U.S. Fish & Wildlife Service

Species Survey Guidelines

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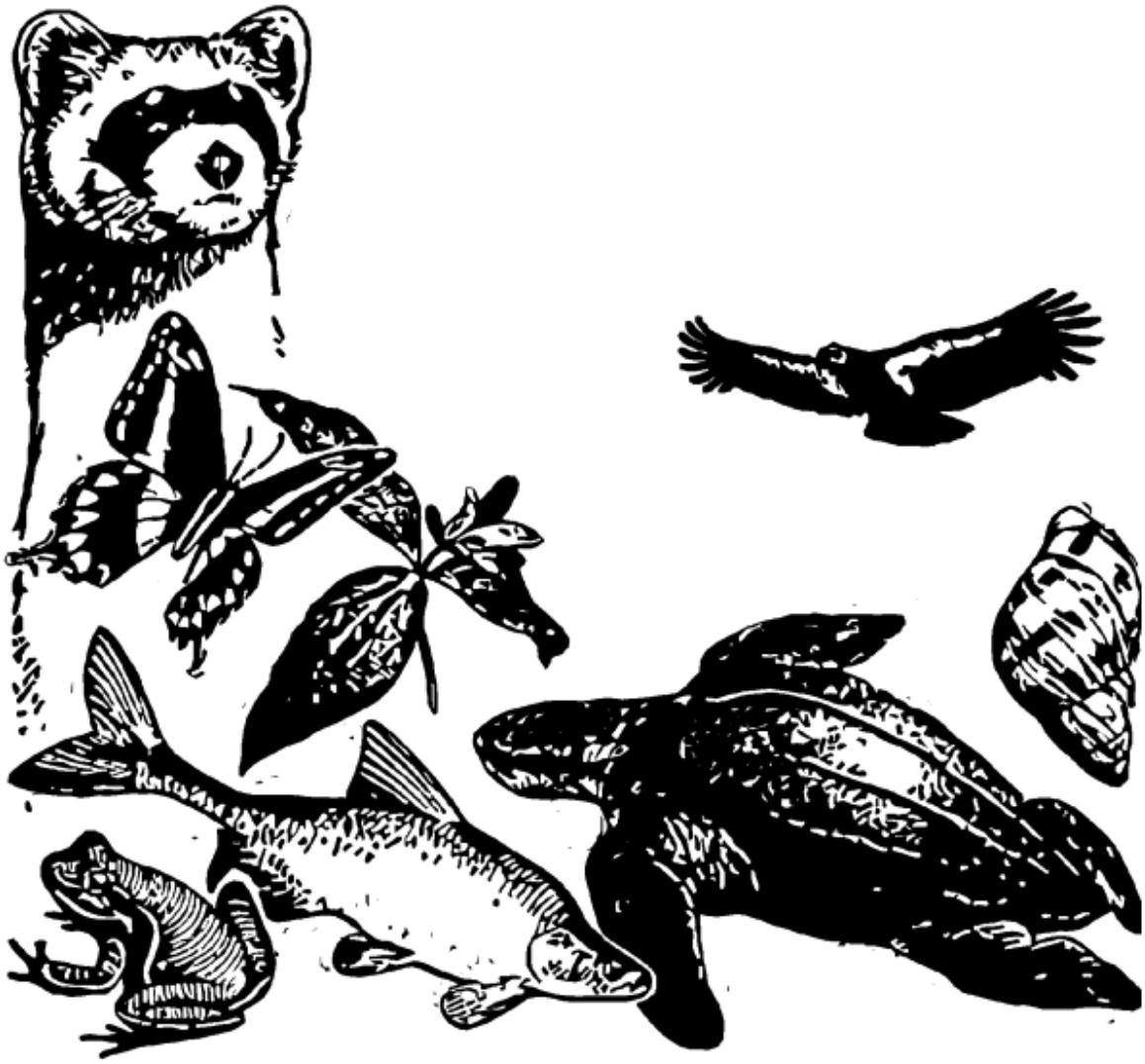

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West Virginia
Mussel Survey Protocols

April 2016

Middle Island Creek mussels including federally endangered Snuffbox. Photo by Janet L. Clayton

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Introduction

All mussels are protected in the State of West Virginia pursuant to West Virginia §20-2-4 and CSR 58-60-5.11. In addition, nine federally endangered freshwater mussel species are known to occur in the State. These species are protected by the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Impacts to State and Federal protected mussels and their habitats should be avoided and minimized to the maximum extent practicable. All streams that contain mussels or potential mussel habitat must be surveyed prior to any proposed streambed disturbance. Areas with mussels or mussel habitat should be avoided whenever possible.

As such, the protocols herein are designed to document the potential presence or absence of federally listed mussel species as well as provide for the protection of all native mussels within West Virginia. These protocols were developed to provide consistent and standardized guidance to project applicants about acceptable survey methods and levels of effort for different types of projects that are commonly encountered. Currently accepted protocol and supporting materials can be found at the West Virginia Division of Natural Resources' (WVDNR) website http://www.wvdnr.gov/Mussels/Main.shtm.

General Protocol Guidelines

Who Can Conduct Surveys in WV: Only approved surveyors will be permitted to conduct mussel surveys in WV. Approval is a two part process.

- Identification testing is required through the WVDNR.
    - Approved for endangered species streams (Groups 2 and 4): overall score of 85% and score 100% on the endangered species.
    - Non-endangered mussel streams (Groups 1 and 3): overall score of 85%.
    - The test is closed book and closed shell (simulating live condition).
- Must possess adequate experience and submit references.
    - Endangered species streams (Groups 2 and 4): at least 3 years of field experience conducting surveys similar to the WV Mussel Survey Protocols and submit two acceptable letters of reference.
    - Non-endangered species streams (Groups 1 and 3): at least 2 years of field experience conducting surveys similar to the WV Mussel Survey Protocols and submit two acceptable letters of reference.

