

GUIDELINES FOR MUSSEL SURVEYS IN THE NAVIGABLE OHIO AND ALLEGHENY RIVERS

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Sand and gravel in the Allegheny and Ohio Rivers is a non-renewable resource for both the commercial sand and gravel dredging industry and for aquatic habitat supporting fish, freshwater mussels and other aquatic life. Habitat in deeply dredged areas is permanently altered through factors such as reduced and redirected currents, substrate modification, and reduced light penetration. These changes make such dredged areas permanently unsuitable for many species and disrupt riverine ecosystem function. Areas in the Ohio River and commercially navigable Allegheny River that are functioning as riverine habitat with gravel substrate and moderate flows are limited by existing channel modifications, industrial and urban inputs, and past dredging, but remain important social and environmental resources. Concentrations of freshwater mussels (*i.e.*, mussel beds) are important indicators of the remaining riverine habitat in the Allegheny and Ohio Rivers and are important for the recovery and survival of federal and state listed endangered mussels.

Commercial sand and gravel mining in the Allegheny and Ohio Rivers is regulated the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers. Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) places certain responsibilities¹ upon federal agencies to conserve federally-listed species and directs those agencies to consult with the U.S. Fish and Wildlife Service on actions that “*may affect*” federally listed species or critical habitat. A “*may affect*” determination includes actions that are “*not likely to adversely affect*,” as well as those “*likely to adversely affect*” listed species. If the action is “*not likely to adversely affect*” listed species, and the Service agrees with that determination, the Service provides concurrence to the federal agency in writing and no further consultation is required. If the action is “*likely to adversely affect*” listed species, the federal action agency must request initiation of formal consultation. This request is made in writing to the Service and concludes with the Service’s issuance of a biological opinion to the federal action agency, and if appropriate, an incidental take statement².

RATIONALE

A freshwater mussel survey (when conducted according to these guidelines) is undertaken to determine presence or probable absence of freshwater mussel species of concern, including endangered or threatened species, and provide the information the Service and Corps needs to evaluate the effects of the proposed action. Following these guidelines will standardize survey procedures. It will help maximize the potential for detection of endangered mussels at previously undocumented sites at a minimum acceptable level of effort. Although the detection of federally listed mussels confirms their presence, failure to detect them does not absolutely confirm their absence (likewise, federally listed species do not occur in all appropriate habitats and many seemingly suitable sites are devoid of these species). Surveys as extensive as outlined below are usually sufficient to detect the most abundant freshwater mussel species at a site and provide the information needed to evaluate the potential that federally listed mussels might be present; however, there have been instances in which additional effort was necessary to detect less abundant species, especially when habitat was less than optimum, survey conditions were less than ideal, or mussel densities were low.

The following guidelines (*i.e.*, the Phase 1 and Phase 2 survey protocols) were developed and peer-reviewed by biologists and statisticians having expertise in the species, methods and habitats covered by the guidelines. Any requests to conduct a mussel survey in a different manner than described herein or under different environmental conditions will be evaluated by Service on a case-by-case basis. As additional information becomes available regarding survey techniques and effectiveness, these survey guidelines may be updated and revised. Contact the Fish and Wildlife Service for the most recent version of these guidelines.

PRIOR TO CONDUCTING ANY SURVEYS

If gravel dredging is proposed to occur in the Ohio or Allegheny Rivers in Pennsylvania, contact the Service and Pennsylvania Fish and Boat Commission to determine whether or not any federal or state endangered, threatened, or candidate species are known to occur in or near the proposed dredge area.

- If the river reach is *known* to support endangered, threatened or federal candidate species, measures must be taken to avoid impacts to these species. The Service and State fish or wildlife agency will work with federal, state and local regulatory agencies and permit applicants to ensure that adverse effects to protected species, including freshwater mussels, are avoided.
- If river reaches in or adjacent to the proposed dredge area are *not* known endangered mussel habitat, conduct a mussel presence survey (Phase 1 survey).

The endangered and candidate mussel species native to the Ohio and Allegheny Rivers occur in communities within suitable habitat. Areas of concentrated mussel numbers are sometimes referred to as “mussel beds”. The presence of a concentration of freshwater mussels is the best evidence that habitat conditions are suitable for freshwater mussels, and potentially suitable for endangered and threatened mussel species. However, since a natural mussel community is unlikely to develop in a deeply dredged area, information about past dredging activity may preclude the need to do further investigations in certain areas proposed for dredging. Based on this information, the Service and Fish and Boat Commission will determine the need for additional mussel surveys.

