Statewide MS4 Biological Database
Data Guide

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Resource Assessment Service

Maryland

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Introduction and Overview

This guide provides a general overview of the MS4 Biological Database, which was developed to house biological data collected in support of MS4 permit guidance. This guide describes each table in the database with detailed explanations of the fields comprising them. For additional details on MBSS field, lab, and analytical protocols, see the [MBSS Sampling Manual](#) (Stranko et al. 2019), [Benthic Laboratory Standard Operating Procedures](#) (Dziepak et al. 2022), and other supporting documents (see [Literature Cited](#)).

The MS4 Biological Database is intended to collect, archive, and facilitate the querying of biological data collected by MS4 jurisdictions to address their permit requirements. This database has been expanded to include additional biological sampling data that jurisdictions collect and report to MDE (such as fish sampling).

To facilitate navigation through the database, database tables are organized according to content into five groups. The *MS4 Data* group encompasses all of the database tables that contain only raw data submitted by MS4 jurisdictions, and all of the data submitted by MS4 jurisdictions are entered into this section of the database. The *Master Taxa Lists* group encompasses database tables that describe the taxonomy and characteristics of sampled organisms. The *Data Review* group encompasses database tables that summarize the comparability of submitted data. The *Indices of Biotic Integrity* group includes database tables that list Maryland Index of Biotic Integrity Scores and component metric scores for corresponding jurisdiction-submitted biotic samples. The *Questionnaire* group encompasses database tables that relate to the questionnaire that was distributed to MS4 jurisdictions in 2021.

In order to provide clarity on the MS4 permit requirements, a column has been added to document tables that require data submitted by MS4 jurisdictions, titled "MS4 Permit Requirement." This column details if the field represents a MS4 Permit stipulation that is "Mandatory," "Recommended," or "Optional." Parameters identified as "Mandatory" in this column should be filled in by the jurisdiction if it is reporting data within that table and are requirements of the permit. Parameters identified as "Recommended" may be filled in by the jurisdiction in order to provide additional information about a sample and to complete the applicable table, but are not requirements of the permit. Parameters identified as optional may be filled in by the jurisdiction if they wish to report ancillary data collected at a site, which may be used by MDE for other purposes (BSID, listing and delisting, etc.) but are not considered for the permit.

This database houses only biological and associated habitat and water quality data. MDE is developing a separate database and templates that MS4 jurisdictions should use to report other monitoring requirements, such as baseflow-stormflow water quality, continuous, and bacteria data.

The data recorded in certain fields must be reported using the correct measurement units or defined values. Many of the defined values are shorthand codes or numerical designations, which facilitates inter-annual continuity in data reporting and promotes efficiency in queries. Please refer to this data guide and the field manual (Stranko et al. 2019) to ensure that data are reported in a consistent manner and that codes are used correctly.

The MS4 biological database is organized into a series of database tables that are listed under their relevant grouping in this document's Table of Contents. Each database table is composed of multiple fields, and the fields are described in further detail under the corresponding sections within this document.

Data types for each field are given in the following metadata. The data type can give insight into the expected values of the expected fields. Five data types are used in the tables: Short Text, Long Text, Integer (whole numbers), Double (numbers with decimal points), Date (formatted mm/dd/yyyy), and Time (formatted 24:00, in local time). The 'key' symbol (🔑), which appears throughout this document, indicates the primary keys of each table. These primary keys, in combination, designate a uniquely identifiable record for each table.

1.   MS4Data

The 11 tables included in this section of the database are designed to store data submitted by MS4 jurisdictions. MS4 jurisdictions will be provided with blank spreadsheets with headings that mirror those in the database; these spreadsheets will then be appended to the corresponding database tables. <u>All of the data in the MS4Data section of the database are submitted by MS4 jurisdictions.</u>

General information about the samples is conveyed through three database tables. MS4 jurisdictions are expected to submit a list of samples with submitted data, along with pertinent information about why and how each site was sampled on a given date; this information is used to populate the <u>MasterSampleList</u> table (Database Table 1.1). For each sample on the MasterSampleList, the parameters that were sampled should be specified in the <u>SampleInfo</u> table (Database Table 1.2). All sites on the MasterSampleList should also be included in the <u>SiteCoordinatesTable</u> (Database Table 1.3), which provides geographical information on the sites. Useful notes and comments about each of the samples should be provided by jurisdictions in the <u>Comments</u> table (Database Table 1.4).

Results of benthic macroinvertebrate sampling are conveyed through two database tables. Benthic macroinvertebrate sampling results are incorporated into the <u>BenthicData</u> table (Database Table 1.5). It is also recommended that jurisdictions provide additional information about sampled habitats, which are used to populate the <u>BenthicSampledHab</u> table (Database Table 1.6).

Habitat inventory and assessment data are stored among three database tables. The majority of habitat assessment data are reported through the <u>Habitat</u> table (Database Table 1.7). Additional data related to a specific inventory is conveyed through two additional tables only if riparian buffer breaks or stream modifications were noted. Riparian buffer breaks that occurred within inventoried reaches are further reported in the <u>RiparianBufferBreaks</u> table (Database Table 1.8). Channelization, culverts, stream blockages, and stream restorations that occurred within inventoried reaches are further reported in the <u>StreamModification</u> table (Database Table 1.9). Water chemistry sampling results are stored in the <u>WaterChemistry</u> table (Database Table 1.10), which contains data pertaining to *in situ* water quality and laboratory-analyzed water chemistry and water quality variables.

The <u>FishTable</u> (Database Table 1.11) is provided for jurisdictions to (optionally) submit fish sampling data to MDE. Fish sampling is not required for the MS4 permit, but jurisdictions that conduct fish sampling are encouraged to submit this data for inclusion in this database table and other future uses (e.g., BSID).

In order to provide clarity on the MS4 permit requirements, a column has been added to document tables that require data submitted by MS4 jurisdictions, titled "MS4 Permit Requirement." This column details if the field represents a MS4 Permit stipulation that is "Mandatory," "Recommended," or "Optional." Parameters identified as "Mandatory" in this column should be filled in by the jurisdiction if it is reporting data within that table and are requirements of the permit. Parameters identified as "Recommended" may be filled in by the jurisdiction in order to provide additional information about a sample and to complete the applicable table, but are not requirements of the permit. Parameters identified as optional may be filled in by the jurisdiction if they wish to report ancillary data collected at a site, which may be used by MDE for other purposes (BSID, listing and delisting, etc.) but are not considered for the permit.

1.1. MasterSampleList

This table is populated entirely with data submitted by MS4 jurisdictions. <u>MS4 jurisdictions must submit a list of sampled sites along with pertinent information, in the following format, about why and how each site was sampled.</u>

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported the corresponding data	Mandatory
SITE🔑	Short Text	Site or sample corresponding to the data	Mandatory
YEAR🔑	Integer	Year that corresponding data were collected	Mandatory
SType	Short Text	Site type; randomly-selected (R) or targeted (T)	Mandatory
Project	Short Text	Project abbreviation	Mandatory
Project_Description	Long Text	Project description	Mandatory
Method	Short Text	MBSS or other	Mandatory
Method_Description	Long Text	Method description or reference, if not MBSS	Mandatory
NumVisits	Integer	Number of visits (samples) at the site within the year	Mandatory

1.1.1. JURISDICTION
A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.1.2. SITE
The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with year, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.1.3. YEAR
The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.1.4. Site Type (SType)
This field specifies whether a site is randomly-selected (R) or targeted (T).

1.1.5. Project
Abbreviation of the specific project associated with each sample site. If the site is associated with BMP effectiveness monitoring, the abbreviation should be "MS4-BMP;" if associated with watershed assessment and trends, the abbreviation should be "MS4-WAT." MS4 jurisdictions have the flexibility to choose their own abbreviation for any project not associated with MS4 monitoring that they wish to report in this database.

1.1.6. Project_Description
Short description of the project associated with each sample site.

1.1.7. Method
Sampling method used for each site. If MBSS protocols are used, enter "MBSS." If another method has been used, use the abbreviation that best represents the method and provide additional information in Method_Description.

1.1.8. Method_Description
Method description or reference, if different than MBSS protocols.

1.1.9. NumVisits
Number of sampling visits to the site within the year. For example, if the site was sampled once for benthic macroinvertebrates, this would be "1"; whereas, if the site was sampled once for benthic macroinvertebrates and once for fish, this would be "2."

1.2. SampleInfo

This table stores records about which parameters were sampled and when they were sampled, and details about sample processing. This table also stores details about fish samples, if reported.

Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by the field for DATE. The number of entries for each site within a year should correspond to the NumVisits field in the MasterSampleList database table. For each entry: any parameters that were sampled should be indicated by entering an "S", any parameters that were not sampled as a matter-of-protocol should be indicated by entering "0", and any parameters that were not sampled for other reasons should be indicated using the appropriate sampleability codes (given in the MBSS Sampling Manual and below).

This table is populated entirely with data provided by MS4 Jurisdictions. <u>All fields pertaining to parameter sampleability and laboratory details are mandatory.</u> Optional fields pertaining to fish sampling are necessary for calculating a Fish Index of Biotic Integrity score.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported data	Mandatory
SITE🔑	Short Text	Site or sample corresponding to the data	Mandatory
YEAR🔑	Integer	Year that corresponding data were collected	Mandatory
DATE🔑	Date	Date that corresponding data were collected	Mandatory
SAMP_BEN	Short Text	Sampleability for benthic macroinvertebrates	Mandatory
SAMP_HAB	Short Text	Sampleability for physical habitat	Mandatory
SAMP_WQT_FLD	Short Text	Sampleability for *in situ* water quality	Mandatory
SAMP_WQT_LAB	Short Text	Sampleability for lab-analyzed water chemistry	Mandatory
SAMPELEC	Short Text	Sampleability for electrofishing	Mandatory
GRIDS	Integer	Number of grids picked to achieve the reported subsample	Mandatory
BEN_SAMPLER		Name of crew leader who sampled or oversaw sampling of benthic macroinvertebrates	
HAB_OBSERVER		Name of person who observed and recorded habitat data	
BEN_SUBSAMPLER		Name of person who picked or oversaw picking of the subsample	
BEN_LAB	Short Text	Name of laboratory that provided benthic identification	Mandatory
BEN_TAXONOMIST	Short Text	Name of taxonomist that provided benthic identification	Mandatory
WQT_LAB	Short Text	Name of laboratory that provided water chemistry analysis	Mandatory
LENGTH_EFISH	Integer	Length of segment electrofished	Optional[1]
FISH_BIOMASS	Integer	Total biomass of sampled fish (g)	Optional[1]
FISH_SAMPLER	Integer	Name of crew leader who sampled/oversaw fish sampling	Optional[1]

[1] These fields are necessary if fish data were submitted with the intent of calculating a Fish Index of Biotic Integrity score.

1.2.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.2.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.2.3. YEAR

The year that corresponding data were collected. When combined with the SITE and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.2.4. DATE

The date that corresponding data were collected. Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by this field.

1.2.5. Parameter Sampleability (SAMP_BEN, SAMP_HAB, SAMP_WQT_FLD, SAMP_WQT_LAB, SAMPELEC)

Any parameters that were sampled should be indicated by entering an "S". Any parameters that were not sampled as a matter-of-protocol should be indicated by entering "0". Any parameters that were not sampled for other reasons should be indicated using the appropriate sampleability codes: S=Sampleable; 1=Dry streamed; 2=Too deep; 3=Marsh, no defined channel; 4=Excessive vegetation; 5=Impoundment; 6=Tidally influenced; 7=Permission denied; 8=Unsafe; 9=Beaver; 10=Other.

If a parameter was not sampled, no corresponding records appear in the corresponding table. For example, if electrofishing was not conducted because it was a spring sampling event, that would be indicated as a 0 in the SAMPELEC field, and no corresponding records would appear in the FishData table.

Database tables that may accumulate pieces of data variously collected during multiple site visits all have a field named DATE. In such tables, data are to be provided in separate records corresponding to the dates they were collected (and matching the dates entered in this database table).

1.2.6. GRIDS

The reported number of grids picked to achieve the reported subsample of benthic macroinvertebrates.

1.2.7. BEN_SAMPLER

Name of crew leader who sampled or oversaw sampling of benthic macroinvertebrates.

1.2.8. HAB_OBSERVER

Name of person who observed and recorded habitat data.

1.2.9. BEN_SUBSAMPLER

Name of person who picked or oversaw picking of the subsample.

1.2.10. BEN_LAB

Name of the laboratory that identified the corresponding benthic sample.

1.2.11. BEN_TAXONOMIST

Name of the taxonomist that identified the corresponding benthic sample.

1.2.12. WQT_LAB

Name of the laboratory that processed and analyzed the corresponding water chemistry sample.

