

USFWS Mussel Reporting Form

Instructions for Electronic Submittal of Freshwater Mussel Survey Data for U.S. Fish and Wildlife Service

Spreadsheet Version 1.17

In an effort to reduce redundancy, increase efficiency, and minimize data entry errors, the U.S. Fish and Wildlife Service (Service) and its Service Field Offices in Region 3 (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) have collaborated to create a single standardized spreadsheet¹ for electronic submittal of freshwater mussel survey data by federal permittees to the Service. Permit terms and conditions require submission of data in the format provided by Service Field Offices (i.e., information identified in the standardized reporting spreadsheet). In addition to a traditional narrative report, permittees receiving Region 3 issued permits are required to report their survey data using the “standard” format provided in the standardized permit reporting spreadsheet (i.e., providing the standardized spreadsheet information) to fulfill the annual reporting requirements of a section 10(a)(1)(A) Recovery Permit (Please note: Other Service Field Offices may require the same spreadsheet). Permittees are encouraged to submit their survey data via the standardized reporting spreadsheet not only to facilitate determination of reporting compliance, but also to facilitate improved assemblage of data to determine impacts on the species. If permittees intend to collect additional data that does not fit within the format of this spreadsheet, they should coordinate with the Service Field Office for the study area regarding how to report the additional data. If multiple Federal agencies are contracted and/or subcontracted to conduct mussel surveys as part of a single large project, each permittee is required to separately report mussel data collected under their permit so that the permittee responsible for data collected within a specific survey site can be identified. Due to the decline in unionid mussel populations throughout Region 3, the Service is requesting that data on all unionid species be submitted, regardless of current Federal status.

Instructions:

The spreadsheet is divided into several worksheets (survey and location info, habitat data, method protocol data, mussel community data, and individual mussel data). **It is important to start by filling out the “Survey and Location Info” worksheet for whichever surveys have been completed because the information from these worksheets populates drop-down menus in other worksheets.** Anything colored orange is always a required field, and pink indicates a field that is required if applicable. A light blue color indicates it is data we are requesting if a permittee is willing to provide the information.

Definitions: Includes definitions and explanation of terms used in other tabs. Note that field formatting (color coding) appears at the top.

Survey and Location Information: The “Survey ID” is an automatically generated unique identifier composed of the waterbody name, date, and site ID. The “Survey ID” will be used throughout the entire database to track the correct information. The survey date captures when the survey was conducted. A new row should be entered for each date conducted at a site; surveying on multiple dates should be entered separately since method and mussel species identification may be different. The “Site ID” is a unique identifier of a specific survey site. The Survey Area is the total area represented and captured in that Survey ID; in square meters. To clearly delineate the survey area, latitude and longitude should be entered in degrees (in geographic coordinate system NAD 83) for the most upstream end of survey area and at the most downstream end of survey area. The “Distance Above and Below Access” should be filled out using the number of river miles and direction. The county and county in which the survey was conducted are entered using drop-down menus. Once the spreadsheet is turned into a GIS Service the GPS points will be plotted and the county provided by the surveyor will be compared to the county where the site actually is located. Sites where the two values do not match will be flagged as possible bad GPS points. Surveyors responsible for sites that are flagged will likely be contacted to verify the location of the survey site.

Method Protocol Data: The permittee will be prompted to select “Survey or Release Protocol” from the dropdown menu (River Mussel Survey Protocol; Smith et al 2001; Michigan Mussel; Survey Protocols and Relocation Procedures; West Virginia Survey Protocols; Mussel Sampling Guidelines for Indiana; Minnesota Freshwater Mussel Survey and Relocation Protocol; Mussel Relocation Protocol; Wisconsin Guidelines for Sampling Mussels in Wadeable Streams; Other) to inform what protocols are also being required in addition to federal permit requirements.

The “Survey/ Release Method” has pre-set options to select from in the dropdown box (snorkel, polywog, viewer/bait, shoreline/midden survey, reintroduction, augmentation, relocation, other). The “Survey/ Release Metric” defines the effort with pre-set options in a dropdown box².

Habitat Data: The “Stream Type, Classification or River Group” is a requested data field, not required, where a brief description of the type of river can be included (e.g., small river, large river, small stream, large stream, intermittent, navigable, non-wadeable) or stream classification. The “Habitat” field has pre-selected options in a dropdown box that the permittee can select (pool - deep with slow water; riffle - shallow with fast, turbulent water running over rocks; run - deep with fast water and little or no turbulence; glide - slow moving, non-turbulent flow, too shallow to be a pool, and too slow to be a run; and other types). The “Dominant Substrate and; Second Dominant Substrate” characterize the substrate in the survey area and are defined by the permittee in the requested field “Percent Dominant Substrate”. “Visibility” is the approximate distance the surveyor(s) can see through the water and is captured by dropdown options (Zero - less than 1 ft; Low - 1ft to 3 ft; Medium - greater than 3ft). “Velocity” should be recorded in meters per second as measured on site. “USGS Gauge Location” reports the location of the relevant gauge as reported at <https://waterdata.usgs.gov/nwis/rt>. “USGS Gauge Date” reports the date that the relevant gauge was collected also as reported at <https://waterdata.usgs.gov/nwis/rt>. “Discharge” data is collected from the relevant USGS gauge as reported at <https://waterdata.usgs.gov/nwis/rt> and is captured in cubic feet per second. “Water Height” data is collected from the relevant gauge as reported at <https://waterdata.usgs.gov/nwis/rt> and reports height in feet. If there is a defined mussel bed within the survey site, the “Description of Mussel Bed Boundary” can be freely filled out by the permittee. “Species Richness” is the number of species found in the survey area.

Mussel Community Data: The data in this worksheet is for the collection of information on both federally listed and non-listed mussels at the species level to understand the composition of the mussel community in the survey area. The data in the "Mussel Community Data" tab are straight forward in terms of the information being requested. Due to recent changes in nomenclature and systematic taxonomy for the family Unionidae, please refer to the following reference when filling in the "Genus" and "species" fields: Williams *et al.* 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia: Unionidae) of the United States and Canada. Understanding the age composition of the mussel bed is important, but methods to age mussels are limited. We used American Fisheries Society definitions (see "Definitions" tab) for shell ages (Southwick and Loftus 2018, page 10). An approximate number of live or recently dead individuals is required, while only presence or absence of older shells is required. "Signs of Reproduction" has pre-selected drop down options (i.e., Yes; No; Unknown; NA). Signs of reproduction include gravid females (inflated gills), juvenile mussels present, lure displays, releases of conglomerates and/or glochidia. "Catch Per Unit Effort (CPUE)" is the number of individuals found per hour and the "Density" is the number of individuals per square meter.

Individual Mussel Data: The data in this worksheet is for more detailed information, that is required for live individuals of federally listed species, but can be used to provide detailed information on any individual mussel, if desired. The data in this worksheet is somewhat similar to the data captured in the **Mussel Community Data** worksheet with additional required information such as individual number, tag type etc. The "Specimen Latitude" and "Specimen Longitude" captures the most precise location information for where the species was found (e.g., of the transect, cell, quadrat, etc.). Ages are important to understand the age structure of mussel populations. "Signs of Reproduction" are represented by a drop down of pre-selected options i.e., gravid females; full lure display; partial lure display; releases of conglomerates; releases of glochidia). Sometimes voucher specimens and/or genetic samples are collected. For both the fields "Voucher Disposition Location" and "Genetic Sample Location" the location of the physical specimen and/or sample is requested. The field "Location Number" is the identifying number assigned to a particular quadrat or transect etc. where the individual is found, if applicable.

