
Higgins Reservoir	"	"	15,340	14,980	31,409	10,007	20,155
"	Kokanee	"	40,000	-	-	-	-
"	Brook T.	"	8,010	9,900	-	-	-

1/ Exclusive of Eagle Creek

Appendix VI (continued)

Stream	Species	Size	Number Stocked per Year 1960	1961	1962	1963	1964
Highway 203 Pond	Brook T.	Fingerling	-	980	992	1,003	-
"	"	Legal	-	1,287	3,007	2,408	3,503
Lookingglass Lake	Cutthroat	Fingerling	-	3,950	-	-	8,172
"	Brook T.	"	-	-	-	5,130	-
Lost Lake	"	"	-	1,960	-	3,420	7,980
Maiden Gulch Pond	Rainbow	Legal	7,039	999	-	-	-
North Powder Pond	"	"	3,050	3,106	5,043	5,318	3,501
"	"	Fingerling	-	-	-	-	2,820
Pondosa Pond	Rainbow	"	-	-	-	-	6,190
Rock Creek Lake	Brook T.	"	8,010	-	-	-	-
Summit Lake	Rainbow	"	20,060	-	8,000	-	-
Trout Creek Pond	Rainbow	"	-	-	-	-	2,060
Thief Valley Reservoir	"	"	-	106,000	-	200,000	200,000
Twin Lake	"	"	10,030	-	20,660	-	2,040
"	Brook T.	"	8,010	-	-	-	-
Unity Reservoir	Cutthroat	"	60,660	-	-	-	-
"	Rainbow	"	99,920	99,875	73,489	406,648	299,989
Van Patten Lake	"	"	10,020	-	12,000	-	6,950
Whitney Dredge Ponds	"	"	-	-	15,982	-	2,078
Wyatt Lake	"	"	-	2,965	3,151	3,000	-
"	"	Legal	-	2,009	3,017	3,907	-
Lake Total			369,344	463,282	320,870	1,063,370	602,618
Grand Total			402,671	524,211	350,170	1,235,413	648,434


APPENDIX VIII
FORMER ANADROMOUS FISH DISTRIBUTION
LEGEND
SPRING CHINOOK SALMON
(known)
(suspected)
STEELHEAD TROUT
(known)
(suspected)
November 1965
0 5 10
MILES
STATE WATER RESOURCES BOARD
POWDER BASIN
MAP NO. 9.4
UNION
WALLOWA
BAKER
GRANT
MALHEUR
IDAHO
North Powder
Haines
Baker
Sumpter
Bourne
Wingville
Rock Cr.
Telocaset
Thief Valley Reservoir
Pondosa
Medical Sprs.
Keating
Sparta
Cornucopia
Halfway
Homestead
Oxbow Dam
Brownlee Dam
Richland
Pleasant Valley
Durkee
Greenhorn
Whitney
Mason Reservoir
Unity Reservoir
Unity
Hereford
Bridgeport
Rye Valley
Weatherby
Huntington
Olds Ferry
POWDER
RIVER
BURNT
SNAKE
Clark's Creek
R35E
R35½E
R36E
R37E
R38E
R39E
R40E
R42E
R45E
R46E
R47E
R48E
T5S
T6S
T7S
T8S
T9S
T10S
T11S
T12S
T13S
T14S


UNION
WALLOWA
BAKER
GRANT
MALHEUR
IDAHO
North Powder
Haines
Bourne
Sumpter
Baker
Greenhorn
Whitney
Unity
Hereford
Bridgeport
Durkee
Pleasant Valley
Keating
Sparta
New Bridge
Halfway
Cornucopia
Homestead
Weatherby
Rye Valley
Huntington
Olds Ferry
Mason Reservoir
Unity Reservoir
Thief Valley Reservoir
Brownlee Dam
Oxbow Dam
APPENDIX VII
RESIDENT GAME FISH DISTRIBUTION
LEGEND
TROUT
(known)
(suspected)
WARM-WATER GAME FISH
November 1965
0 5 10
MILES
STATE WATER RESOURCES BOARD
POWDER BASIN
MAP NO. 9.4