**Supplementary Material**

Assessment of flow–ecology relationships for environmental flow standards: a synthesis focused on the southeast USA

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**Table S1.** Basin/state, all flow metrics, and all ecological metrics for the studies used in the synthesis.

| Basin/State | Flow metrics | Ecological metrics |
| --- | --- | --- |
| James/Rappahannock/ Shenandoah rivers | Mean monthly flow (January–August) | Smallmouth-bass recruitment |
|  | Minimum monthly flow (January–August) |  |
|  | Maximum monthly flow (January–August) |  |
|  | Standard deviation of monthly flow (January–August) |  |
| Georgia Piedmont | Withdrawal index | Abundance of habitat generalist fish taxa |
|  | Depth | Abundance of fluvial specialist fish taxa |
|  | Velocity |  |
|  | Temperature |  |
|  | Turbidity |  |
|  | Dissolved oxygen |  |
|  | Drainage area |  |
|  | Reservoir presence |  |
|  | Urban land use |  |
| Tombigbee | Mean April/May/August/September flow | Lotic fish indicator species |
|  | 1-day minimum | Lentic fish indicator species |
|  | 3-day minimum |  |
|  | 7-day minimum |  |
|  | 30-day minimum |  |
|  | 30-day maximum |  |
|  | Baseflow index |  |
|  | Low-pulse count |  |
|  | High-pulse count |  |
|  | High-pulse duration |  |
|  | Number of reversals |  |
| Massachusetts | Percent alteration of August median flow from surface-water returns | Fluvial-fish species richness |
|  | Percent alteration of August median flow from septic returns | Fluvial-fish relative abundance |
|  | Percent alteration of Augyst median flow from groundwater withdrawals | Brook trout relative abundance |
|  | Percent alteration of mean annual flow from surface-water withdrawals |  |
|  | Percent alteration of mean annual flow from total withdrawals |  |
|  | Percent alteration of mean annual flow from total returns |  |
|  | Net percent alteration of August median flow, surcharged sites |  |
|  | Net percent alteration of August median flow, depleted sites |  |
|  | Water-use intensity |  |
|  | Net percent alteration of mean annual flow for surcharged sites |  |
|  | Net percent alteration of mean annual flow for depleted sites |  |
| Potomac | 1-day maximum | ASPT modified index |
|  | 3-day maximum | Beck's index |
|  | Annual mean | Chessie BIBI |
|  | Median | Gold index |
|  | Q85Seas | Hilsenhoff family biotic index |
|  | August median | # Ephemoptera (mayflies) families |
|  | Baseflow index | # sensitive taxa |
|  | 1-day minimum | # Chironomidae |
|  | 3-day minimum | # clingers |
|  | 7Q10 | # collectors |
|  | High-pulse duration | # dominant 3 |
|  | High-flow volume index MH21 | % Ephemoptera |
|  | High-flow duration DH17 | % EPT |
|  | Flood-free season | % filterers |
|  | Low-pulse duration | % gatherers |
|  | Extreme low-flow duration | % scrapers |
|  | High-pulse count | % swimmers |
|  | High-flow frequency | % tolerants |
|  | Number of reversals | Shannon-Wiener index |
|  | Low-pulse count | Taxa richness |
|  | Extreme low-flow frequency |  |
|  | Flashiness |  |
|  | Rise rate |  |
|  | Fall rate |  |
| Upper Tennessee | Mean daily flow | Fish richness |
|  | Daily CV | Riparian cover |
|  | Baseflow index |  |
|  | Low-flow frequency |  |
|  | High-flow frequency 1-3 |  |
|  | 1-day low flow |  |
|  | 3-day low flow |  |
|  | 7-day low flow |  |
|  | 30-day low flow |  |
|  | 90-day low flow |  |
|  | Low-flow duration |  |
|  | 1-day high flow |  |
|  | 3-day high flow |  |
|  | 7-day high flow |  |
|  | 30-day high flow |  |
|  | 90-day high flow |  |
|  | High-flow duration |  |
|  | Constancy |  |
|  | Predictability |  |
|  | Date annual min |  |
|  | Date annual max |  |
|  | Rise rate |  |
|  | Fall rate |  |
|  | Number of reversals |  |
| Tennessee | Mean annual flow | Pool-dwellers |
|  | Maximum October flow | Riffle-dwellers |
|  | Q15 | Natives |
|  | September median | Specialized insectivores |
|  | Rate of streamflow recession | Inverticores |
|  | 30-day maximum | Omnivores |
|  | Baseflow index | Top predators |
|  | Constancy | Lithophilic spawners |
|  | Number of day rises | Headwater-intolerants |
|  | Frequency of moderate flooding (7x median) | Intolerants |