1.2.13. LENGTH_EFISH

The length sampled for fish (LENGTH_EFISH) reflects the linear extent of the watered stream channel that was sampled. LEN_SAMP is typically 75 m, unless the stream was partially dewatered; for partially dewatered stream channels, LEN_SAMP is the cumulative length of watered habitat within the 75-m stream reach.

1.2.14. FISH_BIOMASS

The total biomass of fish in the sample (TOTBIOM) is the sum of the two passes, reported in g.

1.2.15. FISH_SAMPLER

Name of crew leader who sampled/oversaw fish sampling.

1.3. SiteCoordinates

This table lists the coordinates for sampled sites. This table lacks a field for YEAR, thus repeatedly sampled sites can be represented by a single site-entry that is applicable across years. Such sites can also be represented by duplicate annual entries, each with a unique SITE code.

This table is populated entirely with data submitted by MS4 jurisdictions. <u>MS4 jurisdictions are required to submit location information, and are encouraged to submit site descriptions.</u> They may also submit data pertaining to the local drainage area for each site and FIBI stratum designations, which are necessary if Fish Index of Biotic Integrity (FIBI) scores will be calculated.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION 🔑	Short Text	MS4 jurisdiction that reported data	Mandatory
SITE 🔑	Short Text	Site or sample corresponding to the data	Mandatory
LATITUDE	Double	Latitude, in decimal degrees	Mandatory
LONGITUDE	Double	Longitude, in decimal degrees	Mandatory
ST_NAME	Short Text	Stream name	Recommended
DESCRIPTION	Short Text	Descriptive site information	Recommended
DRAINAGEAREA_ACRES	Double	Drainage area of catchment; required for calculating FIBI	Optional[1]
MDE6Digit	Short Text	Basin where the site is located	Mandatory
MDE6Name	Short Text	Basin where the site is located	Recommended
MDE8Digit	Short Text	Watershed where site is located	Mandatory
MDE8Name	Short Text	Watershed where site is located	Recommended
DNR12DIG	Short Text	Subwatershed where site is located	Recommended
CountyName	Short Text	Name of county where site is located	Mandatory
BIBIStrata	Short Text	Physiographic stratum in which site is located	Mandatory
FIBIStrata	Short Text	Physiographic stratum in which site is located	Optional[1]
ORDER	Double	Strahler stream order	Mandatory
MAP_SCALE	Short Text	Map scale used by MS4 jurisdictions	Mandatory

[1] Jurisdictions may submit these data if available. These fields are necessary if fish data were submitted with the intent of calculating a Fish Index of Biotic Integrity (FIBI) score.

1.3.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.3.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. This table lacks a field for YEAR, thus repeatedly sampled sites can be represented by a single entry that is applicable across years.

1.3.3. LATITUDE, LONGITUDE

The reported location of the site midpoint, in Latitude and Longitude, given in positive decimal degrees.

1.3.4. DESCRIPTION

Any jurisdiction-provided descriptive information about the stream name, site location, etc.

1.3.5. DRAINAGEAREA_ACRES

Drainage area of each catchment in acres. This is required for calculating the Maryland Fish Index of Biotic Integrity. These values may be provided by MS4 jurisdictions. If MS4 jurisdictions conduct fish sampling and wish to report that data to include in the database, this field must be provided.

1.3.6. MDE6Digit, MDE6Name

The MDE6Digit code identifies the basin where the site is located. These are generally broad-area watersheds that drain to major rivers and tributaries. This delineation breaks the state into 21 basins. The corresponding names may

also be specified in the MDE6Name field. The entered values must include the leading zeroes; in Excel, this annotation can be forced by entering an apostrophe (') preceding the value.

1.3.7.   MDE8Digit, MDE8Name

The MDE8Digit code identifies the watershed where the site is located. There are 138 of these watersheds in Maryland. The corresponding names may also be specified in the MDE8Name field. The entered values must include the leading zeroes; in Excel, this annotation can be forced by entering an apostrophe (') preceding the value.

1.3.8.   DNR12Digit

The subwatershed where the site is located. This fine-scale delineation breaks the state up into 1,100+ subwatersheds.

1.3.9.   CountyName

Name of the county where the site is located.

1.3.10.   BIBIStrata

Calculation of the Benthic Index of Biotic Integrity requires knowledge of the physiographic stratum in which each site is located. The strata used for benthic IBI calculations are: Coastal, Epiedmont, and Highland (Southerland et al. 2005). The GIS layer depicting these strata is available:
https://data.imap.maryland.gov/datasets/maryland::maryland-biological-stream-survey-ibi-strata/about

1.3.11.   FIBIStrata

Calculation of the Fish Index of Biotic Integrity requires knowledge of the physiographic stratum in which each site is located. The four strata are: Coastal, Eastern Piedmont (Epiedmont), Highland, and Cold (Southerland et al. 2005).

1.3.12.   ST_NAME

The waterbody name.

1.3.13.   ORDER

The Strahler convention (Strahler 1957) was used for ranking stream reaches by order. This interpretation is somewhat sensitive to map scale; a higher resolution map may result in a stream being ranked as a higher order than it would be if a lower resolution were used.

1.3.14.   MAP_SCALE

Data associated with the map scale used by each of the MS4 jurisdictions. This can potentially affect site selection, drainage area calculations, and stream order designations. MDE recommends using a 1:24,000 map scale.

1.4. Comments

This table is populated entirely with data submitted by MS4 jurisdictions. If no comments or notes were recorded, an entry should be made for the site visit, but corresponding cells should be blank. <u>MS4 jurisdictions are required to submit all recorded comments and notes that correspond with spring benthic macroinvertebrate sampling, and may also submit comments and notes that correspond with summer fish sampling, if applicable.</u>

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported the corresponding data	Mandatory
SITE🔑	Short Text	Site or sample corresponding to the data	Mandatory
YEAR🔑	Integer	Year that corresponding data were collected	Mandatory
DATE🔑	Date	Date that corresponding data were collected	Mandatory
Comments	Long Text	Comments that were noted during the visit	Mandatory
SampleNotes	Long Text	Comments about the biologic sample	Mandatory

1.4.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.4.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.4.3. YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.4.4. DATE

The date that corresponding data were collected. Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by this field.

1.4.5. Comments

Any useful comments that were noted. Can be blank if no comments were noted.

1.4.6. SampleNotes

Comments about the benthic or fish sample that were noted. Can be blank if no sample notes were noted.

1.5. BenthicData

Benthic macroinvertebrate sampling data provided by the MS4 jurisdictions are stored in this table.

This table is populated entirely with data submitted by MS4 jurisdictions. The data appearing in this table are identical to the raw data submitted by the MS4 jurisdictions; no post-processing or corrections are applied to these data. MS4 jurisdictions are required to submit all data elements presented in this table.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION 🔑	Short Text	MS4 jurisdiction that reported the corresponding data	Mandatory
SITE 🔑	Short Text	Site or sample corresponding to the data	Mandatory
YEAR 🔑	Integer	Year that corresponding data were collected	Mandatory
MS4_TAXON 🔑	Short Text	Taxon name, as reported by the MS4 jurisdiction	Mandatory
N_TAXA	Integer	Number of individuals identified in the subsample	Mandatory
EXCLUDE	Short Text	Specifies non-unique taxa	Mandatory

1.5.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.5.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.5.3. YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.5.4. MS4_TAXON

Taxa reported by the indicated MS4 jurisdiction. No corrections to taxa naming were applied to these data. Any taxa that were reported across multiple rows for the same site and year were combined.

1.5.5. N_TAXA

The number of individuals identified in the subsample corresponding to the indicated taxa name.

1.5.6. EXCLUDE

Specifies non-unique taxa (i.e., parent taxon with one or more children taxa present in the sample; Boward and Friedman 2019). For example, if the data include a Family-level identification along with Genera within that same Family, and taxonomists could not conclude whether the organism is of a different Genus than those already recorded, it is indicated as EXCLUDE = "Y".

This field is essential for accurately calculating richness-based BIBI metrics, as it indicates that a taxon is excluded from corresponding calculations. This designation may or may not affect final BIBI scores, depending on sample composition. In some cases, EXCLUDE designations can be assigned by carefully checking the data for possible conflicts within each sample and assigning the appropriate designation. But in some cases, the EXCLUDE designation could not be unambiguously assigned without further taxonomic verification.

1.6. BenthicSampledHab

Benthic macroinvertebrate sampling data provided by the MS4 jurisdictions are stored in the MS4BenthicData table.

This table is populated entirely with data submitted by MS4 jurisdictions. Data in this table can provide insight into available benthic macroinvertebrate habitats, help explain unusual or outlying results, and provide further documentation about the sample. It is recommended that MS4 jurisdictions submit data for this table, but are not required to do so for the MS4 Permit.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported the corresponding data	Recommended
SITE🔑	Short Text	Site or sample corresponding to the data	Recommended
YEAR🔑	Integer	Year that corresponding data were collected	Recommended
RIFFLE	Integer	Number of square-foot samples in riffle habitat	Recommended
ROOTWAD	Integer	Number of square-foot samples in rootwad habitat	Recommended
LEAFPACK	Integer	Number of square-foot samples in leafpack habitat	Recommended
MACROPHYTE	Integer	Number of square-foot samples in macrophyte habitat	Recommended
UNDERCUT	Integer	Number of square-foot samples in bank undercut habitat	Recommended
OTHER	Integer	Number of square-foot samples in other habitat types	Recommended
OTHER_TYPE	Short Text	Type of other habitat sampled	Recommended

1.6.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.6.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.6.3. YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.6.4. Sampled habitat (RIFFLE, ROOTWAD, LEAFPACK, MACROPHYTE, UNDERCUT, OTHER, OTHER_TYPE)

These fields indicate the number of one-square-foot samples taken in each of the following habitat types: riffle and run habitat (RIFFLE), root wads (ROOTWAD), leaf packs (LEAFPACK), in-stream macrophytes (MACROPHYTE), undercut banks (UNDERCUT), or other habitat types (OTHER).   If one or more unique habitats were sampled (i.e., OTHER > 0), they should be described in the OTHER_TYPE field.

1.7. Habitat

The Habitat table contains data pertaining to the physical habitat at a site. Data collection is conducted following the protocols and notations set forth in the MBSS sampling manual.

Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by the field for DATE. Any data collected on a specific date should be entered into the corresponding record (row). If all data are collected on a single date, all fields in that record should be completed. If various pieces of data are collected during each of the index periods (spring and summer), they should be entered into the records corresponding to the collection date; in such cases, some fields will be left blank during either the spring or the summer, but all fields should be addressed within the annual sampling period. Recommended index periods for each of the variables are given in the MBSS Sampling Manual. <u>MS4 jurisdictions will provide data to populate this data table and all elements are mandatory.</u>

Field Name	Data Type	Defined Values	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text		MS4 jurisdiction that reported the corresponding data	Mandatory
SITE🔑	Short Text		Site or sample corresponding to the data	Mandatory
YEAR🔑	Integer		Year sampled	Mandatory
DATE🔑	Date		Date that corresponding data were collected	Mandatory
CHANNEL	Short Text	Y, N	Evidence of channel straightening or dredging	Mandatory
CULVERT	Short Text	Y, N	Presence of culvert	Mandatory
BLOCKAGE	Short Text	Y, N	Presence of stream blockage	Mandatory
StreamRestoration	Short Text	Y, N	Evidence of stream restoration	Mandatory
RipBufferBreakL	Short Text	Y, N	Buffer break present, left bank	Mandatory
RipBufferBreakR	Short Text	Y, N	Buffer break present, right bank	Mandatory
RIP_WID_L	Double	0-50	Riparian buffer width, left bank (m)	Mandatory
RIP_WID_R	Double	0-50	Riparian buffer width, right bank (m)	Mandatory
AdjCoverL	Short Text	Cover code	Adjacent land cover type, left bank	Mandatory
AdjCoverR	Short Text	Cover code	Adjacent land cover type, right bank	Mandatory
VegType1L	Short Text	Veg. code	Primary buffer vegetation type, left bank	Mandatory
VegType1R	Short Text	Veg. code	Primary buffer vegetation type, right bank	Mandatory
VegType2L	Short Text	Veg. code	Secondary buffer veg. type, left bank	Mandatory
VegType2R	Short Text	Veg. code	Secondary buffer veg. type, right bank	Mandatory
VegType3L	Short Text	Veg. code	Tertiary buffer vegetation type, left bank	Mandatory
VegType3R	Short Text	Veg. code	Tertiary buffer vegetation type, right bank	Mandatory
VegType4L	Short Text	Veg. code	Quaternary buffer veg. type, left bank	Mandatory
VegType4R	Short Text	Veg. code	Quaternary buffer veg. type, right bank	Mandatory
OldFieldObs	Short Text	Y, N	Old field observed from site	Mandatory
DecidForestObs	Short Text	Y, N	Deciduous forest observed	Mandatory
ConifForestObs	Short Text	Y, N	Coniferous forest observed	Mandatory
WetlandObs	Short Text	Y, N	Wetland observed from site	Mandatory
CroplandObs	Short Text	Y, N	Cropland observed from site	Mandatory
SurfaceMineObs	Short Text	Y, N	Surface mine observed from site	Mandatory
LandfillObs	Short Text	Y, N	Landfill observed from site	Mandatory
ResidentialObs	Short Text	Y, N	Residential observed from site	Mandatory
CommIndObs	Short Text	Y, N	Commercial/industrial observed	Mandatory
GolfcourseObs	Short Text	Y, N	Golf course observed from site	Mandatory
PastureObs	Short Text	Y, N	Pasture observed from site	Mandatory
OrchVineObs	Short Text	Y, N	Orchard/vineyard observed from site	Mandatory
DIST_RD	Double		Distance to nearest road (m)	Mandatory
AESTHET	Integer	0-20	Trash rating	Mandatory
INSTRHAB	Integer	0-20	Instream habitat structure	Mandatory
EPI_SUB	Integer	0-20	Epifaunal substrate	Mandatory
VEL_DPTH	Integer	0-20	Velocity/depth diversity	Mandatory
POOLQUAL	Integer	0-20	Pool/glide/eddy quality	Mandatory

