

Methods and Documentation used to Propose State Resource Water (SRW) and Superior High Quality Water (SHQW) Classifications for Ohio's Water Quality Standards



Kokosing River: SRW Candidate

Introduction

Ohio EPA has drafted revisions to the State's antidegradation policy¹ which incorporate a level of protection between the minimum antidegradation policy required under the Clean Water Act and the maximum protection afforded by federal regulations. The most stringent application of antidegradation is to allow absolutely no lowering of water quality in waters designated as Outstanding National Resource Waters. The minimum requirement allows for a lowering of water quality to the established water quality standards applicable to the water body if a determination is made that the lowering of quality is necessary to accommodate important social and economic development. The agency is proposing two intermediate levels of protection for certain ecologically and recreationally important water bodies in the State that will permanently reserve a portion of the unused pollutant assimilative capacity, thereby assuring that future generations will enjoy a higher water quality than the minimally acceptable standard. This document outlines the criteria which will be used to select candidate streams for these two tiers: 1.) State Resource Water² (SRW) and 2.) Superior High Quality Water (SHQW).

1. Authority under 6111.12

High quality water bodies are valued public resources because of their ecological and human benefits. Intact aquatic ecosystems provide substantial environmental benefits to long-term, sustainable environmental quality. The biological components of these systems act as a warning system that can indicate potential threats to human health, degradation of aesthetic values, reductions in the quality and quantity of recreational opportunities, and other ecosystem benefits or "services." Some of these other services include reliable and safe supplies of water for human consumption and industrial production, assimilation of human and other waste products, sediment transport, water retention for reduced flooding, and the purification of both ground and surface waters. The ability of streams and rivers to provide those beneficial services and to act as environmental indicators is reduced whenever their integrity is degraded (Ohio EPA 1996). The antidegradation policy for the State Resource and Superior High Quality Waters reserves a portion of the remaining assimilative capacity to protect the integrity of Ohio's highest quality streams.

2. The existing SRW definition is being phased out and part of the process will be to move these waters to the appropriate new tier.

Selection Criteria

The selection of candidate water bodies and delineation of SRW and SHQW segments were based on the following types of information:

1.) *The presence of endangered and threatened fish, mussel, crayfish, and amphibian species* as designated for Ohio by the Ohio DNR (Department of Natural Resources), Division of Wildlife (2001). The inclusion of this information helps to focus on those species that: (1) are most at risk from increased point and nonpoint source pollution, (2) may not be adequately protected by water quality criteria, and (3) are associated with those aesthetic properties of water bodies (e.g., high quality habitat) valued by the public. These high quality water indicators have deteriorated throughout the United States; 55 percent of the freshwater mussels fauna is considered extinct or imperiled (Williams et al. 1993) and 20 percent of the native fish fauna is considered imperiled (Master 1990). The SRW and SHQW designations are intended to minimize further impoverishment of Ohio's aquatic biodiversity heritage. The data used in this process is from the late 1970s to the present and is either in Ohio EPA, Ohio DNR, or Ohio DOT (Department of Transportation) databases, from universities (e.g., Ohio State University Museum of Biodiversity), or published in reports. Frequency distributions of

these species in our current electronic databases are illustrated in Figures A-1 (all sampling stations) and A-2 (cumulative species by stream reach).

2.) *The presence of viable populations of fish species with a declining distribution across Ohio since 1978 (Ohio EPA 1996).*

Declining species are species that have suffered reductions and increased fragmentation of their distributional range and abundance across Ohio (based on data collected by various state agencies and universities over the past 15 years) compared to historical distributions as documented in the Fishes of Ohio (Trautman 1981). These species have similar properties to the endangered and threatened species, and will likely follow suit if conditions continue to decline in Ohio's high quality waters. Added to the endangered and threatened status list (25 percent of Ohio fish fauna), the declining designation brings the proportion of the state fish fauna as potentially imperiled to 33 percent. It is important to protect watersheds from large scale alterations to make recovery of these species possible. Frequency distributions of declining species are illustrated in Figures A-5 (all sampling stations) and A-6 (cumulative species by stream reach).

