

PENNSYLVANIA'S WILD SPECIES—THE 2013 BOX SCORE

GROUP OF ORGANISMS	SPECIES OR SUBSPECIES OF IMMEDIATE CONCERN				TOTAL SPECIES AND SUBSPECIES					
	PABS-RECOMMENDED ENDANGERED IN PENNSYLVANIA*	PABS-RECOMMENDED THREATENED IN PENNSYLVANIA*	DOWNLISTED SINCE 1990 DUE TO INCREASE IN POPULATION	PRESUMED EXTIRPATED FROM PENNSYLVANIA	EXTINCT (GLOBALLY)	REPRODUCING CURRENTLY IN THE WILD IN PENNSYLVANIA			NON-BREEDING MIGRANTS	PENNSYLVANIA RESPONSIBILITY SPECIES [‡]
						NATIVE	NONNATIVE	TOTAL [†]		
PLANTS										
Vascular plants (Tracheophyta) Revised January 2012—T. Block	GL: 24 PA: 300	GL: 4 PA: 115	0	GL: 10 other: 97	2	2,076	933	3,009	—	needs study
Mosses (Bryophyta) Revised Jan. 2014—S. Schuette	GL: 2	GL: 18	0	3	0	443	0	443	—	0
Liverworts (Marchantiophyta) Revised Jan. 2014—S. Schuette	0	GL: 3	0	1	0	135	0	135	—	0
Hornworts (Anthocerotophyta) Revised Jan. 2014—S. Schuette	0	GL: 1	0	0	0	3	0	3	—	0
Stoneworts, pondweeds (Charophyta)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Green algae (Chlorophyta)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
ANIMALS I—VERTEBRATES (Chordata)										
Birds (Aves) Revised Aug. 2012, reviewed Nov. 2013—M. Brittingham	GL: 1 PA: 15	PA: 4	2	GL: 2 other: 5	2	183	5	188	116	9
Mammals (Mammalia) Revised May 2012; reviewed Dec. 2013—H. Whidden	GL: 1 PA: 6	GL: 2 PA: 1	1	9	0	63	4	65	0	4
Turtles (Testudines) Revised Dec. 2013—H. Reinert	GL: 1 PA: 1	PA: 1	0	1	0	13	2	15	0	3
Snakes, lizards (Squamata) Revised Dec. 2013—H. Reinert	GL: 1 PA: 2	0	0	0	0	26	0	26	0	4
Amphibians (Amphibia) Revised Dec. 2013—H. Reinert	PA: 5	PA: 2	1	1	0	38	0	38	0	3
Bony fishes (Actinopterygii) Revised Jan. 2012—R. Criswell; reviewed Nov. 2013—D. Argent	GL: 5 PA: 22	GL: 2 PA: 6	6	GL: 2 other: 14	1	158	19	177	26	11
Jawless fishes or lampreys (Cyclostomata) Revised Jan. 2012—R. Criswell; reviewed Nov. 2013—D. Argent	PA: 1	PA: 1	0	0	0	7	0	7	0	2