Prior Notification: Even though standardized protocols are established for most types of projects, survey plans must be provided to appropriate State and Federal officials when applying for a scientific collecting permit. This is to ensure that the appropriate level of effort is being applied for the given stream type and construction activity and to allow time for agency staff to review existing data from the proposed survey area and work with the applicant to design the appropriate survey extent as described below. Appropriate State and Federal officials shall be notified at <u>least 30 days prior to the time the actual survey will occur</u>. In addition, State and Federal agencies shall be given at least 30 days to review survey results prior to the anticipated start of any construction activity. Contact information is provided in Table 1.

Requests for surveys should include a full description of the project, so that we can evaluate the effects from all aspects of the project, and also consider whether other federally listed resources may be affected. It is important to note that "project" includes all project features, not just the portion of the project prompting the need for a mussel survey or the submittal of a permit application (*e.g.*, to West Virginia Department of Environmental Protection or the U. S. Army Corps of Engineers). For example, an oil or gas pipeline stream crossing project would include not only the stream crossing, but also the well pad, the roads, staging areas, impoundments and holding pits, and oil and gas lines associated with the well or well field. This data will help us to better conserve mussel resources, ensure that effects from interrelated and interdependent projects are considered, evaluate cumulative impacts, and better implement recovery efforts for these species.

Activities to be conducted on any federally endangered species (ES) stream or potential ES stream (Groups 2 and 4) must have received written concurrence from the U.S. Fish and Wildlife Service (USFWS) prior to conducting any project activities including surveys, relocations and/or construction activities. Non ES streams (Groups 1 and 3) require coordination with the WVDNR only.

Data Longevity: Survey data collected on a specific site will be considered valid for five years from the date the survey was conducted. If mussel relocations are conducted, they should be done within the same field season as the expected instream activities. If these instream activities are to be conducted before June 15, then relocations may be conducted within the previous field season. After June 15, additional relocation efforts may be required just prior to construction activities depending on the results of earlier survey/relocation efforts. Areas that have been dredged within the previous five year period do not need to be resurveyed unless the area is to be expanded or moved.

Mussel Survey Period: The survey period shall be from May 1 to October 1. Requests to conduct surveys outside this time period will generally not be approved. Surveys to be completed in the current calendar year should have the scope of work to the appropriate State and Federal official by September 1. Any survey work outside this period will be done only under extenuating circumstances, with separate approval obtained from the appropriate State and Federal agencies prior to conducting the work, and may require a revised protocol.

Visibility Requirements: Qualitative surface surveys must have a minimum visibility of one-half meter (approx. 20in), with or without lights at **depth of survey**. If suitable visibility is not present at the intended time of the survey, then the survey must be re-scheduled, or a different protocol must be employed in consultation with the appropriate State and Federal agencies. (Example, more extensive quantitative surveys with excavations may be required).

Workable Flow Requirements: If the area cannot be effectively surveyed under existing flow conditions (low to moderate flows) the survey must be re-scheduled. Any variance must be approved by the appropriate State and Federal agencies.

Minimum Data to be Recorded: Standard WVDNR data sheets can be found at http://www.wvdnr.gov/Mussels/Main.shtm. **All data sheets are to be completed in their entirety and shall be incorporated as appendices in the final project report.** Data shall be compiled and summarized separately at a minimum for area of direct impact (ADI), downstream buffer (DSB), upstream buffer (USB), and lateral buffer (LB), if applicable. At a minimum, coordinates, in decimal degrees, shall be

provided for the US and DS extent of each area defined above and any relocation sites. A photographic voucher of all native species must be provided to the appropriate State and/or Federal representatives. Any questionable individuals should also be photo vouchered and should be videoed providing a better reference for verification. The final report shall include a map of the surveyed area along with the proposed project activities, and a copy of the valid collecting permit. **Note: Stating "see attached report" on the data sheet is not acceptable. <u>If you are asked to collect a particular type of data, it should be in the report or attached as appendices</u>.**

Report Checklist: Below is a checklist of deliverables to be included in a mussel survey report. If supplying reports addressing multiple sites, please place all materials for each site together so each can be easily reviewed in its entirety.

- Visibility at time of survey
- Summary Data Table by area (USB, ADI, LB, DSB, total salvaged) by species by method
- Mussel Data by cell or transect segment
- Habitat Data by cell or transect segment
- Group 2&4 – Species Richness Curve with calculations
- Protocol Form (updated with actual survey information)
- Figure showing cell/transect locations with planned impact area(s)
- Photo Vouchers
- Results of qualitative survey at relocation site with coordinates
- DNR Data Sheets
    - Site Record
    - Current Stream Weather Conditions
    - Mussel Survey Data Sheet by species (summary by area with total for site)
- Copy of state scientific collecting permit
- Copy of federal concurrence form

Stream Groups: For ease of determining the appropriate level of effort, West Virginia streams have been placed into four groups. A stream list by County is provided as Appendix A. Please double check those streams that act as a county boundary. They may be listed in one county and not the other.

<u>Group 1</u>: High Quality Streams (as listed by the WVDNR as having potential habitat for mussels) and State listed mussel streams, ES not expected.

<u>Group 2</u>: Small to mid-sized streams with ES expected.

Group 2 (½): These are typically small streams that join either a Group 2 or Group 4 Stream which may potentially contain ES and thus the lower ½mile of the stream is considered a Group 2.

<u>Group 3</u>: Large Rivers where ES are not expected. These include the Ohio River US of Hannibal Lock and Dam and the Monongahela River.

<u>Group 4</u>: Large Rivers where ES are expected. These include the Ohio River DS of Hannibal Lock and Dam, Little Kanawha River (slack-water section adjoining the Ohio River) and the Kanawha River.

All West Virginia mussel streams (Appendix A) require a mussel survey of the ADI and associated buffers if applicable if the watershed area above the direct impact point is 2590ha (10mi^2) or larger.

The lower ½mile of a designated Group 2(½) stream, described below, requires a survey regardless of upstream drainage area.