Field Name	Data Type	Defined Values	Definition	MS4 Permit Requirement
EXPOOL	Double		Extent of pool or glide (m)	Mandatory
RIFFQUAL	Integer	0-20	Riffle/run quality	Mandatory
EXRIFRUN	Double		Extent of riffle or run (m)	Mandatory
EMBEDDED	Double	0-100	Embeddedness (%)	Mandatory
SHADING	Double	0-100	Shading (%)	Mandatory
MAXDEPTH	Double		Maximum depth in sample reach (cm)	Mandatory
AVGWID	Double		Average wetted width (m)	Mandatory
AVGTHAL	Double		Average thalweg depth (cm)	Mandatory
AVG_VEL	Double		Average velocity (m/s)	Recommended
INSTREAMWOOD	Integer		Number of instream woody debris	Mandatory
DEWATERWOOD	Integer		Number of dewatered woody debris	Mandatory
INSTREAMROOT	Integer		Number of instream rootwads	Mandatory
DEWATERROOT	Integer		Number of dewatered root wads	Mandatory
BAR_FORM	Integer	0-3	Bar formation	Mandatory
COB_BAR	Short Text	Y, N	Cobble bar substrate present	Mandatory
GRAV_BAR	Short Text	Y, N	Gravel bar substrate present	Mandatory
SAND_BAR	Short Text	Y, N	Sand bar substrate present	Mandatory
SC_BAR	Short Text	Y, N	Silt/clay bar substrate present	Mandatory
BRAIDED	Short Text	A, P, E	Presence of stream braiding	Mandatory
RIFFLE	Short Text	A, P, E	Presence of stream riffles	Mandatory
RUNGLIDE	Short Text	A, P, E	Presence of runs and glides	Mandatory
DEEPOOL	Short Text	A, P, E	Presence of deep pools	Mandatory
SHALPOOL	Short Text	A, P, E	Presence of shallow pools	Mandatory
LRGBOULD	Short Text	A, P, E	Presence of large boulders	Mandatory
SMLBOULD	Short Text	A, P, E	Presence of small boulders	Mandatory
COBBLE	Short Text	A, P, E	Presence of cobble	Mandatory
BEDROCK	Short Text	A, P, E	Presence of bedrock	Mandatory
GRAVEL	Short Text	A, P, E	Presence of gravel	Mandatory
SAND	Short Text	A, P, E	Presence of sand	Mandatory
SILTCLAY	Short Text	A, P, E	Presence of silt/clay	Mandatory
UNDERCUT	Short Text	A, P, E	Presence of undercut	Mandatory
OH_COVER	Short Text	A, P, E	Presence of overhead cover	Mandatory
BEAVPND	Short Text	A, P, E	Presence of beaver pond	Mandatory
DischargeCFS	Double		Discharge, estimated based on cross section	Recommended
DischError	Short Text		Description of any issues affecting discharge estimate	Recommended
ErosionSeverityL	Integer	0-3	Erosion severity along left bank	Mandatory
ErosionSeverityR	Integer	0-3	Erosion severity along right bank	Mandatory
ErodedExtentL	Integer		Extent of erosion along left bank (m)	Mandatory
ErodedExtentR	Integer		Extent of erosion along right bank (m)	Mandatory
ErodedHeightL	Double		Avg. height of erosion on left bank (m)	Mandatory
ErodedHeightR	Double		Avg. height of erosion on right bank (m)	Mandatory
CrayfishBurrows	Short Text	A, P, E	Presence of crayfish burrows	Recommended

1.7.1.   JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.7.2.   SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.7.3.   YEAR

The year that corresponding data were collected. When combined with the SITE and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.7.4. DATE

The date that corresponding data were collected. Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by this field.

1.7.5. CHANNEL

Evidence of stream channelization or channel modifications within the sample reach. If CHANNEL = "Y", additional details must be given in the StreamModification table and further description should be provided in the Comments table.

1.7.6. CULVERT

Presence of a stream culvert within the sample reach. If CULVERT = "Y", additional details must be given in the StreamModification table and further description should be provided in the Comments table.

1.7.7. BLOCKAGE

Presence of a stream blockage within the sample reach. If BLOCKAGE= "Y", additional details must be given in the StreamModification table and further description should be provided in the Comments table.

1.7.8. StreamRestoration

Presence of any form of recent or ongoing active stream restoration activities within the sample reach. If StreamRestoration = "Y", additional details are provided as a comment (in the Comments table) describing the observed restoration activity and the linear extents of some stream restoration components must also be reported in the StreamModification table. Examples of restoration may include, but are not limited to: planted riparian tree saplings or live stakes; bank stabilization via recently-placed rip-rap, woody debris, or erosion matting; or extensive channel or bank modifications. If no recent or ongoing active stream restoration is evident, an "N" is recorded in this field.

1.7.9. Buffer Breaks (RipBufferBreakL, RipBufferBreakR)

If no riparian buffer breaks were present within the reach, an "N" was recorded in this field. If any riparian buffer breaks were noted, a "Y" was recorded in this field and additional information about the buffer breaks is recorded in the RiparianBufferBreaks table.

1.7.10. Riparian Buffer Width (RIP_WID_L, RIP_WID_R)

The width of the vegetated riparian buffer was estimated in m, to a maximum of 50 m, and independently estimated for the left (RIP_WID_L) and right (RIP_WID_R) sides of the stream.

1.7.11. Adjacent Land Cover (AdjCoverL, AdjCoverR)

The dominant type of adjacent land cover, recorded independently for the left (AdjCoverL) and right (AdjCoverR) sides of the stream. Adjacent land cover was abbreviated using the following codes: CP=Cropland; DI=Dirt Road; EM=Emergent Vegetation; FR=Forest; GR=Gravel Road; HO=Housing; LN=Mowed Lawn; LO=Logged Area; OF=Old Field; OR=Orchard; PK=Parking/Industrial/Commercial; PV=Paved Road; PA=Pasture; RR=Railroad; SL=Bare Soil; TG=Tall Grass.

1.7.12. Adjacent Vegetation (VegType1L, VegType1R, VegType2L, VegType2R, VegType3L, VegType3R, VegType4L, VegType4R)

The primary vegetation type on the left bank (VegType1L) and right bank (VegType1R) are noted in a survey of the surrounding area. If more than one vegetation type is present, secondary (VegType2L and VegType2R), tertiary (VegType3L and VegType3R), and quaternary (VegType4L and VegType4R) vegetation types may be recorded. These values are recorded using the Adjacent Vegetation Codes: A=Regenerative coniferous (<4 in DBH); B=Young coniferous (4-12 in DBH); C=Mature coniferous (12-24 in DBH); D=Old coniferous trees; G=Grasses; L=Lawn; M=Mature deciduous trees (12-24 in DBH); O=Old deciduous trees (>24 in DBH); R=Regenerative deciduous trees (<4 in DBH); Y=Young deciduous trees (4-12 in DBH).

1.7.13. Adjacent Landuse (OldFieldObs, DecidForestObs, ConifForestObs, WetlandObs, CroplandObs, SurfaceMineObs, LandfillObs, ResidentialObs, CommIndObs, GolfcourseObs, PastureObs, OrchVineObs)

Any surrounding land use that can be observed while in or alongside the stream at the site received a "Y" and any that cannot be observed received an "N." The specific classes of adjacent land use include old fields (OldFieldObs), deciduous forest (DecidForestObs) or coniferous forest (ConifForestObs), wetlands (WetlandObs), crop fields (CroplandObs), surface mining (SurfaceMineObs), landfill (LandfillObs), residential housing (ResidentialObs), commercial or industrial properties (CommIndObs), golf courses (GolfcourseObs), pasture (PastureObs), and orchards or vineyards (OrchVineObs).

1.7.14. Distance from Road (DIST_RD)

The visually estimated distance to the nearest road, recorded in m. Dist_Rd is related to remoteness score through the formula presented in Paul et al. 2003.

1.7.15. Aesthetic Score (AESTHET)

The aesthetic rating is based on the visual appeal of the site and the presence or absence of human refuse. Scores range from 0 (poor) to 20 (optimal).

1.7.16. Instream Habitat Score (INSTRHAB)

Instream habitat was rated based on perceived value of the habitat to the fish community. Higher scores were assigned to sites with a variety of habitats and particle sizes. In addition, higher scores were assigned to sites with a high degree of hypsographic complexity (uneven bottom). In streams where iron flocculant was present, instream habitat scores were not lowered unless the precipitate changed the gross physical nature of the substrate. Low scores were assigned to streams that contained favorable substrate types but experienced low flows that precluded fish from using the habitat. If none of the habitat within a segment was usable by fish, a score of zero was assigned. Scores range from 0 (poor) to 20 (optimal).

1.7.17. Epifaunal Substrate Score (EPI_SUB)

Epifaunal substrate was rated based on the amount and variety of hard, stable substrates usable by benthic macroinvertebrates. Because they inhibit colonization, flocculent materials or fine sediments surrounding otherwise good substrates were assigned low scores. Scores were also reduced when substrates were less stable. Scores range from 0 (poor) to 20 (optimal).

1.7.18. Velocity-and-Depth Diversity Score (VEL_DPTH)

Velocity depth and diversity was scored based on the variety of velocity/depth regimes present at the site: slow-shallow (<0.3 m/s, <0.5 m), slow-deep (<0.3 m/s, ≥0.5 m), fast-shallow (≥0.3m/s, <0.5 m), and fast-deep (≥0.3m/s, ≥0.5 m). Scores range from 0 (poor) to 20 (optimal).

1.7.19. Pool Quality Score and Extent (POOLQUAL, EXPOOL)

Pool quality (POOLQUAL) was based on the variety and special complexity of slow- or still-water habitat within the sample segment. It should be noted that even in high-gradient segments, functionally important slow-water habitat may exist in the form of larger eddies. Within a category, higher scores were assigned to segments that had undercut banks, woody debris or other types of cover for fish. Scores range from 1 (poor) to 20 (optimal) and a score of 0 was assigned if this habitat type is entirely absent. The linear extent of the pool-type habitat within the site segment (EXPOOL) was recorded in m. The combined extent of pool and riffle habitat may be more than 75 m if more than one channel was present or if both habitat types co-occurred along a perpendicular transect. The combined extent of pool and riffle habitat may be less than 75 m if part of the site was dewatered.

1.7.20. Riffle Quality Score and Extent (RIFFQUAL, EXRIFRUN)

Riffle quality is based on the depth, complexity, and functional importance of riffle/run habitat present at the site, with highest scores assigned to segments dominated by deeper riffle/run areas, stable substrates, and a variety of current velocities. Scores range from 1 (poor) to 20 (optimal) and a score of 0 is assigned if this habitat type is entirely absent. The linear extent of the riffle/run habitat within the site segment is recorded in m. The combined extent of pool and riffle habitat may be more than 75 m if more than one channel is present or if both habitat types co-occur along a perpendicular transect. The combined extent of pool and riffle habitat may be less than 75 m if part of the site is dewatered.

1.7.21. Substrate Embeddedness (EMBEDDED)

The percentage of the surface area of larger particles surrounded by fine sediments and/or flocculent on the stream bottom.

1.7.22. Percent of Channel Shaded (SHADING)

The shading extent and duration during the summer. A site that is fully exposed all day during the summer would have 0% shading, while a site that is fully shaded all day during the summer would have 100% shading.