Name Change Details: Information is provided for mussel species that have had changes in taxonomy / scientific name. This field does not require data entry; it is only provided for reference.

DO NOT move columns or adjust the format of this spreadsheet.

Missing Data: For columns where data was not collected, enter "NA" without quotation marks or leave blank. DO NOT enter "not applicable", or "N/A".

Naming instructions for saving files:

If all of the surveys for a permit number are on one spreadsheet (this can be multiple states), save the file as that permit number (e.g., TE000000).

If all of the surveys have the same permit number but are on several spreadsheets broken up by states, use the permit number then list out the state names (e.g., TE000000_OHIO_INDIANA, TE000000_IOWA).

If there are multiple permit numbers from the same organization/individual's name, use the organization/individual's name and state or states (e.g., Leibii_Inc_OHIO). To avoid confusion, this should include every survey that organization/individual has conducted in that state.

Please coordinate within your organization to ensure that multiple individuals aren't submitting the same data.

For questions about using USFWS spreadsheets contact your local Service Field Office. Software developers seeking technical the USFWS spreadsheets should contact Erik Olson at: Erik_Olson@fws.gov

FWS Form 3-2523 (Rev. 10/2020)
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Last updated 07/24/2020

¹ Prior to data submittal, permittees should ensure they are using the most current version of the permit reporting spreadsheet, which will be available on the Service's R3 Mussel Survey web page (...).

² Please see the Definitions tab or attached Mussel Reporting Definitions document of survey effort terminology.

Mussel Reporting Spreadsheet Definitions

Field formatting (to assist with error checking and completeness)

required

required if applicable

not applicable

potential error

field has validation (underlined)

Survey and Location Information Tab Fields

Field Definitions

Federal Permit Number

federal permit number

Surveyor Name

federal permit holder or person conducting survey (if different from the name that is on the title page of your report).

Report Name or Number

Site ID

unique identifier of a specific survey site; If more than one site is surveyed at a location, the Site ID must be unique for each site.

Waterbody Name

name of waterbody where survey occurred

Survey Date

date a survey is conducted at a site; surveying on multiple dates is allowed

Survey ID

auto-generated unique identifier composed of the Site ID, Primary State, and Primary County

Primary State

primary state where survey occurred

Primary County

primary county where survey occurred

Township

township where survey occurred

Secondary State

secondary state where survey occurred for waterbodies that cross state boundaries

Secondary County

secondary county where survey occurred for waterbodies that cross county boundaries

Latitude Upstream

latitude at most upstream end of survey area; in decimal degrees

Longitude Upstream

longitude at most upstream end of survey area; in decimal degrees

Latitude Downstream

latitude at most downstream end of survey area; in decimal degrees

Longitude Downstream

longitude at most downstream end of survey area; in decimal degrees

Search Area

total area of habitat searched for mussels; in square meters

General Location Information

Any additional site description information

Watershed Drainage Area

in square km

Distance Above or Below Access

river km and direction

Survey Location Comments

free text to add additional information; Additional survey comments

Method Protocol Data Tab Fields

Field Definition or Dropdown Option

Survey ID

auto-generated unique identifier from Survey and Location Information Tab

Activity

(DROP DOWN OPTIONS)

Survey

Removal: Salvage/Rescue

Release: Reintroduction

Release: Augmentation

Release: Relocation

Release: Release_Other

Activity Protocol

(DROP DOWN OPTIONS--individual options depend on act

Ohio River Mussel Survey Protocol

Smith et al 2001

Michigan Mussel Survey Protocols and Relocation Proced

West Virginia Mussel Survey Protocols

Mussel Sampling Guidelines for Indiana

Minnesota Freshwater Mussel Survey and Relocation Prot

Wisconsin Mussel Relocation Protocol

Wisconsin Guidelines for Sampling Mussels in Wadeable S

State of Ohio Mussel Survey Protocols

Michigan Natural Features Inventory Protocol

Pit_Tag_reading_only

Survey protocol - Other

Removal protocol - Other

Release protocol - Other

Activity Equipment

(DROP DOWN OPTIONS--individual options depend on act

SCUBA

SSA

Snorkel

Polywog/Noodling

Viewer/bucket

Brail

Shoreline/midden survey

Survey - other

Removal - other

No special equipment

Release - other

Multiple - ADD IN COMMENTS

<u>Activity Metric</u>	(DROP DOWN OPTIONS--individual options depend on act
	Transect
	Timed/area
	Timed
	Quadrat
	Quadrat - random
	Quadrat - systematic
	Quadrat - other
	Cells
	Reconnaissance
	Uniform distribution
	Random distribution
	Other
<u>Quadrat Size</u>	in square meters
<u>Number of Quadrats</u>	total number of quadrats surveyed
<u>Percentage of Quadrats That Were Excavated</u>	(digging down and removing substrate) - number 0-100; d
<u>Mean Transect Length</u>	mean transect length in meters
<u>Mean Transect Area</u>	mean transect area in square meters
<u>Cell Size</u>	in square meters
<u>Total Search Time</u>	total time spent searching by all surveyors' in person minu
<u>Recon Area</u>	area covered by a reconnaissance survey; in square meter
<u>Method Comments</u>	free text to add additional information

Habitat Data Tab Fields	Field Definition or Dropdown Option
<u>Survey ID</u>	auto-generated unique identifier from Survey and Locatio
<u>Water Temperature</u>	in degrees Celsius
<u>Visibility</u>	(DROP DOWN OPTIONS)

	<p>Zero - < 30 cm Low - 30 cm < X < 1m Moderate - >1 m</p>
Stream Type, Classification or River Group	brief description of the type of river (e.g., small river, large wadeable, non-wadeable) or stream classification
<u>Habitat</u>	<p>(DROP DOWN OPTIONS)</p> <p>Pool Riffle Run Glide Other Multiple habitat types</p>
<u>Dominant Substrate</u>	<p>(DROP DOWN OPTIONS)</p> <p>Bedrock: large solid surface Boulder: >256mm Cobble: 64-256mm Pebble: 4-64mm Granule: 2-4mm Very Coarse Sand Grain: 1-2mm Coarse Sand Grain: .5-1mm Medium Sand Grain: .25-.5mm Fine Sand Grain: .125-.25mm Very Fine Sand Grain: .06-.125mm Silt Clay Woody debris: sticks, leaves, etc. Zebra mussels Other</p>
<u>Percent Dominant Substrate</u>	number 0 to 100
<u>Secondary Substrate</u>	<p>(DROP DOWN OPTIONS)</p> <p>Bedrock: large solid surface Boulder: >256mm Cobble: 65-256mm Coarse gravel: 17-64mm Medium gravel: 9-16mm Fine gravel: 2-8mm Sand: <2mm Silt: <.06mm Clay: solid clay surface</p>