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						NATIVE	NONNATIVE	TOTAL [†]		
ANIMALS II—ARTHROPODS (Arthropoda)										
ARTHROPODS 1—INSECTS & CLOSE RELATIVES (Hexapoda)										
Butterflies, skippers (Lepidoptera, in part) Revised January 2012—B. Leppo	GL: 4 PA: 7	GL: 1 PA: 38	1	GL: 1 other: 5	0	122	2	124	20	2
Moths (Lepidoptera, in part) Adapted from Rawlins, 2007 (see endnotes); estimated total revised January 2012—B. Leppo	GL: 29 PA: 48	GL: 1 PA: 19	0	GL: 4 other: 2	0	unknown	unknown	estimated >1,500	unknown	3
Dragonflies, damselflies (Odonata) Revised January 2012—B. Leppo	GL: 5 PA: 45	PA: 22	0	0	0	179	0	179	unknown	1
Stoneflies (Plecoptera) Revised Aug. 2010—J. Earle	GL: 1 PA: 2	GL: 6 PA: 3	0	1	0	141	0	141	—	1
Bristletails (Archaeognatha)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Cockroaches (Blattaria)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Beetles (Coleoptera) Adapted from Rawlins, 2007 (see endnotes)	GL: 5 PA: 1	PA: 9	0	2	unknown	unknown	unknown	estimated >1,000	—	needs study
Springtails (Collembola)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Earwigs (Dermaptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Two-pronged bristletails (Diplura)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
True flies, gnats, crane flies (Diptera) Adapted from Rawlins, 2007 (see endnotes)	PA: 1	needs study	0	unknown	unknown	unknown	unknown	estimated >1,000	—	needs study
Mayflies (Ephemeroptera) Adapted from Rawlins, 2007 (see endnotes)	GL: 6	needs study	0	unknown	unknown	unknown	unknown	>230	—	needs study
True bugs, water-striders, cicadas, leaf-hoppers, aphids, scale insects (Hemiptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated >1,000	—	needs study
Wasps, bees, ants, sawflies (Hymenoptera) Adapted from Rawlins, 2007 (see endnotes)	needs study	needs study	0	GL: 1	unknown	unknown	unknown	estimated >1,000	—	needs study

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Termites (Isoptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Mantids (Mantodea)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Scorpionflies, hangingflies (Mecoptera) <small>Adapted from Rawlins, 2007 (see endnotes)</small>	needs study	PA: 1	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Dobsonflies, fishflies, alderflies (Megaloptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Lacewings, ant-lions (Neuroptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Grasshoppers, crickets, katydids (Orthoptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Walking-sticks (Phasmatodea)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Chewing lice, sucking lice (Phthiraptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Coneheads (Protura)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Booklice, barklice (Psocoptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Fleas (Siphonaptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Twisted-wing insects (Strepsiptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Thrips (Thysanoptera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Silverfish, firebrats (Thysanura)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Caddisflies (Trichoptera) <small>Adapted from Rawlins, 2007 (see endnotes)</small>	GL: 6	needs study	0	unknown	unknown	unknown	unknown	>312	—	needs study

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Angel insects (Zoraptera) From Rawlins & Bier, 1998 (see endnotes)	0	0	0	0	0	1	0	1	—	0
ARTHROPODS 2—MYRIAPODS (Myriapoda)										
Centipedes (Chilopoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Millipedes (Diplopoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Pauropods (Pauropoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Symphylans (Symphyla)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
ARTHROPODS 3—ARACHNIDS (Arachnida)										
Mites, ticks (Acari)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 101–1,000	—	needs study
Spiders (Araneae) Revised Jan. 2012—C. Bier	under study	under study	0	unknown	unknown	estimated 600–1,000	unknown	estimated 600–1,000	—	under study
Daddy-longlegs (Opiliones) From Hribar, 1989 (see endnotes)	needs study	needs study	0	unknown	0	~20	2	~22	—	needs study
Pseudoscorpions (Pseudoscorpiones)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Scorpions (Scorpiones) From Rawlins & Bier, 1998 (see endnotes)	0	0	0	0	0	1	0	1	—	0
ARTHROPODS 4—CRUSTACEANS (Crustacea)										
Crayfishes (Decapoda, in part) Revised Nov. 2013—D. A. Lieb (see endnotes)	GL: 1 PA: 3	0	0	0	0	12	4	16	—	2
Crabs, grass shrimps (Decapoda, in part)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	unknown	needs study
Scuds (Amphipoda) Revised Nov. 2013—D. S. Glazier	GL: 6	PA: 2	0	unknown	unknown	unknown	unknown	estimated 11–100	—	2