1.7.23. Maximum Depth (MAXDEPTH)

Maximum stream depth within the 75 m segment, recorded in cm.

1.7.24. Average Stream Width (AVGWID)

The wetted width of the stream, in m, was measured along transects at the 0, 25, 50, and 75 m points of the sample segment. The average of these measures is reported in m. In cases where the stream was dewatered at any or all of these points, the stream width was measured as 0 and was incorporated into the average.

1.7.25. Average Thalweg Depth (AVGTHAL)

Thalweg depth, the deepest portion of the lateral transect of the stream, was measured in cm at the 0, 25, 50, 75 m points of the sample segment. The average of these measures is reported in cm. In cases where the stream was dewatered at any or all of these points, the thalweg depth at dewatered points was measured as 0 and was incorporated into the average.

1.7.26. Average Velocity (AVG_VEL)

Thalweg velocity was measured with a flowmeter at the deepest portion of the lateral transect at the 0, 25, 50, and 75 m points of the sample segment. Average thalweg velocity is reported in m/s. In cases where the stream was dewatered at any or all of these points, velocity at dewatered points was measured as 0 and was incorporated into the average.

1.7.27. Woody Debris and Rootwads (INSTREAMWOOD, DEWATERWOOD, INSTREAMROOT, DEWATERROOT)

Counts of instream woody debris (INSTREAMWOOD) and root wads (INSTREAMROOT), and for dewatered woody debris (DEWATWOOD) and root wads (DEWATERROOT).

1.7.28. Bar Formation and Composition (BAR_FORM, COB_BAR, GRAV_BAR, SAND_BAR, SC_BAR)

Bar formation (BAR_FORM) is presented as 0 (absent), 1 (minor), 2 (moderate), or 3 (extensive). The presence (Y) or absence (N) of the dominant particle type(s) that make up the bars in the site is indicated for the following: cobble (COB_BAR), gravel (GRAV_BAR), sand (SAND_BAR), silt and/or clay (SC_BAR). More than one particle type can be present; however, particles comprising only a minor part of the substrate are not indicated.

1.7.29. Stream Character (BRAIDED, RIFFLE, RUNGLIDE, DEEPOOL, SHALPOOL, LRGBOULD, SMLBOULD, COBBLE, BEDROCK, GRAVEL, SAND, SILTCLAY, UNDERCUT, OH_COVER, BEAVPND)

A variety of stream characters were recorded as absent (A), present (P), or extensive (E). Morphological characteristics that are documented include braided channels (BRAIDED), riffles (RIFFLE), runs or glides (RUNGLIDE), pools deeper than 50 cm (DEEPOOL) and pools shallower than 50 cm (SHALPOOL), undercut banks (UNDERCUT), overhead cover (OH_COVER), and beaver ponds (BEAVPND). Substrate types that are assessed include boulders larger than 2 m along the z-axis (LRGBOULD) and smaller than 2 m (SMLBOULD), cobble (COBBLE), bedrock (BEDROCK), gravel (GRAVEL), sand (SAND), and silt or clay (SILTCLAY).

1.7.30. Estimated Discharge (DischargeCFS, DischError)

Discharge, estimated based on measurements from a single cross-section, is reported in Cubic Feet per Second (DischargeCFS). Any issues affecting discharge estimate may be described in the DischError field.

1.7.31. Eroded Extent (ErodedExtentL, ErodedExtentR)

The visually estimated linear extent of erosion on the left bank (ErodedExtentL) and right bank (ErodedExtentR) of the stream, within the 75-m site. It is possible in braided streams to have the total extent of eroded bank on either side exceed 75 m. Reported in m.

1.7.32. Erosion Severity (ErosionSeverityL, ErosionSeverityR)

The visually estimated average severity of erosion, where it occurs, along the left bank (ErosionSeverityL) and right bank (ErosionSeverity_R). Severity scores are recorded as 0 (absent), 1 (minimal), 2 (moderate), or 3 (severe).

1.7.33. Eroded Height (ErodedHeightL, ErodedHeightR)

The visually estimated average height of erosion, where it occurs, along the left bank (ErosionSeverityL) and right bank (ErosionSeverity_R). Reported in m.

1.7.34. CrayfishBurrows

Crayfish burrows are marked as absent (A), present (P), or extensive (E) based on visual observations.

1.8. RiparianBufferBreaks

This table stores details about riparian buffer breaks that were observed during stream surveys. Each riparian buffer break type should be noted separately for each side of the stream. This table is populated entirely with data provided by MS4 Jurisdictions. The items in this table should only be entered by MS4 jurisdictions for sites where riparian buffer breaks were noted.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION 🔑	Short Text	MS4 jurisdiction that reported data	Mandatory[1]
SITE 🔑	Short Text	Site or sample corresponding to the data	Mandatory[1]
YEAR 🔑	Integer	Year that corresponding data were collected	Mandatory[1]
DATE 🔑	Date	Date that corresponding data were collected	Mandatory[1]
BufferBreakSide 🔑	Short Text	Side of stream with buffer break (L, R)	Mandatory[1]
BufferBreakType 🔑	Short Text	Type of buffer break	Mandatory[1]
BufferBreakSeverity	Short Text	Severity of buffer break (M-Minor, S-Severe)	Mandatory[1]

[1] Records should only be entered for sites where riparian buffer breaks were noted

1.8.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.8.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction. Only sites with riparian buffer breaks should be entered into this table.

1.8.3. YEAR

The year that corresponding data were collected. When combined with the SITE and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.8.4. DATE

The date that corresponding data were collected. Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by this field.

1.8.5. BufferBreakSide

If a buffer break is observed, the side of the stream (L=Left, R=Right) with the buffer break is indicated.

1.8.6. BufferBreakType

Type of buffer break (Storm drain, Tile drain, Impervious drainage, Gully, Orchard, Crop, Pasture, New construction, Dirt road, Gravel road, Railroad).

1.8.7. BufferBreakSeverity

If a buffer break is observed, the severity of the break is recorded as minor (M) or severe (S).

1.9. StreamModification

This table stores details about stream modifications at sites where channelization, culverts, or stream blockages were noted. This table is populated entirely with data provided by MS4 Jurisdictions. <u>The items in this table should only be entered by MS4 jurisdictions for sites where stream modifications (channelization, culverts, blockages, or restorations) were noted.</u>

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported data	Mandatory[1]
SITE🔑	Short Text	Site or sample corresponding to the data	Mandatory[1]
YEAR🔑	Integer	Year that corresponding data were collected	Mandatory[1]
DATE🔑	Date	Date that corresponding data were collected	Mandatory[1]
ConcreteL	Double	Extent of concrete on left bank	Mandatory[2]
ConcreteB	Double	Extent of concrete along stream bottom	Mandatory[2]
ConcreteR	Double	Extent of concrete on right bank	Mandatory[2]
GabionL	Double	Extent of gabion baskets on left bank	Mandatory[2]
GabionB	Double	Extent of gabion along stream bottom	Mandatory[2]
GabionR	Double	Extent of gabion baskets on right bank	Mandatory[2]
RiprapL	Double	Extent of riprap on left bank	Mandatory[2]
RiprapB	Double	Extent of riprap along stream bottom	Mandatory[2]
RiprapR	Double	Extent of riprap on right bank	Mandatory[2]
BermL	Double	Extent of earthen berm on left bank	Mandatory[2]
BermR	Double	Extent of earthen berm on right bank	Mandatory[2]
DredgeL	Double	Extent of dredge spoils on left bank	Mandatory[2]
DredgeR	Double	Extent of dredge spoils on right bank	Mandatory[2]
PipeL	Double	Extent of pipe on left bank	Mandatory[2]
PipeB	Double	Extent of pipe along stream bottom	Mandatory[2]
PipeR	Double	Extent of pipe on right bank	Mandatory[2]
BankRegrL	Double	Extent of bank regrading on left bank	Mandatory[2]
BankRegrR	Double	Extent of bank regrading on right bank	Mandatory[2]
WoodL	Double	Extent of strategic wood placement on left bank	Mandatory[2]
WoodB	Double	Extent of strategic wood placement on stream bottom	Mandatory[2]
WoodR	Double	Extent of strategic wood placement on right bank	Mandatory[2]
EroConL	Double	Extent of erosion control matting on left bank	Mandatory[2]
EroConB	Double	Extent of erosion control matting on stream bottom	Mandatory[2]
EroConR	Double	Extent of erosion control matting on right bank	Mandatory[2]
CulvertSampleable	Short Text	Sampleability of culvert using standard MBSS methods	Mandatory[3]
CulvertWidth	Double	Culvert width (m)	Mandatory[3]
CulvertLength	Double	Culvert length (m)	Mandatory[3]
StreamBlockLat	Short Text	Latitude of stream blockage	Mandatory[4]
StreamBlockLong	Short Text	Longitude of stream blockage	Mandatory[4]
StreamBlockHeight	Double	Stream blockage height	Mandatory[4]
StreamBlockType	Short Text	Stream blockage type	Mandatory[4]
Description	Long Text	Descriptive narrative about noted stream modifications	Recommended[1]

[1] Records should only be entered for sites where stream modifications were noted
[2] Records should only be entered for sites where stream channelization or restoration was noted
[3] Records should only be entered for sites where culverts were noted
[3] Records should only be entered for sites where stream blockages were noted

1.9.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.9.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.9.3. YEAR

The year that corresponding data were collected. When combined with the SITE and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.9.4. DATE

The date that corresponding data were collected. Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by this field.

1.9.5. CONCRETE (ConcreteL, ConcreteB, ConcreteR)

Linear extent of concrete along the left bank (ConcreteL), right bank (ConcreteR), and the stream bottom (ConcreteB), measured in m.

1.9.6. GABION (GabionL, GabionB, GabionR)

Linear extent of gabion baskets along the left bank (GabionL), right bank (GabionR), and the stream bottom (GabionB), measured in m.

1.9.7. RIPRAP (RiprapL, RiprapB, RiprapR)

Linear extent of riprap material along the left bank (RiprapL), right bank (RiprapR), and the stream bottom (RiprapB), measured in m.

1.9.8. BERM (BermL, BermR)

Linear extent of earthen berm along the left bank (BermL) and right bank (BermR), measured in m.

1.9.9. DREDGE (DredgeL, DredgeR)

Linear extent of dredge spoils along the left bank (DredgeL) and right bank (DredgeR), measured in m.

1.9.10. PIPE (PipeL, PipeB, PipeR)

Linear extent of pipe the left bank (PipeL), right bank (PipeR), and the stream bottom (PipeB), measured in m.

1.9.11. BANK REGRADING (BankRegrL, BankRegrR)

Linear extent of stream bank that was artificially regraded to achieve a less steep angle, measured along the left bank (BankRegrL) and right bank (BankRegrR), in m.

1.9.12. WOOD (WoodL, WoodB, WoodR)

Linear extent of strategically placed wood on the left bank (WoodL), right bank (WoodR), and the stream bottom (WoodB), measured in m.

1.9.13. EROSION CONTROL MATTING (EroConL, EroConB, EroConR)

Linear extent of erosion control matting placed along the left bank (EroConL), right bank (EroConR), and stream bottom (EroConB), in m.

1.9.14. CULVERT (CulvertSampleable, CulvertWidth, CulvertLength)

The presence of a culvert within the site. Sampleability of the culvert using standard MBSS fish sampling methods is indicated using "Y" or "N". Culvert width and culvert length were measured in m.

1.9.15. STREAM BLOCKAGE (StreamBlockLat, StreamBlockLong, StreamBlockHeight, StreamBlockType)

Latitude (StreamBlockLat) and longitude (StreamBlockLong) of stream blockage in decimal degrees. Stream blockage height (StreamBlockHeight) is measured in m. Stream blockage type (StreamBlockType) is abbreviated using the following Instream Blockage Codes: DM=Dam; PC=Pipe culvert; F=Fishway; G=Gabion; PX=Pipeline Crossing; AC=Arch culvert; BC=Box culvert; GW=Gaging station.

1.9.16. Description

Descriptive narrative about noted stream channelization, restoration, culvert, or blockage. Jurisdictions are encouraged to submit any notes or ancillary data that they may record about these features.

1.10.   WaterChemistry

The WaterChemistry table contains data pertaining to in situ water quality and laboratory-analyzed water chemistry and water quality variables. If applicable, the name of the laboratory that analyzed water samples should be specified in the SampleInfo table. This database table is populated entirely with data provided by MS4 Jurisdictions.

