RECOMMENDED FLOWS TO PROTECT AQUATIC HABITAT IN GEORGIA STREAMS

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Abstract. Rising demand for surface water withdrawals to support a rapidly growing population prompted us to compare Georgia's current method of protecting stream flows below permitted withdrawals with other methods considered adequate by fisheries professionals for protecting aquatic habitat. U.S. Geological Survey stream gage records from 31 widely-distributed sites were analyzed for broadly applicable relationships among parameters such as average annual flow, mean monthly flow, and 7Q10 flow, in order to define a flow policy that would preserve good habitat quality for most aquatic organisms. These analyses, coupled with a thorough literature review, were used to develop higher flow recommendations that were submitted to the State Environmental Protection Division for replacing the current policy that reserves only the 7Q10 flow (the lowest average flow expected for seven consecutive days with an average frequency of once in ten years).

INTRODUCTION

The increasing demand for water to support Georgia's growing human population creates significant challenges for natural resource managers responsible for protecting the state's fish and wildlife. Heavy dependence on surface water supplies for municipalities, industry, and agriculture has severely depleted and/or altered natural stream flows, adversely impacting aquatic habitat. Georgia's present policy (Georgia Department of Natural Resources 1996) protects stream flow from being depleted below the 7Q10 flow (a ten-year frequency drought event), but there is an overwhelming consensus among aquatic resource managers that higher flows are necessary to support the fish and wildlife, recreation, and aesthetics that Georgia's citizens expect from their natural environment. The 7Q10 flow was not intended to define adequate base flows for aquatic habitat requirements or other instream uses; its purpose was to ensure adequate water quality for aquatic life survival downstream from point source discharges during expected low flow conditions by providing a basis for calculating instream concentrations of specific pollutants in such discharges.

BACKGROUND

The number of North American freshwater fishes believed to be endangered, threatened, or of special concern has increased by 45% during the past decade (Williams et al. 1989). Alteration of natural stream flows has been cited as the primary cause of deteriorating stream fishery resources (Peters 1982, Tyus 1990). Dams, stream channelization, and water withdrawals impact the timing, duration, and magnitude of flows. Flow reductions alter water temperatures and channel morphologies and thus may destroy critical habitat for various life stages of numerous aquatic species. Establishing historic low flows as the acceptable minimum tends to perpetuate and legitimize worse case conditions and limit fish populations to whatever the degraded habitat can support (Filapek *et al.*, 1987), resulting in resource decline below reasonable public expectations.

Instream flow requirements for fisheries and methods to protect stream flows have been the subject of extensive study. Such efforts range from simple "office" methods that establish general statewide guidelines to more time-consuming and expensive field methods that may be necessary to develop site-specific recommendations for controversial projects. Many states have developed comprehensive instream flow recommendations for considerably greater flows than 7Q10. A revised policy based on broadly applicable office methods is proposed for Georgia. The proposed standards would provide significantly better protection for native stream fishes than the current policy, is simple to understand and apply, and is scientifically defensible.

METHODS

Several methods were used to develop flow recommendations for 31 test streams, based on historical stream gage records at sites distributed throughout all of Georgia's physiographic regions. These sites were analyzed by physiographic region for broadly applicable relationships among parameters such as average annual discharge, mean monthly flow, and the 7Q10 flow, in order to define a flow policy that would provide generally good habitat quality for most aquatic organisms. This is a subjective approach, but it is soundly based on the work of many researchers who have spent decades defining actual flow regimes that meet specific habitat needs (Orsborn and Allman 1976, Wesche and Rechard 1980).

RESULTS AND DISCUSSION

Analyses of Georgia flow records indicate that adequate protection from harmful low flows can be afforded most streams by using a combination of methods that have been widely tested in other states. For most of the state's unregulated streams, the recommendation of 30% of average annual discharge originally developed by D. L. Tennant (Tennant 1976) appears to be adequately protective, yet simple to apply. Other categories of streams, although composing only a small percentage of the state's total, require separate flow regimes to assure adequate protection. These stream categories, described in detail below, are trout streams, regulated streams (except those with peaking hydropower projects), "special case streams", and streams with peaking hydropower facilities.

In Georgia's Blue Ridge Province streams, correlations between drought flows and percentages of average discharge were not consistent with those from streams in other portions of the state, suggesting a more conservative approach is needed. Because most of these are trout streams which are already given special status in water quality regulations, applying a more protective flow assessment method is appropriate. The need to protect trout streams from high summer temperatures provides further justification for a separate method. Both the New England Aquatic Base Flow Method (August median flow) and a widely used modification (September median) are often used for eastern trout streams. The September median flow is recommended as an acceptable compromise between the 7Q10 standard and the more protective August median flow. Since September median flows appear comparable to August low flows in most trout streams, this recommendation should adequately protect these streams both from de-watering and high temperatures.

While it is critical to prevent stream flows from dropping below naturally occurring levels in order to maintain minimum wetted areas, periodic high flows are also necessary to maintain normal channel morphology and prevent sediment from destroying stream habitat diversity (Stalnaker 1979). In unregulated streams, natural storm events provide needed high flows, but projects (such as large dams and diversions) that regulate total stream flow need methods to ensure both acceptable minimum flows and periodic higher flows. These are provided for in the recommended policy.

Site-specific field studies may be required to determine adequate flows in special case streams or stream reaches identified for special protection on a case-by-case basis. Examples of these would include the habitat of protected species, certain anadromous species, and higher quality trout waters. Instream flow recommendations for such streams should be formulated only after collecting the site-specific information needed to assess flow requirements.

A separate method is also recommended for the final category of peaking hydropower projects. These projects typically cause frequent, rapid changes in stream flow and can have profound effects on downstream aquatic ecosystems. A generalized statewide flow policy may not adequately protect aquatic life and stream channel integrity downstream of these facilities. To evaluate such potentially significant impacts, and to determine whether more complex flow regimes are required to protect downstream resources, field studies using the state-of-the-art Instream Flow Incremental Methodology (IFIM) should be required.

Table 1. Recommended Instantaneous Flows to Protect Aquatic Life in Georgia Streams

Category/ sub-category	Season	Recommended Flow
Unregulated Streams		
Warm water streams	All	30% AAD[1]
Trout streams	All	Sept Median
Regulated Streams	July-Nov	30% AAD
	Jan-April	60% AAD
	May, June, Dec	40% AAD
Special Case Streams		
Field studies to determine flow requirements		
Peaking Hydropower Projects		
Site-specific IFIM studies		

[1]Average Annual Discharge

RECOMMENDATIONS

Recommended protective flows are summarized in Table 1. These recommendations should be based on at least ten years of continuous flow records where possible, and in all cases are instantaneous flow requirements rather than averages over various time periods. We suggest that these recommendations be applied, like the current method, by requiring the stated minimum flow or natural flow, whichever is less. Our recommendations would not require stream flow augmentation during natural drought conditions.

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