



Monitoring Freshwater Mussels in Big South Fork National River and Recreation Area and Obed Wild and Scenic River

Data Quality Standards

Natural Resource Report NPS/APHN/NRR—2018/1857



ON THE COVER

Clockwise from top left: Wavyrayed Lampmussel (*Lampsilis fasciola*), mantle fish lure display, mussel sampling at Big South Fork NRR, Littlewing Pearlymussel (*Pegias fabula*)

Photographs by: Brian Watson and Nora Murdock, Appalachian Highlands Inventory and Monitoring Network, National Park Service; Caitlin Worth, Blue Ridge Parkway

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Abstract

The purpose of this report is to document the standards used by the Appalachian Highlands Network (APHN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in *Monitoring Freshwater Mussels in Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the Appalachian Highlands Network and supplement the National Inventory & Monitoring Division Quality Management Plan (in prep). The plan also serves as a guide for all APHN personnel who are involved in protocol or program activities, and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

With thirteen federally-listed endangered freshwater mussel species (eleven at BISO and two at OBRI), Big South Fork National River and Recreation Area (BISO) and Obed Wild and Scenic River (OBRI) provide sanctuary for a nationally significant mussel fauna. The park has been the site of an ongoing mussel restoration effort, which aims to recover species that occurred historically in the Big South Fork and are disappearing from other sites in the region where their habitat is in jeopardy. Along with many other significant aquatic resources, Obed WSR protects one of four populations of the federally-listed endangered Tennessee bean (*Venustaconcha trabalis*), and potentially, the endangered Alabama Lampmussel (*Lampsilis virescens*), which was thought to have been extirpated in the Obed-Emory system, but was rediscovered upstream of the park in 2011 (Dinkins et al. 2012). That discovery included an observation of a “fresh dead” individual within the Obed WSR boundary. A mussel inventory is underway to refine our understanding of mussel species distributions within Obed WSR.

Large declines in the parks’ mussel fauna in the last 100 years illustrate how rapidly changes can occur. Roughly fifty-five species were known from the Big South Fork in the early years of the twentieth century. Prior to an ongoing mussel restoration effort, which began in 2010, only twenty-six of these species remained; seven having gone extinct, vanishing completely from their historic range (Ahlstedt et al. 2003; Bakaletz 1991). As a result of restoration work, Big South Fork NRRA waters now support forty-two mussel species, of which eleven are federally endangered. We are less certain about the historic distribution of mussels at Obed WSR, but it is known that several populations of Tennessee bean in the Obed River and Daddy’s Creek, first reported in the 1960s, have disappeared, one sizable population having been extirpated within the last 15 years (Dinkins and Faust 2015; McGregor 2012). Because of the significance of the mussel fauna in these two river systems and the potential for upstream impacts in park watersheds, long-term trend data are needed to monitor changes in freshwater mussel populations.

The overall goal for this monitoring effort is to obtain information that will aid Big South Fork NRRA and Obed WSR in making informed management decisions that will protect and enhance freshwater mussel populations within the parks. With that goal in mind, the following objective has been established for long-term monitoring of freshwater mussels:

- Determine long-term trends in species richness and population size of freshwater mussel populations at selected locations in the major rivers and tributaries of Big South Fork NRRA and Obed WSR.

Monitoring data addressing this objective are collected from random sampling of square meter sampling units at selected index sites along the Big South Fork of the Cumberland and Obed Rivers and their major tributaries. At each monitoring site, data are collected every three years.

Protocol Activities and Modules

Data are collected or derived as a part of the Monitoring Freshwater Mussels in Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative (Emmott et al. 2018) in seven different activities or modules (Table 1).

Table 1. Protocol activity matrix for *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018).

Activity type	Activity Number	Activity	Description
Site recon, establishment, and maintenance	1	Site recon/plot validation	Evaluation of additional sites for quantitative or qualitative monitoring, based on field validation of mussel populations and assessment of habitat characteristics.
	2	Quantitative/qualitative plot establishment	Site description, geolocation and photo documentation of permanent plot baseline and establishment of plot reference markers.
	3	Quantitative/qualitative plot maintenance	Re-establishment/replacement of plot reference markers, as needed.
Field observations	4	Quantitative sampling	Counts and measurements of shell length of individual mussels within randomly selected square meter sampling units, and identification of individuals to species. Document any unknown species with measurements and voucher photos for later identification.
	5	Qualitative sampling	Counts and measurements of shell length of individual mussels within a predefined survey area for a predetermined amount of time; and identification of individuals to species. Document any unknown species with measurements and voucher photos for later identification.
QA/QC Data	6	Mussel Detection	Two quadrats per observer per day are resampled by a separate observer using removal sampling to check for any mussels missed by the first observer.
	7	Species ID	5% of quadrats are randomly selected and individual mussels are photo documented for verification.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Protocol activity-level sample design matrix for *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018).