	Woody debris: sticks, leaves, etc.
	Zebra mussels
	Other
<u>Percent Secondary Substrate</u>	number 0 to 100
<u>Dissolved Oxygen</u>	DO in milligrams per liter
<u>pH</u>	number 0-14
<u>Conductivity</u>	in millisiemens per centimeter
<u>Mean Water Depth</u>	measured or approximated average depth of the water in the survey area; in meters
<u>Velocity</u>	in meters per second as measured on site
<u>Most Relevant USGS Gauge Location</u>	location of the relevant gauge as reported at https://waterdata.usgs.gov/nwis/rt
<u>USGS Gauge Date</u>	date that the data from relevant gauge was collected as reported at https://waterdata.usgs.gov/nwis/rt
<u>USGS Gauge Discharge</u>	in cubic feet per second; data from relevant gauge as reported at https://waterdata.usgs.gov/nwis/rt
<u>USGS Gauge Height</u>	height in feet; data from relevant gauge as reported at https://waterdata.usgs.gov/nwis/rt
<u>Description of Mussel Bed Boundary</u>	free text to add description of the mussel bed boundary if
<u>Species Richness</u>	number of species found in the survey area
<u>Overall CPUE</u>	CPUE = Catch per unit effort, the number of individuals for
<u>Overall Density</u>	number of individuals per square meter of all species
<u>Standard Deviation</u>	standard deviation of the Overall Density (see previous ro
<u>Habitat Data Comments</u>	free text to add additional information

Mussel Community Data Tab Fields	Field Definition or Dropdown Option
<u>Survey ID</u>	auto-generated unique identifier from Survey and Locatio
<u>Genus</u>	(DROP DOWN OPTIONS)
<u>Species</u>	(DROP DOWN OPTIONS BASED ON SELECTED GENUS)
<u>Number Live</u>	(DROP DOWN OPTIONS)
	0
	1-5
	6-15
	16-30
	>31
<u>Number Fresh Dead</u>	(DROP DOWN OPTIONS)

	1-5 6-15 16-30 >31
<u>Weathered Dead Present</u>	(DROP DOWN OPTIONS) Present Absent
<u>Subfossil Present</u>	(DROP DOWN OPTIONS) Present Absent
<u>Signs of Reproduction</u>	(DROP DOWN OPTIONS) Yes No Unknown NA
<u>Species Specific CPUE</u> <u>Species Density</u> <u>Species Standard Deviation</u>	CPUE = Catch per unit effort, the number of individuals found mean number of individuals per square meter of identified standard deviation of the Density (see previous row)
Photo Voucher File Name	Name of photo file. Recommended file name convention: "YYYY_MM_DD_GenusInitial_SpeciesName_Surveyor_Site" USFWS via email.
Community Comments	free text to add additional information

Individual Mussel Data Tab Fields	Field Definition or Dropdown Option
<u>Survey ID</u>	auto-generated unique identifier from Survey and Location
<u>Specimen Latitude</u>	most precise location information where the species was found (e.g., of the transect, cell, quadrat, etc.) in decimal degrees in NAD 83 geographic coordinate system
<u>Specimen Longitude</u>	most precise location information where the species was found (e.g., of the transect, cell, quadrat, etc.) in decimal degrees in NAD 83 geographic coordinate system
<u>Specimen Habitat</u>	(DROP DOWN OPTIONS) Pool Riffle Run Glide

	Other
	Not Recorded
<u>Genus</u>	(DROP DOWN OPTIONS)
<u>Species</u>	(DROP DOWN OPTIONS BASED ON SELECTED GENUS)
<u>Length</u>	Measurement in millimeters of the longest anterior to posterior dimension
<u>Height</u>	Measurement in millimeters of longest dorsal to ventral dimension
<u>Width</u>	Measurement in millimeters from valve to valve
<u>Thickness</u>	Measurement in millimeters
<u>Age</u>	In years, as indicated by number of annuli counted or estimated as precisely as practicable.
<u>Method of Aging</u>	(DROP DOWN OPTIONS)
	Actual
	Estimated
	Not Discernible
<u>Sex</u>	(DROP DOWN OPTIONS)
	F
	M
	Unknown
	NA
<u>Sign of Individual Reproduction</u>	(DROP DOWN OPTIONS)
	Gravid female
	Full lure display
	Partial lure display
	Releases of conglutinates
	Releases of glochidia
	Not checked
	No - none of the above
<u>Tag 1 Number</u>	tag identification number
<u>Tag 1 Type</u>	(DROP DOWN OPTIONS)
	PIT
	Dot
	Shellfish
	Etching

	Other
Tag 1 Color	tag color
Tag 1 Placed During Survey	(DROP DOWN OPTIONS)
	Yes
	No
	NA
Tag 2 Number	tag identification number
Tag 2 Type	(DROP DOWN OPTIONS)
	PIT
	Dot
	Shellfish
	Etching
	Other
Tag 2 Color	tag color
Tag 2 Placed During Survey	(DROP DOWN OPTIONS)
	Yes
	No
	NA
Type of Reader	type of tag reader used
Photo or Video File Name	name of photo or video file
Voucher or Disposition Location	physical location where dead specimen will be housed
Genetic Sample Location or Where Analyzed	if a genetics sample was taken or analyzed, physical locati
Location Number	identifying number assigned to a particular quadrat, trans
Individual Comments	free text to add additional information

References:

[Southwick, R.I., and A.J. Loftus, editors. 2018. Investigation and monetary values of fish and freshwater mo](#)

ifferent than permit holder)
urvey is conducted in a day, use some kind of identifier here to differentiate them.
dates should be entered separately since method and mussel species identified may be different
, waterbody name, and date
at border states
that border states
degrees in NAD 83 geographic coordinate system
l degrees in NAD 83 geographic coordinate system
ial degrees in NAD 83 geographic coordinate system
mal degrees in NAD 83 geographic coordinate system
rs
ors names can be added here if applicable

Dropdown Definitions (where applicable)	
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n Information sheet

ivity selection)

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treams

If your survey protocol does not fall within one of these categories please specify in the comments field.

If your removal protocol does not fall within one of these categories please specify in the comments field.

If your release protocol does not fall within one of these categories please specify in the comments field.

ivity selection)

Self contained underwater breathing apparatus

Surface supplied air equipment

surveyors used mask and snorkels; typically this is in relatively shallow water where SCUBA is not needed

Generally means collected by hand. Other regional terms may apply, such as raccooning.

visual search using a device to view mussels from the surface; typically a bucket with a plexiglass bottom

capture device that is dragged along the bottom consisting of a metal or wooden rod fitted with pronged hooks. (See Carlander 1954)

Surveys conducted on land to search for shells stockpiled by animals (e.g. muskrats) in middens or otherwise deposited on the shore.

If your survey equipment does not fall within one of these categories please specify in the comments field.

Mussels were moved from the survey area to another area or brought to a facility (specify details in the comments field).

No equipment was used.

Mussels were released in the survey area to from a different area or facility (specify details in the comments field).