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Fairy shrimps, water-fleas (Branchiopoda) Adapted from Rawlins, 2007 (see endnotes)	needs study	needs study	0	unknown	unknown	unknown	3	<i>estimated 11–100</i>	—	needs study
Pillbugs, woodlice (Isopoda) Revised Nov. 2013—D. S. Glazier	GL: 2	PA: 1	0	unknown	unknown	unknown	unknown	<i>estimated 11–100</i>	—	2
Fishlice, copepods (Maxillopoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	<i>estimated 11–100</i>	—	needs study
Opossum shrimps (Mysida) From Rawlins & Bier, 1998 (see endnotes)	0	0	0	0	0	1	0	1	—	0
Mussel shrimps (Ostracoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	<i>estimated 11–100</i>	—	needs study
Tongue worms (Pentastomida)	needs study	needs study	0	unknown	unknown	unknown	unknown	<i>estimated 2–10</i>	—	needs study
ANIMALS III—MOLLUSKS (Mollusca)										
Mussels (Bivalvia, in part) Revised Feb. 2012—M. Walsh; reviewed Nov. 2013 E. Meyer	GL: 4 PA: 23	GL: 11 PA: 27	0	GL: 6 other: 13	0	54	3	57	—	6
Other bivalves (Bivalvia, in part) Revised June 2010—T. Pearce; reviewed Nov. 2013 E. Meyer	0	0	0	0	0	18	4	22	—	0
Land snails (Gastropoda, in part) Revised June 2010—T. Pearce; reviewed Nov. 2013 E. Meyer	PA: 4	PA: 50	0	0	0	105	20	125	—	0
Freshwater snails (Gastropoda, in part) Revised June 2010—T. Pearce; reviewed Nov. 2013 E. Meyer	PA: 3	PA: 6	0	0	0	52	3	55	—	0
ANIMALS IV—PHYLA OTHER THAN CHORDATES, ARTHROPODS & MOLLUSKS (LISTED ABOVE)										
Leeches (Annelida: Hirudinida)	needs study	needs study	0	unknown	unknown	unknown	unknown	<i>estimated 11–100</i>	—	needs study
Earthworms (Annelida: Oligochaeta) From Reynolds, 2008, 2012 (see endnotes)	7 recorded species are at edge of range & rare in PA		0	unknown	unknown	8 recorded; needs study	19 recorded; needs study	27	—	needs study
Polychaetes (Annelida: Polychaeta)	needs study	needs study	0	unknown	unknown	unknown	unknown	<i>estimated 2–10</i>	—	needs study

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Bryozoans (Bryozoa)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Hydras, freshwater jellyfish (Cnidaria) From Rawlins & Bier, 1998 (see endnotes)	needs study	needs study	0	unknown	unknown	unknown	1	estimated 2–10	—	needs study
Entoprocts (Entoprocta) From Rawlins & Bier, 1998 (see endnotes)	0	0	0	0	0	0	1	1	—	0
Hairy-backs (Gastrotricha)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Sporozoans (Myxozoa)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Roundworms (Nematoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 101–1,000	—	needs study
Horsehair worms (Nematomorpha)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Proboscis worms (Nemertea) From Rawlins & Bier, 1998	0	0	0	0	0	1	0	1	—	needs study
Tapeworms (Platyhelminthes: Cestoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Flukes (Platyhelminthes: Trematoda)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Flatworms (Platyhelminthes: Turbellaria) Adapted from Rawlins, 2007 (see endnotes)	GL: 1	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	1
Sponges (Porifera) Adapted from Rawlins, 2007 (see endnotes)	GL: 1 PA: 1	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Rotifers, spiny-headed worms (Rotifera)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 11–100	—	needs study
Water-bears (Tardigrada)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study