3.) *The achievement of high biological integrity as defined by the Exceptional Warmwater Habitat biocriteria for fish and macro-invertebrates delineated in the Ohio WQS.* Because biological integrity is defined in relation to least impacted reference sites, attainment of the Exceptional Warmwater Habitat (EWH) criteria indicates a site has scored within the range of the top 25 percent of the least impacted reference sites in Ohio, or the nearest to "unimpacted" as it exists today. These are the sites that generally harbor the strongest and most viable populations of rare, endangered, threatened, special status, and declining species and are ecologically the most important water bodies in

Ohio. Certain water bodies may have especially intact, "near-pristine" levels of biotic integrity (e.g., W. Fk. L. Beaver Creek, Captina Creek, certain small tributaries in the Hocking State Forest and Wayne National Forest) and may qualify for Superior High Quality Water designations without the presence of the listed species. The concept of "biological integrity" is a goal of the Clean Water Act and Ohio EPA has incorporated this concept into water quality management. Frequency distributions of IBI and ICI scores are illustrated in Figures B-1 and B-3 (all sampling stations) and B-2 and B-4 (cumulative species by stream reach).

4.) *Adjustments for Lake Erie drainage tributaries.* Lake Erie drainage streams pose a special case in assigning antidegradation tiers because of the zoogeography of Ohio fishes and unionids. Because of Ohio's glacial history, the Lake Erie drainage has fewer endemic fish and mussel species than the Ohio River basin, and consequently has fewer endangered species. Because the IBI metrics calibrated for Ohio are based on expectations derived heavily from the Ohio River basin, fewer fish species being present in the Lake Erie basin also has implications for IBI scores. For any given Lake Erie basin stream, IBI scores are likely to be lower because metrics depending on the number of species in a sample, especially the number of darter species and total number of species, are likely to underperform expectations derived from the Ohio River basin. Taken together in light of points 1-3 above, Lake Erie tributaries are likely to have fewer endangered fish species, fewer endangered mussel species, and lower IBI scores on average than Ohio River tributaries. These chance occurrences have no reflection on the intrinsic biological integrity of a given stream segment within the Lake Erie drainage, and no reflection on the ecological integrity of a given drainage basin as a whole within the Lake Erie watershed, and therefore, should be accounted for when assigning *water quality* antidegradation tiers.

An additional biological attribute that can be used as a screening tool for assigning antidegradation tiers to

***State Resource Waters:
Old Definition***

The previous category of SRW was applied to streams that were either; 1.) designated as EWH streams or 2.) stream that flowed through a federal, state, or local park or natural area. Although some of these assignments were verified through biosurveys, many were based on "table-top" decisions for the 1978 water quality standards. The new SRW/SHQW definitions emphasizes their ecological quality and vulnerability or their recreational characteristics. All streams currently designated as SRW in the water quality standards need to be changed to one of the new tiers. Current SRW streams without ambient data will remain in a "holding" category where their location (e.g., adjacent to other high quality waters) or other information (e.g., judgement of field scientists) indicates the possibility of qualifying for a SRW or SHQW tier. At a minimum these waters will receive a higher priority for future baseline monitoring and this listing will prompt agency actions related to any antidegradation reviews.

streams in the Lake Erie drainage is an unusually high proportion of pollution intolerant fish species within a given waterbody compared to statewide collections stratified by stream size (Figure 3). Here, unusually high is defined as greater than or equal to 2 standard deviations. The abundance of pollution intolerant fish species is dependent on both water and habitat quality; therefore, waterbodies supporting unusually high relative abundances of these species are likely to have exceptional water and habitat quality and should be protected accordingly.

In addition to consideration of these primary factors, other information is incorporated into this process, especially when determining the boundaries of the Superior High Quality water segments. These types of information may include, but are not limited to:

A.) The quality of the habitat available for aquatic life. The Qualitative Habitat Evaluation Index (QHEI) is the primary habitat assessment tool used by Ohio EPA.

High quality habitats are critical because maintenance of biological integrity depends on high quality aquatic habitat as much as or perhaps more than good chemical water quality to maintain robust, healthy, and high value populations of aquatic life. Although many of the endangered, threatened, and declining species are especially sensitive to water quality, many are also habitat specialists and can be extirpated if their habitats are degraded or eliminated. High quality habitat also reflects those aesthetic qualities of natural water bodies that the antidegradation philosophy attempts to protect for future generations. Frequency distributions of QHEI are illustrated in Figures A-3 (all sampling stations) and A-4 (QHEI ≥ 80 by stream reach).