Field Name	Data Type	Field/ Lab	Definition	MS4 Requirement
JURISDICTION🔑	Short Text			Mandatory
SITE🔑	Short Text		Sample identification	Mandatory
YEAR🔑	Integer		Year sampled	Mandatory
DATE🔑	Date		Date that corresponding data were collected	Mandatory
TIME	Time		Time of day sample obtained	Mandatory
TIMEZONE	Short Text		EST or EDT	Mandatory
TEMP_FLD	Double	F	Temperature	Mandatory
TEMP_FLD_UNIT	Short Text	F	Unit of measurement (Suggested Unit: °Celcius)	Mandatory
TEMP_FLD_METHOD	Short Text	F	Analytical method	Mandatory
TEMP_FLD_QUALIFIER	Short Text	F	Qualifier code, if applicable	Mandatory
DO_FLD	Double	F	Dissolved oxygen concentration	Mandatory
DO_FLD_UNIT	Short Text	F	Unit of measurement for DO (Suggested Unit: ppm)	Mandatory
DO_FLD_METHOD	Short Text	F	Analytical method	Mandatory
DO_FLD_QUALIFIER	Short Text	F	Qualifier code, if applicable	Mandatory
PH_FLD	Double	F	pH	Mandatory
PH_FLD_UNIT	Short Text	F	Unit of measurement for pH (Suggested Unit: pH)	Mandatory
PH_FLD_METHOD	Short Text	F	Analytical method	Mandatory
PH_FLD_QUALIFIER	Short Text	F	Qualifier code, if applicable	Mandatory
COND_FLD	Double	F	Conductance	Mandatory
COND_FLD_UNIT	Short Text	F	Unit of measurement (Suggested Unit: µs/cm)	Mandatory
COND_FLD_METHOD	Short Text	F	Analytical method	Mandatory
COND_FLD_QUALIFIER	Short Text	F	Qualifier code, if applicable	Mandatory
TURB_FLD	Double	F	Turbidity	Mandatory
TURB_FLD_UNIT	Short Text	F	Unit of measurement (Suggested Unit: NTU)	Mandatory
TURB_FLD_METHOD	Short Text	F	Analytical method	Mandatory
TURB_FLD_QUALIFIER	Short Text	L	Qualifier code, if applicable	Mandatory
PH_LAB	Double	L	pH	Optional
PH_LAB_UNIT	Short Text	L	Unit of measurement for pH (Suggested Unit: pH)	Optional
PH_LAB_METHOD	Short Text	L	Analytical method	Optional
PH_LAB_QUALIFIER	Short Text	L	Qualifier code, if applicable	Optional
COND_LAB	Double	L	Conductance	Optional
COND_LAB_UNIT	Short Text	L	Unit of measurement (Suggested Unit: µs/cm)	Optional
COND_LAB_METHOD	Short Text	L	Analytical method	Optional
COND_LAB_QUALIFIER	Short Text	L	Qualifier code, if applicable	Optional
ANC_LAB	Double	L	Acid Neutralizing Capacity	Optional
ANC_LAB_UNIT	Short Text	L	Unit of measurement (Suggested Unit: µeq/L)	Optional
ANC_LAB_METHOD	Short Text	L	Analytical method	Optional
ANC_LAB_QUALIFIER	Short Text	L	Qualifier code, if applicable	Optional
DOC_LAB	Double	L	Dissolved organic carbon concentration	Optional
DOC_LAB_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Optional
DOC_LAB_METHOD	Short Text	L	Analytical method	Optional
DOC_LAB_QUALIFIER	Short Text	L	Qualifier code, if applicable	Optional
DOC_LAB_MDL	Double	L	Minimum Detection Limit	Optional
CL_LAB	Double	L	Chloride concentration	Recommended
CL_LAB_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
CL_LAB_METHOD	Short Text	L	Analytical method	Recommended
CL_LAB_QUALIFER	Short Text	L	Qualifier code, if applicable	Recommended
CL_LAB_MDL	Double	L	Minimum Detection Limit	Recommended

SO4_LAB	Double	L	Sulfate concentration	Optional
SO4_LAB_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Optional
SO4_LAB_METHOD	Short Text	L	Analytical method	Optional
SO4_LAB_QUALIFIER	Short Text	L	Qualifier code, if applicable	Optional
SO4_LAB_MDL	Double	L	Minimum Detection Limit	Optional
TN	Double	L	Total nitrogen concentration	Recommended
TN_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
TN_METHOD	Short Text	L	Analytical method	Recommended
TN_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
TN_MDL	Double	L	Minimum Detection Limit	Recommended
TP	Double	L	Total phosphorus concentration	Recommended
TP_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
TP_METHOD	Short Text	L	Analytical method	Recommended
TP_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
TP_MDL	Double	L	Minimum Detection Limit	Recommended
O_PHOS	Double	L	Orthophosphate concentration	Recommended
O_PHOS_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
O_PHOS_METHOD	Short Text	L	Analytical method	Recommended
O_PHOS_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
O_PHOS_MDL	Double	L	Minimum Detection Limit	Recommended
NH3	Double	L	Ammonia concentration	Recommended
NH3_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
NH3_METHOD	Short Text	L	Analytical method	Recommended
NH3_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
NH3_MDL	Double	L	Minimum Detection Limit	Recommended
NO2	Double	L	Nitrite concentration	Recommended
NO2_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
NO2_METHOD	Short Text	L	Analytical method	Recommended
NO2_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
NO2_MDL	Double	L	Minimum Detection Limit	Recommended
NO3	Double	L	Nitrate concentration	Recommended
NO3_UNIT	Short Text	L	Unit of measurement (Suggested Unit: mg/L)	Recommended
NO3_METHOD	Short Text	L	Analytical method	Recommended
NO3_QUALIFIER	Short Text	L	Qualifier code, if applicable	Recommended
NO3_MDL	Double	L	Minimum Detection Limit	Recommended

1.10.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.10.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.10.3. YEAR

The year that corresponding data were collected. When combined with the SITE and DATE, this provides a unique identifier for each sampling event by a jurisdiction.

1.10.4. DATE, TIME, TIMEZONE

Date and time when water quality readings were achieved and/or water chemistry sample was obtained. DATE is to be entered MM/DD/YYYY, and TIME is to be entered in local time on a 24-hr clock (24:00). TIMEZONE should be specified as EST if on Eastern Standard Time or as EDT if on Eastern Daylight Time (clocks have been set ahead by 1 hr). Each visit to a site is to be entered as a separate entry on this data table, and repeat visits within the same year are differentiated by the DATE field.

1.10.5. Field-collected water quality measurements (TEMP_FLD, DO_FLD, PH_FLD, COND_FLD, TURB_FLD)

These measurements are achieved *in situ* through direct measurements.

1.10.6. Laboratory-derived water chemistry measurements (PH_LAB, COND_LAB, ANC_LAB, DOC_LAB, CL_LAB, SO4_LAB, TN, TP, O_PHOS, NH3, NO2, NO3_LAB)

These measurements are achieved from water samples that are analyzed in a laboratory.

1.10.7. _UNIT

The standard measurement unit associated with each measurement must be specified. The standard units of measurement that are recommended by MDE are provided in the summary table above.

1.10.8. _METHOD

The analytical method used to determine the reported values. For laboratory-derived water chemistry variables, this code should be provided by the analytical laboratory. For field-collected water quality variables, the analytical method code can be found in the instrument manual or from the manufacturer's support center.

1.10.9. _QUALIFIER

Qualifier codes are associated with specific water quality measurements, and are used to identify any qualifying issues that affect results. If there were no issues affecting the reported measurement, this field should be blank. If more than one qualifier code is associated with a measurement, all of the relevant qualifier codes should be listed in this field and separated by semicolons.

There are over 200 result qualifier codes currently defined, and they are administered via the US Environmental Protection Agency WQX. Some of the more common codes are: H3 = Sample was received or analysis requested beyond the recognized method holding time; IS = instrument sensitivity problem; FPP = sample field preparation problem; NRS = Non Representative Sample; Sample does not represent the environmental conditions; SCX = Suspected Contamination, unknown; SCP = Suspected Contamination, lab preparation; SCF = Suspected Contamination, field; BQL = Below Quantitation Limit; GT = The listed result is greater than the upper quantitation limit for either the analytical method or the meter used for the measurement; FEQ = Field Equipment Questionable.

1.10.10. _MDL

Minimum detectable limit for the specified analyte.

1.11. FishData

This table lists all fish collected for each fish sampling event and their abundances. Fish sampling must be conducted during the summer index period, as specified in the MBSS Sampling Manual. <u>MS4 jurisdictions are not required to submit fish sampling data for the permit.</u> However, jurisdictions that conduct fish sampling are encouraged to submit these data to MDE for other uses (e.g., BSID) and inclusion in this table.

Field Name	Data Type	Definition	MS4 Permit Requirement
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported data	Optional[1]
SITE	Short Text	Sample identification	Optional[1]
YEAR	Integer	Year sampled	Optional[1]
FishTaxa	Short Text	Common Name	Optional[1]
Pass1	Integer	Number of fish sampled on first pass	Optional[2]
Pass2	Integer	Number of fish sampled on second pass	Optional[2]
TOTAL	Integer	Total number sampled using MBSS protocols	Optional[1]
NumRet	Integer	Number of voucher specimens retained	Optional[2]
NumPhoto	Integer	Number of photographs	Optional[2]
Comments	Long text	Comments	Optional[2]
Anomalies	Short text	Any anomalies observed	Optional[2]

[1] Fish sampling is not required for the MS4 Permit Requirements, but these data are necessary for calculating a FIBI
[2] Fish sampling is not required for the MS4 Permit Requirements, but these data are useful for evaluating the sample

1.11.1. JURISDICTION🔑

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

1.11.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with YEAR, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.11.3. YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

1.11.4. FishTaxa

Fish species common name. Any common name recorded in this table must also appear in the CHARFish list. Sampling events where no fish were sampled using MBSS electrofishing protocols were indicated in this table as a single record with "NO FISH OBSERVED" recorded in the FishTaxa field.

1.11.5. Pass1, Pass 2

The number of fish sampled on the first and second passes of an MBSS fish survey.

1.11.6. TOTAL

The total number of fish sampled during the two passes that comprise an MBSS fish survey.

1.11.7. NumRet

Number of voucher samples retained. Vouchers may be retained to confirm field-identification, identify species in the lab, document a novel species or phenotypic variation, or add to a reference collection.

1.11.8. NumPhoto

Number of photographs. Specimens may be photographed to confirm field-identification, identify species in the lab, document a novel species or phenotypic variation, or add to a collection of photographed fishes.

1.11.9. Anomalies

Unusual anomalies can include, but are not limited to, excessive black spot or black spot on an atypical species, multiple skeletal deformities, fin erosion, lesions, tumors, fungus, discoloration, excessive external parasites, or other unusual appearance. For each species, a Y in this field indicates unusual occurrences of anomalies, and additional description of the anomaly should be provided in the FishData Comments field.

1.11.10. Comments

Any comments about the record (observed anomalies, sampling inconsistencies, or other notable observations).

## 2.	Master Taxa Lists

The two master taxa lists in this database are updated by DNR. The MasterTaxaList_Benthic (Database Table 2.1) provides taxonomic information and functional characteristics about benthic macroinvertebrate taxa known to occur in Maryland. The MasterTaxaList_Fish (Database Table 2.2) provides taxonomic information and functional characteristics about fishes in Maryland. These tables are provided as reference, and jurisdictions are not expected to submit any data for the Master Taxa List database tables.

## 2.1.	MasterTaxaList_Benthic

The MasterTaxaList_Benthic table presents standard information about benthic macroinvertebrates that is necessary for calculating the MBSS Benthic Index of Biotic Integrity (BIBI) score. Information related to functional feeding group, habit, and tolerance to urban stressors was collected from a standard sources (Bressler et al. 2004, Barbour et al. 1999, Merritt et al. 2019). The master taxa file is cumulative; old taxa that have changed taxonomically are not deleted and taxonomic traits are not added or revised. New taxa and their corresponding traits are added to this table as needed, following a review process.

This table is updated annually by DNR. Jurisdictions are not expected to submit any data for this database table. However, this table should be referenced to be consistent with MBSS naming conventions. If MS4 jurisdictions encounter an organism that is not currently included on the Master Taxa List, they are encouraged to work with DNR to confirm the identification and update the Master Taxa List accordingly.

Field Name	Data Type	Definition
Taxon 🔑	Short Text	Lowest possible taxonomic identification
Phylum	Short Text	Taxonomic designation
Class	Short Text	Taxonomic designation
Order	Short Text	Taxonomic designation
Family	Short Text	Taxonomic designation
Genus	Short Text	Taxonomic designation
Other_Taxa	Short Text	Taxonomic designation
Tribe	Short Text	Taxonomic designation
FFG	Short Text	Functional feeding group
FAM_TV	Double	Family tolerance value
Habit	Short Text	Life history habit
FinalTolVal07	Double	Urban tolerance
Comment	Short Text	Comments about taxon
Year_Added	Integer	Year taxon was added to the master taxa list

### 2.1.1.	Taxon

The lowest possible taxonomic identification. Taxon is the primary identifier; it is linked to all other classification and characteristic information.

