USFWS Mussel Reporting Form

Instructions for Electronic Submittal of Freshwater Mussel Survey Data for U.S. Fish a

Spreadsheet Version 1.17

In an effort to reduce redundancy, increase efficiency, and minimize data entry errors, the U.S. Fish and Wildlife Service (Servi
Services Field Offices in Region 3 (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) have collaborat
single standardized spreadsheet[1] for electronic submittal of freshwater mussel survey data by federal permittees to the Servic
permit terms and conditions require submission of data in the format provided by Service Field Offices (i.e., information ident
standardized reporting spreadsheet). In addition to a traditional narrative report, permittees receiving Region 3 issued permit
to report their survey data using the "standard" format provided in the standardized permit reporting spreadsheet (i.e., provis
spreadsheet information) to fulfill the annual reporting requirements of a section 10(a)(1)(A) Recovery Permit (Please note: O
and/or Field Offices may require the same spreadsheet). Permittees are encouraged to submit their survey data via the standa
reporting spreadsheet not only to facilitate determination of reporting compliance, but also to facilitate improved assemblage
determine impacts on the species. If permittees intend to collect additional data that does not fit within the format of this spr
should coordinate with the Service Field Office for the study area regarding how to report the additional data. If multiple Fede
contracted and/or subcontracted to conduct mussel surveys as part of a single large project, each permittee is required to sep
mussel data collected under their permit so that the permittee responsible for data collected within a specific survey site can
identified. Due to the decline in unionid mussel populations throughout Region 3, the Service is requesting that data on all uni
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, m
community data, and individual mussel data). **It is important to start by filling out the "Survey and Location Info" w
for whichever surveys have been completed because the information from these worksheets populates drop-dow
other worksheets.** Anything colored orange is always a required field, and pink indicates a field that is required if ap
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 codin
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 correc information. The survey date captures when the survey was conducted. A new row should be entered for each dat conducted at a site; surveying on multiple dates should be entered separately since method and mussel species ide different. The "Site Id" is a unique identifier of a specific survey site. The Survey Area is the total area represented captured in that Survey ID; in square meters. To clearly delineate the survey area, latitude and longitude should be degrees (in geographic coordinate system NAD 83) for the most upstream end of survey area and at the most down survey area. The "Distance Above and Below Access" should be filled out using the number of river miles and direc and county in which the survey was conducted are entered using drop-down menus. Once the spreadsheet is turne Service the GPS points will be plotted and the county provided by the surveyor will be compared to the county whe actually is located. Sites where the two values do not match will be flagged as possible bad GPS points. Surveyors re 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 River Mussel Survey Protocol; Smith et al 2001; Michigan Mussel; Survey Protocols and Relocation Procedures; Wes Survey Protocols; Mussel Sampling Guidelines for Indiana; Minnesota Freshwater Mussel Survey and Relocation Pro Mussel Relocation Protocol; Wisconsin Guidelines for Sampling Mussels in Wadeable Streams; Other) to inform wha 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/b shoreline/midden survey, reintroduction, augmentation, relocation, other). The "Survey/ Release Metric" defines l effort with pre-set options in a dropdown box[2].

Habitat Data: The "Stream Type, Classification or River Group" is a requested data field, not required, where a brie the type of river can be included (e.g., e.g., small river, large river, small stream, large stream, intermittent, navigab non-wadeable) or stream classification. The "Habitat" field has pre-selected options in a dropdown box that the pe select (pool - deep with slow water; riffle - shallow with fast, turbulent water running over rocks; run - deep with fas little or no turbulence; glide - slow moving, non-turbulent flow, too shallow to be a pool, and too slow to be a run; r types). The "Dominant Substrate and; Second Dominate Substrate" characterize the substrate in the survey area ar defined by the permittee in the requested field "Percent Dominant Substrate". "Visibility" is the approximate dista surveyor(s) can see through the water and is captured by dropdown options (Zero - less than 1 ft; Low - 1ft to 3 ft; M greater than 3ft). "Velocity" should be recorded in meters per second as measured on site. "USGS Gauge Location" of the relevant gauge as reported at https://waterdata.usgs.gov/nwis/rt. "USGS Gauge Date" reports the date that relevant gauge was collected also as reported at https://waterdata.usgs.gov/nwis/rt. "Discharge" data is collected relevant USGS gauge as reported at https://waterdata.usgs.gov/nwis/rt and is captured in cubic feet per second. " Height" data is collected from the relevant gauge as reported at https://waterdata.usgs.gov/nwis/rt and reports he there is a defined mussel bed within the survey site, the "Description of Mussel Bed Boundary" can be freely filled c 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 an
listed mussels at the species level to understand the composition of the mussel community in the survey area. The
in the “Mussel Community Data” tab are straight forward in terms of the information being requested. Due to rece
nomenclature and systematic taxonomy for the family Unionidae, please refer to the following reference when fillin
“Genus” and "species" fields: Williams *et al*. 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia: Unio
United States and Canada. Understanding the age composition of the mussel bed is important, but methods to age
We used American Fisheries Society defintions (see "Definitions" tab) for shell ages (Southwick and Loftus 2018, pag
approximate number of live or recently dead individuals is required, while only presence or absence of older shells
“Signs of Reproduction” has pre-selected drop down options (i.e., Yes; No; Unknown; NA). Signs of reproduction in
females (inflated gills), juvenile mussels present, lure displays, releases of conglutinates and/or glochidia. “Catch Pe
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 indivi
listed species, but can be used to provide detailed information on any individual mussel, if desired. The data in this
somewhat similar to the data captured in the ***Mussel Community Data*** worksheet with additional required informa
number, tag type etc. The “Specimen Latitude” and “Specimen Longitude” captures the most precise location infor
the species was found (e.g., of the transect, cell, quadrat, etc.). Ages are imporant to understand the age structure
populations. “Signs of Reproduction” are represented by a drop down of pre-selected options i.e., gravid females; f
partial lure display; releases of conglutinates; releases of glochidia). Sometimes voucher specimens and/or genetic
collected. For both the fields “Voucher Disposition Location” and “Genetic Sample Location” the location of the phy
and/or sample is requested. The field “Location Number” is the identifying number assigned to a particular quadrat
etc. where the individual is found, if applicable.