B.) Biodiversity. A component of the biological criteria, species richness (biodiversity) is of special interest and is often highly correlated with biological integrity. Consideration of the top sites in Ohio, in terms of the total number of species, taxa, or sensitive species groups (e.g., Ephemoptera, Plecoptera, Tricoptera - EPT taxa) captured, provides strong confirmation that water bodies are biologically significant. While the concept of biological integrity certainly includes biodiversity, it additionally encompasses ecosystem processes (i.e., nutrient cycles, trophic interactions, speciation, etc.). It will also consider whether the biodiversity is important as repopulation epicenters for currently degraded rivers (e.g., Yellow Creek and Furnace run for the Cuyahoga River).

C.) The existence of institutional designations that have already acknowledged the special characters of a water body. The Scenic River designation in Ohio usually coincides with many of the ecological characteristics outlined above and has the additional advantage of being supported by public policy that identifies each as having significant ecological and aesthetic value to Ohioans. Furthermore, substantial public and private resources are often invested in scenic rivers. Scenic rivers which support a high quality biological community are recommended for inclusion into the SRW tier in recognition of the

exceptional ecological and recreational significance of these waters to Ohioans. For additional rationale regarding the assessment of scenic rivers, refer to "Antidegradation Classifications Assigned to State and National Scenic River in Ohio."

D.) Geomorphological "boundaries", such as ecoregion boundaries, escarpments, the glacial boundary and associated glacial features, and confluences with tributaries of major subbasins which can strongly affect aquatic habitat characteristics and the resulting fauna. Many of the stronger populations of endangered, threatened and declining species and sites with high biological community performance tend to occur at or near these boundaries. Stream gradient is another physical feature which has a profound effect on ecological con-

ditions. High stream gradient tends to discourage clayey silts from depositing on and embedding stream substrates and maintains high oxygen levels in streams and rivers (e.g., provides suitable conditions for freshwater mollusks in the tailwaters of Muskingum River locks and dams).

E.) Proximity of major urban population centers and existing water quality management plans. Pollution control efforts at some municipal and industrial facilities have been so successful that formerly grossly polluted aquatic environments are now substantially recovered. In a few cases, endangered species and/or very high biological diversity have returned. These recovered systems may merit special protection through designation as Superior High Quality Waters. In designating the specific

Table 1: General guidelines for assigning SRW, SHQW, and GHQW tiers.
Attributes are considered singly and in aggregate.

Attribute	SRW	SHQW	GHQW
Endangered & Threatened Species	Multiple species, large populations, include most vulnerable	Present; smaller populations; may be less vulnerable species	Absent, or if present, small populations or low vulnerability
Declining Species	> 4 declining fish species/segment, large populations	2-4 declining fish species/segment, moderate populations	< 2 declining species, typically small populations
IBI, ICI	High mean scores, very high max scores	Lower mean scores, fewer high max scores or if more higher scores few other attributes	Lower mean scores, few or none very high
Vulnerability	Little effluent, high vulnerability	May be more effluent, moderate vulnerability	Lower vulnerability, for vulnerable components Director can still deny antidegradation application
QHEI	High percentage QHEI scores > 80	Fewer QHEI scores > 80, many above 70	Few or no QHEI scores > 80, fewer above 70
Relative Abundance of Fish Species Sensitive to Pollution and Habitat Destruction	Relative abundance is ≥ 3 SD compared to statewide collections of similar sized streams.	Relative abundance is ≥ 2 SD compared to statewide collections of similar sized streams.	Relative abundance < 2 SD.
Multiple Attributes	High co-occurrence of above attributes	Lower co-occurrence or individual attributes more marginal	Little co-occurrence, individual attributes often marginal if present