Mussel Concentrations and Potential ES areas Defined: Not detecting an ES during a Phase 1 survey does not confirm that it is not present. The presence of a diverse mussel concentration indicates ES potential. A mussel concentration is defined as an area encompassing all triggered areas connected by similar habitat plus a 10 m buffer around it. The mussel concentration area may encompass multiple areas only if they are separated by more than 20m of dissimilar or unsuitable habitat, otherwise the entire area should be surveyed. Trigger criteria are as follows:

- Group 1 and 2: 2 species not in Table 2 and/or density of $0.5/m^2$ (all species combined)
- Group 3 and 4: 3 species not in Table 2 along any 1 transect or combination of transects equal to 100m or within $100m^2$ of cells, or within a timed search survey between transects (all species combined) and/or density of $0.5/m^2$ within any area of the survey.

If a mussel concentration is found, then ES may be present. If the area cannot be avoided then a Phase 2 survey must be undertaken as described below. The species listed in Table 2 are not used in describing a mussel concentration with ES potential due to their general habitat preference and being commonly found in lakes and slackwater and not typically associated with the current list of ES found within West Virginia.

Visual or Surface Searches: A visual search includes moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5cm (2in) of substrate in order to better view the mussels which may be there. A minimum effort of 1.0 min/m^2 shall be expended in areas of heterogeneous substrate for transect surveys, 0.2 min/m^2 for cells without mussels and 0.5 min/m^2 for cells with mussels. The effort can be reduced in homogenous substrates such as coarse mobile sand, thick silt or bedrock. The effort for timed searches in Group 1 streams is the same as that for cells.

Site Analysis and Alternatives

Project Justification: Various laws, regulations, and policies require that impacts to aquatic resources, including freshwater mussels and endangered species, be avoided and minimized to the maximum extent practicable. For example, Clean Water Act 404(b)(1) Guidelines state that “no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem.” The Guidelines further specify that the evaluation of practicable alternatives should include alternative construction methods that do not involve dredge or fill material into waters of the U.S. and alternative locations including “areas not presently owned by the project proponent but which could reasonably be obtained, utilized, expanded or managed in order to fulfill the basic purpose of the proposed activity” (§ 230.10 (a)(2)). Nationwide permit pre-construction notifications for the U.S. Army Corps of Engineers in West Virginia must include a “description of the ways in which the proposed project has been designed to avoid and minimize adverse impacts”. The General Conditions that apply to all nationwide permits in West Virginia also

specify that "no activity may occur in areas of concentrated shellfish populations," unless the activity is related to various shellfish harvesting or restoration activities. The Endangered Species Act, through the Section 7 consultation process, requires that Federal agencies consult with the USFWS to identify and implement measures to avoid or minimize adverse effects to federally listed species, prior to issuing any permits that may result in the incidental take of federally listed species.

Project proponents can frequently save time and money, and avoid delays in their project permitting, by developing project alternatives early in their planning process. In addition, during previous project consultations involving impacts to mussel populations, the USFWS and WVDNR have found that practicable alternatives to avoid and minimize impacts can be developed for almost all projects. **To ensure that projects are implemented consistent with regulations and to minimize project delays, all survey proposals submitted to the USFWS and WVDNR should include documentation that avoidance is not possible and should also include an alternative analysis.** Survey permits may not be approved if the applicant does not provide adequate justification that instream impacts cannot be avoided. **Discussion of alternatives and how impacts will be avoided and minimized shall be included in the scope of work.**

Alternative Construction Methods: Projects should first be designed to avoid and minimize impacts to waters of the U.S. including impacts to streams containing mussel populations. For example, where possible, road crossings should be designed to completely span mussel streams. Routes for pipelines should be designed to avoid crossing mussel streams and minimize the number of stream crossings. Activities such as pipeline/waterline crossings shall address alternative methods such as directional boring. Horizontal drilling practices shall be the first priority over open trenching to possibly minimize impacts to mussels and avoid habitat degradation and fragmentation. A response plan for an inadvertent release shall be provided along with a notation on the potential for such an event to occur. If horizontal drilling practices are not being proposed, documentation as to why this alternative is not practicable shall be provided. This documentation shall include detailed information on project constraints, and engineering and/or geologic evaluations sufficient to justify why this construction method cannot be implemented or would have a high likelihood of failure.

Alternative Locations: Moving project locations slightly upstream or downstream, or making minor modifications to the project design, is often sufficient to avoid and minimize impacts to mussel populations including endangered species and may allow projects to proceed with minimal delays. Any project that has potential alternative locations for activities (example: bridge alignments, pipeline crossings) shall include surveys for alternative locations. We recommend a phased approach to prioritize sites with follow-up surveys within the least impacting project site selected. All proposals shall include survey areas large enough to include all alternative locations.

Extent of Areas to be Surveyed

Survey Extent: Minimum coverage shall include the area of direct impact (ADI) and appropriate buffers, including any alternative locations. Table 3 summarizes buffer requirements by stream group and

activity type. If the project may affect the local hydraulics of the stream, such as hydropower projects or installation of in-stream structures, then the survey effort shall encompass the area that may be affected. Hydraulic modeling may be required to determine the extent of hydraulic changes. If modeling is not conducted prior to surveying, the survey shall extend at least 1.6km (1mi) downstream. Additional surveys may be required if subsequent modeling determines hydraulic changes will extend further downstream.

The mixing zone of an outfall shall be included within the survey area as shall the appropriate buffers around the mixing zone as described in Table 3. According to the WV Department of Environmental Protection (WVDEP) (http://www.dep.wv.gov/WWE/permit/individual/Documents/370_Mzguide.pdf), an outfall should not discharge within 5 river widths of sensitive areas, endangered species, public water supply intakes, bathing areas, tributary mouths, or other point source discharges. If they do, the initial downstream boundary estimations for the mixing zone should be at a distance preventing overlap. If not, the initial downstream boundary estimations should be a distance of 5 river widths. Mixing zone, as defined, cannot harm endangered species. Some mussels, including endangered species are more sensitive than species used to develop WV water quality criteria, and in these cases the mixing zones should be developed based on review of the available literature. The buffer zone should extend at least an additional 100m downstream of the mixing zone. Hydraulic and mixing zone model data should be included with the proposed scope of work to define the survey area.