PHASE 1 SURVEY PROTOCOL³

The objectives of the Phase 1 survey protocol are to determine mussel presence and distribution within the area likely to be directly or indirectly affected by activities related to commercial sand and gravel dredging. The Phase 1 protocol minimizes search effort while documenting concentrations of mussels that indicate potential habitat for endangered species. This phase of the survey assumes that searching the substrate surface, with minimal hand disturbance, will not uncover all the mussels that are present in the substrate. Therefore, the survey effort in this phase is usually *not* sufficient to: 1) detect the presence of rare or listed species, 2) prove the absence of a rare or listed species, 3) determine how many mussels are present in the project area, 4) document evidence of recruitment, or 5) establish true relative abundance.

- Prior to conducting the survey, *acquire a scientific collector's permit* valid for the location and period of the survey.
- Submit a site-specific study plan based on the Phase 1 protocol to the Service for review and comment at least 30 days prior to conducting the survey. Include bathymetric mapping of the proposed dredge area and buffer area.

The following methods should be utilized in the area likely to be *directly or indirectly affected*, which includes the proposed dredge area and an area extending at least 500 feet upstream and laterally from the proposed dredge area, and 1500 feet downstream.

1. This survey will be overseen by a *qualified surveyor*⁴ for the Ohio River basin (see attached list), who has experience in successfully locating and identifying freshwater mussels, and successfully locating and identifying species in their river habitat. The qualified surveyor must be present on site at all times during the investigation. Any assistants who conduct searches for mussels must have at least some previous experience successfully conducting mussel surveys.
2. *Surveys can be performed between May 1 and October 15*, contingent upon suitable and safe weather (air and water temperatures should be a *minimum of 55° F*) and river discharge conditions. Most freshwater mussels native to the Ohio and Allegheny Rivers are likely to be more active during this period and, therefore, more likely to be visible to divers. During this active period mussels are better able to reburrow when returned to the river.
3. Transects will be established perpendicular to river flow throughout the proposed dredge area and buffer zones. Parallel transects will be *spaced no farther than 328 feet (100 meters) apart*. Reduced transect spacing may be used to meet specific permit information needs.
4. Each transect will be *subdivided into 10-meter segments*.
5. Along each transect, paired divers will *visually search an area one meter wide for mussels* (0.5 meter on each side of the transect). A visual search includes moving cobble and woody debris, hand sweeping away silt and small detritus, and disturbing/probing the upper one to two inches of substrate in order to better view the mussels that may be partially buried. Since this is a qualitative survey of the substrate surface relying primarily on visual cues, *minimum visibility is one-half meter (approx. 20 inches)*, with or without lights, at the depth of the survey. This distance is approximately the length of one side of a quarter meter square sampling frame.
6. *A minimum of ten diver-minutes of visual searching will be spent in each segment* in which mussels and/or suitable mussel habitat is present (paired divers would each spend half the time, or at least five minutes, searching half of the segment). Observations documenting the reason habitat is unsuitable must be provided for any 10-meter segment not searched. Unsuitable habitat includes bedrock or areas with silt deposition exceeding 10 inches deep. Some habitats and conditions are more complex and difficult to search (*e.g.*, due to the presence of overlying silt, zebra mussel colonization, larger cobble/boulder surface material) and will likely require additional search time to collect all visible mussels.
7. In each 10-meter segment, mussels observed will be bagged and brought to the surface for further processing and positive identification. All mussels *will be recorded as occurring on a particular segment of a transect*.
8. If no mussels are observed in two adjacent transects, with at least one of the transects containing apparently suitable mussel habitat, then a dive search of a minimum of 10 minutes (per diver) in length 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 dives, then an additional transect will be placed there and a search

conducted as previously described.

9. All listed mussels must be returned to the point of capture as soon as possible on the same day as capture. No listed mussels may be removed from the subject river reach without permission from the Service and Commission. They should only be held long enough to identify, measure and photograph them, during which time their exposure to temperature extremes must be avoided. Photo-documentation of each mussel species located will be required. The photos should be in color and of sufficient detail and clarity to identify the species. Therefore, photographs of the side, anterior, and posterior of the shell should be taken of each individual listed mussel, and at least one representative of all other species found.
10. A voucher specimen of each mussel species observed dead will be provided to the appropriate Service or Commission representative.
11. The Service and Commission will be sent a copy of survey results for review and concurrence, including the following *required data*: persons collecting information, diver(s) and mussel identifier, surface weather conditions, air and water temperature, visibility (see aforementioned visibility requirements), survey methodology; a site map; a description of the river within the project area (*e.g.*, river miles, past river bed disturbance if known, substrate description, water clarity); river discharge at the nearest USGS gage; collecting time, river location, dates of sampling; time spent per transect segment; GPS coordinates of ends of dive transects, substrate information (use Wentworth size scale to determine percent silt, sand, gravel, cobble, boulder, bedrock, scoured substrate, *etc.*), relative compaction of the sand and gravel substrate, an estimate of the percent zebra mussel coverage of the substrate, and identification of mussels, both live and dead, to species. *Optional data* includes the presence/absence of live snails, the size range of mussels (to help determine recruitment), photographs of state listed species, and other information the collector deems worthy to include.
12. Bathymetric monitoring of the site will occur prior to, immediately after, and one year after the dredging activity. This information will be provided to the appropriate Service, Corps, Commission and DEP within two weeks after each phase of bathymetric monitoring occurs. After the post one year bathymetric monitoring is conducted, the applicant/action agency will consult with the appropriate state and federal agency representative to determine if additional bathymetric monitoring will be required.