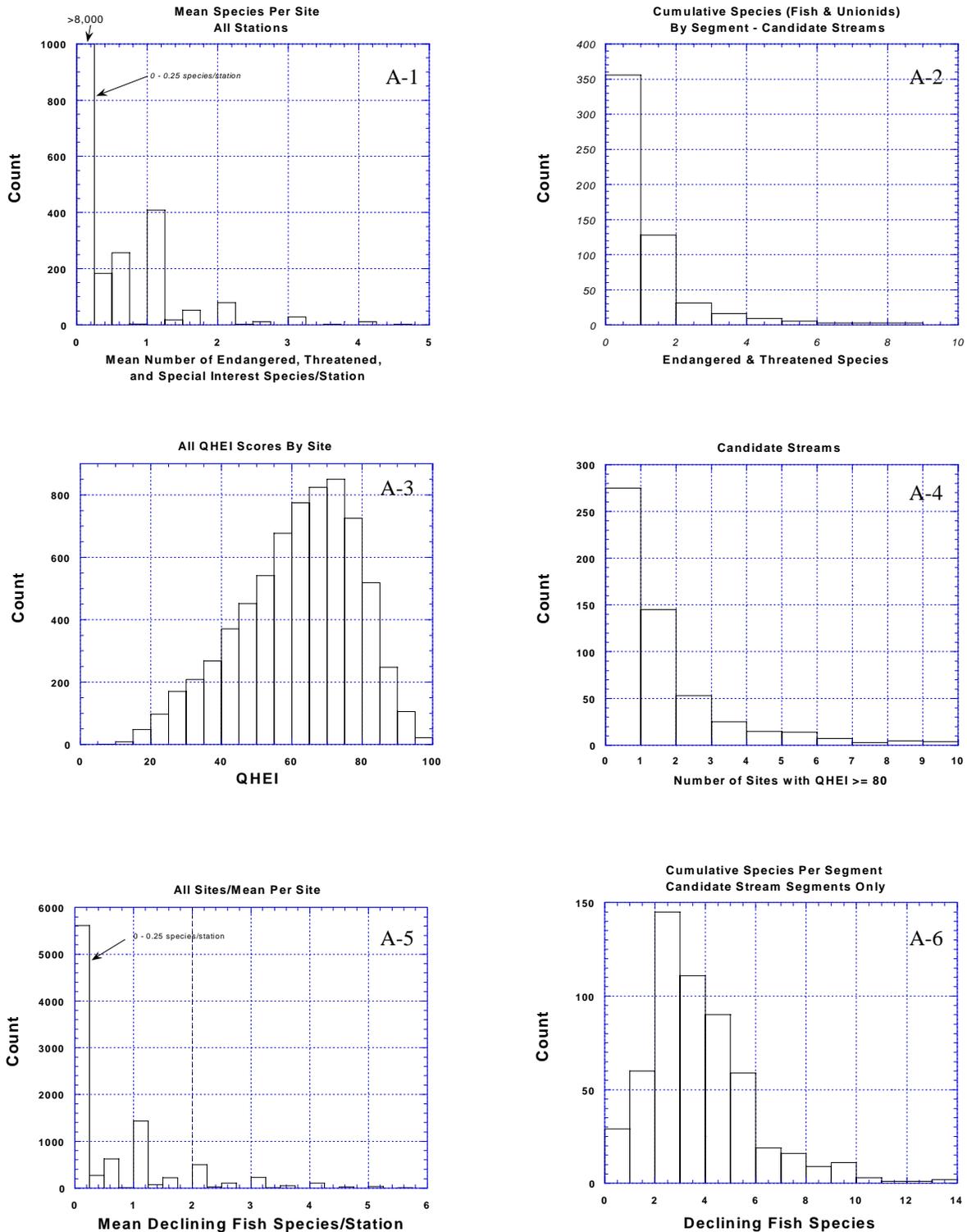


Figure A. Frequency distributions of: 1.) state endangered, threatened, and special concern species at all sampling stations, 2.) cumulative fish and unionid species number by segment for candidate streams, 4.) QHEI scores at all sampling stations, 4.) number of samples with QHEI scores > 80 in candidate stream segments, 5.) declining fish species at all sampling stations, and 6.) cumulative declining species number by segment for candidate streams.