Survey Definitions

Timed Search (qualitative) surveys consist of visually searching throughout a larger defined area (such as DSB, ADI, LB, USB or mussel concentration) for a given period of time.
Timed searches can be applied to each Group as follows:

- Group 1: no need to divide into cells though may want to consider this with respect to potential mussel salvage. Cover the whole ADI or buffer area in a time period defined by the size of the area to be surveyed (timed search within USB, ADI, DSB, LB) at a rate of 0.2 min/m^2 in areas of heterogeneous substrate, then an additional 0.3 min/m^2 if mussels are found. You may wish to subdivide the areas into smaller units (cells – no size limit) if the area can be stratified by habitat. For example the DSB has a large area that appears to be of poor habitat and you don't anticipate finding mussels. Delineate it and survey at rate of 0.2 min/m^2. The other sub area has higher potential for mussels and indeed a few were found. This area would then be required to be surveyed for an additional 0.3 min/m^2.
- Group 2: no need for timed searches, cells are used within mussel concentration,
- Group 3: use to delineate mussel concentration if needed,
- Group 4: conduct timed searches between transects with suitable habitat (if no mussels are found along the transect), and in mussel concentrations to increase the probability of finding an ES and develop a species richness curve. In mussel concentrations, sampling should continue until no new species are found in 6 consecutive samples (plateau on the species richness curve).

Cells are more appropriate for surveying small to mid-sized Group 2 streams and required on Group 2 streams 20m wide or less. Cells are encouraged for all surveys except in Group 4 streams that have

extensive ADI and buffer areas. In these large areas the mussel concentrations are best delineated using transects. A cell survey is conducted by dividing each area (USB, ADI, LB, and DSB) into a series of cells in which each cell is surveyed and data recorded separately. Maximum acceptable cell size is 100m^2. Minimum search effort shall be 0.2 min/m^2. If any mussels are found then an additional 0.3 min/m^2 is required which provides for a minimum total search effort of 0.5 min/m^2. Cells are required for relocations unless using moving transects.

Cells further defined by group:

- Group 1: not required though may be used if needed to better apply search effort in areas with mussels and suitable habitat
- Group 2: all streams <20 m wide, preferred in all Group 2 streams, particularly if impact area and buffers are small. If surveying with transects, once a trigger is established, all triggered areas plus areas of similar habitat between triggered areas plus a 10m buffer surrounding are to be surveyed using cells.
- Group 3: small impact areas (i.e. boat ramp, barge cell, water intake, bridges)
- Group 4: small impact areas (i.e. boat ramp, barge cell, water intake)

Transect Surveys are conducted by placing lines perpendicular to flow and sub-divided into segments as noted below for each stream Group. A transect survey must contain at least 500m of transect search area and consist of a minimum of five transects, three of which must be placed within the ADI. Along each transect, surveyors shall visually search an area 1m wide for mussels and record all data separately for each segment. The entire segment must be covered and the minimum search effort for transects shall be 1min/m^2 in heterogeneous substrates.

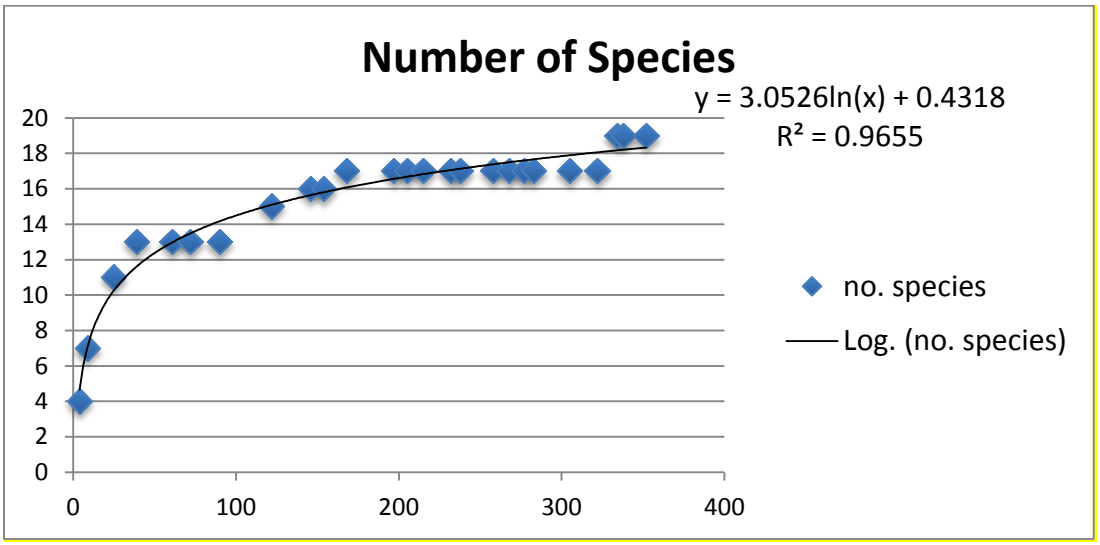
- Group 1: Transects (5m segments) may be used on large (>50m width) Group 1 streams to delineate areas which require additional survey effort.
- Group 2: Transects (5m segments) may be used for Group 2 streams (greater than 20m wide) if it appears the reach may be stratified by habitat and some strata appear to have limited mussel resources. Transects would be used to delineate the habitats and mussel resources that require further survey effort by cells. If surveying with transects, once a trigger is established, all triggered areas plus areas of similar habitat between triggered areas plus a 10m buffer surrounding are to be surveyed using cells.
- Group 3 and 4: Transects (10m segments) may be used for large impact areas such as proposed maintenance dredging. If using transects, a Phase 1 survey within a Group 4 stream must include qualitative timed search surveys for development of a species richness curve.

Salvage Zone is defined as the area within the ADI containing mussels connected by similar habitat plus associated buffers areas described in Table 3 from which mussels must be relocated prior to conducting instream activities.

Quantitative Samples are required within the salvage zone as part of a Phase 2 survey on Group 2 streams only if a mussel concentration area is located within the salvage zone. These samples shall consist of 0.25m^2 quadrats using random start methodology as described by Smith *et al.* 2001. Substrate shall be excavated to a depth of 15cm (6in) or hardpan. The material shall be collected and taken to the surface and sorted removing all live and dead shell material. The minimum number of samples required

is based on the rate of 3 quads per 100m^2 or 3 quads per 10 by 10m cell area within the delineated area of the mussel concentration area within the salvage zone only. If an ES has been observed then a minimum of 30 quadrat samples shall be collected regardless of sample area.

