

CHECKLIST OF THE FRESHWATER SNAILS (MOLLUSCA: GASTROPODA) OF PENNSYLVANIA, USA⁴

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ABSTRACT

Despite a high degree of imperilment, freshwater snails have received little attention from conservation scientists. We collected museum records and conducted field studies in order to develop a species checklist for Pennsylvania. Our research reports 63 species of freshwater snails for the Commonwealth of Pennsylvania. We hope this information will make the group more visible to state agencies and stimulate additional research. [J PA Acad Sci 82(2/3): 92–97, 2008]

INTRODUCTION

Freshwater mollusks are one of the most highly imperiled groups of organisms in North America today (Ricciardi and Rasmussen 1999). Within the past 20 years, freshwater mussel research in the United States has provided valuable new information on the conservation status, biology, and ecology of species. While there is a growing body of knowledge regarding freshwater gastropods (see information reviews in Dillon 2000; Smith 2001), information on the conservation status of United States species is poorly known (Bogan 1997). Approximately 600 species of freshwater snails occur in the United States. Forty-two species are thought to be extinct (Turgeon et al. 1998), 24 species are considered threatened or endangered and 11 species are currently listed as candidates for federal protection under the Endangered Species Act (USFWS 2006).

A basic knowledge of the regional fauna does not exist in many parts of the United States. Too few trained malacologists, unresolved taxonomic issues, and a general lack of interest by state agencies are just a few factors that have contributed to a poor knowledge of our freshwater snail fauna. However, in recent years, there have been an increasing number of studies that have documented or reported on the freshwater snail fauna for some states:

Connecticut (Jokinen 1987), Iowa (Stewart 2006), Maine (Martin 1999), Missouri (Wu et al. 1997), New York (Jokinen 1992), and Virginia (Stewart and Dillon 2004) are visible examples.

Although a number of professional and amateur malacologists have collected freshwater gastropods in Pennsylvania over the past 150 years, there has never been a comprehensive, published list of species for the state. The goals of this study were to gather museum records for the Commonwealth of Pennsylvania and to supplement the list through field collections in order to develop a checklist of the state fauna.

MATERIALS AND METHODS

Museum Records

Several major collections were accessed for Pennsylvania records, though only the Carnegie Museum of Natural History collection was physically visited. Typically museum records were requested or obtained through searches from the respective institution website. Museum record searches were done for: The Academy of Natural Sciences, Philadelphia (ANSP); Bell Museum at the University of Minnesota (BMNH); California Academy of Sciences (CAS); Carnegie Museum of Natural History, Pittsburgh (CMNH); Delaware Museum of Natural History, Wilmington (DMNH); The Field Museum, Chicago (FM); Florida Museum of Natural History, Gainesville (FMNH); Frost Museum at Pennsylvania State University, State College (PSU); Illinois Natural History Survey, Illinois (INHS); Ohio State University Museum (OSUM), and Smithsonian Museum, Washington, D.C. (SMNH). Museum records were maintained in a File-maker Pro database.

Field Sampling

Field sampling was carried out from March 2003 to June 2006. Sampling was focused in streams of various drainage orders in Pennsylvania, although there was some opportunistic sampling in lakes, wetlands, and other habitats. We generally attempted to sample in streams of the

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highest habitat and water quality. The goal at each site was to maximize species richness and not total population abundance; sampling typically continued until no new species were collected. We sampled in all major drainage basins in the state across its 67 counties. Collections were made in available microhabitats (backwaters, undercut banks, cobble flats, mud flats, etc.) and substrates (woody debris, trash, large rocks, cobbles, silt/sand edges). Hand collecting, handheld sieves, and d-frame nets were used in wadable areas; some SCUBA diving was done in the lower Allegheny River. Specimens were generally placed directly in 70% ethanol in the field. Hydrobiidae were first relaxed during menthol crystals prior to fixing in 70% ethanol (Dillon 2005).

Taxonomy

Shell morphology was typically used to identify most families, while penial sheath morphology was used to identify species of *Physa* and Hydrobiidae. Nomenclature follows ICZN (1998), Turgeon et al. (1998), Smith (2000), and Wethington and Lydeard (2007). All specimens collected in the course of field study have been deposited at Carnegie Museum of Natural History in Pittsburgh, PA.