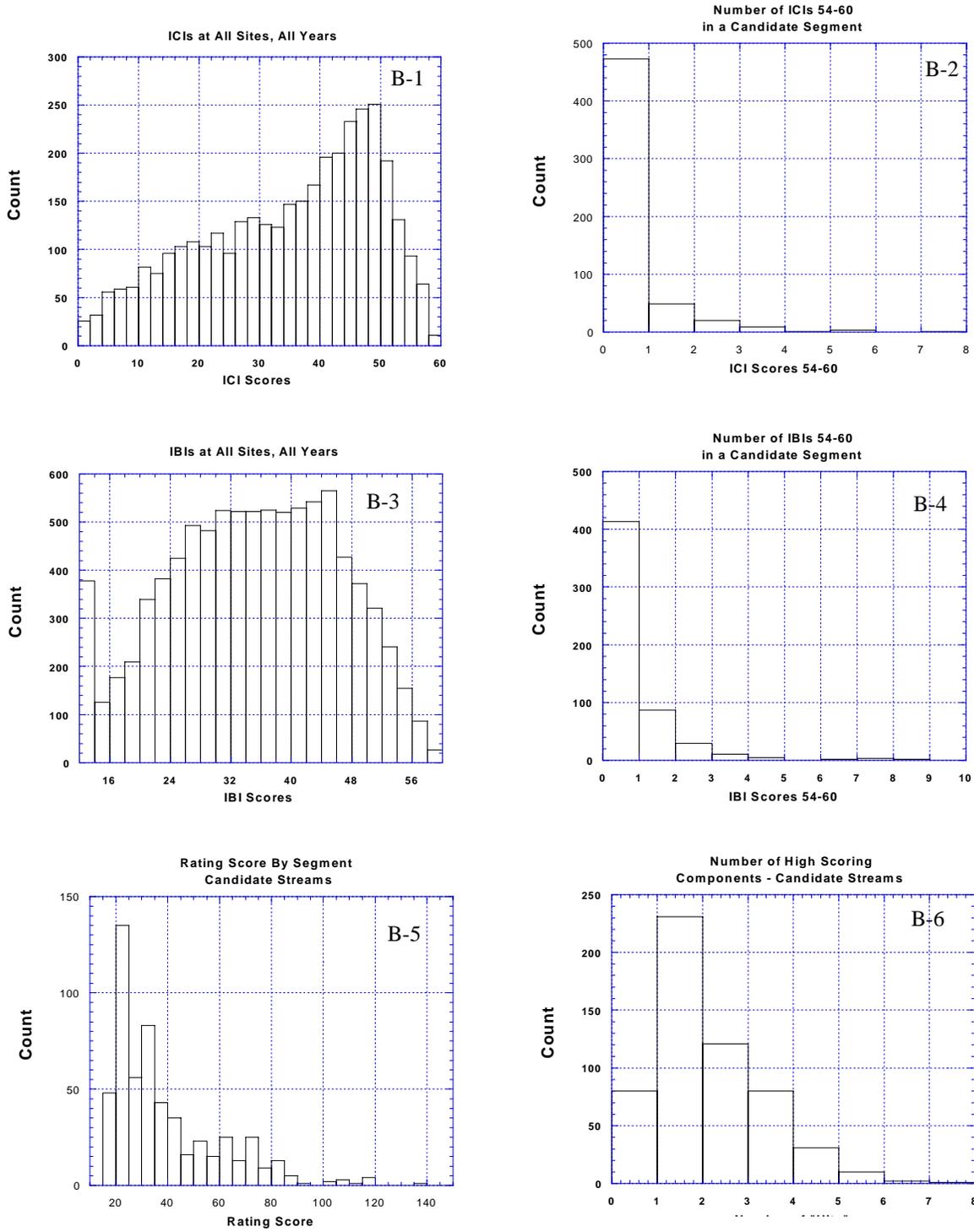


Figure B. Frequency distributions of: 1.) ICI scores at all sampling stations, 2.) ICI scores 54-60 by segment for candidate streams, 3.) IBI scores at all sampling stations, 2.) IBI scores 54-60 by segment for candidate streams, 5.) rating scores for all candidate segments, and 6.) number of multiple attributes per segment for candidate streams.

Superior High Quality Water, the Agency must provide a reasonable approach that recognizes the need to protect the aquatic resource and the need to provide continuity with previous wastewater management plans. These previous plans often used 100 percent of the pollutant assimilative capacity in the stream, in which case the Superior High Quality Water designation has little effect on discharge related parameters. The SHQW tier, however, would provide more protection for nonpoint and habitat impacts. Nonpoint source degradation can have the affect of decreasing the assimilative capacity of streams and the SHQW tier can be used to protect this. This existence of water quality management plans will be factored into the delineation of Superior High Quality Water segments whenever appropriate.

Selecting Candidate Water Bodies

Candidates for Superior High Quality Water designation were generated by examining data in Ohio EPA databases

and ecological databases provided by Ohio DNR (Wildlife, Natural Areas and Preserves), and others (e.g., Ohio DOT). Candidate water bodies have one or more of the following attributes:

- (1) viable populations of endangered or threatened species of fish, unionid mollusks, amphibians, or crayfish;
- (2) segments within which attainment of the Exceptional Warmwater Habitat (EWH) biocriteria for the IBI (Index of Biotic Integrity) and/or the ICI (Invertebrate Community Index) have been observed;
- (3) “near pristine” characteristics of biological integrity, which is defined as consistent, strict attainment of the EWH biocriteria and a significant proportion of locations with IBI or ICI scores greater than or equal to 56, and in the Lake Erie watershed, a fish community having a composition of pollution intolerant species equalling or exceeding two standard deviations compared to statewide collections;

(4) three or more species of fish that are considered to be declining across Ohio. To aid in examining candidate streams a rating was derived to broadly select candidates depending on the strength of each of these attributes and the occurrence of multiple attributes.