Species Richness Curve shall be developed for Group 2 and 4 streams to demonstrate that most species have been recorded. Data from samples within mussel concentration areas (potential ES) should be used to develop the curve. Data collected from Group 2 cells do not need supplemented with timed searches. Data from Group 4 transects will need to be supplemented with timed searches conducted within the mussel concentration area (5 to 10min increments) until no new species are found in six consecutive samples. The Species Richness Curve is generated by plotting cumulative number of individuals (X axis) vs. cumulative number of species (Y axis). Sufficient data should be collected in the survey to reach the plateau on this chart. A chart depicting the curve and associated logarithmic regression line shall be provided in the report. The number of individuals required to be collected for recovery of an additional species shall be calculated using the regression model. In the example below, a total 352 individuals were collected of 19 species. Using the regression formula, it would require 611 individuals to find one additional species.



Mussel Concentration Area is defined as an area encompassing all triggered areas connected by similar habitat plus a 10m buffer surrounding it.

Moving Transect is a method used for Group 1 surveys or mussel salvage whereby a defined section is cleared, and then the line is moved to define a new area for clearing. For example, a 1m area upstream of an established transect line is searched and mussels salvaged. A minimum effort of 0.5 minute/m^2 is required per pass if mussels are observed. Successive passes are to be made through the area until two or fewer mussels per 100m^2 area or less than 5 percent of the original number of mussels observed on the first pass are recovered on the last pass. Once the area is cleared, the transect is moved upstream in 1m increments, and the new areas are cleared sequentially. The process is repeated until the entire salvage area is cleared of mussels.

Mussel Processing: In each segment or cell, mussels observed (live and dead) will be bagged and brought to the surface for further processing and positive identification, unless the appropriate State and Federal agency representatives both agree to allow some mussel identification to occur at the survey depth. However, any species which may resemble a federally listed species must be brought to the surface for positive identification and photographing. Mussels should be kept in water at all times, except for the brief period that they need to be out of the water to be measured or photographed, but no longer than five minutes at a time. Mussels observed along the transect or within a cell will be recorded as occurring in a particular segment or cell. Appropriate information describing the depth and habitat conditions (using modified Wentworth scale) along each transect and within each cell shall be recorded for each segment or cell. Additional descriptions, such as depositional areas, detritus, scoured areas, etc., may be used for further clarification.

All ES are to be hand-placed into the substrate. For Group 3 and 4 streams, non-ES mussels may be dropped from a boat into the delineated area From May 1 to September 1. In areas of high velocity such as the upper Kanawha River, Group 1 and 2 streams, or any stream from September 1 to May 1, mussels shall be hand-placed into the substrate.

Stream Type Specific Guidance

Group 1 streams are those small to mid-sized streams not suspected of containing ES and timed search surveys are acceptable.

These streams only require coordination with the WVDNR. If avoidance of instream impact is not possible, a mussel survey and subsequent relocation is required. At a minimum, data are to be provided for the ADI, USB, DSB and LB **separately**. Each of the above areas shall be searched for a minimum effort of 0.2 minute/m^2. A minimum search effort of 0.5 minutes/m^2 shall be conducted in areas with mussels. If mussels are observed, the salvage zones shall be delineated as described in Table 3. Relocation effort shall be systematically conducted by establishing cells not to exceed 100m^2 or by a “moving transect”. A minimum search effort of 0.5 minutes/m^2 shall be conducted per pass. Additional passes through each cell or moving transect containing mussels shall be conducted until two or fewer mussels, or until less than 5 percent of the number collected on the original pass, are recovered on the final pass. **Group 1 streams only require coordination with the WVDNR unless an ES is found, at which time, all work shall cease and the WVDNR and USFWS must be contacted immediately.**

Group 2 streams are those small to mid-sized streams with ES expected and require coordination with the WVDNR and the USFWS. The objective of a Phase 1 is to determine if the project area supports a mussel concentration and/or has the potential to harbor ES (defined by the trigger criteria below), so that impacts to mussel concentrations can be avoided and minimized If triggers are met within the ADI and salvage buffers and avoidance is not an option, quantitative sampling (Phase 2) is required within the salvage zone to increase the probability of finding small-buried ES. The salvage zone is defined as an area within the ADI containing mussels connected by similar habitat plus buffers (as defined in Table 3). However, non-avoidance must be justified as Phase 2 will only be allowed in areas that will likely require salvage of mussels.

Phase 1

Phase 1 surveys are used to determine the mussel distribution within the project area and delineate mussel concentrations and/or areas that have potential to harbor ES. Data is to be compiled separately for USB, ADI, LB and DSB. **Streams 20m wide or less** must be surveyed using cells not to exceed 100m^2 in size. Each cell with heterogeneous habitat will be searched for 0.2 min/m^2 or 20 min per 100m^2 cell. All cells in which any mussels are found are to be searched for an additional 0.3 min/m^2 (30 min/100 m^2 cell). Data (mussels and habitat) are to be recorded by cell position. For **streams greater than 20m wide**, the preferred survey method is by cells; however, transects may be used to delineate mussel concentrations or areas that potentially support ES. These areas will require further survey effort by cells. Transects may also be more appropriate for surveys where the objective is to determine the area of least impact (best alternative) over a long stretch of stream. Once the priority location is selected, cells are then required within the mussel concentration areas. If surveying by transect, once a trigger is established (see below), all triggered transect segments and areas of similar habitat between triggered transect segments and a 10m buffer surrounding are to be surveyed using cells. Transects, as defined, shall be surveyed 1m in width, spaced no more than 10m apart, and placed perpendicular to stream flow. Data (mussels and habitat) are to be recorded by 5m segment along the transect. Delineate the area that includes all transect segments that meet the criteria below and all similar habitat between these segments (delineate the habitat) plus 10m surrounding area. Divide the area into cells no more than 100m^2. Search each cell for a total of 0.5min per m^2 (the area and time already searched along the transect can be subtracted.

