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INSTREAM FLOW RECOMMENDATIONS FOR AQUATIC LIFE KOOTENAI AND CLARK FORK RIVER BASINS

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Introduction and Scope

For all life, water is necessary; for many uses it is convenient; and in much of it's functioning, it is commonplace. But commonplace things are often the least appreciated and the hardest to understand. Throughout the ages, people have elected or have been compelled to settle in regions where water was deficient in amount, inferior in quality, or erratic in behavior. Thus man has long been harnessing the power of falling water and diverting streams for agricultural and domestic purposes. Until the present century, however, man's impact on river ecosystems was relatively insignificant. Modern technology has made it possible to control the largest of rivers and now large dams impounding huge reservoirs of water are common. Man has progressed to be the grand manipulator, if not the destroyer, of the lotic ecosystem.

Montana still possess a truly unique natural resource: her productive, free flowing rivers. But that water is not flowing unnoticed. Irrigational demands continue to grow. Low flow years illustrate the problems associated with this inefficient use of water. As communities grow, more water is needed to meet domestic and municipal uses. And industry wants their's too. In eastern Montana, coal development wants 2.6 million acre feet of water annually from the Yellowstone River system alone. This doesn't consider additional needs dictated by population growth that is sure to accompany the coal development.

The sad threat to our resource is simply that without water in the channel, we can't provide the truly quality fishery we now enjoy. And this is true whether we are talking of cutthroat in the headwaters or channel catfish in the lower reaches.

It was the objective of this study to determine reasonably accurate instream flow values for streams recognized on Montana's 1965 Stream Fisheries Classification map. By including these instream flow values in Montana's water requirements, we will assure state and national planners that all or at least most of our water is now being put to use. If only the traditional uses for which diversion is required were considered, it would be difficult if not impossible, to give such assurances. By including fishery benefits as a beneficial use of water, Montana's truly unique natural resource will be protected.

Methodology

The key to adequate determination of instream flow recommendations is to quantify the water flow needs of the organisms involved. The tools and techniques currently available for determining these values are not well developed. These techniques range from pure guess work and arbitrary decisions to dignified and detailed field studies.

Instream flow methodology workshops were attended in Portland, Oregon; Olympia, Washington; Boise, Idaho; and Laramie, Wyoming to discuss techniques currently being used. These workshops provided a meeting ground for an exchange of information and ideas. The concept of instream values for aquatic life is relatively new and there is not a defined "handle" to grasp that fits each situation.

Methodologies currently employed in the West Coast states (Washington and Oregon) reflect flow depth and velocity requirements of fish for each of the biological activities of passage, spawning, incubation, and rearing (Thompson, 1972; Collings, 1972). After these requirements are defined, monthly flows for a river or reach of river are recommended as the highest flow needed to meet the biological activity of important species occurring during that period. Some of the advantages of a detailed field study include: justification for recommended flows is enhanced; recommended flow regimens gain continuity; bias inherent in individual judgmental interpretations is avoided. The disadvantages are: the studies are extremely time consuming and expensive (about 8 months per stream); and the relationship between recommended flows and fish production is not clearly demonstrated.

The "Montana Method" of determining instream flow values was devised after observing stream discharges and associated fishery values. This method is based on percentages of mean annual flow of record. Observations suggested that a flow equaling 10% of the mean annual flow was, at best, a short time survival flow, while a discharge greater than 30% can be described as a satisfactory fishery flow. Of course, the more water, up to flood stage, the better the fishery potential. A flow of 100% of the mean annual flow represents a good bank full flow, not flood stage. The Montana Method reflects recommended flow levels required by time periods to sustain at least the present levels of fish and fishing. Instream flows which will enhance existing natural conditions are also identified. The concept is not to insure a percentile flow for the period defined, but to identify the flow at which any storage and/or diversion of the natural flow must cease. When natural flows fall below the recommended level, they must be allowed to remain in the channel. The Montana Method suggests a minimum flow of 30% of the mean annual flow for the period October-March and a 60% minimum flow for April-September on Class 1 and 2 (blue and red ribbon) streams. Class 3 (yellow ribbon) streams receive 25 and 50%, respectively, while Class 4 (grey) streams receive 20 and 40%, respectively.