Activity Type	Activity Number	Activity	Sampling Design	Revisit Design
Field observations	4	Quantitative sampling	At selected index sites, sample units are chosen using Generalized Random Tessellation Stratified sampling within a grid which encompasses the resident mussel population. Counts and measurements of shell length of individual mussels are made within square meter sampling units; each mussel is identified to species, measured and replaced in the substrate in its original orientation. Sample units are searched to a substrate depth of 10 centimeters.	Sites are monitored once every three years.
	5	Qualitative sampling	In a predefined area beyond the quantitative grid, at sites where mussels are too rare, or where habitat is not conducive to quadrat sampling, timed searches are done for mussels that are visible at the substrate surface. Individual mussels are identified to species, shell length is measured, and mussels are replaced in the substrate.	Same as Activity 4.

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 6.

Table 3. Data Quality Values (DQVs) for *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018).

Data Quality Category	Data Quality Value	Definition	Protocol Considerations
Intrinsic data quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	All mussels are properly identified to species level for all observations. Counts represent the true number of individuals of target species within each sample unit. Shell measurements represent the true dimensions of individual mussels or shells.
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Mussel populations are subjectively chosen for monitoring based on sites which are known to contain relatively large, diverse mussel populations. GRTS provides spatial balance of randomly chosen sample units within a plot.
Contextual data quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	All sample locations are monitored following the schedule and methods outlined within Emmott et.al (2018). Data are collected consistently to permit comparisons among and between years but not necessarily between locations.
	Completeness	All data / measures required to evaluate accuracy and representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	All sampling locations are monitored following the schedule described in Emmott et al. 2018. The design and analysis methods can accommodate occasional missing data.
Representational data quality	Consistent representation	Use of standard definitions when describing data quality or resource quality based on data	Data quality is defined as raw, provisional, or accepted based on definitions provided in NPS (2016). Resource condition classes have not yet been defined.
Data accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Data are legally protected due to the rarity and protected status of the resource. Protected data may be released in limited cases only with park Superintendent approval following park procedures.

Table 4. Measurement Quality Objectives for *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018).

Activity	Measure/Quality Indicator	Quality Objective
Plot Establishment	Location accuracy	± 0.1 meter horizontal, ± 0.1 meter vertical. ± 2 degrees for bearing accuracy.
	Location description detail	Description provided with enough detail to relocate without use of GPS equipment.
Plot Location/Maintenance	Witness trees	All tags are checked and replaced as needed. New witness trees established as needed.
	Rebar or permanent markers	All rebar or permanent markers located. Missing rebar replaced, or permanent markers maintained as needed.
	Plot locational accuracy	± 0.2 meter
Quantitative Sampling	Quadrat location accuracy	± 0.1 meter
	Taxonomic resolution	Identifications made to the species level (see taxonomic standards)
	Identification accuracy	100% accuracy
	Count accuracy	100% accuracy
	Measurement accuracy	± 0.5 millimeter
Qualitative Sampling	Qualitative sampling area accuracy	± 2 meter
	Taxonomic resolution	Identifications made to the species level (see taxonomic standards).
	Identification accuracy	100% accuracy
	Count accuracy	100% accuracy
	Measurement accuracy	± 0.5 millimeter

Table 5. Taxonomic standards to be used in *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018) for the collection and reporting of observational data.

Activity Number	Activity	Standard to be Used	Reference / Authority
4	Quantitative sampling	Scientific publication	Parmalee and Bogan (1998)
5	Qualitative sampling	Scientific publication	Parmalee and Bogan (1998)

Table 6. Data Protection standards for *Monitoring Freshwater Mussels at Big South Fork National River and Recreation Area and Obed Wild and Scenic River: Protocol Narrative* (Emmott et al. 2018). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Data Type	Data	Level of Protection	Rules for Dissemination
Resource data and information	Locations of rare (NatureServe rarity ranks G1, G2, S1 or S2), federally or state endangered or threatened species	Legally protected	Presence of species reported at the park centroid level only.
Location data and information	Permanent sampling locations	Legally protected	Sample locations redacted from all dissemination.
Personally identifiable information	Non-NPS staff information	Legally protected	All but first name and last initial redacted from public release.

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