If the below triggers are met within any portion of the delineated area, that area should be avoided (direct and indirect impacts) during construction and operation of the project. If the area cannot be avoided a Phase 2 survey will be required. If ES are found, additional minimization and conservation measures must be developed and/or formal consultation with FWS will be required.

Phase 2

Before a Phase 2 survey can be conducted:

- The area of unavoidable impact must be defined,
- Documentation of why avoidance is not possible must be provided and approved.

Phase 2 triggers:

- Mussel density of 0.5/m^2 (all species included) within the salvage zone determined during Phase 1,
- Presence of at least two species not listed in Table 2 found within the salvage zone.

If a trigger is met during Phase 1 and avoidance is not an option, then a Phase 2 survey shall be conducted within the salvage zone mussel concentration areas as described in Table 3. The objective of a Phase 2 is to collect sufficient data to further determine if ES are likely to be present within the salvage zone and provide additional density information if an ES is observed. The Phase 2 survey for a Group 2 stream consists of a quantitative survey using excavations as described by Smith *et al.* (2001). This survey shall be conducted using the systematic random start methodology throughout the area meeting the trigger criteria within the salvage zone only. This area is defined as an area encompassing all triggered areas connected by similar habitat plus a 10m buffer surrounding it. The boundary of the Phase 2 area should not exceed the salvage area. The number of quantitative samples to be collected

shall be calculated at the rate of 3 quads per 100m^2 of the area. If surveying using cells, this equates to 3 quads per 10 by 10m cell. If an ES has been observed anywhere within the entire survey reach then a minimum of 30 quadrats are required within the mussel concentration area of the salvage zone.

Salvage/Relocation

A relocation effort cannot be conducted until a written report presenting the above material is provided to the WVDNR and USFWS. Written concurrence to proceed must be obtained from the USFWS. Effort required is provided below.

Group 3 streams are large rivers where ES are not expected. These include the Ohio River US of Hannibal Lock and Dam and the Monongahela River.

The objective of the survey is to determine if mussels are present and to delineate the area of mussel concentration. The survey design shall consist of transects, 1m in width, spaced no more than 50m apart, placed perpendicular to stream flow or cells not to exceed 10m by 10m in size. Data shall be compiled for each area (USB, ADI, LB and DSB) **separately**. Record data by 10m segment along each transect or by cell position. Cells are encouraged in those areas without an extensive ADI and buffer area. Cells allow better transition for moving into the relocation phase. In larger areas, such as maintenance dredging, long linear projects, and scoping projects, the targeted mussel areas are best delineated using transects. Delineate the distribution of mussels and/or suitable habitat (generally heterogeneous substrate) using data obtained during sampling of cells or transects.

Salvage/Relocation

If avoidance is not an option within an area containing mussels, mussels will need to be relocated from the salvage zone as defined in Table 3. The relocation effort shall be systematically conducted by establishing cells not to exceed 100m^2 or by a “moving transect”. A minimum search effort of 0.5 minutes/m^2 per pass shall be conducted in areas with mussels. Additional passes through each cell or moving transect containing mussels shall be conducted until two or fewer mussels per 100m^2 or until less than 5 percent of the number collected on the original pass, are recovered on the final pass. **Group 3 streams only require coordination with the WVDNR unless an ES is found, at which time, all work shall cease and the WVDNR and USFWS must be contacted immediately.**

Group 4 streams are large rivers where ES are expected. These include the Ohio River DS of Hannibal Lock and Dam, Little Kanawha River (slack-water section adjoining the Ohio River) and the Kanawha River.

Phase 1

The objective of a Phase 1 is to determine if a mussel concentration is present and to delineate the area which could potentially contain ES), so that impacts to mussel concentrations can be avoided and minimized. The survey design shall consist of transects, 1m in width, placed perpendicular to stream flow or cells not to exceed 100m^2 in size. Maximum transect spacing depends on project type (Table 3) but shall not exceed 50m unless a scoping project. If transect spacing is greater than 10m and no mussels are observed in two adjacent transects, with at least one of the transects containing apparent suitable mussel habitat, then a timed search for a minimum of 10 minutes will occur between the two transects in the area of suitable mussel habitat. If any live and/or fresh dead mussels are found between the two transects during the search, then an additional transect will be placed there and a search conducted as previously described. Data shall be compiled for each of the areas (USB, ADI, LB and DSB) **separately**. Record data separately by 10m segment along each transect or by cell position. Additionally

timed search surveys shall be conducted within areas of mussel concentrations until at least six samples are collected with no new species (plateau is reached on the species richness curve).

If the triggers are met within any portion of the delineated area, that area should be avoided (direct and indirect impacts) during construction and operation of the project. If the area cannot be avoided a Phase 2 survey will be required. If ES are found, additional minimization and conservation measures must be developed and/or formal consultation with FWS will be required.

If a trigger is met (see below) and avoidance is not an option, then a Phase 2 survey shall be conducted.

Survey results that trigger avoidance or a Phase 2 survey include:

- Mussel density of $0.5/m^2$ (all species included) in any area of the survey and/or
- Presence of at least three species not listed in Table 2 along any one transect (at least 100m in length) or a combination of adjacent transects (at least 100m combined length), within $100m^2$ of cell area, or within a qualitative survey conducted between transects.

Phase 2

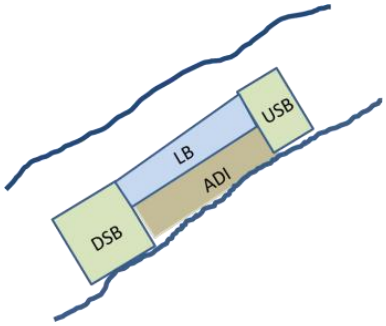
The objective of a Phase 2 is to collect sufficient data to increase the probability of detecting an ES. A Phase 2 survey shall consist of additional transects placed between the original surveyed transects within the mussel concentration area. The mussel concentration area is defined as an area encompassing all triggered areas connected by similar habitat plus a 10m buffer surrounding it. In other words, an additional transect shall be placed downstream of the most downstream transect that met the above criteria and upstream of the most upstream transect that met the above criteria. If the distance to the next transect upstream and downstream is greater than 10m, the additional transects shall be placed 10m upstream and downstream. The boundary of the Phase 2 area shall not exceed the Phase 1 area.