State Resource Waters vs. Superior High Quality Waters: Vulnerability

Biological condition or integrity of Ohio streams occurs along a continuum in Ohio. The top tiers associated with the antidegradation rule are designed to protect high quality waters for future generations. The primary difference between the SRW and SHQW tiers is the assimilative capacity set-aside associated with each: 70% for SRW and 35% for SHQW. The criteria outlined above are the baseline characteristics for SRW or SHQW. The distinction between these two groups of waters is somewhat more subjective and is based on the “vulnerability of a water to deleterious human impacts. Often, the waters with good populations of the endangered, threatened and declining species, and high biological integrity are the most vulnerable to change and are also where there is significant uncertainty regarding their ability to withstand substantial changes in water or habitat quality.

Some waters with extremely high diversity, however, may not be considered highly vulnerable or we may be more certain of the response that the biota may exhibit based on their response to existing stressors. The Scioto River downstream of Columbus, for example, was severely impacted by point source impacts. This river has responded tremendously to pollutant load reductions from WWTPs, both in IBI changes and in the return of certain endangered, threatened, and declining species. Because the recovery occurred under current pollutant loadings, the river is not extremely “vulnerable” to this range of loadings. While portions of the river merit a SHQW tier (slightly elevated anomalies still indicate some effects that would likely be addressed by an EWH designation) it would not be deemed vulnerable enough for a SRW

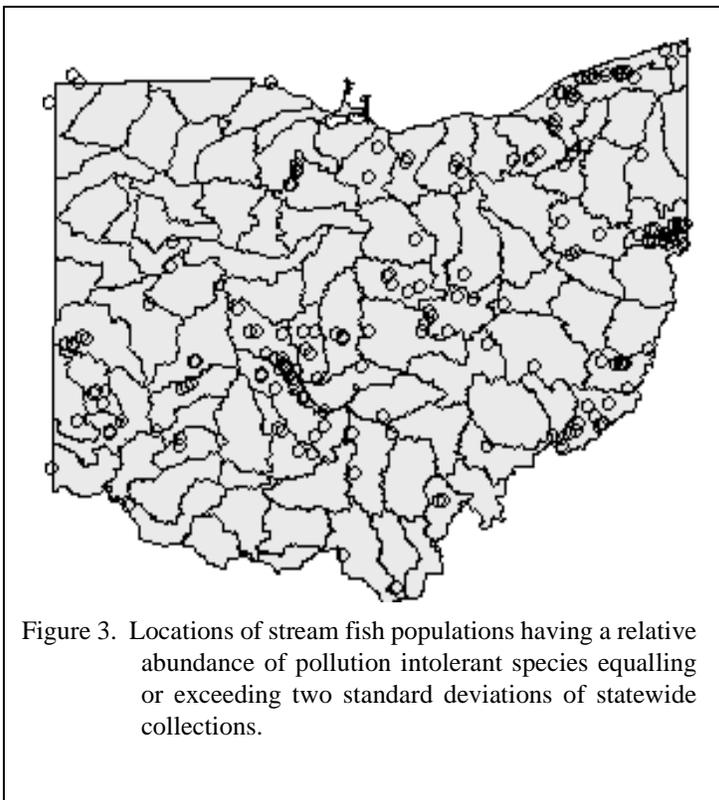


Figure 3. Locations of stream fish populations having a relative abundance of pollution intolerant species equalling or exceeding two standard deviations of statewide collections.

tier. In addition, the current assemblages are likely most vulnerable to sedimentation and habitat degradation, and those threats can be addressed through the SHQW tier. The intact habitat in the Scioto River has permitted the recovery of this river. Streams that have shown recovery despite relatively high pollutant loadings, or streams with species that, on a case-by-case basis, are generally less vulnerable would be less likely candidates for SRW. Waters that are the most likely candidates for SRW will be those at the upper end of the distribution of sensitive ecological attributes being considered and those that are not already effluent limited.