RESULTS

A total of 442 collections were made from 2003–2006. From the results of field sampling and gathering of museum

Table 1. List of the freshwater snail species of Pennsylvania. See list of museums in Methods section for list of museum collection abbreviations.

Scientific Name	Common Name	Record Source
Order Basommatophora		
Ancylidae		
<i>Ferrissia fragilis</i> (Tryon, 1863)	fragile ancylid	This study
<i>Ferrissia parallelus</i> (Haldeman, 1841)	oblong ancylid	This study
<i>Ferrissia rivularis</i> (Say, 1817)	creeping ancylid	Clapp (1895); Schick (1895); Rhoads (1899); Caffrey (1911); Heilman (1951); Heilman (1952); ANSP; CMNH; DMNH; OSUM; This study
<i>Laevapex fuscus</i> (C. B. Adams, 1841)	dusky ancylid	Rhoads (1899); ANSP; CMNH; DMNH; This study
Lymnaeidae		
<i>Galba exigua</i> (I. Lea, 1841)	none	Heilman (1951); Heilman (1952); CMNH; This study
<i>Galba humilis</i> (Say, 1822)	marsh galba	Schick (1895); ANSP; CMNH; DMNH; OSUM
<i>Galba modicella</i> (Say, 1825)	rock galba	Heilman (1952); CMNH; FMNH; This study
<i>Galba obrussa</i> (Say, 1825)	golden galba	Heilman (1951); Heilman (1952); ANSP; CMNH; This study
<i>Galba parva</i> (I. Lea, 1841)	pygmy galba	Clapp (1895); Heilman (1951); CMNH; This study
<i>Galba rustica</i> (I. Lea, 1841)	none	CMNH; This study
<i>Lymnaea stagnalis</i> (Linnaeus, 1758)	swamp lymnaea	ANSP; CMNH; This study
<i>Pseudosuccinea columella</i> (Say, 1817)	mimic lymnaea	Rhoads (1899); Heilman (1951); Heilman (1952); ANSP; CMNH; DMNH; This study
<i>Radix auricularia</i> (Linnaeus, 1758)	big-eared radix	Long (1912); ANSP; CMNH; SMNH
<i>Stagnicola caperata</i> (Say, 1829)	wrinkled marshsnail	DMNH; FMNH
<i>Stagnicola catascopium</i> (Say, 1817)	woodland pondsnail	Schick (1895); Caffrey (1911); ANSP; CMNH; DMNH; FMNH; This study
<i>Stagnicola elodes</i> (Say, 1821)	marsh pondsnail	ANSP; CMNH; This study
<i>Stagnicola emarginata</i> (Say, 1821)	St. Lawrence pondsnail	CMNH; Heilman (1951); Heilman (1952); This study
Planorbidae		
<i>Gyraulus circumstriatus</i> (Tyron, 1866)	disc gyro	This study
<i>Gyraulus deflectus</i> (Say, 1824)	flexed gyro	Schick (1895); Caffrey (1911); Heilman (1951); ANSP; CMNH; DMNH; FMNH; This study
<i>Gyraulus parvus</i> (Say, 1817)	ash gyro	Schick (1895); Heilman (1951); Heilman (1952); ANSP; CMNH; FMNH; This study
<i>Helisoma anceps</i> (Menke, 1830)	two-ridge rams horn	Heilman (1951); Heilman (1952); ANSP; CMNH; DMNH; FMNH; This study
<i>Micromenetus dilatatus</i> (Gould, 1841)	bugle sprite	Clapp (1895); Schick (1895); This study
<i>Planorbella campanulata</i> (Say, 1821)	bellmouth rams-horn	Caffrey (1911); Heilman (1951); Heilman (1952); CMNH; FMNH; This study
<i>Planorbella trivolvis</i> (Say, 1817)	marsh rams-horn	Schick (1895); Rhoads (1899); Heilman (1951); Heilman (1952); ANSP; CMNH; DMNH; FMNH; OSUM; This study
<i>Planorbula armigera</i> (Say, 1821)	thicklip rams-horn	Schick (1895); CMNH; FMNH
<i>Promenetus exacuous</i> (Say, 1821)	sharp sprite	Schick (1895); ANSP; CMNH; DMNH; This study
Physidae		
<i>Aplexa elongata</i> (Say, 1821)	lance aplexa	Schick (1895); This study
<i>Physa (=Physella) acuta</i> (Draparnaud, 1805)	European physa	Schick (1895); Rhoads (1899); Caffrey (1911); Heilman (1951); ANSP; CMNH; FMNH; SMNH; This study
<i>Physa (=Physella) ancillaria</i> (Say, 1825)	pumpkin physa	Schick (1895); Caffrey (1911); ANSP; CMNH; DMNH; This study
<i>Physa (=Physella) gyrina</i> (Say, 1821)	tadpole physa	Heilman (1951); ANSP; CMNH; DMNH; This study
<i>Physa skinneri</i> (Taylor, 1954)	glass physa	ANSP
<i>Physa vernalis</i> (Taylor and Jokinen, 1984)	vernal physa	This study