Salvage/Relocation

A relocation effort cannot be conducted until a written report presenting the above material is provided to the WVDNR and USFWS. Written concurrence to proceed must be obtained from the USFWS. Effort required is provided below.

Project Specific Guidance

Table 3 summarizes the specific layout of buffer zones, survey areas and salvage zones, organized by stream Group and potential project type. Where a project does not span the width of the stream, the survey widths of the USB and the DSB shall be equal to the width of the ADI and includes any associated LB applied to the ADI (Example at right). Any special considerations are discussed in more detail below.



Dredging

1. Instream disposal of dredge material and commercial sand and gravel dredging are not covered within project specific guidance and will require additional coordination with the WVDNR and USFWS.
2. If less than 5 years has elapsed since the last dredging of the specific site, then no additional surveys shall be required. If more than 5 years has elapsed or the previously dredged area is being expanded or moved, then mussel surveys shall be required.
3. Areas in which work barges are spudded should be included within the ADI for Group 4 streams.

Barge Loading Facilities

1. If the location of mooring cells are known, transects shall be placed to bisect these areas or placed as close to anticipated locations as possible. Transect spacing shall not exceed 50m. If constructing new or modifying mooring cells within existing footprint of existing facility and no dredging is planned, only the mooring cell locations need to be surveyed using cells.
2. For Group 4 streams, if the proposed activity is a new facility or expansion of an active facility downstream, the survey extent shall include at a minimum 500m DSB and 150m USB and 150m LB of the ADI. The survey shall include sufficient area such that placement of structures and barge activities can be placed within the area least likely to impact mussel communities or potential habitat. If the proposed activity includes an active facility and the expansion is upstream then the survey extent shall include a 150m buffer surrounding the ADI.
3. Areas in which work barges are spudded should be included within the ADI for Group 4 streams.

Large Scoping Projects (such as hydropower studies or new barge loading facilities, determining alignment for bridges, or determining location for any instream construction such as intakes and discharges)

1. Such a transect layout is not designed to find ES but to document mussel concentrations to aid in project design. Once the project design is drafted then a Phase 1 and potentially a Phase 2 survey would be required. This type of survey assists in the first step which is to avoid impacts. Transect spacing shall not exceed 100m.
2. Transects should be placed throughout any potential alternative areas plus buffer zones

Bridge Projects

1. **Note: hydraulic changes occur with causeway construction and shall be considered as part of the ADI. If a causeway is deemed necessary, temporary bridges incorporated into the causeway design is the preferred method.**
2. The ADI shall include any area that may be impacted by bridge construction, demolition, or causeway, staging areas, etc. Any area that may be physically and hydraulically impacted shall be included in the survey extent.
3. For new bridges, or complete removal and replacement of existing bridges, initial surveys shall include all areas that can be used for alternative construction sites.
4. If no other impacts, the ADI will include a 5m buffer surrounding a pier.

Waterline/Pipeline and other Corridor Disturbances

1. Discharge Outfalls, including those with diffusers, shall include the mixing zone (MZ) and appropriate buffer as described previously.

2. If pipe is not trenched (example – suspended on pillars), a 5m buffer is acceptable on the DS extent. Depending on discharge composition of outfall, relocation of mussels from the MZ may be required.

Water Intake

1. Water Intake structures covered here are associated with the stream edge. Those that extend into the stream would be covered under waterline/pipeline above. Water withdrawals from Group 2 streams are not permitted without special authorization from the USFWS which requires an approved monitoring plan and evaluation of areas that could be affected by the water withdrawal.
2. Areas in which work barges are spudded should be included within the ADI for Group 4 streams.

Shoreline Protection (example rip-rap, gabion baskets, longitudinal dikes, etc)

1. Areas in which work barges are spudded should be included within the ADI for Group 4 streams.

Projecting Dike Structures (Group 3 and 4 streams only, finger dikes, zipper dikes, those not parallel to shore)

1. Areas in which work barges are spudded should be included within the ADI for Group 4 streams.

Non-Commercial Docks in Group 3 and 4 streams do not require a mussel survey as long as they meet the following criteria:

1. Do not extend riverward more than 10m from low water mark (water's edge),
2. Do not contain any fill material other than pilings or post, and any shoreline protection material such as riprap is only placed above the low water mark,
3. Contain 4 or fewer pilings or posts that impact an area less than a combined total of $1m^2$,
4. Are less than 10m (32.8ft) in length,
5. If within 500m (1640ft) of an island must receive clearance from USFWS.

Relocations

All native mussels are protected within the state of WV and if avoidance options are exhausted, mussels must be relocated from the area of direct impact and appropriate buffer areas (salvage zone) as described in Table 3. **No mussels are to be moved without prior authorization from appropriate State and Federal authorities.** On streams with potential ES (Groups 2 and 4), coordination with the USFWS must occur prior to any relocation efforts. Relocation of any federally listed mussels will require formal consultation. This consultation process requires that the Federal action agency develop a Biological Assessment (BA) that quantifies the potential impacts to the species and that an incidental take authorization is issued by the USFWS prior to conducting any activities that could adversely affect these species. This process may take up to 135 days from the time that a completed BA is submitted to the USFWS. Impacts to federally listed mussel species and their habitats must be avoided and minimized to the extent practicable. Additional conservation measures above and beyond relocations may be required if the proposed project may adversely affect federally listed species.