List all equipment used in the comments field.

ivity selection)

surveys conducted by placing lines perpendicular to flow and sub-divided into segments. Along each tr visually search a defined area for mussels and record all data separately for each segment. The entire covered.

area defined and a timed search is conducted. Timed search is limited to a specific area.

qualitative surveys consisting of visually searching throughout a larger survey area for a given period c search is used to determine if mussels are present and to generate species richness curves.

a plot of defined area where the surface is searched and/or the substrate is excavated (substrate is du sorted through for mussels)

randomly chosen quadrats; plots of defined area where the surface is searched and/or the substrate is dug up and removed to be sorted through for mussels)

systematically chosen quadrats; plots of defined area where the surface is searched and/or the substr excavated(substrate is dug up and removed to be sorted through for mussels)

used to divide the affected area into a series of cells in which they would be completely surveyed usin

used to determine presence or absence of unionid mussels within a project area that will require in-st is intended for small wadeable streams not known to contain federally listed species. Beginning at the buffer zone, the stream substrates, stream banks, and gravel bars should be visually searched for shell mussels. All habitat should be searched, but close attention should be focused on heterogenous subst that smaller streams (10-100 square miles) should be searched for at least 60 minutes and 90 minutes (above 100 square miles).

individuals placed uniformly within the survey area (or other defined area)

individuals placed randomly within the survey area

If your survey metric does not fall within one of these categories please specify in the comments field.

efault is 100%

ites

's

Dropdown Definitions (where applicable)

n Information sheet

in degree Celcius, approximate temperature if not directly measured

approximate distance the surveyor(s) can see through the water

river, small stream, large stream, intermittent, navigable,

deep with slow water

shallow with fast, turbulent water running over rocks

deep with fast water and little or no turbulence

slow moving, non-turbulent flow; too shallow to be a pool and too slow to be a run

most common substrate in the survey area based on the Wentw

second most common substrate in the survey area

Were weathered dead mussels found? Indicators: nacre chalky, probably dead more than a few months (from Southwick and Loftus 2018).

Were Subfossil mussels found? Indicators: periostracum missing, shell chalky, probably dead for several decades (from Southwick and Loftus 2018).

Signs of reproduction include gravid females (inflated gills), juvenile mussels present, lure displays, releases of conglutinates and/or glochidia

ind per hour of identified species
d species

æName_Photonumber". Files should be sent separately to

Dropdown Definitions (where applicable)

n Information sheet

if numerous individuals of the same species are located in the same general area, you can use the same lat/long

if numerous individuals of the same species are located in the same general area, you can use the same lat/long

This field is not required

deep with slow water

shallow with fast, turbulent water running over rocks

deep with fast water and little or no turbulence

slow moving, non-turbulent flow; too shallow to be a pool and too slow to be a run

Required for federally listed species

Required for federally listed species

Required for federally listed species

Describes method used to describe mussel age.

Annuli were counted with little error

Annuli were not completely discernible or age was estimated by size.

Age could not be observed or estimated

Required for federally listed species

Female

Male

Unknown

Not Applicable

Required for federally listed species

Passive Integrated Transponder

e.g., dot of superglue or waterproof paint pen on outside of shell

alpha numeric tag

Passive Integrated Transponder

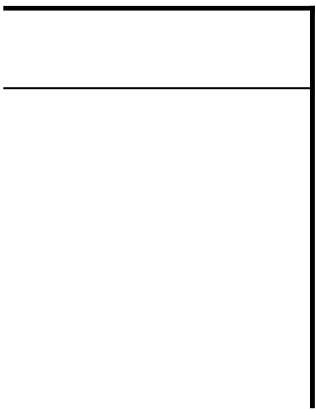
e.g., dot of superglue or waterproof paint pen on outside of shell

alpha numeric tag

on where the specimen will be held

ect, cell, etc. where individual found, if applicable

Illus. [Illus. kills. American Fisheries Society, Special Publication 35, Bethesda, MD, USA.](#)



ransect, surveyors shall
segment must be

of time. This type of

ig up and removed to be

s excavated (substrate is

ate is

g visual tactile methods.

ream work. This method
e downstream end of the
ls, shell fragments, or live
trate. We recommend
; for larger streams

Federal Permit Number	Surveyor Name	Report Name or Number	Site ID

Waterbody Name

Survey Date

Survey ID

Primary State

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<u>Primary County</u>	Township	<u>Secondary State</u>	<u>Secondary County</u>	<u>Latitude Upstream</u>	<u>Longitude Upstream</u>

<u>Latitude Downstream</u>	<u>Longitude Downstream</u>	<u>Search Area</u>	<u>General Location Information</u>	<u>Watershed Drainage Area</u>