The Montana Method offered a simple solution to the problem of assigning instream flow values to Montana's streams. But when it came to evaluating the various flow regimens in relation to instream needs of the fish species involved, we were lost. Fisheries workers on the West Coast concerned with anadromous species have found that these fish have a rather narrow tolerance to velocity and depth when selecting a spawning site (Fraser, 1971). Stream studies have revealed that these parameters are also important to trout, however pertinent information regarding specific instream needs is rare. Lewis (1969), found that current velocity and cover accounted for 66% of the variation in trout numbers between pools. Hoppe and Finnell (1970) found by examining trout egg survival under different flow regimens that suitable spawning habitat should have a minimum velocity of 1.5 fps.

A study was undertaken to evaluate the Montana Method in relation to various physical parameters (Elser, 1972). The average velocity of each study section showed the greatest response to the decreased flow levels. On each stream the average velocity at the 10% level was less than 1.0 fps, while average velocities at the 30% flow regimen were between 1.35 and 1.53 fps, which approximated the minimum velocity necessary for successful salmonid reproduction. A study conducted on two small trout streams in Wyoming by Wesche (1973) used the Montana Method as a basis to evaluate instream needs of trout and substantiated our findings. He found that the greatest rate of decrease for the hydrologic parameters and brown trout cover occurred in flow reduction from 25% to 12.5% of the average daily flow (ADF). While an optimum flow was not identified, a discharge in the 25% ADF range will provide substantially more available trout habitat than a 12.5% ADF. By using the 25-30% level for an instream value, the flow range resulting in the greatest rate of habitat decrease is avoided.

Since resources (time, money, and help) were limited, the Montana Method was selected as the basis for estimating Montana's instream flow needs. A base flow is readily obtainable since U.S.G.S gaging records are easily transformed into the desired regimens. Conversely, ungaged streams pose a problem. However, annual flows can be calculated based on watershed area and average yield. Estimates of mean monthly and mean annual discharge was obtained from the U.S.G.S. based on two models. The Riggs Method applies a formula to monthly measurements and projects the estimates to an annual flow (McMurtrey, U.S.G.S. personal correspondence). Mean monthly and mean annual flows were also computed from basin characteristics using methods as outlined by Boner and Buswell (1970).

Field measurements were made during low flow periods to evaluate the instream recommendations. A two man crew took instantaneous discharge measurements and colored photographs on streams selected by Regional Fish Managers. This information was used to evaluate specific instream recommendations. Additional measurements and photographs were taken by a crew provided by the Montana Water Resources Board. The Water Board crew measured 152 stations on 134 streams during the fall of 1971 and the spring of 1972. Several stations were visited more than once to obtain data at various flow levels. A total of 92 stations on 72 streams were measured during the summers of 1972 and 1973 by the Department of Fish and Game crew. Each Fish and Game station was measured at least twice (at approximately a one month interval) to allow comparison of physical parameters under different flow conditions. A minimum of two transects were measured at each station.

Results

This report segment includes instream flow recommendations for streams classified blue, red and yellow in the Kootenai and Clark Fork of the Columbia River drainages in Montana, (Figure 1). These recommendations are of sufficient reliability for planning, representing the first approximation of instream flows necessary to maintain aquatic life. The instream values must be considered preliminary in nature and maybe revised on the basis of review and input by Regional Fish Managers.

Instream flow values are recommended for eight stream reaches classified 1, 2, and 3, in the Kootenai River Basin (Table 1). From the standpoint of sheer volume of fishing water, the basin is generously endowed. Sport fish of importance found in the area are cutthroat trout, rainbow trout, brook trout, Dolly Varden, lake trout, kokanee, mountain whitefish, and white sturgeon. Streams and lakes in the Kootanei Basin provide substantial recreational opportunities.