(continued next page)

records considered valid, 63 nominal species in 9 families of freshwater snails are believed to have existed or are currently found in Pennsylvania (Table 1). We believe that records for several species are in error.

Recent New Records for Pennsylvania (this study)

Ancylidae: *Ferrissia fragilis*
Ferrissia parallelus

Physidae: *Physa vernalis*

Planorbidae: *Gyraulus circumstriatus*

Recent Taxonomic Updates

Ancylidae: *Laevapex diaphanus* (Halderman, 1841). Records for this species were located in Rhoads (1899), ANSP, and CMNH. Based on mitochondrial DNA, Walther et al. (2006) found *Laevapex diaphanus* to be a part of a group of species

that showed little variation from *Laevapex fuscus*. We therefore treated all records of *Laevapex diaphanus* as *L. fuscus*.

Physidae: Following Wethington and Lydeard (2007), the Pennsylvania Physidae have been classified into 4 groups: an *Aplexa elongata* group (containing *Aplexa elongata*), *Physa* Type A group (containing *Physa vernalis* and *P. skinneri*), a *Physa* (= *Physella*) *acuta* group (which groups *P. heterostropha* and *P. integra* under the name *Physa acuta*) and finally, a *Physa gyrina* group (which contains *Physa gyrina* and *P. ancillaria*).

Questionable Records

Campeloma crassula (Rafinesque 1819). Records were listed for this species from Pennsylvania (ANSP 365189, 365190, 365191). According to Burch (1989), this is a mid-

Table 1. continued.