|  | Frequency of moderate flooding (3x median) |  |
|  | Variability of March flow |  |
|  | Variability in baseflow |  |
|  | Variability of annual minimum |  |
|  | Variability in high-pulse duration |  |
|  | Variability in low-pulse count |  |
|  | Annual minimum |  |
|  | Annual maximum |  |
|  | Flow-direction reversals |  |
| North Carolina | Annual 7Q10 | Blacknose dace fry |
|  | Monthly 7Q10 | Blacknose dace juvenile |
|  | September median | Blacknose dace spawning |
|  | Monthly median | Brown trout adult |
|  | 10%-60% of mean annual flow | Brown trout fry |
|  | 70%-90% "flow-by" of instantaneous modeled baseline flow | Brown trout juvenile |
|  |  | Brown trout spawning |
|  |  | Creek chub adult |
|  |  | Creek chub young-of-year |
|  |  | Ephemoptera (mayflies) |
|  |  | Longnose dace |
|  |  | Mottled sculpin |
|  |  | Northern hog sucker juvenile |
|  |  | Plecoptera (stoneflies) |
|  |  | Rainbow trout adult |
|  |  | Rainbow trout fry |
|  |  | Rainbow trout spawning |
|  |  | Trichoptera (caddisflies) |
| Virginia | Mean annual flow | Number of individual fish |
|  | 1-day maximum | Number of fish taxa - benthic insectivores |
|  | 1-day minimum | Number of fish taxa - benthic |
|  | 30-day maximum | Number of taxa - Centrachidae (sunfish) |
|  | 30-day minimum | Number of taxa - darters |
|  | 3-day maximum | Number of fish taxa - fast flow preference |
|  | 3-day minimum | Number of fish taxa - moderate flow preference |
|  | 7-day maximum | Number of fish taxa - slow flow preference |
|  | 7-day minimum | Number of taxa - intolerant suckers |
|  | 7Q10 | Number of fish taxa - native benthic |
|  | 90-day maximum | Number of taxa - native Centrarchidae (sunfish) |
|  | 90-day minimum | Number of taxa - native Cyprinidae (carps/minnows) |
|  | April mean monthly flow | Number of taxa - native insectivorous Cyprinidae (carps/minnows) |
|  | April low flow | Number of fish taxa - native |
|  | August mean monthly flow | Number of taxa - native round-bodied suckers |
|  | August low flow | Number of taxa - native sunfish |
|  | Baseflow index | Number of taxa - suckers |
|  | Date of maximum | Number of taxa - sunfish |
|  | Date of minimum | Number of fish taxa - total |
|  | December mean monthly flow | Percent individuals - Cottidae (scuplins) |
|  | December low flow | Percent individuals - dace |
|  | Extreme-low duration | Percent fish individuals - dominant taxon |
|  | Extreme-low frequency | Percent fish individuals - fast flow preference |
|  | Extreme-low peak | Percent fish individuals - moderate flow preference |
|  | Extreme-low timing | Percent fish individuals - slow flow preference |
|  | Fall rate | Percent individuals - game fish |
|  | February mean monthly flow | Percent fish individuals - insectivore |
|  | February low flow | Percent individuals - insectivorous Cyprinidae (carps/minnows) |
|  | High-flow duration | Percent fish individuals - insectivore and piscivore |
|  | High-flow fall rate | Percent fish individuals - lithophils |
|  | High-flow frequency | Percent fish individuals - non-native |
|  | High-flow peak | Percent fish individuals - omnivores |
|  | High-flow rise rate | Percent individuals - round-bodied suckers |
|  | High-flow timining | Percent fish individuals - tolerant |
|  | High-pulse count | Percent fish individuals - top carnivore |
|  | High-pulse duration | Index - evenness (fish) |
|  | High-pulse threshold | Index - Shannon-Wiener (log base) (fish) |
|  | January mean monthly flow | Number of benthic macroinvertebrate individuals |
|  | January low flow | Number of taxa - Bivalvia (bivalves) |
|  | July mean monthly flow | Number of benthic macroinvertebrate taxa - collectors |
|  | July low flow | Number of benthic macroinvertebrate taxa - climbers |
|  | June mean monthly flow | Number of benthic macroinvertebrate taxa - clingers |
|  | June low flow | Number of taxa - Coleoptera (beetles) |
|  | Large-flood duration | Number of taxa - Diptera (flies) |
|  | Large-flood fall rate | Number of taxa - Ephemoptera (mayflies) |
|  | Large-flood frequency | Number of taxa - Ephemoptera (mayflies), Plectoptera (stoneflies), and Trichoptera (caddisflies) |