### 2.1.2.	Phylum

All taxa were identified to phylum (or a finer taxonomic classification). To accommodate approximate identifications, traits are assigned for the phyla Nematoda and Mollusca.

### 2.1.3.	Class

Class is indicated for all taxa identified to this or a finer taxonomic resolution. To accommodate approximate identifications, traits were assigned to the classes Gastropoda, Bivalvia, Hirudinea, Nematomorpha, Oligochaeta, and Turbellaria.

2.1.4. Order

Order is indicated for all taxa identified to this or a finer taxonomic resolution. To accommodate approximate identifications, traits were assigned to the orders Diptera, Ephemeroptera, Amphipoda, Branchiobdellida, Cladocera, Collembola, Copepoda, Hymenoptera, Isopoda, Lepidoptera, Lumbricina, Megaloptera, Odonata, Ostracoda, Plecoptera, Trichoptera, and Veneroida.

2.1.5. Family

Family is indicated for all taxa identified to this or a finer taxonomic resolution. To accommodate approximate identifications and versatility with family-level biotic indices (e.g., Maryland Streamwaders BIBI), traits were assigned to all families of benthic macroinvertebrates in the database.

2.1.6. Genus

For the MBSS, genus-level identification is typically the target resolution. Genus is indicated for all taxa identified to this taxonomic resolution.

2.1.7. Other_Taxa

Other_Taxa includes Subphylum, Superfamily, and Subfamily information. This field is not populated for most taxa.

2.1.8. Tribe

For most taxa in this table, tribe is not populated. However, this field is used to designate the Tanytarsini tribe of midges, which is used as a metric in calculating BIBI scores in the Highland geographic stratum.

2.1.9. FFG

Benthic macroinvertebrates may be assigned to one (and only one) of the following functional feeding groups (FFG): Collector, Filterer, Piercer, Predator, Scraper, Shredder. This characteristic is important in BIBI calculations for the Coastal Plain and Highland geographic strata. Some of the taxa lack FFG info and this field is not populated for those records. Trophic information was gathered from Merritt and Cummins 1996 (Mid-Atlantic) and U.S. EPA 1999 (Mid-Atlantic).

2.1.10. FAM_TV

Family level tolerance values (TV) ranging from 0 to 10; used in Family Level BIBI calculations (Bressler et al. 2004).

2.1.11. Habit

Benthic macroinvertebrates may be assigned to the following habits: burrowers (bu), climbers (cb), clingers (cn), skaters (sk), sprawlers (sp), swimmers (sw), divers (dv). This characteristic is important in BIBI calculations, representing one component metric in each stratum. Taxa can have more than one habit. Some of the taxa in the current database have no habit information, and this field will be blank. Habit information was gathered from Merritt and Cummins 1996 (Mid-Atlantic) and Merritt et al. 1996.

2.1.12. FinalTolVal07

References urban tolerance; used in calculation of Percent Intolerant Urban metric – one component metric in each BIBI (Bressler et al. 2004). For MBSS BIBI calculation, intolerant taxa are those with values that are 3.0 or less.

2.1.13. Comment

Any relevant notes about the taxon.

2.1.14. Year_Added

Documentation regarding the year that each taxa was added to the master taxa list by biologists at Maryland DNR.

2.2. MasterTaxaList_Fish

The MasterTaxaList_Fish table presents standard information about fish that is necessary for calculating the MBSS Fish Index of Biotic Integrity (FIBI) score. This table is updated as necessary by DNR. <u>Jurisdictions are not expected to submit any data for this database table.</u> However, jurisdictions should reference this table to be consistent with MBSS naming conventions.

Field Name	Data Type	Definition
SPECIES	Short Text	Common species name
TYPE	Short Text	General taxonomic grouping
PTOLR	Short Text	Tolerance
NATIVE	Short Text	Nativity
TROPHIC	Short Text	Trophic habit
SILT	Short Text	Lithophilic spawner
DATEADDED	Date	Date taxon was added to table
REASON	Short Text	Reason fish species was added to table
SOURCE	Short Text	Taxonomy guide used for classification
FAM	Short Text	Taxonomic designation
GENUS	Short Text	Taxonomic designation
SP_SCI	Short Text	Scientific name (Genus species)
IN_KEY	Yes/No	Taxa in Maryland Fishes Key

2.2.1. SPECIES
Common fish species name.

2.2.2. TYPE
General taxonomic grouping. Fish may be assigned to one of the following: DARTER, LAMPREY, MADTOM, OTHRCYPR, SCULPIN, SHINER, SUCKER, SUNFISH, NOTYPE, [blank].

2.2.3. PTOLR
Tolerance value assigned to species. T = Tolerant, I = Intolerant, NOTYPE/[blank] = Not categorized. This rating of fish tolerance to anthropogenic stress was derived using MBSS data collected prior to 1998 and an analysis that ranked occurrences of individual species at degraded or minimally disturbed sites (Roth et al. 1998, *in* Environmental Monitoring and Assessment).

2.2.4. NATIVE
Nativity of Maryland fishes. N = Native, I = Introduced statewide, IC = Introduced to Chesapeake Bay Watersheds, IY = Introduced to Youghiogheny Watershed, NOTYPE/[blank] = Not categorized.

2.2.5. TROPHIC
All of the fishes listed in the table are assigned to one, and only one, trophic habit, as determined from literature. Trophic habit of Maryland fishes include: FF=Filter Feeder, GE=Generalist, IS=Insectivore, IV=Invertivore, OM=Omnivore, TP=Top Predator, AL=Algivore, HE=Herbivore, NOTYPE/[blank]=Not categorized.

2.2.6. SILT
This field indicates whether a Maryland fish species is categorized as a lithophilic spawner, as determined from literature. Yes=lithophilic spawner.

2.2.7. DATEADDED
Date a taxon was added to the table, if not included in the original fish characteristics table.

2.2.8. REASON
This field is only populated for taxa not included in the original fish characteristics table. It indicates the reason a fish species was added to the table (e.g., new species occurrence, change in taxonomy).

2.2.9. SOURCE

Taxonomy guide used for classification variables.

2.2.10. FAM

Taxonomic designation: Family.

2.2.11. GENUS

Taxonomic designation: Genus.

2.2.12. SP_SCI

Scientific name (*Genus species*).

2.2.13. IN_KEY

Indicates whether taxon is in the Key to the Freshwater Fishes of Maryland (Kazyak and Raesly 2009).

3.   Data Review

This section of the database is composed of three tables that are updated as DNR reviews data submitted by MS4 jurisdictions. The MS4BenthicDataComparability table (Database Table 3.1) details the comparability of data to MBSS protocols. The other two tables provide translations from benthic macroinvertebrate naming conventions encountered in MS4 datasets to those required by MBSS (MBSS-MS4Translations; Database Table 3.2) and for uploading to AWQMS (MBSS-AWQMSTranslations; Database Table 3.3).

3.1.   MS4BenthicDataComparability

This table details, on a sample-by-sample basis, which samples can be considered comparable to samples collected using MBSS protocols. All fields in this data table are determined and populated by MDE and DNR. MS4 jurisdictions are not expected to submit any data for this database table.

Field Name	Data Type	Definition
JURISDICTION 🔑	Short Text	MS4 jurisdiction that reported the corresponding data
SITE 🔑	Short Text	Site or sample corresponding to the data
YEAR 🔑	Integer	Year that corresponding data were collected
COMP_MBSS	Short Text	Comparability with MBSS (Y/N)
COMP_NOTES	Long Text	Short narrative describing inconsistencies with MBSS

3.1.1.   JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

3.1.2.   SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with year, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

3.1.3.   YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

3.1.4.   COMP_MBSS

Indicates whether the data corresponding to the indicated sample are comparable to MBSS, in terms of final BIBI scores. "Y" indicates the data have been examined and deemed comparable. "N" indicates the data have been examined and deemed incomparable.

3.1.5.   COMP_NOTES

A short narrative that identifies any inconsistencies in the corresponding benthic data.

3.2.   MBSS-MS4Translations

This table lists taxa that were reported by each of the MS4 jurisdictions but were not consistent with the MBSS master taxa list, describes the inconsistencies, and provides suggested translations. This table is maintained by DNR. MS4 jurisdictions are not expected to submit any data for this database table. However, jurisdictions should reference this table and continue to work to update their taxa to those that are consistent with the MBSS master taxa list.

Field Name	Data Type	Definition
JURISDICTION🔑	Short Text	MS4 jurisdiction that reported the corresponding data
MS4_TAXON🔑	Short Text	Taxonomic name assigned to taxon by MS4 jurisdiction
MBSS_TAXON	Short Text	Closest equivalent name in the MBSS master taxa list
ISSUE	Short Text	Reason for inconsistency
NOTES	Long Text	Additional notes

3.2.1.   JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

3.2.2.   MS4_TAXON

Taxa reported by the indicated MS4 jurisdiction that are not consistent with the MBSS master taxa list.

3.2.3.   MBSS_TAXON

The primary identifier of the referenced taxon, consistent with the MBSS MasterTaxaList_Benthic table.

3.2.4.   ISSUE

Categorizes the reason why the taxon reported by the indicated MS4 jurisdiction is not consistent with the MBSS master taxa list. Currently identified issues are: Hierarchical differences, Misspelling, Needs verification (likely incorrect/possibly incorrect/possibly correct), Not picked by MBSS, Synonymous name.

3.2.5.   NOTES

A short narrative that identifies why the taxon reported by the indicated MS4 jurisdiction is not consistent with the MBSS master taxa list and justification for the suggested translation.

3.3. MBSS-AWQMSTranslations

This table includes the translations used to upload the taxa listed in the MasterTaxaList_Benthic table to the AWQMS system. All taxa that are included in the MasterTaxaList_Benthic table are also included in the MBSS-AWQMS Translations table. This table can be used to translate names prior to uploading in AWQMS.

Table is maintained and updated annually by DNR. <u>MS4 jurisdictions are not expected to submit any data for this database table.</u>

Field Name	Data Type	Definition
MBSS_TAXON🔑	Short Text	Primary identifier of taxon, consistent with the MBSS MasterTaxaList_Benthic table
IN_AWQMS	Short Text	Is taxon currently in AWQMS? (Y/N)
AWQMS_TAXON1	Short Text	Acceptable but potentially outdated AWQMS translations
AWQMS_TAXON2	Short Text	The most current acceptable AWQMS translations for the referenced taxon
NOTES	Long Text	Special considerations for assigning AWQMS translations

3.3.1. MBSS_TAXON

Lowest possible taxonomic identification, consistent with the MBSS MasterTaxaList_Benthic table. The primary identifier of the referenced taxon.

3.3.2. IN_AWQMS

Indicates whether the taxon is currently in AWQMS (as formatted). "Y" indicates that the organism is listed in AWQMS and can be uploaded without applying a translation. "N" indicates that a translation is required.

3.3.3. AWQMS_TAXON1

Any acceptable but potentially outdated AWQMS translations for the referenced taxon. If IN_AWQMS="Y", this field is identical to the MBSS_TAXON.

3.3.4. AWQMS_TAXON2

The most current acceptable AWQMS translations for the referenced taxon.   If IN_AWQMS="Y", this field is identical to the MBSS_TAXON.

3.3.5. NOTES

Any special considerations for assigning AWQMS translations, including exceptions, inconsistencies, and misclassifications.

4. Indices of Biotic Integrity

Index of Biotic Integrity scores corresponding to benthic macroinvertebrate and fish samples are generated using the submitted data. IBI scores and metrics are independently calculated by DNR and values presented in this table reflect DNR's calculations. <u>MS4 jurisdictions are not expected to submit any data for these database tables.</u>

4.1. MS4BIBI

This table presents Maryland Benthic Index of Biotic Integrity (BIBI) scores for sites sampled by MS4 jurisdictions, and all component metric values. These values were calculated using the process outlined in Southerland et al. 2005. The component metrics that are used depend on the physiographic stratum where they were collected. Applicability to each stratum is listed below (Coast. = Coastal, Pied. = Eastern Piedmont, High. = Highland).