Phase 1 Survey Results

- Phase 1 survey results will be submitted to the Service and Commission for review and concurrence. These agencies will determine whether a Phase 2 survey should be conducted, and if so, within what area(s) of the river.
- *Federally listed mussel species present* – If one or more live or fresh dead (*i.e.*, soft tissues present or limited nacre oxidation) federally listed mussel species is found, all direct and indirect effects will be avoided in consultation with the Service. No dredging will be permitted within at least 1500 feet upstream, 500 feet lateral and 500 downstream of the listed species. In some cases, a larger buffer may be necessary to avoid potential adverse effects.

- *Mussel concentration present* – Transect segments supporting an *observed* mussel density of at least 0.5 mussel per square meter will be avoided. This represents an *actual* density of 1.0 mussel per square meter, assuming only 50 percent of the mussels are visible on the substrate surface. This density would be reached if five or more live mussels are observed within any 10 square meter transect segment. No dredging will be permitted within at least 1500 feet upstream, 500 feet lateral and 500 downstream of these areas.
- *Potential area of concern* – Transect segments supporting an *observed* mussel density of between 0.3 and 0.5 mussel per square meter (= *actual* density of 0.6 to 1.0 mussel per square meter) may support federally listed mussels, especially if one or more indicator species are present (see Table 2). In that case, either: 1) no dredging will be permitted within at least 1500 feet upstream, 500 feet lateral and 500 downstream of these areas; or 2) a Phase 2 survey will be conducted to determine if federally listed mussels are present, and if so, at what density.
- *Dredge areas* – Pending Service concurrence with the Phase 1 survey results, the following areas are likely to qualify for dredging, provided they do not occur within mussel buffer zones.
 - Transect segments supporting an *observed* mussel density less than 0.3 mussel per square meter (= *actual* density less than 0.6 mussel per square meter).
 - Transect segments supporting an *observed* mussel density of between 0.3 and 0.5 mussel per square meter (= *actual* density of 0.6 to 1.0 mussel per square meter), provided indicator species are not present (see Table 2) and substrate conditions are unsuitable for federally listed species.

PHASE 2 SURVEY PROTOCOL

If a river reach is identified as a potential area of concern, and direct and indirect effects will *not* be avoided (*i.e.*, the applicant wishes to proceed with dredging in that area), a Phase 2 survey will be conducted. This survey will be done in accordance with the specifications in *Survey protocol for assessment of endangered freshwater mussels in the Allegheny River* (Smith *et al.* 2001). Submit a site-specific survey plan based on the Smith *et al.* (2001) protocol to the Service and Commission at least 30 days prior to conducting the survey.

The objectives of this protocol are to determine species presence as well as species-specific density, abundance, and size distribution within the project area where freshwater mussel species are likely to be affected. Survey results will provide information necessary to assess the direct effects of the action on the species.

Phase 2 Survey Results

- Phase 2 survey results will be submitted to the Service and Commission for review and concurrence.
- *Federally listed mussels present* – If one or more live or fresh dead federally listed mussels are found, all direct and indirect effects will be avoided in consultation with the Service. No dredging will be permitted within at least 1500 feet upstream, 500 feet lateral and 500 downstream of the listed species. In some cases, a larger buffer may be necessary to avoid

potential adverse effects. The Corps will submit the Phase 2 report to the Service, along with a map identifying no dredge areas, and a description of the proposed action. The Corps will request Service concurrence with the Corps' "not likely to adversely affect" determination. A concurrence letter from the Service concludes informal consultation on the proposed action.

- *Federally listed mussels not present* – If no live or fresh dead federally listed mussel species are found, the Corps will submit the Phase 2 report to the Service, along with a request for concurrence on the Corps' "not likely to adversely affect" determination. A concurrence letter from the Service concludes informal consultation on the proposed action.
- *Mussel concentration area present* – Transect segments supporting an *actual* density of 1.0 mussel per square meter will be protected. No dredging will be permitted within at least 1500 feet upstream, 500 feet lateral and 500 downstream of these areas.

¹ Section 7(a)(1) of the Act directs agencies to carry out specific programs for the conservation of federally-listed species. Section 7(a)(2) requires federal agencies to ensure that the actions they authorize, fund or carry out are not likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat.