Name Change Details: Information is provided for mussel species that have had changes in taxonomy / scientific na
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 "
applicable", or "N/A".

Naming instructions for saving files:

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

If all of the surveys have the same permit number but are on several spreadsheets broken up by states, use the per
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/individua
state or states (e.g., Leibii_Inc_OHIO). To avoid confusion, this should include every survey that organization/individ
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)
OMB Control No. 1018-0094
Expires ##/##/20##

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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 diffe
Report Name or Number	the name that is on the title page of your report.
Site ID	unique identifier of a specific survey site; If more than one
Waterbody Name	name of waterbody where survey occurred
Survey Date	date a survey is conducted at a site; surveying on multiple
Survey ID	auto-generated unique identifier composed of the Site ID,
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 th
Secondary County	secondary county where survey occurred for waterbodies
Latitude Upstream	latitude at most upstream end of survey area; in decimal d
Longitude Upstream	longitude at most upstream end of survey area; in decima
Latitude Downstream	latitude at most downstream end of survey area; in decim
Longitude Downstream	longitude at most downstream end of survey area; in deci
Search Area	total area of habitat searched for mussels; in square mete
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 surveyd

Method Protocol Data Tab Fields	Field Definition or Dropdown Option
Survey ID	auto-generated unique identifier from Survey and Locatio
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 Procedu
	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

Activity Metric	(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
Quadrat Size	in square meters
Number of Quadrats	total number of quadrats surveyed
Percentage of Quadrats That Were Excavated	(digging down and removing substrate) - number 0-100; d
Mean Transect Length	mean transect length in meters
Mean Transect Area	mean transect area in square meters
Cell Size	in square meters
Total Search Time	total time spent searching by all surveyors' in person minu
Recon Area	area covered by a reconnaissance survey; in square meter
Method Comments	free text to add additional information

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

	Zero - < 30 cm
	Low - 30 cm < X < 1m
	Moderate - >1 m
Stream Type, Classification or River Group	brief description of the type of river (e.g., small river, large wadeable, non-wadeable) or stream classification
Habitat	(DROP DOWN OPTIONS)
	Pool
	Riffle
	Run
	Glide
	Other
	Multiple habitat types
Dominant Substrate	(DROP DOWN OPTIONS)
	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
Percent Dominant Substrate	number 0 to 100
Secondary Substrate	(DROP DOWN OPTIONS)
	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

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

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

0

	1-5
	6-15
	16-30
	>31
Weathered Dead Present	(DROP DOWN OPTIONS)
	Present
	Absent
Subfossil Present	(DROP DOWN OPTIONS)
	Present
	Absent
Signs of Reproduction	(DROP DOWN OPTIONS)
	Yes
	No
	Unknown
	NA
Species Specific CPUE	CPUE = Catch per unit efort, the number of individuals fou
Species Density	mean number of individuals per square meter of identifie
Species Standard Deviation	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
Survey ID	auto-generated unique identifier from Survey and Locatio
Specimen Latitude	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
Specimen Longitude	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
Specimen Habitat	(DROP DOWN OPTIONS)
	Pool
	Riffle
	Run
	Glide

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

erent than permit holder)
e survey 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
nat border states
that border states
degrees in NAD 83 geographic coordinate system
l degrees in NAD 83 geographic coordinate system
al 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)	
n Information sheet	

ivity selection)

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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 t
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 i
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 th
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%

utes

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

e 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

Gauge information is optional to include

Gauge information is optional to include

Gauge information is optional to include

Gauge information is optional to include

present

und per hour of all species

w)

Dropdown Definitions (where applicable)	
n Information sheet	
Reference document provided for consultation: Williams et al. 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada.	
Total number of live mussels found	
Total number of fresh dead mussels found; Indicators: nacre still lustrous, hinge line still intact, animal probably died within the past few months (from Southwick and Loftus 2018).	