|  | Large-flood peak | Number of benthic macroinvertebrate taxa - predators |
|  | Large-flood rise rate | Number of benthic macroinvertebrate taxa - filterers |
|  | Large-flood timining | Number of taxa - Gastopoda (snails) |
|  | Low-pulse count | Number of benthic macroinvertebrate taxa - intolerant |
|  | Low-pulse duration | Number of taxa - Plecoptera (stoneflies) |
|  | Low-pulse threshold | Number of benthic macroinvertebrate taxa - predators |
|  | March mean monthly flow | Number of benthic macroinvertebrate taxa - scrapers |
|  | March low flow | Number of benthic macroinvertebrate taxa - shredders |
|  | May mean monthly flow | Number of benthic macroinvertebrate taxa - sprawlers |
|  | May low flow | Number of benthic macroinvertebrate taxa - swimmers |
|  | November mean monthly flow | Number of benthic macroinvertebrate taxa - tolerant |
|  | November low flow | Number of benthic macroinvertebrate taxa - total |
|  | Number of reversals | Number of taxa - Trichoptera (caddisflies) |
|  | Number of zero days | Percent individuals - Amphipoda (malacostracan crustaceans) |
|  | October mean monthly flow | Percent individuals - ratio of Baetidae (small mayflies) to Ephemoptera (mayflies) |
|  | October low flow | Percent individuals - Bivalvia (bivalves) |
|  | Richards-Baker flashiness index | Percent individuals - Chironomidae (midges) |
|  | Rise rate | Percent benthic macroinvertebrate individuals - collectors |
|  | September mean monthly flow | Percent benthic macroinvertebrate individuals - climbers |
|  | September low flow | Percent benthic macroinvertebrate individuals - clingers |
|  | Small-flood duration | Percent individuals - Coleoptera (beetles) |
|  | Small-flood fall rate | Percent individuals - Corbicula (clams) |
|  | Small-flood frequency | Percent individuals - Crustacea (crustaceans) |
|  | Small-flood peak | Percent individuals - Decapoda (malacostracan crustaceans) |
|  | Small-flood rise rate | Percent individuals - Diptera (flies) |
|  | Small-flood timing | Percent benthic macroinvertebrate taxa - dominant taxon |
|  |  | Percent benthic macroinvertevrate taxa - dominant 2 taxa |
|  |  | Percent individuals - Ephemoptera (mayflies) |
|  |  | Percent individuals - EPT (Ephemoptera-mayflies, Plecoptera-stoneflies, and Trichoptera-caddisflies) |
|  |  | Percent individuals - Ephemoptera (mayflies) and Trichoptera (caddisflies), no Hydropsychidae (net-spinning caddisflies) |
|  |  | Percent benthic macroinvertebrate individuals - filterers |
|  |  | Percent individuals - Gastropoda (snails) |
|  |  | Percent individuals - ratio of Hydropsychidae (net-spinning caddisflies) to Ephemoptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) |
|  |  | Percent individuals - ratio of Hydropsychidae (net-spinning caddisflies) to Trichoptera (caddisflies) |
|  |  | Percent benthic macroinvertebrate individuals - intolerant |
|  |  | Percent individuals - Mollusca (molluscs) |
|  |  | Percent individuals - non-Insecta (insects) |
|  |  | Percent individuals - Odonata (dragonflies and damselflies) |
|  |  | Percent individuals - Oligochaeta (worms) |
|  |  | Percent individuals - Plecoptera (stoneflies) |
|  |  | Percent benthic macroinvertebrate individuals - predators |
|  |  | Percent individuals - Plecoptera (stoneflies) and Trichoptera (caddisflies), not Hydropsychidae (net-spinning caddisflies) |
|  |  | Percent benthic macroinvertebrate individuals - scrapers |
|  |  | Percent benthic macroinvertebrate individuals- shredders |
|  |  | Percent benthic macroinvertebrate individuals - sprawlers |
|  |  | Percent benthic macroinvertebrate individuals - swimmers |
|  |  | Percent benthic macroinvertebrate individuals - tolerant |
|  |  | Percent individuals - Trichoptera (caddisflies) |
|  |  | Index - Beck's (benthic macroinvertebrates) |
|  |  | Index - evenness (benthic macroinvertebrates) |
|  |  | Index - Gomphidae (clubtail dragonflies), Oligochaeta (worms), Diptera (flies) |
|  |  | Index - Hilsenhoff (benthic macroinvertebrates) |
|  |  | Index - Shannon-Wiener (log base) (benthic macroinvertebrates) |
|  |  | Coastal Plain Multimetric Index (genus) (benthic macroinvertebrates) |
|  |  | Stream Condition Index (family) (benthic macroinvertebrates) |