Distance Above or Below **Survey Location**
Access **Comments**

Survey ID

Activity

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Activity Protocol

Activity Equipment

Activity Metric



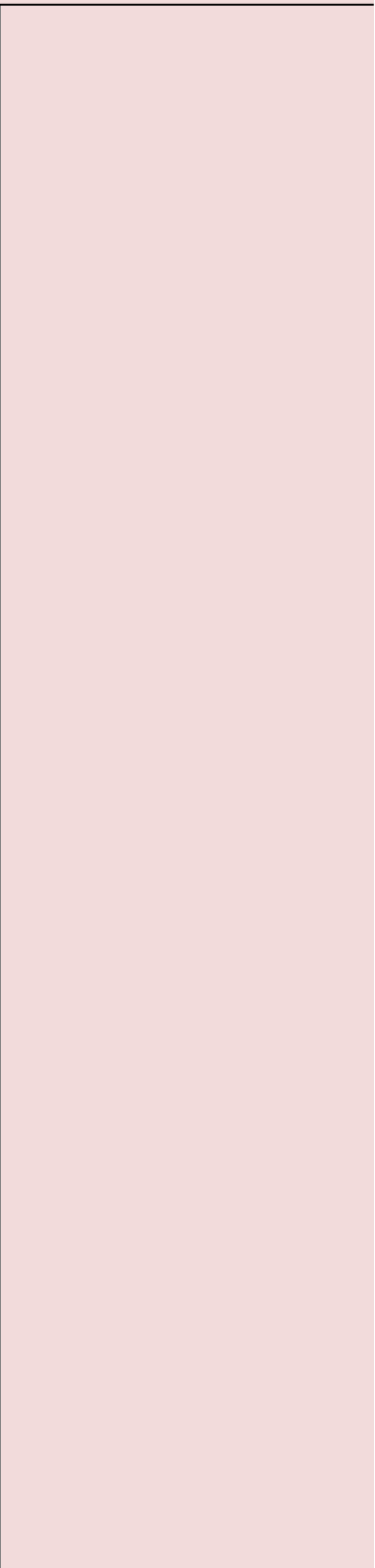
Quadrat Size

Number of
Quadrats

Percentage of Quadrats That
Were Excavated

Mean Transect
Length

Mean
Transect Area





Cell Size

Total Search Time

Recon Area

Method Comments

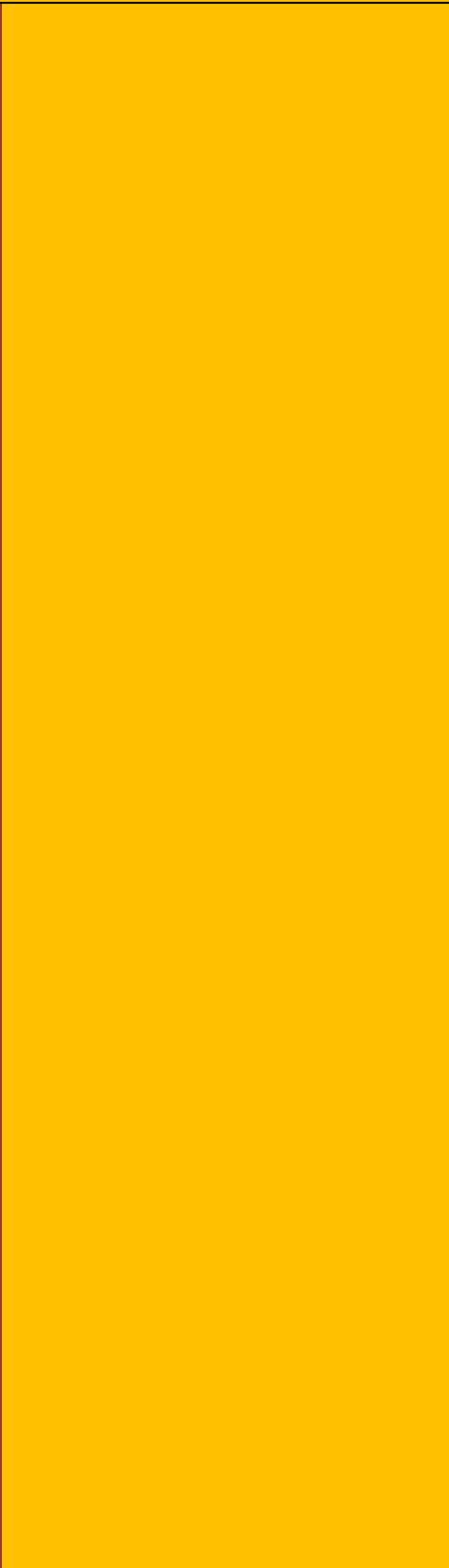
Survey ID

Water
Temperature

Visibility

Stream Type,
Classification or
River Group

Habitat



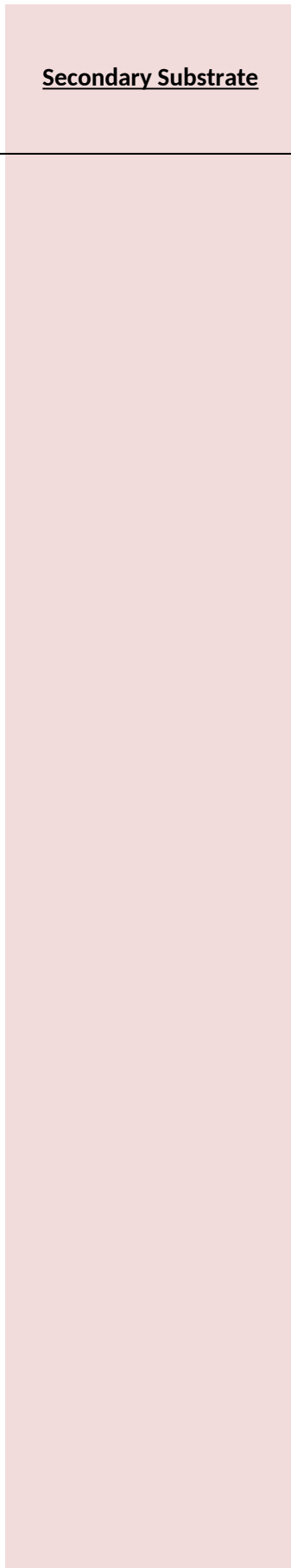
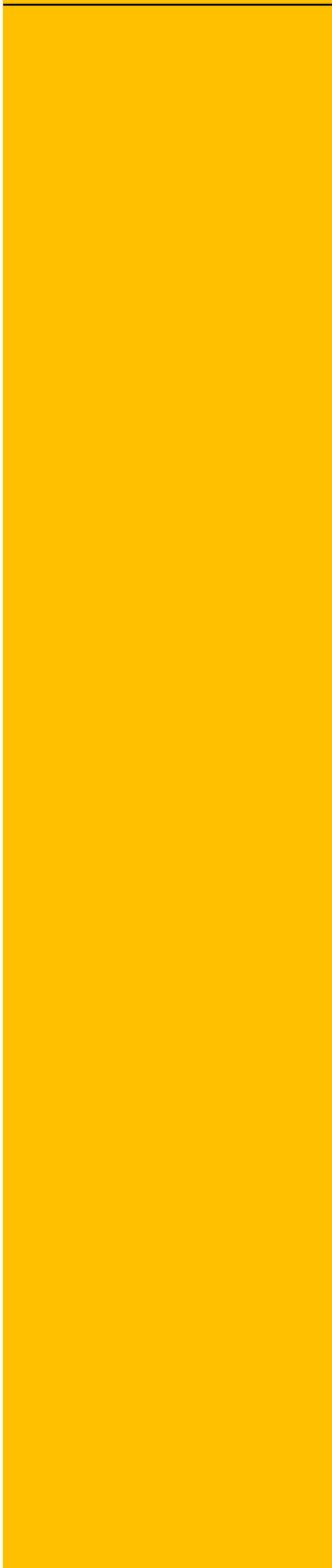


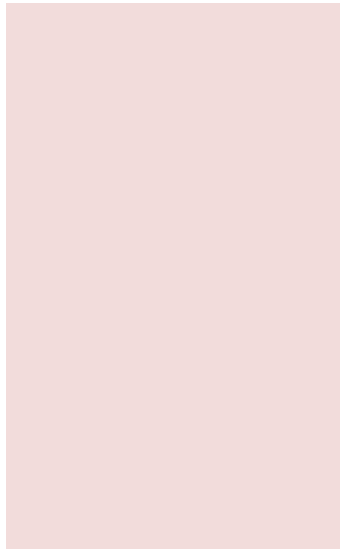
Dominant Substrate

Percent Dominant
Substrate

Secondary Substrate

Percent Secondary
Substrate





Dissolved
Oxygen

pH

Conductivity

Mean Water
Depth

Velocity

Most
Relevant
USGS Gauge
Location

USGS Gauge
Date

USGS Gauge
Discharge

USGS Gauge
Height

Description of Mussel Bed
Boundary

Species
Richness

Overall CPUE

Overall Density

Overall Standard
Deviation

Habitat Data
Comments

Survey ID

Genus

Species



<u>Number Live</u>	<u>Number Fresh Dead</u>	<u>Weathered Dead Present</u>	<u>Subfossil Present</u>	<u>Signs of Reproduction</u>	<u>Species Specific CPUE</u>



