Compliance With Instream Flow Agreements in Colorado, Montana, and Wyoming

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ABSTRACT

A total of 119 stream locations were identified in Colorado, Montana, and Wyoming to which minimum streamflows have been applied as a result of agreements between management agencies and water developers. Post-agreement streamflow data were available for 12 months or more for only 61 of the 119 locations. Assessment of these streamflow data showed that flows below the minimum flow agreed upon by developers were common. Flows were below the minimum agreed upon at least one time at 54 locations and equaled only 25% (or less) of the minimum agreed upon at least one time at 28 locations. Actual flows were lower than flows agreed upon for 20% or more of the time at 17 of the 61 locations. Limited monitoring and enforcement by permitting agencies appeared to contribute to the lack of compliance by water developers.

Water development projects in the United States frequently lead to reduced or modified flow regimes in streams. Fisheries biologists must often determine the amount of water needed in a stream to maintain fisheries resources. An instream flow is the amount of water in a stream channel measured at a given place and time. Numerous methods have been developed to determine and negotiate instream flow needs (Wassenberg et al. 1979; Reiser et al. 1989), and several states have legislation aimed at preserving streamflows for fisheries protection (McKinney and Taylor 1988). Agencies appear to have made substantial strides during the last 2 decades in developing strategies for obtaining instream flow agreements with water developers (Orsborn and Allman 1976). Despite these advances, little attention has been given to determining the extent of compliance with instream flow agreements between management agencies and water developers, or in assessing the biological effectiveness of the agreements.

Our objectives were to define the extent of compliance with instream flow agreements and to identify factors that may be affecting compliance by water developers. We evaluated compliance with instream flow agreements by water developers in a three-state region of the central Rocky Mountains—Colorado, Montana, and Wyoming. Opportunities for protection of instream flows were recently identified in these states (Bristow and Gould 1986; Trembly 1987), and the effects of altered streamflows on fisheries resources were assessed more than a decade ago (Nelson et al. 1976). We hoped to identify water development projects having good documentation of the process used in establishing streamflow agreements, and good adherence to the flows agreed upon, so that the biological effectiveness of the agreements could be evaluated in the future. Since nearly all of streamflow agreements were for a minimum level of streamflow, we focused our evaluation on projects with a prescribed low flow or minimum streamflow. This paper summarizes detailed information presented in Raley et al. (1988).

Methods

We limited our assessments to water development projects with a minimum instream flow agreement because very few projects had streamflow agreements requiring more than a minimum flow and the nature of agreements for streamflows other than a minimum flow were highly varied. All water development projects in the three-state area with minimum streamflow agreements were identified; existing streamflow records for these projects were obtained; and the extent and magnitude of discrepancies from the minimum flows agreed on were determined (Raley et al. 1988). Water development projects with minimum streamflow agreements had to meet three criteria: (1) a written agreement existed between a management agency and water developer that specified minimum instream flow; (2) the prescribed minimum streamflow was intended to maintain fish habitat, water quality, or stream channel integrity, but not downstream water rights; and (3) construction of the project was completed, the agreement was in effect, and flow data for at least 12 months were available.

In 1987 and 1988 we contacted all state and federal agencies involved in construction, permitting, or environmental review, as well as several private water developers, to identify projects and obtain records of the agreements. Govern-

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ment agencies that were contacted included the fisheries management agency and water control agency in each state, as well as regional and state offices of the following federal agencies: Bureau of Reclamation, Bureau of Land Management, Army Corps of Engineers, Federal Energy Regulatory Commission, Fish and Wildlife Service, Forest Service, and Soil Conservation Service. Streamflow data were obtained from the U.S. Bureau of Reclamation, the U.S. Geological Survey, and state agencies. We obtained and reviewed the minimum streamflow agreements for all identified projects to determine the methods by which the agreements were reached and the clarity of the specifications in the agreements.

Results

We believe that our census identified all water development projects having minimum streamflow agreements before 1988 in Colorado, Montana, and Wyoming. A total of 119 locations with minimum flow agreements were identified—64 in Colorado, 17 in Montana, and 38 in Wyoming. However, streamflow data at only 61 of these locations enabled an assessment of compliance. Almost half (58) of the projects could not be evaluated due to the lack of daily streamflow monitoring downstream from the water development project for a minimum of 12 months.

At the 61 stream locations evaluated in the three states, flows were below those agreed upon, on at least one occasion for 54 of the projects (Table 1). Short periods of large reductions in flow below the level of the minimum streamflow agreements were common among the 61 streams for which data were available. At 28 locations, flows were 25% or less of the established agreement on at least one occasion. At several locations, flows were chronically below those specified in the agreements. For example, measured flows were lower than those agreed upon during 20% or more of the period of record, at 17 of the 61 locations.