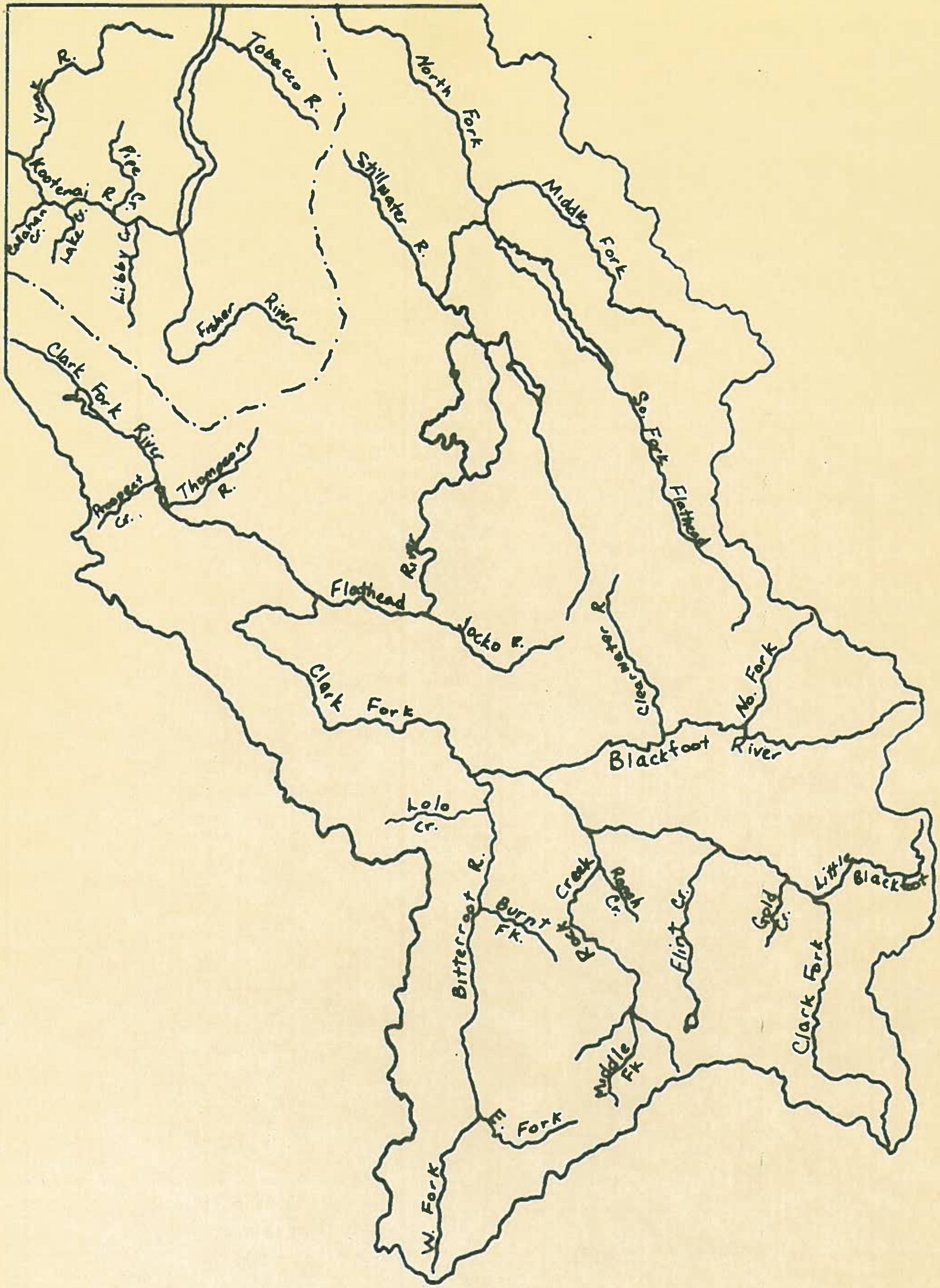

Figure 1. Classified streams of the Kootanei and Clark Fork River Basins.

Table 1. Recommended instream flow values for blue, red, and yellow (Class 1, 2, and 3, respectively) ribbon streams in the Kootenai River Basin in Montana.

Stream	Reach	Class	Miles	Avg. (cfs)	Oct-Mar (cfs)	April-Sept (cfs)
Kootenai River	Internation Bdry-Mont-Idaho State Line	2	100	10,560	3,150	6,300
Yaak River	Below Hellroaring Creek	2	22	935	290	560
Callahan Creek	At the Mouth	3	7	211	50	100
Fisher River	At the Mouth	3	27	571	140	280
Lake Creek	At the Mouth	3	12	516	130	260
Pipe Creek	At the Mouth	3	19	290	75	150
Tobacco River	At the Mouth	3	14	305	75	150
Yaak River	Above Hellroaring Creek	3	24	536	135	270

Table 2. R ommended instream flow values for blue, red and yellow (Class 1, 2 and 3, respectively) ribbon strea with historic flow data in the Clark Fork of the Columbia River Basin in Montana.