Table 1 summarizes some of the characteristics that were used to distinguish between SRW, SHQW, and GHQW tiers.

Defining Superior High Quality and SRW Segments

The delineation of Superior High Quality stream segments is based on an overlay of the types of available data. The presence of an endangered or threatened species is considered significant, but the influence of this criterion is tempered with caveats. The identity of the species and its regional status are additionally considered (Is it a resident species? Is it a stray from another area? Is the population significant? Are these locations the core of its remaining population in Ohio?). Stream segments where we find two or more declining species per sample (one or more in headwater streams) are considered significant, with many of the same caveats listed for endangered or threatened species.

The attainment of the Exceptional Warmwater Habitat (EWH) biocriteria for fish or macro-invertebrate communities is also considered a significant factor. Sites with consistent attainment of EWH biocriteria at most sites and with index values that reach 56 or higher at some locations are evidence of “near pristine conditions” and receive proportionately more weighting in the Superior segment delineation even when imperiled species are absent. These near-pristine communities are related to limited development in large

Table 2. Waters currently designated as SRW that were not candidates for SRW/SHQW because they did not have sufficient ecological attributes or because no data exists. A “Holding” SRW is designed to raise the priority for sampling and to be considered as potentially high quality in any future antidegradation or regulatory decisions that could affect these waters before they can be monitored.

River Code	Stream	Current SRW	Recommendation
02-245	Clover Groff Ditch	*	LQW
02-212	Barron Creek	+	Holding SRW/SHQW
02-215	Howard Run	+	Holding SRW/SHQW
02-216	Lake Run	+	Holding SRW/SHQW
02-217	Jumping Run	+	Holding SRW/SHQW
02-218	Clover Run	+	Holding SRW/SHQW
02-001	Scioto River (Little Scioto River to Bokes Creek)	+	GHQW

expanses of the floodplain and nearby land areas (e.g., Hocking State and Wayne National Forests).

One of the most important pieces of supporting information is the habitat quality of the water body as measured by the QHEI. Habitat quality reflects many of the other supporting factors (ecoregion characteristics, stream gradient, stream modifications, tributary confluences) also considered to be important. Average QHEI values greater than 70-75 over a segment are generally considered sufficient for EWH attainment, given suitable water quality. Thus we consider this level as an additionally significant criterion for delineating Superior segments. QHEI values greater than 80-90 are extraordinary with only 2-3 percent of our sites scoring at or above this value; such high scores are also given heavy weighting in delineating Superior reaches.

Although the designation process includes objective criteria, the incorpo-

ration of standardized ecological data, experience and technical judgement is still needed to determine the boundaries of Superior segments. The water body specific rationale for individual segment delineations is summarized in a justification document supporting the delineation of antidegradation tiers. Streams and rivers are open ecosystems and segments are considered and designated as SHQW within an ecosystem and watershed framework. Management of aquatic habitats in a watershed framework has been urged if we are to halt increasing imperilment of more species. The purpose of the Superior High Quality Water designation system is to further protect our best remaining aquatic ecosystems from activities that would create pollution.

Nominated Streams

The streams or stream segments that were selected for the SRW and SHQW tiers are illustrated in Figure 4, and listed alphabetically with rationale and

supporting information in Appendix 1. Some stream segments that anecdotally appear to be high quality do not appear on the map because insufficient data exist. These waters are placed in a "Holding SRW/SHQW" category. Several examples of streams like these appear in Table 2, and a list of all segments on "Hold" appear in Appendix 2. These streams will receive a high priority for future monitoring and will receive more scrutiny for other activities that might affect them.

References

Ohio EPA. 1996. Ohio Water Resource Inventory, Volume 1. Ohio EPA, Division of Surface Water.

Ohio DNR. 2001. Wildlife that are considered to be endangered, threatened, of special interest, extirpated, or extinct in Ohio. Ohio Division of Wildlife Inservice Note, June 2001.

USFWS. 1999. Endangered, threatened, proposed, and candidate species [Federal]; Ohio. U.S. Fish and Wildlife Service, Reynoldsburg, Ohio.

Master, L. 1990. The imperiled status of North American aquatic animals. Biodiversity Network News 3: 1-2, 7-8.

Trautman, M. B. 1981. Fishes of Ohio. The Ohio State University Press, Columbus, Ohio.

Williams, J. D., Warren, M. L. Jr., Cummings, K. S., Harris, J. L., and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9): 6-22.

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