We attempted to determine the factors associated with lack of compliance by assessing trends in compliance relative to six factors: (1) state where the project was located, (2) precipitation levels in the drainage basin, (3) size of the stream on which the development was located, (4) agency with which the agreement was made, (5) primary use of the water (e.g., hydropower, irrigation, etc.), and (6) drought cycles during the period of streamflow record. Differences in the extent of compliance were observed among the three states in relation to precipitation levels, primary uses of water, and the extent of water development. The fewest locations with minimum flow discrepancies were in Montana, but in this state the annual precipitation in the projects' basins was highest, the developments were on sizable streams and rivers, there were fewer water developments and less complex water management systems, and water developments were primarily for hydropower production rather than for agricultural and municipal uses. Streams with discrepancies were most numerous in Colorado, but water development projects in this state tended to occur in a more arid climate, on smaller streams, and in drainages with numerous water developments where municipal and agricultural uses dominated. Compliance in Wyoming was intermediate between Colorado and Wyoming, but so was the extent of annual participation and magnitude of water development. We observed no evidence of relations between agencies permitting the projects, or drought, on compliance with the agreements by water developers.

Discussion

The results of this project point out that instream flow agreements do not assure that adequate flows will be maintained to protect fishery resources. Failures to comply with instream flow agreements appear to be common among water development projects. The reasons for such failures are not well defined, but we suggest that lack of streamflow data, inadequate project monitoring, and limited enforcement probably decrease the effectiveness of formal streamflow agreements. Without flow data it is impossible to evaluate compliance, to identify factors contributing to lack of compliance, or to develop appropriate solutions for compliance failures. Many of the agreements that we reviewed included no provisions for streamflow gaging or reporting of streamflows to permitting agencies. Once instream flow agreements have been established it is critical to monitor flows, but monitoring is a complex adminsitrative problem

Table 1. Frequency with which different magnitudes of flow discrepancies occurred among the 61 stream locations with minimum streamflow agreements and streamflow data in Colorado, Montana, and Wyoming. For a particular discrepancy criterion, entries represent the number of stream locations in each frequency class.

Discrepancy criterion	Frequency %[a]					
	0	1	1–20	21–40	41–60	61–80
Flows below the minimum	7	10	27	11	4	2
Flows 90% of the minimum or less	11	11	29	7	3	0
Flows 75% of the minimum or less	16	13	25	6	1	0
Flows 50% of the minimum or less	23	15	21	2	0	0
Flows 25% of the minimum or less	33	20	8	0	0	0

[a]Percentage of days in the period of hydrologic record when measured streamflows were below the stated discrepancy criterion.

given its year round nature, equipment needs, data processing requirements, and personnel demands (McKinney and Taylor 1989). Effective instream flow monitoring is very costly. The agreements also failed to identify monitoring schedules, methods for assessing compliance, or penalties for failure to comply with flows agreed upon.

Although federal agencies were generally the permitting agents, and had authority to review water development and require mitigation to protect fishery resources, the responsibilities for monitoring and enforcement of minimum streamflow agreements were not defined in the agreements that we reviewed. States are responsible for managing fish populations; thus, somewhat by default, state fisheries management agencies are often relied upon to monitor water development projects with minimum flow agreements. However, state fisheries management agencies have neither the manpower nor funds to establish regular "monitoring programs," nor are they automatically made aware of all projects that are permitted by federal agencies. The result is that some projects may be "monitored" on a routine basis (e.g., those with high quality fisheries), but others are ignored. Furthermore, in many streams that state agencies might be able to monitor, they do not have enforcement authority; consequently the responsibility to secure compliance falls back on the federal permitting agency.

We found very few projects in the three-state area that were suitable for assessing the biological effectiveness of streamflow agreements, due to the lack of streamflow data and failure of water developers to comply with streamflow agreements, as well as lack of historical baseline data on fish populations. Another factor that would hinder biological evaluation is poor documentation of negotiations leading to agreements. Projects with flow agreements were easily identified, and the agreements were available in agency records, but there was generally no documentation of the methods used to recommend minimum streamflows or the negotiation process that resulted in flow agreements. Without such documentation, biological success or failure of an agreement is difficult to evaluate.

It is evident that fisheries biologists have numerous tools at their disposal to define and negotiate streamflows, such as the Instream Flow Incremental Method (Bovee 1982) and a large body of legislation (McKinney and Taylor 1988), but they must also focus on the needs for monitoring and enforcement if their efforts are to be effective. Agencies responsible for negotiating and establishing streamflow agreements should create policies to guide their personnel so as to assure that monitoring and enforcement responsibilities are clearly defined, funding is available, and a process to obtain mitigation for compliance failures is firmly established. Research is needed to understand better the reasons for compliance failures and to identify water management strategies that will reduce the frequency of compliance failures.

We believe that institutional responsibilities for monitoring and enforcement need to be more clearly defined in formal streamflow agreements. Items that should be specified are the location of stream gages, responsibilities for funding and operating gaging stations, responsibilities for evaluation and enforcement of the agreement, and the penalties for compliance failure. It is evident that fisheries biologists have numerous tools at their disposal to define and negotiate streamflows, but they must also focus on the needs for monitoring and enforcement if the extent of compliance failure is to be reduced and adequate flows maintained for fishery resources.

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