Species Density

Species Standard
Deviation

Photo Voucher
File Name

Community
Comments

Survey ID

Specimen
Latitude

Specimen
Longitude

Specimen
Habitat

Genus



Species

Length

Height

Width

Thickness

Age

Method of Aging

Sex

Sign of Individual
Reproduction

Tag 1
Number

Tag 1 Type

Tag 1 Color

Tag 1 placed
during this
survey

Tag 2
Number

Tag 2 Type

Tag 2
Color

Tag 2 placed
during this
survey

Type of Reader

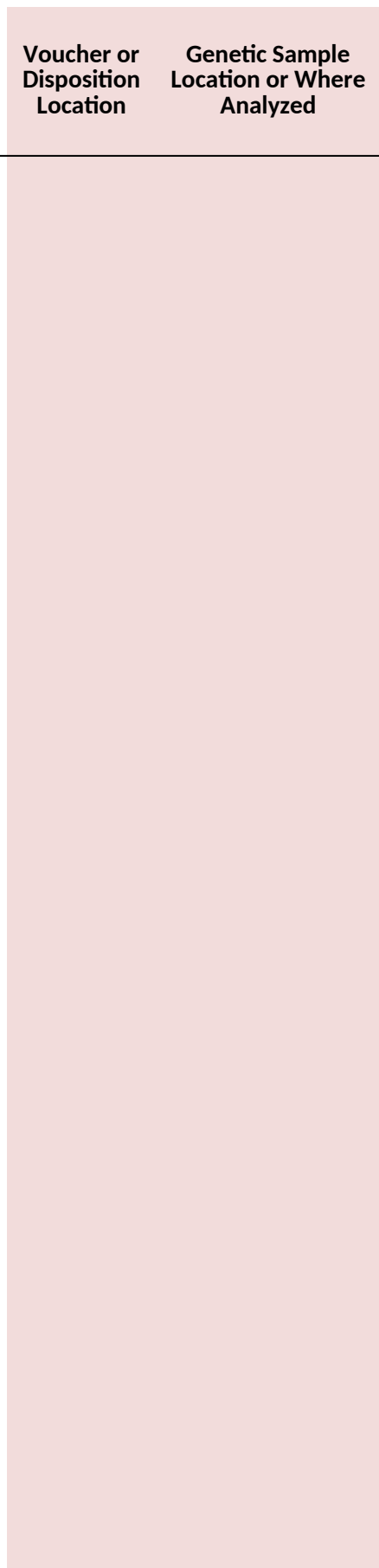
**Photo or Video File
Name**

**Voucher or
Disposition
Location**

**Genetic Sample
Location or Where
Analyzed**

**Location
Number**

**Individual
Comments**



Mussels with name changes are highlighted in pink for quick reference.

Common Name	Current genus	Current Species
Mucket	<i>Actinonaias</i>	<i>ligamentina</i>
Elktoe	<i>Alasmidonta</i>	<i>marginata</i>
Triangle floater	<i>Alasmidonta</i>	<i>undulata</i>
Slippershell mussel	<i>Alasmidonta</i>	<i>viridis</i>
Threeridge	<i>Amblema</i>	<i>plicata</i>
Cylindrical Papershell	<i>Anodontoides</i>	<i>ferussacianus</i>
Rock Pocketbook	<i>Arcidens</i>	<i>confragosus</i>
Asian clam	<i>Corbicula</i>	<i>fluminea</i>
Wartyback	<i>Cyclonaias</i>	<i>nodulata</i>
Wartyback	<i>Cyclonaias</i>	<i>nodulata</i>
Pimpleback	<i>Cyclonaias</i>	<i>pustulosa</i>
Pimpleback	<i>Cyclonaias</i>	<i>pustulosa</i>
Purple Wartyback	<i>Cyclonaias</i>	<i>tuberculata</i>
Western Fanshell	<i>Cyprogenia</i>	<i>aberti</i>
Fanshell	<i>Cyprogenia</i>	<i>stegaria</i>
Quagga mussel	<i>Dreissena</i>	<i>bugensis</i>
Zebra mussel	<i>Dreissena</i>	<i>polymorpha</i>
Butterfly	<i>Ellipsaria</i>	<i>lineolata</i>
Eastern elliptio	<i>Elliptio</i>	<i>complanata</i>
Elephantear	<i>Elliptio</i>	<i>crassidens</i>
Ohio riffleshell	<i>Epioblasma</i>	<i>cincinnatiensis</i>
Curtis pearlymussel	<i>Epioblasma</i>	<i>curtisii</i>
Leafshell	<i>Epioblasma</i>	<i>flexuosa</i>
Catspaw	<i>Epioblasma</i>	<i>obliquata</i>
White catspaw	<i>Epioblasma</i>	<i>perobliqua</i>
Round combshell	<i>Epioblasma</i>	<i>personata</i>
Tennessee riffleshell	<i>Epioblasma</i>	<i>propinqua</i>
Northern riffleshell	<i>Epioblasma</i>	<i>rangiana</i>
Wabash riffleshell	<i>Epioblasma</i>	<i>sampsonii</i>
Tubercled Blossom	<i>Epioblasma</i>	<i>torulosa</i>
Snuffbox	<i>Epioblasma</i>	<i>triquetra</i>
Spike	<i>Eurynia</i>	<i>dilatata</i>
Wabash pigtoe	<i>Fusconaia</i>	<i>flava</i>
Ozark pigtoe	<i>Fusconaia</i>	<i>ozarkensis</i>
Longsolid	<i>Fusconaia</i>	<i>subrotunda</i>
Cracking Pearlymussel	<i>Hemistena</i>	<i>lata</i>
Pink mucket	<i>Lampsilis</i>	<i>abrupta</i>
Northern brokenray	<i>Lampsilis</i>	<i>brittsi</i>
Plain pocketbook	<i>Lampsilis</i>	<i>cardium</i>
Wavyrayed lampmussel	<i>Lampsilis</i>	<i>fasciola</i>

Higgins eye	<i>Lampsilis</i>	<i>higginsii</i>
Lousiana fatmucket	<i>Lampsilis</i>	<i>hydiana</i>
Pocketbook	<i>Lampsilis</i>	<i>ovata</i>
Eastern lampmussel	<i>Lampsilis</i>	<i>radiata</i>
Neosho mucket	<i>Lampsilis</i>	<i>rafinesqueana</i>
Arkansas brokenray	<i>Lampsilis</i>	<i>reeveiana</i>
Fatmucket	<i>Lampsilis</i>	<i>siliquoidea</i>
Yellow sandshell	<i>Lampsilis</i>	<i>teres</i>
Yellow sandshell	<i>Lampsilis</i>	<i>teres</i>
White heelsplitter	<i>Lasmigona</i>	<i>complanata</i>
Creek heelsplitter	<i>Lasmigona</i>	<i>compressa</i>
Fluted shell	<i>Lasmigona</i>	<i>costata</i>
Fragile papershell	<i>Leptodea</i>	<i>fragilis</i>
Scaleshell	<i>Leptodea</i>	<i>leptodon</i>
Eastern pondmussel	<i>Ligumia</i>	<i>nasuta</i>
Black sandshell	<i>Ligumia</i>	<i>recta</i>
Pondmussel	<i>Ligumia</i>	<i>subrostrata</i>
Spectaclecase	<i>Cumberlandia</i>	<i>monodonta</i>
Washboard	<i>Megalonaias</i>	<i>nervosa</i>
Lake fingernailclam	<i>Musculium</i>	<i>lacustre</i>
	<i>Musculium</i>	<i>partumenium</i>
Pond fingernailclam	<i>Musculium</i>	<i>securis</i>
Long fingernailclam	<i>Musculium</i>	<i>transversum</i>
Threehorn wartyback	<i>Obliquaria</i>	<i>reflexa</i>
Southern hickorynut	<i>Obovaria</i>	<i>arkansasensis</i>
Hickorynut	<i>Obovaria</i>	<i>olivaria</i>
Ring pink	<i>Obovaria</i>	<i>retusa</i>
Round hickorynut	<i>Obovaria</i>	<i>subrotunda</i>
Adam peaclam	<i>Pisidium</i>	<i>adamsi</i>
Ubiquitous peaclam	<i>Pisidium</i>	<i>casertanum</i>
Ridgedbeak peaclam	<i>Pisidium</i>	<i>compressum</i>
Alpine peaclam	<i>Pisidium</i>	<i>conventus</i>
Ornamented peaclam	<i>Pisidium</i>	<i>cruciatum</i>
Greater Eastern peaclam	<i>Pisidium</i>	<i>dubium</i>
Round peaclam	<i>Pisidium</i>	<i>equilaterale</i>
River peaclam	<i>Pisidium</i>	<i>fallax</i>
Rusty peaclam	<i>Pisidium</i>	<i>ferrugineum</i>
Great Northern peaclam	<i>Pisidium</i>	<i>idahoense</i>
Lilljeborg peaclam	<i>Pisidium</i>	<i>lilljeborgi</i>
Shiny peaclam	<i>Pisidium</i>	<i>nitidum</i>
Perforated peaclam	<i>Pisidium</i>	<i>punctatum</i>
Striate peaclam	<i>Pisidium</i>	<i>punctiferum</i>