Scientific Name	Common Name	Record Source
Order Neotaenioglossa		
Bithyniidae		
<i>Bithynia tentaculata</i> (Linnaeus, 1758)	mud bithynia	CMNH
Hydrobiidae		
<i>Amnicola decicus</i> (Haldeman, 1845)	none	Caffrey (1911)
<i>Amnicola limosus</i> (Say, 1817)	mud amnicola	Schick (1895); Caffrey (1911); CMNH; Heilman (1952); This study
<i>Birgella subglobosus</i> (Say, 1825)	globe siltsnail	OSUM
<i>Cincinnatia integra</i> (Say, 1829)	midland siltsnail	This study
<i>Fontigens nickliniana</i> (I. Lea, 1838)	watercress snail	Hershler et al. (1990); CMNH; FMNH; SMNH; This study
<i>Fontigens orolibas</i> (Hubricht, 1957)	Blue Ridge springsnail	Hershler et al. (1990)
<i>Gillia altilis</i> (I. Lea, 1841)	buffalo pebblesnail	Schick (1895); Caffrey (1911); ANSP; FMNH
<i>Lyogyrus granum</i> (Say, 1822)	squat duskysnail	Schick (1895); Caffrey (1911); ANSP; CMNH; SMNH
<i>Lyogyrus pupoideus</i> (Gould, 1841)	pupa duskysnail	This study
<i>Potomopyrgus antipodarum</i> (J. E. Gray, 1853)	New Zealand mudsnail	Levri et al. (2007)
<i>Pyrgulopsis lustrica</i> (Pilsbry, 1890)	boreal marstonia	CMNH
<i>Somatogyrgus integra</i> (Say, 1829)	Ohio pebblesnail	CMNH; This study
<i>Somatogyrgus pennsylvanicus</i> (Walker, 1904)	shale pebblesnail	Walker (1904); This study
Pleuroceridae		
<i>Elimia livescens</i> (Menke, 1830)	liver elimia	Brooks (1927); ANSP; CMNH; FMNH; OSUM; This study; SMNH
<i>Elimia virginica</i> (Say, 1817)	Piedmont elimia	Schick (1895); Caffrey (1911); Brooks (1927); Heilman (1951); Heilman (1952); ANSP; CMNH; INHS; OSUM; This study
<i>Leptoxis carinata</i> (Bruguère, 1792)	crested mudalia	Brooks (1927); Heilman (1951); CMNH; FMNH; OSUM; This study
<i>Leptoxis dilatata</i> (Conrad, 1835)	seep mudalia	Brooks (1927); ANSP
<i>Lithasia obovata</i> (Say, 1829)	Shawnee rocksnail	Brooks (1927); CMNH; FMNH; This study
<i>Pleurocera acuta</i> (Rafinesque, 1831)	sharp hornsail	Brooks (1927); FMNH; This study
<i>Pleurocera canaliculata</i> (Say, 1821)	silty hornsail	Clapp (1895); Rhoads (1899); Brooks (1927); This study
Pomatiopsidae		
<i>Pomatiopsis lapidaria</i> (Say, 1817)	slender walker	Schick (1895); Caffrey (1911); ANSP; FMNH
Valvatidae		
<i>Valvata bicarinata</i> (I. Lea, 1841)	two-ridge valvata	Schick (1895); Rhoads (1899); Walker (1902); Caffrey (1911); FMNH
<i>Valvata sincera</i> (Say, 1824)	mossy valvata	CMNH
<i>Valvata tricarinata</i> (Say, 1817)	threeridge valvata	Schick (1895); Caffrey (1911); Heilman (1952); ANSP; BMNH; CMNH; FMNH
Viviparidae		
<i>Bellamyia chinensis malleata</i> (Reeve, 1863)	Chinese mysterysnail	ANSP; This study
<i>Bellamyia japonica</i> (von Martens, 1861)	Japanese mysterysnail	ANSP
<i>Campeloma decisum</i> (Say, 1816)	pointed campeloma	Schick (1895); Rhoads (1899); Caffrey (1911); Heilman (1951); Heilman (1952); FMNH; OSUM; This study
<i>Campeloma rufum</i> (Haldeman, 1841)	unnamed campeloma	ANSP
<i>Lioplax subcarinata</i> (Say, 1816)	ridged lioplax	Schick (1895); Caffrey (1911); ANSP; CMNH; FMNH
<i>Viviparus georgianus</i> (I. Lea, 1834)	banded mysterysnail	ANSP; CMNH

western species unlikely to be found in Pennsylvania. We considered records of this species in the state to be *Campeloma decisum* pending the future results molecular analyses needed to clarify the taxonomy within the genus.

Elimia semicarinata (Say 1829). This species does not occur as far east as Pennsylvania according to Burch (1989). Records from Shenango (labeled as Chenango) River (ANSP 364269) and Eighteenmile Creek, Erie County (ANSP 364270, 364271) are likely misidentified specimens of *Elimia livescens*.

Fontigens antroecetes (Hubricht 1957). Records listed for this species from Pennsylvania from the Smithsonian Museum (SMNH 522087; 522846; 853173) are likely misreported *Fontigens orolibas* (Hershler et al., 1990).

Somatogyrus depressus (= *S. integer*), (Tryon 1862). Ortmann reported this species from the Allegheny River (CMNH 62.7485). There is great uncertainty of the taxonomy within the genus *Somatogyrus* and there is a lack of characters to consistently differentiate many taxa (Walker, 1915; Watson, 2000). Until there is better taxonomic information available, we are using the name applied by Ortmann in earlier Pennsylvania freshwater gastropod collections, which is *Somatogyrus integra* (Say 1829).

Viviparus contectus (Millet 1813). This is a European species that was reported to occur in Philadelphia (Bailey, 1909). It is unclear whether this is actually *Viviparus contectus* or *Viviparus georgianus*, which has been documented to occur in Philadelphia (ANSP 98696, 105814, 105977) and the Lehigh River (CMNH 62.12838).