Stream	Reach	Class	Miles	Average Flow (cfs)	Instream Needs Oct-Mar (cfs)	Instream Needs April-Sept (cfs)
Flathead River	Below North and Middle Forks	1	45	9,774	2,900	5,800
Rock Creek	Mouth to the Forks	1	50	620	190	380
Bitterroot River	Above Hamilton	2	31	930	280	560
Blackfoot River	Mouth to North Fork	2	50	1,720	520	1,040
Clark Fork River	At Drummond	2	34	620	190	380
East Fork Bitterroot	Mouth to Reservoir	2	42	291	90	180
Middle Fork Flathead R.	Mouth to Cox Creek	2	76	2,917	875	1,750
N. Fork Flathead River	Mouth to Canadian Bdry	2	68	2,370	710	1,420
So. Fork Flathead River	Above Hungry Horse Res.	2	50	3,524	1,050	2,100
Swan River	Swan Lake to Lindberg L.	2	41	1,144	340	680
Thompson River	Below Bend Guard Station	2	30	473	140	280
Blackfoot River	North Fork to Lincoln	3	30	82	20	40
Burnt Fork Bitterroot R.	At Mouth	3	20	48	12	24
Clark Fork River	At Garrison	3	20	1,866	470	940
Clark Fork River	Palisades to Bonner Dam	3	120	6,506	1,625	3,250
Clearwater River	Mouth to Summit Lake	3	20	541	135	270
Flathead River	Below Kerr Dam	3	73	11,750	2,940	5,880
Flint Creek	Below Georgetown Lake	3	37	99	25	50
Gold Creek	Mouth	3	10	25	6	12
Jocko River	Mouth to Arlee	3	26	393	100	200
Little Blackfoot River	Mouth to Elliston	3	25	110	30	60
Lolo Creek	Mouth to Lolo Hot Springs	3	25	215	55	110
Middle Fork Rock Cr.	Below Moose L.	3	12	126	30	60
No. Fork Blackfoot	At mouth	3	20	166	40	80
Prospect Creek	At mouth	3	11	268	65	130
Ranch Creek	At mouth	3	6	33	8	16
Stillwater River	Above Upper Stillwater L.	3	9	86	20	40
West Fork Bitterroot R.	Below West Fork Reservoir	3	14	292	75	150

Recommendations for instream flows in the Clark Fork River Basin are included for all Class 1 and 2 streams and those Class 3 streams with historic flow information. A total of 28 stream reaches are shown in Table 2. The remaining Class 3 streams and all Class 4 streams will be included when data requested from the U.S.G.S. is received. The Clark Fork of the Columbia River Basin is also well endowed with water and recreational opportunity. In addition to those sport fish found in the Kootanei, brown trout, arctic grayling and lake whitefish are found in the Clark Fork Basin, while the white sturgeon is restricted to the Kootanei Basin.

Discussion

These instream flow values are established to provide managers and planners baseline information on the quality streams of western Montana. Since the conditions which result in stream flow are seldom constant from drainage to drainage or from year to year, we must realize that streams also differ. It would be dangerous to the resource itself to apply these recommendations to individual streams without reviewing each situation.

A recent survey indicated that about 500,000 fisherman-days are expended in western Montana each year (Pacific Northwest River Basins Commission, 1971). The consensus of opinion of Montana anglers, resident and non-resident, is that they prefer to fish in our remaining trout streams and rivers. One of the outstanding attractions of the Kootanei and Clark Fork River Basins is the opportunity to fish for wild trout amidst scenic surroundings. By identifying instream values for the 1,220 miles of quality streams included in this segment, this opportunity may be preserved.

The intensifying demands being placed on Montana's natural resources dictates that instream flow needs be identified on Montana's remaining quality streams. These recommendations will be made as additional data is received and reviewed. Additional evaluation and refinement of current methodologies is also needed. The fantastic demands being made on the water resources of the lower Yellowstone River Basin indicate the need for additional research in southeastern Montana to determine instream needs of the fish of the lower Yellowstone.

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