Fat peaclam	<i>Pisidium</i>	<i>rotundatum</i>
Triangular peaclam	<i>Pisidium</i>	<i>variabile</i>
Walker peaclam	<i>Pisidium</i>	<i>walkeri</i>
Bankclimber	<i>Plectomerus</i>	<i>dombeyanus</i>
White wartyback	<i>Plethobasus</i>	<i>cicatricosus</i>
Orangefoot pimpleback	<i>Plethobasus</i>	<i>cooperianus</i>
Sheepnose	<i>Plethobasus</i>	<i>cyphus</i>
Clubshell	<i>Pleurobema</i>	<i>clava</i>
Round pigtoe	<i>Pleurobema</i>	<i>coccineum</i>
Ohio pigtoe	<i>Pleurobema</i>	<i>cordatum</i>
Rough pigtoe	<i>Pleurobema</i>	<i>plenum</i>
Pyramid pigtoe	<i>Pleurobema</i>	<i>rubrum</i>
Round pigtoe	<i>Pleurobema</i>	<i>sintoxia</i>
Pink heelsplitter	<i>Potamilus</i>	<i>alatus</i>
Fat pocketbook	<i>Potamilus</i>	<i>capax</i>
Pink papershell	<i>Potamilus</i>	<i>ohiensis</i>
Bleufer	<i>Potamilus</i>	<i>purpuratus</i>
Kidneyshell	<i>Ptychobranhus</i>	<i>fasciolaris</i>
Ouachita Kidneyshell	<i>Ptychobranhus</i>	<i>occidentalis</i>
Eastern floater	<i>Pyganodon</i>	<i>cataracta</i>
Giant floater	<i>Pyganodon</i>	<i>grandis</i>
Lake floater	<i>Pyganodon</i>	<i>lacustris</i>
Round lake floater	<i>Pyganodon</i>	<i>subgibbosa</i>
Winged mapleleaf	<i>Quadrula</i>	<i>fragosa</i>
Gulf mapleleaf	<i>Quadrula</i>	<i>nobilis</i>
Mapleleaf	<i>Quadrula</i>	<i>quadrula</i>
Ebonysell	<i>Reginaia</i>	<i>ebenus</i>
Salamander mussel	<i>Simpsonaias</i>	<i>ambigua</i>
River fingernailclam	<i>Sphaerium</i>	<i>fabale</i>
fingernailclam	<i>Sphaerium</i>	<i>occidentale</i>
fingernailclam	<i>Sphaerium</i>	<i>rhomboideum</i>
Grooved fingernailclam	<i>Sphaerium</i>	<i>simile</i>
Striated fingernailclam	<i>Sphaerium</i>	<i>striatinum</i>
Creeper	<i>Strophitus</i>	<i>undulatus</i>
Rabbitsfoot	<i>Theliderma</i>	<i>cylindrica</i>
Monkeyface	<i>Theliderma</i>	<i>metanevra</i>
Purple lilliput	<i>Toxolasma</i>	<i>lividum</i>
Lilliput	<i>Toxolasma</i>	<i>parvum</i>
Texas lilliput	<i>Toxolasma</i>	<i>texasiense</i>
Pistolgrip	<i>Tritogonia</i>	<i>verrucosa</i>
Fawnsfoot	<i>Truncilla</i>	<i>donaciformis</i>
Deertoe	<i>Truncilla</i>	<i>truncata</i>

Pondhorn	<i>Uniomerus</i>	<i>tetralasmus</i>
Paper pondshell	<i>Utterbackia</i>	<i>imbecillis</i>
Flat floater	<i>Utterbackiana</i>	<i>suborbiculata</i>
Ellipse	<i>Venustaconcha</i>	<i>ellipsiformis</i>
Bleedingtooth mussel	<i>Venustaconcha</i>	<i>pleasii</i>
Rayed bean	<i>Villosa</i>	<i>fabalis</i>
Rainbow	<i>Villosa</i>	<i>iris</i>
Little spectaclecase	<i>Villosa</i>	<i>lienosa</i>

Names in Green were Unionids not found in Williams et al 2017.		
Current Full Name	Old genus	Old Species
<i>Actinonaias ligamentina</i> (Lamarck, 1819)		
<i>Alasmidonta marginata</i> Say, 1818		
<i>Alasmidonta undulata</i> (Say, 1817)		
<i>Alasmidonta viridis</i> (Rafinesque, 1820)		
<i>Amblema plicata</i> (Say, 1817)		
<i>Anodontoides ferussacianus</i> (Lea, 1834)		
<i>Arcidens confragosus</i> (Say, 1829)		
<i>Cyclonaias nodulata</i>	<i>Quadrula</i> (previously <i>nodulata</i>	
<i>Cyclonaias nodulata</i>	<i>Quadrula</i>	<i>nodulata</i>
<i>Cyclonaias pustulosa</i>	<i>Quadrula</i> (previously <i>pustulosa</i>	
<i>Cyclonaias pustulosa</i> (Lea, 1831)	<i>Quadrula</i>	<i>pustulosa pustulosa</i>
<i>Cyclonaias tuberculata</i> (Rafinesque, 1820)		
<i>Cyprogenia aberti</i> (Conrad, 1850)		
<i>Cyprogenia stegaria</i> (Rafinesque, 1820)		
<i>Ellipsaria lineolata</i> (Rafinesque, 1820)		
<i>Elliptio complanata</i> (Lightfoot, 1786)		
<i>Elliptio crassidens</i> (Lamarck, 1819)		
<i>Epioblasma cincinnatiensis</i>	<i>Epioblasma</i>	<i>phillipsii</i>
<i>Epioblasma curtisii</i>	<i>Epioblasma</i>	<i>florentina curtisii</i>
<i>Epioblasma flexuosa</i> (Rafinesque, 1820)		
<i>Epioblasma obliquata</i>	<i>Epioblasma</i>	<i>obliquata obliquata</i>
<i>Epioblasma perobliqua</i>	<i>Epioblasma</i>	<i>obliquata perobliqua</i>
<i>Epioblasma personata</i> (Say, 1829)		
<i>Epioblasma propinqua</i> (Lea, 1857)		
<i>Epioblasma rangiana</i> (Lea, 1838)	<i>Epioblasma</i>	<i>torulosa rangiana</i>
<i>Epioblasma sampsonii</i> (Lea, 1861)		
<i>Epioblasma torulosa</i> (Rafinesque, 1820)	<i>Epioblasma</i>	<i>torulosa torulosa</i>
<i>Epioblasma triquetra</i> (Rafinesque, 1820)		
<i>Euryntia dilatata</i>	<i>Elliptio</i>	<i>dilatata</i>
<i>Fusconaia flava</i> (Rafinesque, 1820)		
<i>Fusconaia ozarkensis</i> (Call, 1887)		
<i>Fusconaia subrotunda</i> (Lea, 1831)		
<i>Hemistena lata</i> (Rafinesque, 1820)		
<i>Lampsilis abrupta</i> (Say, 1831)		
<i>Lampsilis brittsi</i> (Simpson, 1900)		
<i>Lampsilis cardium</i> (Rafinesque, 1820)		
<i>Lampsilis fasciola</i> (Rafinesque, 1820)		