² Section 9 of the Endangered Species Act sets forth certain prohibitions relating to the "take" of listed species. "Take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct". This "take" prohibition applies to all "persons" including federal, state, and local agencies, corporations, businesses, and individuals. Section 11 of the Act provides for both civil and criminal penalties for those convicted of section 9 violations.

³ Phase 1 guidelines are taken from *Draft Protocol for Mussel Surveys in the Ohio River Where Dredging/Disposal/Development Activity is Proposed*, developed by the Ohio River Valley Ecosystem Mollusk Subgroup (clarified April 2004). As additional information becomes available regarding survey techniques and effectiveness, the Service may update or revise these survey guidelines. Contact the Fish and Wildlife Service for the most recent version of these guidelines.

⁴ Searching for freshwater mussels and recognizing their habitat is a skill that can take many months or years of field work to develop. This level of expertise is necessary when conducting searches in order to ensure that surveys are effective and protected mussels are not harmed during the survey (*e.g.*, returning them to unsuitable habitat). Many individuals that have been recognized as qualified to conduct freshwater mussel surveys obtained their experience through graduate degree research or employment by a state wildlife agency.

CITATIONS

Smith, D. R., R. F. Villella, D. P. Lemarie. 2001. Survey protocol for assessment of endangered freshwater mussels in the Allegheny River, Pennsylvania. *Journal of North America Biological Society* 20:118-132.

Attachment A

Table 1. Federally listed endangered, candidate, and special concern mussel species native to the Allegheny and Ohio Rivers.

Species	Common name	Habitat ¹	Status
<i>Cyprogenia stegaria</i>	fanshell	lotic	Endangered
<i>Epioblasma torulosa rangiana</i>	northern riffleshell	lotic	Endangered
<i>Hemistena lata</i>	cracking pearlymussel	lotic	Endangered
<i>Lampsilis abrupta</i>	pink mucket	lotic	Endangered
<i>Obovaria retusa</i>	ring pink	lotic	Endangered
<i>Plethobasus cooperianus</i>	orange-foot pimpleback	lotic	Endangered
<i>Pleurobema clava</i>	clubshell	lotic	Endangered
<i>Pleurobema plenum</i>	rough pigtoe	lotic	Endangered
<i>Plethobasus cyphus</i>	sheepnose mussel	lotic	Candidate
<i>Villosa fabalis</i>	rayed bean mussel	lotic	Candidate
<i>Epioblasma triquetra</i>	snuffbox	lotic	Special concern
<i>Quadrula cylindrica</i>	rabbitsfoot	lotic	Special concern
<i>Simpsonaias ambigua</i>	salamander mussel	generalist	Special concern

¹ Habitat description summarized from Parmalee and Bogan (1988) lotic – typical of flowing water and gravel and cobble substrates; lentic – minimal flow, sand or silt substrates; generalist – occurs in both habitat types.

Table 2. Species indicative of flowing water and large river habitats with stable substrates.
* indicates species may be extirpated from the Ohio River and lower Allegheny River

Species	Common name	Habitat
<i>Actinonaias ligamentina</i>	Mucket	lotic
<i>Alasmidonta marginata</i>	Elktoe	lotic
<i>Cyclonaias tuberculata</i> *	purple wartyback	lotic
<i>Amblema plicata</i>	Threeridge	generalist
<i>Ellipsaria lineolata</i> *	butterfly mussel	lotic
<i>Elliptio crassidens</i> *	elephant ear	lotic
<i>Fusconaia flava</i>	Wabash pigtoe	lotic
<i>Fusconaia subrotunda</i>	long-solid	lotic
<i>Lampsilis fasciola</i>	wavyrayed lampmussel	lotic
<i>Lasmigona compressa</i> *	creek heelsplitter	lotic
<i>Ligumia recta</i>	Black sandshell	lotic
<i>Obliquaria reflexa</i>	threehorn wartyback	lotic
<i>Obovaria olivaria</i> *	hickorynut	lotic
<i>Obovaria subrotunda</i>	round hickorynut	lotic
<i>Pleurobema cordatum</i> *	Ohio pigtoe	lotic
<i>Pleurobema rubrum</i> *	pyramid pigtoe	lotic
<i>Pleurobema sintoxia</i>	round pigtoe	lotic
<i>Ptychobranchus fasciolaris</i>	Kidneyshell	lotic
<i>Quadrula metanavra</i> *	monkeyface	lotic
<i>Quadrula pustulosa</i> *	pimpleback	generalist
<i>Truncilla truncata</i> *	deerto	generalist
<i>Tritogonia verrucosa</i> *	pistolgrip mussel	generalist
<i>Villosa iris</i> *	rainbow mussel	lotic