This table is maintained and populated by MDE and DNR, based on benthic macroinvertebrate data submitted by MS4 jurisdictions (i.e., all fields in the "MS4BenthicData" table and BIBIStrata). MS4 jurisdictions are encouraged to calculate and submit their own BIBI scores. However, to ensure consistency in this step, BIBI scores and metrics are independently calculated by DNR and values presented in this table reflect DNR's calculations. <u>MS4 jurisdictions are not expected to submit any data for this database table.</u>

Field Name	Data Type	Applicable Strata Coast.	Pied.	High.	Definition
JURISDICTION🔑	Short Text	x	x	x	MS4 jurisdiction that reported the data for BIBI calculation
SITE🔑	Short Text	x	x	x	Site or sample corresponding to the data
YEAR🔑	Integer	x	x	x	Year that corresponding data were collected
BIBIStrata	Short Text	x	x	x	Physiographic stratum in which each site is located
totind	Integer	x	x	x	Total number of individual organisms identified
ntaxa	Integer	x	x	x	Total number of taxa
nephem	Integer	x	x	x	Number of Ephemeroptera taxa
nept	Integer	x	x	x	Number EPT taxa (Ephemeroptera, Plecoptera, Trichoptera)
totintol_urb	Integer	x	x	x	Total number of individual intolerant urban
nscrape	Integer	x			Number of scraper taxa
totclimb	Integer	x			Total number of individual climbers
totephem	Integer	x			Total number of Ephemeroptera individuals
totchiron	Integer		x		Total number of individual Chironomidae
totcling	Integer		x		Total number of individual clingers
totdipt	Integer			x	Total number of individual Diptera
totscrape	Integer			x	Total number of individual scrapers
totswim	Integer			x	Total number of individual swimmers
tottany	Integer			x	Total number of individual Tanytarsini
pintol_urb	Double	x	x	x	Percentage intolerant urban
pclimb	Double	x			Percentage of climbers
pephem	Double	x			Percentage of Ephemeroptera
pchiron	Double		x		Percentage of Chironomidae
pcling	Double		x		Percentage of clingers
pdipt	Double			x	Percentage of Diptera
pscrape	Double			x	Percentage of individuals classified as scrapers
pswim	Double			x	Percentage of swimmers
ptany	Double			x	Percentage of Tanytarsini
ndipt	Integer				Number of Diptera taxa [Not in MBSS BIBI]
nintol	Integer				Number of intolerant taxa [Not in MBSS BIBI]
becks	Integer				Beck's Index [Not in MBSS BIBI]
nintol_FAM	Integer				Number of intolerant families [Not in MBSS BIBI]
sc_ntaxa	Integer	x	x	x	Score for number of taxa
sc_nephem	Integer	x	x	x	Score for number of Ephemeroptera taxa
sc_nept	Integer	x	x	x	Score for number of EPT taxa
sc_pintol_urb	Integer	x	x	x	Score for percentage intolerant urban
sc_nscrape	Integer	x			Score for number of scraper taxa
sc_pclimb	Integer	x			Score for percentage climbers

| Field Name | Data Type | Applicable Strata | | | Definition |
		Coast.	Pied.	High.	
sc_pephem	Integer	x			Score for percentage Ephemeroptera
sc_pchiron	Integer		x		Score for percentage Chironomidae
sc_pcling	Integer		x		Score for percentage clingers
sc_pdipt	Integer			x	Score for percentage Diptera
sc_pscrape	Integer			x	Score for percentage scrapers
sc_pswim	Integer			x	Score for percentage swimmers
sc_ptany	Integer			x	Score for percentage Tanytarsini
bibi_05	Double	x	x	x	Calculated benthic index of biotic integrity score
Char_Table	Short Text	x	x	x	Characteristics table used to assign taxa traits for the index

4.1.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the data for BIBI calculation.

4.1.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with year, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

4.1.3. YEAR

The year that corresponding data were collected. When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

4.1.4. BIBIStrata

Calculation of the Benthic Index of Biotic Integrity requires knowledge of the physiographic stratum in which each site is located. The strata used for benthic IBI calculations are: Coastal, Epiedmont, and Highland (Southerland et al. 2005).

4.1.5. Total individuals (totind)

Total number of individuals in the subsample that was used for identification.

4.1.6. Number of taxa (ntaxa, sc_ntaxa)

Total number of distinct taxa identified (ntaxa) and the corresponding metric score (sc_ntaxa).

4.1.7. Number of Ephemeroptera taxa (nephem, sc_nephem)

Total number of distinct ephemeroptera taxa (nephem) and the corresponding metric score (sc_nephem).

4.1.8. Number of EPT taxa (nept, sc_nept)

Total number of distinct EPT taxa (Ephemeroptera, Plecoptera, and Trichoptera; nept) and the corresponding metric score (sc_nept).

4.1.9. Percent intolerant individuals (totintol_urb, pintol_urb, sc_pintol_urb)

Total number of individuals intolerant to urban conditions (totintol) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms intolerant to urban conditions (pintol_urb) and generate a corresponding metric score (sc_pintol_urb).

4.1.10. Number of scraper taxa (nscrape, sc_nscrape)

Total number of distinct taxa with a functional feeding habit classified as scrapers (nscrape) and the corresponding metric score (sc_nscrape).

4.1.11. Percent climber individuals (totclimb, pclimb, sc_pclimb)

Total number of individuals classified as climbers (totclimb) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as climbers (pclimb) and generate a corresponding metric score (sc_pclimb).

4.1.12. Percent Ephemeroptera individuals (totephem, pephem, sc_pephem)

Total number of Ephemeroptera individuals (totephem) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as Ephemeroptera (pephem) and generate a corresponding metric score (sc_pephem).

4.1.13. Percent Chironomidae individuals (totchiron, pchiron, sc_pchiron)

Total number of individuals in the family Chironomidae (totchiron) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of Chironomidae (pchiron) and generate a corresponding metric score (sc_pchiron).

4.1.14. Percent clinger individuals (totcling, pcling, sc_pcling)

Total number of individuals classified as clingers (totcling) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as climbers (pcling) and generate a corresponding metric score (sc_pcling).

4.1.15. Percent Diptera individuals (totdipt, pdipt, sc_pdipt)

Total number of diptera individuals (totdipt) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as diptera (pdipt) and generate a corresponding metric score (sc_pdipt).

4.1.16. Percent scraper individuals (totscrape, pscrape, sc_pscrape)

Total number of individuals with a functional feeding habit classified as scrapers (totscrape) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as scrapers (pscrape) and generate a corresponding metric score (sc_pscrape).

4.1.17. Percent swimmer individuals (totswim, pswim, sc_pswim)

Total number of individuals classified as swimmers (totswim) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of organisms classified as swimmers (pswim) and generate a corresponding metric score (sc_pswim).

4.1.18. Percent Tanytarsini individuals (tottany, ptany, sc_ptany)

Total number of individuals in the tribe Tanytarsini (totscrape) is divided by the total number of individual organisms identified (totind) and multiplied by 100 to produce the percentage of Tanytarsini (ptany) and generate a corresponding metric score (sc_ptany).

4.1.19. ndipt

Number of Diptera taxa. Not used in MBSS BIBI.

4.1.20. nintol

Number of intolerant taxa. Not in MBSS BIBI.

4.1.21. becks

Beck's Index. Not in MBSS BIBI.

4.1.22. nintol_FAM

Number of intolerant families. Not in MBSS BIBI.

4.1.23. Benthic Index of Biotic Integrity score (bibi_05)

Final calculated Benthic Index of Biotic Integrity score. Scores were rounded to 14 significant digits. BIBI values range from 1 to 5. Site scores <3.00 are considered "Poor", 3.00-4.00 are considered "Fair", and scores >4.00 are considered "Good." See Southerland et al. 2005 for a more detailed explanation of IBI development.

4.1.24. Char_Table

Specifies the benthic macroinvertebrate characteristics table (master taxa list) used to calculate the BIBI score.

4.2. MS4FIBI

The Fish Index of Biotic Integrity (FIBI) score corresponding to a particular sample is generated using the electrofishing sample composition documented on the FishData table and attributes assigned from the MasterTaxaList_Fish table, as well as information documented in the Habitat and SiteCoordinates tables. The suite of metrics used to calculate a FIBI score depends upon the physical location of a site within one of four geographic strata in Maryland (Coast. = Coastal, Pied. = Eastern Piedmont, High. = Highland, Cold = Coldwater). The Applicable Strata designation in the metadata listed below refers to the applicability of each field to the four suites of calculations used to determine the FIBI score. Further details for calculating FIBI scores are given in Southerland et al. 2005.

This database table is maintained and populated by MDE and DNR, based on (optional) fish sampling data submitted by MS4 jurisdictions (i.e., all fields in the FishData table and FIBISTRATA). MS4 jurisdictions are encouraged to calculate and submit their own FIBI scores. However, to ensure consistency in this step, FIBI scores and metrics are independently calculated by DNR and values in this database table reflect DNR's calculations. MS4 jurisdictions are not expected to submit any data for this database table.

Field Name	Data Type	Coast.	Pied.	High.	Cold	Definition
JURISDICTION 🔑	Short Text	X	X	X	X	MS4 jurisdiction that reported data
SITE 🔑	Short Text	X	X	X	X	Site or sample corresponding to the data
YEAR 🔑	Integer	X	X	X	X	Year that corresponding data were collected
FIBISTRATA	Short Text	X	X	X	X	Fish IBI strata (Coastal, Epiedmont, Highland, Cold)
ACREAGE	Double	X	X	X		Catchment area (acres)
LOGACRES	Double	X	X	X		Log_{10}(catchment area)
LEN_SAMP	Double		X			Length of reach sampled (m)
AVGWID	Double		X			Average wetted width (m)
STRMAREA	Double		X			Stream area in square meters
TOTCNT	Integer	X	X	X	X	Total number of fish sampled
ABUNSQM	Double	X	X	X	X	Fish abundance per square meter
NUMTOL	Integer	X	X	X	X	Number of tolerant individuals
PTOL	Double	X	X	X	X	Percent tolerant individuals
NUMBENTSP	Integer	X	X	X		Number of benthic species
NUMBENTSPA	Double	X	X	X		Number of benthic species adjusted for catchment area
NUMGEOMIV	Integer	X	X	X		Number of generalist, omnivorous, and insectivorous species
PGEOMIV	Double	X	X	X		Percent generalist, omnivorous, and insectivorous species
ABDOM	Integer	X		X		Abundance of dominant taxa
PABDOM	Double	X		X		Percent abundance of dominant taxa
NUMROUND	Integer	X				Number of round-bodied suckers
PROUND	Double	X				Percent of round-bodied suckers
TOTBIOM	Double		X			Total biomass (g)
BIOM_MSQ	Double		X			Biomass per square meter
NUMLITH	Integer		X			Number lithophilic spawners
P_LITH	Double		X			Percent lithophilic spawners
NUMIS	Double			X		Number of insectivores
P_IS	Double			X		Percent insectivores
NUMBROOK	Integer				X	Number of brook trout
PBROOK	Double				X	Percent brook trout
NUMSCULP	Integer				X	Number of sculpins
PSCULP	Double				X	Percent sculpins
SC_ABUNSQM	Double	X	X	X	X	Score for abundance per square meter
SC_PTOL	Double	X	X	X	X	Score for percent tolerant individuals
SC_NUMBENTSPA	Double	X	X	X		Score for number benthic species adjusted for catchment area
SC_PGEOMIV	Double	X	X	X		Score for % generalist, omnivore, and insectivores
SC_PABDOM	Double	X		X		Score for percent abundance of dominant taxa
SC_PROUND	Double	X				Score for percent of round-bodied suckers

Field Name	Data Type	Applicable Strata				Definition
		Coast.	Pied.	High.	Cold	
SC_BIOM_MSQ	Double		X			Score for biomass per square meter
SC_P_LITH	Double		X			Score for percent lithophilic spawners
SC_P_IS	Double			X		Score for percent number of insectivores
SC_PBROOK	Double				X	Score for percent brook trout
SC_PSCULP	Double				X	Score for percent sculpins
FIBI_05	Double	X	X	X	X	Final calculated FIBI score

4.2.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

4.2.2. SITE

The site or sample corresponding to the data submitted by the corresponding jurisdiction. When combined with year, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

4.2.3. YEAR

The year that corresponding data were collected.When combined with the site identifier, this provides a unique identifier for each specific annual sample collected by a jurisdiction.

4.2.4. FIBISTRATA

Calculation of the Fish Index of Biotic Integrity requires knowledge of the physiographic stratum in which each site is located. The four strata are: Coastal, Eastern Piedmont (Epiedmont), Highland, and Cold.

4.2.5. Catchment area (ACREAGE, LOGACRES)

Drainage area of each catchment in acres (ACREAGE) is also given in the SiteCoordinates table. The $\log_{10}$ transformation (LOGACRES) is used as a normalizing variable for the BenthicSpecies metric.

4.2.6. Sampled area (LEN_SAMP, AVGWID, STRMAREA)

The length sampled (LEN_SAMP) reflects the linear extent of the watered stream channel that was sampled. LEN_SAMP is typically 75 m, unless the stream was partially dewatered; for partially dewatered stream channels, LEN_SAMP is the cumulative length of watered habitat within the 75-m stream reach. The average width (AVGWID) used for FIBI calculations is typically the AVGWID from the HABITAT table, unless the stream was partially dewatered; for partially dewatered stream channels, the average width was determined by averaging the mean widths of standing pools. The estimated stream area sampled (STRMAREA) was calculated by multiplying LEN_SAMP and AVGWID.