<i>Lampsilis higginsii</i> (Lea, 1857)		
<i>Lampsilis hydiana</i> (Lea, 1838)		
<i>Lampsilis ovata</i> (Say, 1817)		
<i>Lampsilis radiata</i> (Gmelin, 1791)		
<i>Lampsilis rafinesqueana</i> (Frierson, 1927)		
<i>Lampsilis reeveiana</i> (Lea, 1852)		
<i>Lampsilis siliquoidea</i> (Barnes, 1823)		
<i>Lampsilis teres</i> (Parmalee and Brogan, 1998)	<i>Lampsilis</i>	<i>teres anodontoides</i>
<i>Lampsilis teres</i> (Parmalee and Brogan, 1998)	<i>Lampsilis</i>	<i>teres teres</i>
<i>Lasmigona complanata</i> (Barnes, 1823)		
<i>Lasmigona compressa</i> (Lea, 1829)		
<i>Lasmigona costata</i> (Rafinesque, 1820)		
<i>Leptodea fragilis</i> (Rafinesque, 1820)		
<i>Leptodea leptodon</i> (Rafinesque, 1820)		
<i>Ligumia nasuta</i> (Say, 1817)		
<i>Ligumia recta</i> (Lamarck, 1819)		
<i>Ligumia subrostrata</i> (Say, 1831)		
<i>Cumberlandia monodonta</i> (Say, 1829)		
<i>Megalonaias nervosa</i> (Rafinesque, 1820)		
<i>Musculium lacustre</i> (Müller, 1774)		
<i>Musculium partumenium</i>		
<i>Musculium securis</i> (Prime, 1852)		
<i>Musculium transversum</i> (Say, 1829)		
<i>Obliquaria reflexa</i> (Rafinesque, 1820)		
<i>Obovaria arkansasensis</i> (Lea, 1862)	<i>Obovaria</i>	<i>jacksoniana</i>
<i>Obovaria olivaria</i> (Rafinesque, 1820)		
<i>Obovaria retusa</i> (Lamarck, 1819)		
<i>Obovaria subrotunda</i> (Rafinesque, 1820)		
<i>Pisidium adamsi</i> (Stimpson, 1851)		
<i>Pisidium casertanum</i> (Poli, 1791)		
<i>Pisidium compressum</i> (Prime, 1852)		
<i>Pisidium conventus</i> (Clessin, 1877)		
<i>Pisidium cruciatum</i> (Sterki, 1895)		
<i>Pisidium dubium</i> (Say, 1817)		
<i>Pisidium equilaterale</i> (Prime, 1852)		
<i>Pisidium fallax</i> (Sterki, 1896)		
<i>Pisidium ferrugineum</i> (Prime, 1852)		
<i>Pisidium idahoense</i> (Roper, 1890)		
<i>Pisidium lilljeborgi</i> (Clessin, 1886)		
<i>Pisidium nitidum</i> (Jenyns, 1832)		
split into <i>P. moitessierianum</i> (Paladilhe, 1866) and <i>P. simplex</i> (Sterki, 1905)		
<i>Pisidium punctiferum</i> (Guppy, 1867)		

<i>Pisidium rotundatum</i> (Prime, 1852)		
<i>Pisidium variabile</i> (Prime, 1852)		
<i>Pisidium walkeri</i> (Sterki, 1895)		
<i>Plectomerus dombeyanus</i> (Valenciennes, 1827)		
<i>Plethobasus cicatricosus</i> (Say, 1829)		
<i>Plethobasus cooperianus</i> (Lea, 1834)		
<i>Plethobasus cyphyus</i> (Rafinesque, 1820)		
<i>Pleurobema clava</i> (Lamarck, 1819)		
<i>Pleurobema coccineum</i> (Conrad, 1836)		
<i>Pleurobema cordatum</i> (Rafinesque, 1820)		
<i>Pleurobema plenum</i> (Lea, 1840)		
<i>Pleurobema rubrum</i> (Rafinesque, 1820)		
<i>Pleurobema sintoxia</i> (Rafinesque, 1820)		
<i>Potamilus alatus</i> (Say, 1817)		
<i>Potamilus capax</i> (Green, 1832)		
<i>Potamilus ohiensis</i> (Rafinesque, 1820)		
<i>Potamilus purpuratus</i> (Lamarck, 1819)		
<i>Ptychobranthus fasciolaris</i> (Rafinesque, 1820)		
<i>Ptychobranthus occidentalis</i> (Conrad, 1836)		
<i>Pyganodon cataracta</i> (Say, 1817)		
<i>Pyganodon grandis</i> (Say, 1829)		
<i>Pyganodon lacustris</i> (Lea, 1857)		
<i>Pyganodon subgibbosa</i>		
<i>Quadrula fragosa</i> (Conrad, 1835)		
<i>Quadrula nobilis</i>		
<i>Quadrula quadrula</i> (Rafinesque, 1820)		
<i>Reginaia ebenus</i>	<i>Fusconaia</i>	<i>ebena</i>
<i>Simpsonaias ambigua</i> (Say, 1825)		
<i>Sphaerium fabale</i> (Prime, 1852)		
<i>Sphaerium occidentale</i> (Lewis, 1856)		
<i>Sphaerium rhomboideum</i> (Say, 1822)		
<i>Sphaerium simile</i> (Say, 1817)		
<i>Sphaerium striatinum</i> (Lamarck, 1818)		
<i>Strophitus undulatus</i> (Say, 1817)		
<i>Theliderma cylindrica</i>	<i>Quadrula</i>	<i>cylindrica cylindrica</i>
<i>Theliderma metanevra</i>	<i>Quadrula</i>	<i>metanevra</i>
<i>Toxolasma lividum</i>	<i>Toxolasma</i>	<i>lividus</i>
<i>Toxolasma parvus</i>	<i>Toxolasma</i>	<i>parvus</i>
<i>Toxolasma texasiense</i>	<i>Toxolasma</i>	<i>texasiensis</i>
<i>Tritogonia verrucosa</i> (Rafinesque, 1820)		
<i>Truncilla donaciformis</i> (Lea, 1828)		
<i>Truncilla truncata</i> (Rafinesque, 1820)		

<i>Uniomerus tetralasmus</i> (Say, 1831)		
<i>Utterbackia imbecillis</i> (Say, 1829)		
<i>Utterbackiana suborbiculata</i>	<i>Anodonta</i>	<i>suborbiculata</i>
<i>Venustaconcha ellipsiformis</i> (Conrad, 1836)		
<i>Venustaconcha pleasii</i> (Marsh, 1891)		
<i>Villosa fabalis</i> (Lea, 1831)		
<i>Villosa iris</i> (Lea, 1829)		
<i>Villosa lienosa</i> (Conrad, 1834)		

<i>Anodonta suborbiculata</i> (Say, 1831)	Williams et al. 2017

		Yes
		Yes
publication date corrected		
		Yes
Elevated from synonymy		
Reassigned to Reginaia, spelling correction of species name		
Reassigned from Quadrula		Yes
Reassigned to Theliderma		
Incorrect spelling of species name; parenthesis not needed		
Incorrect spelling of species name		
Incorrect spelling of species name		

Reassigned to Utterbackiana		
		Yes

