

Symposium on the Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Fresh Water Ecosystems. B.G. Isom (ed). American Society for Testing and Materials, Phila., PA

Neves, R. J., G. B. Pardue, E. F. Benfield, and S. D. Dennis. 1980. An evaluation of endangered mollusks in Virginia. Final Report for Virginia Commission of Game and Inland Fish., Proj. No. E-F-1. Richmond, Virginia. 140pp.

Ortmann, A. E. 1918. The Nayades (Freshwater Mussels) of the Upper Tennessee drainage with notes on synonymy and distribution. Proc. Am. Phil. Soc., Vol. 62.

Stansbery, D. H. 1973. A preliminary report on the naiad fauna of the Clinch River in the Southwestern Appalachian Mountains of Virginia and Tennessee (Mollusca: Bivalvia: Unionidae). Bull. Amer. Mal. Union, March 1973. Abstract.

The Status of Freshwater Mussels (Unionidae) of Virginia

Michael L. Lipford
Virginia Natural Heritage Program
Department of Conservation and Historic Resources
203 Governor Street, Suite 402
Richmond, Virginia 23219

The Virginia Natural Heritage Program (VANHP) was established through the joint efforts of The Nature Conservancy and the Commonwealth of Virginia. The VANHP, through inventory technique, maintains a continuously updated database that reflects the current status of biological diversity in Virginia.

The Nature Conservancy is a major, private conservation organization that specializes in ecological data management for the preservation of natural lands. For over a decade this organization, in partnership with state governments, has pursued biological inventory in a unique and systematic manner. Called State Natural Heritage Programs, these biological inventories collect and disseminate information on the existence, status, and precise locations of rare plants and animals and unique or exemplary natural communities. The data are assembled into an integrated system of databases that serve many purposes and are used by various State and Federal land-management agencies and private users. Heritage Programs have been established in forty-nine states, in Canada, and several of the Latin American countries. The success of Heritage methodology is reflected in state acceptance and recognition that a centralized, continually updated inventory that details

specific locality information is critical to successful long-term planning and management. The Natural Heritage Network has made disparate information within and among states comprehensible and, hopefully, consistent, and has facilitated the sharing of ecological data across state and national boundaries.

The VANHP was established in Richmond in November of 1986 and was operated as a Nature Conservancy program under contract with the Commonwealth until 1988, when it was made a fully funded state program under the Natural Resources Secretariat. Administered by the Department of Conservation and Historic Resources, the VANHP is a section within the Department's Division of Natural Areas Conservation. The Division is responsible for preserving the Commonwealth's biological diversity through identification of high priority natural areas to be protected and managed as Virginia Natural Area Preserves.

The methods of data collection and management are consistent among all Natural Heritage Programs. The initial step is to decide which elements of natural diversity (species, natural communities, and other features) need to be inventoried. Natural Heritage Programs rely heavily upon the input of state experts in developing lists of rare species. Through every

phase of the inventory the lists remain flexible and elements are added or deleted as the growing body of knowledge dictates. Once the list of elements in each category is compiled, each element is ranked in order of its overall priority for inventory and protection efforts. A scale of 1 to 5 is utilized and species are ranked from both a state (S) and a global (G) perspective (Table I).

For example, the James spiny mussel (*Pleurobema collina*), known only from a few headwater tributaries of the James River, has a rank of G1/S1 and consequently receives a very high priority for inventory and protection. Although the black sandshell (*Ligumia recta latissima*) is also very rare in Virginia (ranked S1), it is apparently secure over its entire range (G4) and receives somewhat lower priority. Some species, such as the Eastern Elliptio (*Elliptio complanata*) are demonstrably secure throughout most of their known range (G5/S5) and consequently are not actively monitored by the program. Giving first priority to the species that rank the highest, the staff accumulates and processes information on the rarest freshwater mussel species of Virginia. In addition, these ranks are used for setting preservation priorities, planning status survey work, and the preparation of listing packages for State or Federal Endangered species.

The central unit of data in the Natural Heritage Program is termed the "element occurrence", a specific locality that supports one of the listed elements (Table I). For example, the population of the rare Powell River mussel *Quadrula intermedia* Conrad (Cumberland monkeyface) is an element occurrence. Sources for such site-specific information include specimen labels, the scientific literature, personal communications from experts, and field surveys.