4.2.7. Total count (TOTCNT)

Total number of fish sampled. If no fish were observed, all component metric scores and the final FIBI score were assigned values of 1.0.

4.2.8. Fish abundance (ABUNSQM, SC_ABUNSQM)

Abundance per square meter (ABUNSQM) was calculated by dividing the total number of fish sampled (TOTCNT) by the area sampled (STRMAREA) and a corresponding metric score was assigned (SC_ABUNSQM).

4.2.9. Percent tolerant (NUMTOL, PTOL, SC_PTOL)

Total number of individuals that are particularly tolerant to stressors (NUMTOL) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of tolerant individuals (PTOL) and generate a corresponding metric score (SC_PTOL).

Tolerant fishes in Maryland (PTOLR = "T"): Blacknose Dace, Bluegill, Bluntnose Minnow, Brown Bullhead, Creek Chub, Eastern Mudminnow, Golden Shiner, Green Sunfish, Largemouth Bass, Pirate Perch, Pumpkinseed, Redfin Pickerel, Tessellated Darter, White Sucker.

4.2.10.   Number of benthic species (NUMBENTSP, NUMBENTSPA, SC_NUMBENTSPA)

The number of benthic species in a sample (NUMBENTSP) is the number of species classified as the following: Darters (genera *Etheostoma* and *Percina*), Madtoms (genus *Noturus*), and Lamprey (family *Petromyzontidae*). The logarithm of the catchment area (LOGACRES) is used to normalize the number of benthic species according to catchment size (NUMBENTSPA) and generate a corresponding metric score (SC_NUMBENTSPA). The following adjustments are applied, depending on the sample's stratum:

Coastal Plain: NUMBENTSPA = (NUMBENTSP)/(1.69 × LOGACRES – 3.33)
Eastern Piedmont: NUMBENTSPA = (NUMBENTSP)/(1.25 × LOGACRES – 2.36)
Highlands: NUMBENTSPA = (NUMBENTSP)/(1.23 × LOGACRES – 2.35)

Maryland's benthic fishes are indicated by TYPE = "DARTER", "SCULPIN", "MADTOM", and "LAMPREY". Darters: Banded, Blackside, Fantail, Glassy, Greenside, Johnny, Maryland, Rainbow, Shield, Stripeback, Striped, Swamp, Tessellated, and Variegate Darters, and Chesapeake Logperch. Sculpins: Blue Ridge, Checkered, Mottled, Potomac, and Slimy Sculpins. Madtoms: Margined Madtom, Tadpole Madtom, and Stonecat. Lamprey: American Brook, Least Brook, and Sea Lampreys.

4.2.11.   Percent generalist, omnivores, invertivores (NUMGEOMIV, PGEOMIV, SC_PGEOMIV)

The number of individuals classified as generalists, omnivores, or invertivores (NUMGEOMIV) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of generalists, omnivores, or invertivores in the sample (PGEOMIV) and generate a corresponding metric score (SC_PGEOMIV).

Maryland's generalist, omnivorous, and invertivorous fishes are indicated by TROPHIC = "GE", "OM", or "IV". Generalist: American Eel, Black Crappie, Brook Trout, Creek Chub, Fallfish, Green Sunfish, Redbreast Sunfish, Rock Bass, Tiger Trout, Warmouth, White Crappie, Yellow Perch. Omnivore: Blacknose Dace, Blue Catfish, Bluehead Chub, Bluntnose Minnow, Brown Bullhead, Channel Catfish, Common Carp, Common Shiner, Fathead Minnow, Flathead Catfish, Golden Redhorse, Golden Shiner, Goldfish, Longnose Dace, River Chub, Shorthead Redhorse, Silverjaw Minnow, Spottail Shiner, Striped Shiner, White Catfish, White Sucker, Yellow Bullhead. Invertivore: Banded Killifish, Banded Sunfish, Blueback Herring, Bluegill, Bluespotted Sunfish, Chesapeake Logperch, Comely Shiner, Creek Chubsucker, Cutlip Minnow, Eastern Mosquitofish, Eastern Mudminnow, Flier, Johnny Darter, Longear Sunfish, Margined Madtom, Mimic Shiner, Mud Sunfish, Mummichog, Northern Hogsucker, Pearl Dace, Pirate Perch, Pumpkinseed, Rainwater Killifish, Rosyface Shiner, Rosyside Dace, Satinfin Shiner, Spot, Spotfin Shiner, Stonecat, Stripeback Darter, Striped Darter, Striped Killifish, Swallowtail Shiner, Swamp Darter, Tadpole Madtom, Tessellated Darter, White Perch.

4.2.12.   Percent abundance of dominant taxa (ABDOM, PABDOM, SC_PABDOM)

The most abundant fish species (by number; ABDOM) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percent composition of the dominant species (PABDOM) and generate a corresponding metric score (SC_PABDOM).

4.2.13.   Percent round bodied suckers (NUMROUND, PROUND, SC_PROUND)

The number of individuals classified as round-bodied Suckers (NUMROUND) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of round-bodied Suckers in the sample (PROUND) and generate a corresponding metric score (SC_PROUND).

Maryland's round-bodied sucker species: Black Redhorse, Creek Chubsucker, Golden Redhorse, Longnose Sucker, Northern Hogsucker, and Shorthead Redhorse. **NOT** White Sucker.

4.2.14. Total biomass (TOTBIOM, BIOM_MSQ, SC_BIOM_MSQ)

The biomass of each pass comprising a sample was determined by weighing all of the fish collected in the 1-pass subsample sample (typically together) on a scale with 1-g precision. The total biomass of fish in the sample (TOTBIOM) is given in g, and is the sum of the two passes. The biomass per square meter (BIOM_MSQ) was calculated by dividing TOTBIOM by the area sampled (STRMAREA) and a corresponding metric score was assigned (SC_BIOM_MSQ).

4.2.15. Percent Lithophilic Spawners (NUMLITH, P_LITH, SC_P_LITH)

The number of individuals classified as lithophilic spawners is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of lithophilic spawners in the sample (P_LITH) and generate a corresponding metric score (SC_PLITH). On the CHARFish table, lithophilic spawners are indicated as SILT = "Y".

Maryland's lithophilic spawning fishes (SILT = "Y"): Banded Darter, Blue Ridge Sculpin, Bluehead Chub, Brook Trout, Brown Trout, Central Stoneroller, Checkered Sculpin, Chesapeake Logperch, Comely Shiner, Common Shiner, Creek Chub, Cutlip Minnow, Fallfish, Fantail Darter, Glassy Darter, Golden Redhorse, Ironcolor Shiner, Longear Sunfish, Mottled Sculpin, Northern Hogsucker, Pearl Dace, Potomac Sculpin, Rainbow Darter, Rainbow Trout, River Chub, Rock Bass, Rosyface Shiner, Rosyside Dace, Shield Darter, Shorthead Redhorse, Silverjaw Minnow, Spottail Shiner, Striped Shiner, Swallowtail Shiner, Tiger Trout, White Sucker.

4.2.16. Percent Insectivores (NUMIS, P_IS, SC_P_IS)

The number of individuals classified as insectivores (NUMIS) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of insectivores in the sample (P_IS) and generate a corresponding metric score (SC_P_IS).

Maryland's insectivorous fishes (TROPHIC = "IS"): Banded Darter, Blue Ridge Sculpin, Checkered Sculpin, Fantail Darter, Glassy Darter, Greenside Darter, Ironcolor Shiner, Mottled Sculpin, Potomac Sculpin, Rainbow Darter, Shield Darter.

4.2.17. Percent Brook Trout (NUMBROOK, PBROOK, SC_PBROOK)

The number of individual Brook Trout in the sample (NUMBROOK) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percent Brook Trout in the sample (PBROOK) and generate a corresponding metric score (SC_PBROOK).

4.2.18. Percent Sculpins (NUMSCULP, PSCULP, SC_PSCULP)

Total number of individuals identified as Sculpins (family Cottidae; TYPE = "SCULPIN"; NUMSCULP) is divided by the total number of sampled fish (TOTCNT) and multiplied by 100 to produce the percentage of Sculpins in the sample (PSCULP) and generate a corresponding metric score (SC_PSCULP).

4.2.19. FIBI_05

Final calculated Fish Index of Biotic Integrity score. FIBI values range from 1 to 5. Scores were rounded to 14 significant digits. Sites where no fish were observed were assigned FIBI scores of 1.00. Site scores < 3.00 are considered "Poor," 3.00-4.00 are considered "Fair," and scores > 4.00 are considered "Good." See Southerland et al. 2005 for a more detailed explanation of IBI development.

4.2.20. Anomalies

This field is marked "Y" if anomalies were observed on any fish corresponding to the given record. Further details should be provided in the Comments section.

5. Questionnaire

To better understand the sampling data collected by MS4 jurisdictions, an online questionnaire was distributed in 2021. This section of the database archives the questions and answers resulting from this effort. The Questionnaire_StandardAnswers table (Database Table 5.1) has the questions that were asked, ordered numerically, along with standard MBSS-consistent answers to each question. The Questionnaire_MS4Answers table has the answers that were submitted by each of the MS4 jurisdictions, corresponding to the numerical ordering of questions, along with a short narrative detailing comparability with standard MBSS protocols. Finally, the Questionnaire_RespondentInfo table (Database Table 5.3) lists information about questionnaire respondents.

5.1. Questionnaire_StandardAnswers

An online questionnaire was distributed in 2021 to better understand the sampling data collected by MS4 jurisdictions. This table lists answers to the questionnaire that are consistent with MBSS protocols. This table requires no additional input.

Field Name	Data Type	Definition
QUESTIONNUM 🔑	Integer	Question number corresponding to the stated question
SUBSECTION	Short Text	Subsection of the questionnaire
QUESTION	Long Text	Question posed to each jurisdiction
MBSS_ANSWER	Long Text	MBSS-consistent answers to each question

5.1.1. QUESTIONNUM
The question number corresponding to the stated question.

5.1.2. SUBSECTION
The subsection of the questionnaire corresponding to each question.

5.1.3. QUESTION
The question that was posed to each jurisdiction as part of the standard questionnaire distributed in 2021.

5.1.4. MBSS_ANSWER
The MBSS-consistent answers to each of the questions on the questionnaire.

5.2. Questionnaire_MS4Answers

This table details the responses to that questionnaire. Questions are numbered, and each question is specified in the Questionnaire_StandardAnswers table. This table is populated with responses to that questionnaire and requires no additional input. If an additional questionnaire is distributed, this table can accommodate the responses.

Field Name	Data Type	Definition
JURISDICTION 🔑	Short Text	MS4 jurisdiction that responded to the questionnaire
RESPONSEYR 🔑	Integer	Response year
QUESTIONNUM 🔑	Integer	Question number, corresponding to the Questionnaire_StandardAnswers table
ANSWER	Long Text	MS4 Jurisdiction's answer to the indicated question
MBSSCOMPARABLE	Long Text	Comparability with standard MBSS protocols

5.2.1. JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

5.2.2. RESPONSEYR

The year that questionnaire response was given.

5.2.3. QUESTIONNUM

The question number, as specified in the Questionnaire_StandardAnswers table.

5.2.4. ANSWER

MS4 Jurisdiction's answer to the indicated question.

5.2.5. MBSSCOMPARABLE

A short narrative detailing the comparability of methods reported by the jurisdiction with standard MBSS protocols.

5.3.   Questionnaire_RespondentInfo

This table stores information about the respondents to the online questionnaire that was distributed in 2021. This table is populated with responses to that questionnaire and requires no additional input. If an additional questionnaire is distributed, this table can accommodate the responses.

Field Name	Data Type	Definition
JURISDICTION 🔑	Short Text	MS4 jurisdiction that responded to the questionnaire
RESPONSEYR 🔑	Integer	Response year
RESPONSEDATE	Date	Response date
AGENCY	Short Text	MS4 Jurisdiction agency that responded to the questionnaire
RESPONDENT_NAME	Short Text	Name of respondent
RESPONDENT_EMAIL	Short Text	Email address of respondent

5.3.1.   JURISDICTION

A two-letter abbreviation that references the MS4 jurisdiction that reported the corresponding data.

5.3.2.   RESPONSEYR

The year that the questionnaire response was given.

5.3.3.   RESPONSEDATE

The date that the questionnaire response was given.

5.3.4.   AGENCY

Name of the MS4 Jurisdiction agency that responded to the questionnaire.

5.3.5.   RESPONDENT_NAME

Name of the individual who responded to the questionnaire.

5.3.6.   RESPONDENT_EMAIL

Email address of the individual who responded to the questionnaire.

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