1. For Group 1 and 3 streams, prior approval to relocate at time of initial survey may be granted by WVDNR solely.

2. For Group 2 and Group 4 streams, relocations shall not be conducted until a review of findings by the WVDNR and USFWS has been conducted and approved and written concurrence provided by the USFWS.
3. Relocation effort shall be systematically conducted by a "moving transect" or establishing cells not to exceed 100m^2. The minimum effort is 1min/m^2 (0.5min/m^2 first pass, 0.5 minutes/m^2 second pass).
4. Multiple passes shall be made through each cell or moving transect until two or fewer mussels per 100m^2 or less than 5 percent of the original number collected are recovered on the final pass.
5. Relocation efforts shall meet the same standards as surveys (i.e. visibility requirements, workable streamflow conditions, and mussel survey period).
6. WVDNR or USFWS personnel will randomly conduct quality assurance checks on relocations.
7. Relocation sites shall be upstream (preferred) to an area of equal or better habitat, or to an approved relocation site in a discrete area recommended by the WVDNR. For Group 1 streams, a 15min qualitative survey of the relocation site shall be conducted at a minimum. All observations of resident mussels **shall be reported** including site coordinates in decimal degrees. For all other stream groups, one hour of qualitative searches (12, 5 minute searches) to delineate an area with similar species and equal or better density than the collection area shall be conducted. All observations of resident mussels **shall be reported** including site coordinates in decimal degrees. The relocation area should be equal or larger in size to the collection area.
8. Generally, monitoring of common species are not required. Monitoring of relocated ES are required and addressed through the Section 7 consultation process with the USFWS.
9. For Group 3 and 4 streams, non-ES mussels may be dropped from a boat into the delineated area May 1 to September 1. In areas of high velocity such as the upper Kanawha River, Group 1 and 2 streams, or <u>any</u> stream from September 1 to May 1, mussels shall be hand-placed into the substrate. ALL ES are to be hand-placed into the substrate.
10. **If any ES are found during relocation efforts for projects where no ES were found during previous survey efforts, and no incidental take authorization from the USFWS has been received, then relocation efforts must stop and the USFWS and WVDNR should be immediately contacted.**
11. Relocations must be conducted within the same year as the start of instream construction. If instream activities have not commenced prior to June 15 of the next year, additional relocation efforts may be required just prior to construction activities depending on the results of earlier relocation efforts.

Table 1. Contact information for State and Federal Agencies.

West Virginia Division of Natural Resources
Scientific Collecting Permit
Barbara Sargent
PO Box 67
Elkins, WV 26241
304-637-0245
Barbara.D.Sargent@wv.gov

West Virginia Division of Natural Resources
State Malacologist
Janet Clayton
PO Box 67
Elkins, WV 26241
304-637-0245
Janet.L.Clayton@wv.gov

U.S. Fish and Wildlife Service
Ecological Services
Endangered Species Biologist
694 Beverly Pike
Elkins, WV 26241
304-636-6586 x19
Barbara_douglas@fws.gov
(Official requests are to be sent by hard copy mail)

Table 2. Species that can be excluded in defining a diverse mussel concentration by stream group.

Species	**Group 1&2**	**Group 3&4**
Anodonta suborbiculata		X
Lampsilis siliquoidea	X	X
Lasmigona complanata		X
Leptodea fragilis		X
Obliquaria reflexa		X
Potamilus ohiensis		X
Potamilus alatus		X
Pyganodon grandis	X	X
Strophitus undulatus	X	X
Utterbackia imbecillis	X	X

Table 3. Summary of buffer requirements and maximum transect spacing for various types of stream disturbances. Units are in meters. Survey extent shall include all buffers and the area of direct impact (ADI). After demonstrating need and receiving approval, mussels may be relocated from area described (salvage zone).

	US Buffer	**DS Buffer**	**L Buffer**	**Salvage Zone (ADI + Buffer Below)**		**Maximum Transect Spacing**
				US & L	DS	
Group 4	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Dredging (Maintenance)	150	500	150	10	10	50
Barge Loading (active facility)*	25	25	25	5	10	50
Barge Loading (new or expanding US or DS, see page 11 for required buffers) *						
Scoping Projects		Project Specific				100
Bridge Projects	50	100	BB	5	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Water Intakes (at shoreline)	10	10	10	5	10	na cells
Shoreline Protection	10	10	10	5	10	na cells
Projecting Dike Structures	10	20	10	5	10	na cells
Outfalls	10	MZ + 100	10	PS		PS
Group 3	Relocation at time of survey if approved					
Dredging (Maintenance)	50	150	50	10		50
Linear Projects	25	25	25	5	10	50
Scoping Projects		Project Specific				100
Bridge Projects	10	25	BB[b]	5	10	na cells
Waterline/Pipeline Corridor Disturbances	10	25	BB	5	10	na cells
Water Intakes (at shoreline)	10	10	10	5	10	na cells
Shoreline Protection	10	10	10	5	10	na cells
Projecting Dike Structures	10	20	10	5	10	na cells
Outfalls	10	MZ + 20	10	PS		na cells
Group 2	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Scoping Projects		Project Specific				10
Bridge Projects	50	100	BB	5	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Water Intakes (at shoreline)[a]	10	10	10	5	10	na cells
Shoreline Protection	10	10	10	5	10	na cells
Outfalls	10	MZ + 20	10	PS		10
Group 1	Relocation at time of survey if approved					
All Projects	10	25	10 or BB	5	10	TS

[a] additional monitoring may be required, see page 13
*Mooring Cells, etc., not dredging
[b] pier only, 10m LB

TS Qualitative Timed Search Surveys permitted
PS Project Specific
BB Bank to Bank
MZ Mixing Zone

US Upstream
L Lateral
DS Downstream
na cells: not applicable, cells required

References:

Smith, D. R., R. F. Villella, and D. P. Lemarie´. 2001. Survey protocol for assessment of endangered freshwater mussels in the Allegheny River. J. N. Am. Benthol. Soc 20(1):118-132.

Frequently Asked Questions

What is meant by "a survey is good for five years"?
If no mussels are found during a survey, then no mussels are presumed in the area for the next five years.

How long is a relocation effort good for? Until June 15 of the following year. Preferably the relocation is to be completed within the same field season as the initiation of in stream construction.

When is a Species Richness Curve required? For all projects on Group 2 streams (no additional sampling required) and Group 4 streams (at least six timed search surveys collected without observing an additional species).

What is meant by Group 2 (½)? It is typically a small stream that adjoins either a Group 2 or 4 stream in which a Group 2 mussel survey must be conducted within the downstream most ½ mile reach, no matter the size of the listed watershed.

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