For each element occurrence a manual and computerized record (the Element Occurrence Record) is completed. This includes, in addition to the scientific and common names of the element, such information as the element's location, notes on the status of the population, a site description, threats to the site, the date of observation or collection, the name of the source supplying that record, and ownership information. Given the importance of site-specific information, the Element Occurrence Record includes fields for recording latitude and longitude, the USGS quadrangle, county, physiographic province, watershed, etc. Because these records are computerized, data can be sorted and retrieved by any of the numerous fields on

the Element Occurrence Record. Any combination of information on these records can be used to search and order the database. This information can be reported in a format tailored to fit a specific need or request. In addition to this computerized file, the Heritage Program also maintains a complete set of USGS 7.5-minute topographic maps for Virginia on which the exact location of each element occurrence is marked.

One of the keys to the success of Natural Heritage Programs is the hoped for impartiality of their data and the ease with which this information can be retrieved. Because these data can be used to help avert environmental conflicts before they arise, the VANHP is appreciated by both commercial and environmental interests. For these reasons, state agencies and organizations routinely choose to consult Heritage Programs for environmental reviews in the state. Natural Heritage Programs have Memoranda of Agreement with many Federal and State agencies, and private organizations. The U.S. Congressional Office of Technology Assessment recently cited the Heritage network to Congress as the leading effort in biodiversity data management. The National Office of The Nature Conservancy has cited the Virginia Natural Heritage Program as a model program, incorporating and testing the improvements in database management that are now applied by Natural Heritage Programs across the nation.

The purpose of this paper is to make available the freshwater Unionid list (Table II) established by the Virginia Natural Heritage Program. Comments or suggestions on ranks and/or species contained in the list are welcomed and should be addressed to the author.

Acknowledgements

The author wishes to thank the following individuals who contributed to the development of the list: Sally Dennis, Radford University; John Bates, Ecological Consultants, Inc; Richard Hoffman, Virginia Museum of Natural History; Andy Gerberich, U. S. National Museum; Larry Master, The Nature Conservancy; and Steven Ahlstedt, Tennessee Valley Authority. Thanks are also due to my colleague Christopher Pague for productive discussions on ranks.

TABLE I

**Definition of Abbreviations used on element lists of the Virginia Natural Heritage Program
Department of Conservation and Historic Resources**

The following ranks are used by the Virginia Natural Heritage Program to set protection priorities. The primary criterion for ranking species is the number of occurrences, i.e. the number of known distinct populations. For the purpose of recording mussel distributional data and establishing ranks, the term "occurrence" is used to designate a conservation unit rather than an individual record. Closely spaced species records may, therefore, be merged into one "occurrence". Also of great importance is the number of individuals in existence for each occurrence. Other considerations may include the condition of the occurrences, the number of protected occurrences, and threats to each occurrence. However, the emphasis remains on the number of occurrences such that ranks will be an index of rarity.

- S1 Extremely rare; usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
- S2 Very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
- S3 Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
- S4 Common; usually >100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
- S5 Very common; demonstrably secure under present conditions.
- SH Historically known from the state, but not verified for an extended period, usually >15 years; this rank is used primarily when inventory has been attempted recently.
- SU Status uncertain, often because of low search effort or cryptic nature of the element.
- SX Apparently extirpated from the state.

Global ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character; GX means apparently extinct. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity.

These ranks should not be interpreted as legal designations.

Federal Status

The Virginia Natural Heritage Program uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

- | | |
|----------------------------|---|
| LE - Listed Endangered | 3A - Former candidate - presumed extinct |
| LT - Listed Threatened | 3B - Former candidate - not a valid species under current taxonomic understanding |
| PE - Proposed Endangered | 3C - Former candidate - common or well protected |
| PT - Proposed Threatened | |
| C1 - Candidate, category 1 | |
| C2 - Candidate, category 2 | |

State Status

The Virginia Natural Heritage Program uses similar abbreviations for State endangerment, as developed by the Department of Game and Inland Fisheries.