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

ınd per hour of identified species

d species

eName_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 reqiured

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

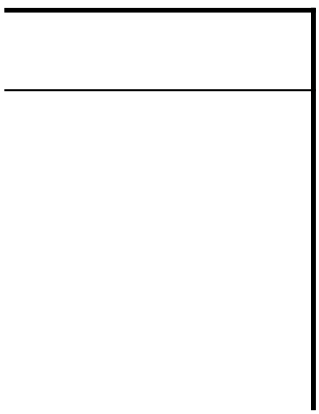
e.g., dot of superglue or waterproof paint pen on outside of shell

alpha numeric tag

on where the specimen will be held

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

llusk kills. American Fisheries Society, Special Publication 35, Bethesda, MD, USA.



ransect, surveyors shall
segment must be

of time. This type of

ıg 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

Primary County	Township	Secondary State	Secondary County	Latitude Upstream	Longitude Upstream

Latitude Downstream	Longitude Downstream	Search Area	General Location Information	Watershed Drainage Area

Distance Above or Below Access	Survey Location Comments

Survey ID	Activity

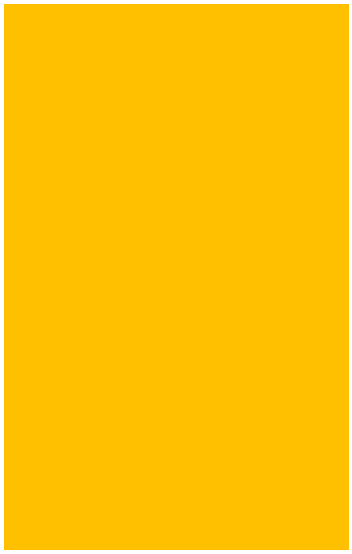
Activity Protocol	Activity Equipment	Activity Metric

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

Number Live	Number Fresh Dead	Weathered Dead Present	Subfossil Present	Signs of Reproduction	Species Specific CPUE

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

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

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

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

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

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

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

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

Old Full Name	Citation
Quadrula nodulata (Rafinesque, 1820)	Williams et al. 2017
Quadrula nodulata (Rafinesque, 1820)	Williams et al. 2017
Quadrula pustulosa (Lea, 1831)	Williams et al. 2017
Quadrula pustulosa pustulosa (Lea, 1831)	Williams et al. 2017
Epioblasma phillipsii (Conrad, 1836)	Williams et al. 2017
Epioblasma florentina curtisii (Frierson and Utterback, 1916)	Williams et al. 2017
Epioblasma obliquata obliquata (Rafinesque, 1820)	Williams et al. 2017
Epioblasma obliquata obliquata (Rafinesque, 1820)	Williams et al. 2017
Epioblasma torulosa rangiana (Lea, 1838)	Williams et al. 2017
Epioblasma torulosa torulosa (Rafinesque, 1820)	Williams et al. 2017
Elliptio dilatata (Rafinesque, 1820)	Williams et al. 2017

Lampsilis teres anadontoides (Lea, 1834)	
Lampsilis teres teres (Rafinesque, 1820)	
Obovaria jacksoniana (Frierson, 1912)	Williams et al. 2017
	http://explorer.natureserve

	Williams et al. 2017
	Williams et al. 2017
Fusconaia ebena (Lea 1831)	Williams et al. 2017
Quadrula cylindrica cylindrica (Say, 1817)	Williams et al. 2017
Quadrula metanevra (Rafinesque, 1820)	Williams et al. 2017
Toxolasma lividus (Rafinesque, 1831)	Williams et al. 2017
Toxolasma parvum (Barnes, 1823)	Williams et al. 2017
Toxolasma texasiensis (Lea, 1857)	Williams et al. 2017

Anodonta suborbiculata (Say, 1831)	Williams et al. 2017

Notes	Final listing FR	Federally TE?
reassigned from Quadrula		
Reassigned to Cyclonaias		
reassigned from Quadrula		
Nominotypical subspecies not required; reassigned to Cyclonaias		
elevated from synonymy		
Subspecies elevated to species		
Nominotypical subspecies not required		
Subspecies elevated to species		
Species elevated from subspecies		Yes
Nominotypical subspecies not required		
Reassigned to Eurynia		

		Yes
?? only teres named in Williams et al.	no teres teres or teres anodontoides	
?? only teres named in Williams et al.	no teres teres or teres anodontoides	
	77 FR 14914	Yes
Synonym of Obovaria arkansasensis		
e.org/servlet/NatureServe?searchName=Pisidium+simplex		

		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