DISCUSSION

This study reported 63 nominal taxa of freshwater snails from Pennsylvania. In adjacent states, Jokinen (1992) reported 63 species from New York, although this number does not reflect recent updates in taxonomy. Taylor (2005) reported records for 25 species from West Virginia; this total was likely low as the fauna reported was missing common species such as *Gyraulus deflectus* and members of the Valvatidae or Hydrobiidae. Because recent survey efforts by the authors have focused on streams and rivers almost exclusively, comprehensive distribution data for lakes, wetlands and other non-riverine habitats is sorely needed in order to corroborate historical records in these habitats and to possibly add new species to Pennsylvania's fauna. Four new species records were found during fieldwork for this study including the first record for *Physa vernalis* from Pennsylvania, a species reported from other northeastern states and of high global conservation concern (NatureServe Explorer, 2007).

Because many museums in the country have done little active curation with freshwater snails, there are likely misidentifications and unidentified specimens in the collections. We examined the validity of all database records by visits to museums to verify specimens and gather records are needed in order to refine this list.

It should be noted that the majority of the species on the list are those currently accepted by Turgeon et al. (1998) and do not necessarily represent valid taxa. Anatomical, breeding and molecular studies are needed to provide definitive taxonomic resolution in these groups and to refine the list presented here. With regards to the Pennsylvania fauna, taxonomic questions remain regarding several of the prosobranch species in the genera *Amnicola*, *Campeloma*, *Galba*, and *Somatogyrus*. Given the extreme phenotypic variation in shell characters that has been reported within the pulmonates (Dillon et al. 2002; Britton and McMahon 2004; McMahon 2004) as well as the prosobranchs (Urabe 1998; Urabe 2000; Hoverman et al. 2005), we feel a conservative treatment is warranted with regards to taxonomy in several families, as many of the published monographs are based principally on external shell characters.

In a recently prepared state list for Iowa, Stewart (2006) grouped all *Galba* into one large group pending future taxonomic resolutions. In another treatment, Baker (1928) separated members of the *Galba obrussa* complex into a *Galba obrussa* group, a *G. exigua* group, a *G. modicella* group, and a *G. rustica* group. These taxonomic distinctions based on slight distinctions in shell sculpture may represent nothing more than intraspecific variation. While retained the use of the nominal *Galba* taxa listed in Turgeon et al. (1998) in compiling this checklist, serious work is needed to resolve the taxonomy. Finally, while we did report *Campeloma rufum* from the state from a museum record, it was primarily in the course of following the nomenclature of Turgeon et al. (1998) and does not endorse the validity of the current taxonomy within the genus *Campeloma*.

The taxonomy of the Physidae in particular remains in a troubled state, particularly within the genus *Physa*. There have been treatments of the Physidae based primarily on anatomy (Te 1978; Taylor 2003) but more recently on molecular data (Wethington and Lydeard 2007). Based on mitochondrial DNA-based phylogenies, Wethington and Lydeard (2007) proposed a reduction from 28 nominal taxa of North American species of *Physa* to 12. The molecular approach by Wethington and Lydeard was sorely needed and further research may prove useful in elucidating this troublesome group. Despite these efforts, more work remains to be done with regard to the systematics of the Physidae. As we include species here which continue to have unresolved taxonomy (such as *Physa skinneri*, *P. vernalis*, *P. ancillaria*, and *P. gyrina*), the number of species in the state could be reduced according to future efforts.

The recent addition of a highly invasive species, *Potamopyrgus antipodarum* (New Zealand mud snail) at Presque Isle, Erie County (Levri et al. 2007) is very troubling. This finding could present problems for the fauna in northwest Pennsylvania, the most diverse area of the state for freshwater gastropods (Evans and Ray, in prep).

Pennsylvania has recently developed a Comprehensive Wildlife Conservation Strategy (PFBC/PGC, 2005). In this document, freshwater snails were included as part of the

long-term strategy for protection. This is a promising step to the conservation of aquatic gastropods in Pennsylvania, and despite the listing of 9 species as being considered Vulnerable or higher in the Pennsylvania Wildlife Strategy, distribution information is certainly lacking for many species. Additional inventory effects of freshwater snails will be needed to help identify key species and populations for these sorts of efforts. We hope that the information presented in this paper will be useful to resource managers. Comments are welcomed on this list.

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