- | | |
|------------------------|------------------------|
| LE - Listed Endangered | LT - Listed Threatened |
|------------------------|------------------------|

TABLE II
 VIRGINIA NATURAL HERITAGE PROGRAM
 COMPLETE LIST OF
 VIRGINIA FRESHWATER UNIONID MUSSELS¹

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL LEGAL STATUS	STATE LEGAL STATUS
<i>Actinonaias carinata</i>	MUCKET	G5	S4		
<i>Actinonaias pectorosa</i>	PHEASANT SHELL	G4	S4		
<i>Alasmidonta heterodon*</i>	DWARF WEDGEMUSSEL	G1	SH	C1	
<i>Alasmidonta marginata</i>	ELKTOE	G5	S4		
<i>Alasmidonta undulata*</i>	TRIANGLE FLOATER	G5	S4		
<i>Alasmidonta varicosa*</i>	BROOK FLOATER	G3	S3		
<i>Alasmidonta viridis</i>	SLIPPERSHELL	G4	S3		
<i>Amblema costata</i>	THREERIDGE	G5	S5		
<i>Anodonta cataracta*</i>	EASTERN FLOATER	G5	S5		
<i>Anodonta imbecillis</i>	PAPER POND SHELL	G5	S4		
<i>Anodonta implicata*</i>	ALEWIFE FLOATER	G5	S4		
<i>Carunculina lividus</i>	PURPLE LILIPUT	G2	SU	C2	
<i>Conradilla caelata</i>	BIRDWING PEARLYMUSSEL	G2	S1	LE	LE
<i>Cumberlandia monodonta</i>	SPECTACLE CASE	G2G3	S1	C2	
<i>Cyclonaias tuberculata</i>	PURPLE WARTYBACK	G5	S4		
<i>Cyprogenia irrorata</i>	FANSHELL	G3	S1	C2	
<i>Dromus dromas</i>	DROMEDARY PEARLYMUSSEL	G2	S1	LE	LE
<i>Dysnomia arcaeiformis</i>	SUGAR SPOON	GX	SX		
<i>Dysnomia brevidens</i>	CUMBERLAND COMBSHELL	G2	S1	C2	LE
<i>Dysnomia capsaeformis</i>	OYSTER MUSSEL	G1	S1	C2	LE
<i>Dysnomia florentina florentina</i>	YELLOW-BLOSSOM	GX	SX	LE	
<i>Dysnomia florentina walkeri</i>	TAN RIFFLESHELL	G1T1	S1	LE	LE
<i>Dysnomia haysiana</i>	ACORNSHELL	GH	SX	3A	
<i>Dysnomia lenior</i>	NARROW CAT SPAW	GX	SX	3A	
<i>Dysnomia lewisii</i>	FORKSHELL	GXQ		SX	3A
<i>Dysnomia stewardsoni</i>	CUMBERLAND LEAF SHELL	GX	SX	3A	
<i>Dysnomia torulosa gubernaculum</i>	GREEN-BLOSSOM	G2T1	S1	LE	LE
<i>Dysnomia triquetra</i>	SNUFFBOX	G4	S1		LE
<i>Elliptio complanata*</i>	EASTERN ELLIPTIO	G5	S5		
<i>Elliptio crassidens</i>	ELEPHANT EAR	G4	S1		
<i>Elliptio crassidens incrassatus*</i>	SOUTHERN ELEPHANT EAR	G4T?	S4		
<i>Elliptio dilatata</i>	SPIKE	G5	S5		
<i>Elliptio fisheriana*</i>	NORTHERN LANCE	G3G4	S3S4		
<i>Elliptio lanceolata*</i>	YELLOW LANCE	G4	S3S4		
<i>Elliptio producta*</i>	ATLANTIC SPIKE	G3Q	S3S4		
<i>Fusconaia barnesiana</i>	TENNESSEE PIGTOE	G3	S3		
<i>Fusconaia cuneolus</i>	FINE-RAYED PIGTOE	G1	S1	LE	LE
<i>Fusconaia edgariana</i>	SHINY PIGTOE	G1	S1	LE	LE
<i>Fusconaia masoni*</i>	ATLANTIC PIGTOE	G3	S1		
<i>Fusconaia subrotunda</i>	LONG SOLID	G4	S4		
<i>Lampsilis cariosa*</i>	YELLOW LAMP MUSSEL	G4	S3		
<i>Lampsilis fasciola</i>	WAVY-RAYED LAMP MUSSEL	G4	S4		
<i>Lampsilis ochracea*</i>	TIDEWATER MUCKET	G4	S4		
<i>Lampsilis ovata</i>	POCKETBOOK	G5	S5		
<i>Lampsilis radiata*</i>	EASTERN LAMP MUSSEL	G5	S4		
<i>Lasmigona complanata</i>	WHITE HEELSPLITTER	G5	S3		
<i>Lasmigona costata</i>	FLUTED SHELL	G5	S5		
<i>Lasmigona holstonia</i>	TENNESSEE HEELSPLITTER	G3	S2	C2	
<i>Lasmigona subviridis*</i>	GREEN FLOATER	G4	S3		
<i>Lastena lata</i>	CRACKING PEARLYMUSSEL	G2	S1	C2	
<i>Leptodea fragilis</i>	FRAGILE PAPER SHELL	G5	S4		
<i>Lexingtonia dolabelloides</i>	SLABSID PEARLYMUSSEL	G2	S1	C2	
<i>Lexingtonia subplana*</i>	VIRGINIA PIGTOE	G1Q	SH		
<i>Ligumia nasuta*</i>	EASTERN POND MUSSEL	G4	S4		

TABLE II (Continued)

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL LEGAL STATUS	STATE LEGAL STATUS
<i>Ligumia recta latissima</i>	BLACK SANDSHELL	G5	S2		
<i>Medionidus conradicus</i>	CUMBERLAND MOCCASIN	G4	S3S4		
<i>Pegias fabula</i>	LITTLE-WINGED PEARLY-MUSSEL	G1	S1	LE	LE
<i>Plethobasus cyphus</i>	SHEEPSNOSE	G3	S1		
<i>Pleurobema collina*</i>	JAMES SPINYMUSSEL	G1	S1	LE	LE
<i>Pleurobema cordatum</i>	OHIO PIGTOE	G4	S2		
<i>Pleurobema oviforme</i>	TENNESSEE CLUBSHELL	G3	S3	C2	
<i>Pleurobema plenum</i>	ROUGH PIGTOE	G1	S1	LE	LE
<i>Pleurobema pyramidatum</i>	PYRAMID PIGTOE	G2G3	S2	C2	
<i>Proptera alata</i>	PINK HEELSPLITTER	G5	S4		
<i>Pychobranchus fasciolaris</i>	KIDNEYSHELL	G4	S3		
<i>Pychobranchus subtentum</i>	FLUTED KIDNEYSHELL	G3	S3		
<i>Quadrula cylindrica</i>	RABBITS FOOT	G3	S2	C2	
<i>Quadrula intermedia</i>	CUMBERLAND MONKEYFACE	G1	S1	LE	LE
<i>Quadrula pustulosa</i>	PIMPLE BACK	G5	S3		
<i>Quadrula sparsa</i>	APPALACHIAN MONKEYFACE	G1Q	S1	LE	LE
<i>Strophitus rugosus</i>	INTERIOR SQUAWFOOT	G5	S3		
<i>Strophitus undulatus*</i>	SQUAWFOOT	G5	S4		
<i>Tritogonia verrucosa</i>	PISTOLGRIP	G4	S2		
<i>Truncilla truncata</i>	DEERTOES	G4	S1		
<i>Unio merus obesus*</i>	SOUTHERN PONDHORN	G2	S2		
<i>Unio merus tetralasmus</i>	PONDHORN	G3	SU		
<i>Villosa constricta*</i>	NOTCHED RAINBOW	G3	S3S4		
<i>Villosa fabalis</i>	RAYED BEAN	G2	S1	C2	
<i>Villosa nebulosa</i>	ALABAMA RAINBOW	G3	S3S4		
<i>Villosa perpurpurea</i>	PURPLE BEAN	G2Q	S2	C2	
<i>Villosa trabalis</i>	CUMBERLAND BEAN MUSSEL	G2	S1	LE	LE
<i>Villosa vanuxemensis</i>	MOUNTAIN CREEKSHELL	G3	S3S4		

* - Restricted to the Atlantic Slope drainage in Virginia.

1 - Scientific names are those listed by the VANHP as "state names" in the Heritage database

- Common names are in general conformance with those listed in the publication Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks. American Fisheries Society Special Publication 16, Bethesda, Maryland, 1988.