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FUNGI & LICHENS										
Fungi Revised June 2010—J. Plischke III	needs study	needs study	0	unknown	unknown	7,260 known (of >15,000?)	7 known	7,267 known (of >15,000?)	—	needs study
Lichens Revised May 2010—J. Lendemer	needs study	needs study	0	2 known	unknown	552 known (of >1,000?)	0 known	552 known (of >1,000?)	—	5
PROTISTS (EUKARYOTES OTHER THAN PLANTS, ANIMALS & FUNGI)										
Coccidea, plasmodia, etc. (Alveolata: Apicomplexa)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 2–10	—	needs study
Ciliates (Alveolata: Ciliophora)	needs study	needs study	0	unknown	unknown	unknown	unknown	estimated 101–1,000	—	needs study
Dinoflagellates (Alveolata: Dinoflagellata)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Slime molds (Amoebozoa: Mycetozoa) Revised June 2010—J. Plischke III	needs study	needs study	0	unknown	unknown	unknown	unknown	188 known (of >1,000?)	—	needs study
Amebas (Amoebozoa: groups other than Mycetozoa)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Cryptomonads (Cryptophyta)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Euglenids, kinetoplasts (Euglenozoa)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Forams (Foraminifera)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Diatoms (Heterokontophyta: Bacillariophyta)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Golden algae (Heterokontophyta: Chrysophyceae)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Water molds (Heterokontophyta: Oomycetes) Revised June 2010—J. Plischke III	needs study	needs study	0	unknown	unknown	unknown	unknown	50 known (of >100?)	—	needs study
Yellow-green algae (Heterokontophyta: Xanthophyceae)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
Diplomonads, trichomonads (Metamonada)	needs study	needs study	0	unknown	unknown	unknown	unknown	unknown	—	needs study
The above sampling of major protist groups is not a complete tally of protist higher taxa living in the wild in Pennsylvania. Furthermore, protist classification is in flux, with little agreement even on the validity or usefulness of the category “protist” itself. The phyla and groups of phyla in this list are provisional and subject to change as phylogenetic research progresses.										

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BACTERIA & ARCHAEA (PROKARYOTES)

Status in the wild in Pennsylvania of bacteria and archaea, which include many thousands of species and are of crucial ecological and economic importance, is virtually unknown. Their species diversity in the state may rival that of all of the plants, animals, fungi and protists put together.

* Endangered and threatened species are the sum of two categories: **GL: globally rare and imperiled + PA: imperiled in Pennsylvania (disjunct from, or at the edge of, species' main range or confined to specialized habitats that are themselves rare)**. Globally rare and imperiled taxa are those with Natural Heritage Network ranks G1, G2, G3, GH, T1, T2, T3 or TH (including -Q & excluding G3G4 or T3T4 and higher). State conservation status is determined by the PABS technical committees for vascular plants, vertebrates and mussels. Status of other organisms is derived from their Natural Heritage Network ranks: endangered—S1, S1?, S1S2 or SH; threatened—S1S3, S2 or S2S3; extirpated—SX.

[†] Totals labeled as estimates are from Rawlins & Bier, 1998 (see endnotes).

[‡] Pennsylvania responsibility species (includes subspecies and varieties) are those for which Pennsylvania plays an important role in sustaining their security range-wide, by hosting core populations or a significant proportion (~10% or more) of the total population.

PENNSYLVANIA'S WILD SPECIES—THE 2013 BOX SCORE

Additional Details

VASCULAR PLANTS—Source: PABS Vascular Plants Technical Committee.

Suggested reading: A. F. Rhoads & T. A. Block, 2007, *The Plants of Pennsylvania: an Illustrated Manual* (second edition), University of Pennsylvania Press, Philadelphia, 1,042 pp.; Pennsylvania Flora Project database, Botany Department, Morris Arboretum of the University of Pennsylvania (www.paflo.org).

MOSESSES, LIVERWORTS, HORNWORTS—Source: PABS Bryophytes & Lichens Technical Committee.

Suggested reading: S. Munch, 2006, *Outstanding Mosses & Liverworts of Pennsylvania & Nearby States*, Sunbury Press, Camp Hill, Pennsylvania, 89 pp.; J. J. Atwood, B. Allen & R. A. Pursell, 2009, Checklist of Pennsylvania Mosses, report to the Pennsylvania Department of Conservation & Natural Resources, Wild Resources Conservation Program, Harrisburg, 165 pp.; G. C. Manville, 2001, An Annotated Checklist of Liverworts & Hornworts (Hepatics & Anthocerotales) of Pennsylvania, published by author, 40 pp.

BIRDS—Accidentals (species recorded in 3 or fewer of the last 10 years) are not included. **Source:** PABS Ornithology Technical Committee.

Downlisted due to population increase: osprey, 1997, from E to T; bald eagle, 2006, from E to T

State endangered: upland sandpiper, migrant loggerhead shrike (globally rare), short-eared owl, American bittern, great egret, black tern, sedge wren, blackpoll warbler, yellow-bellied flycatcher, peregrine falcon, least bittern, yellow-crowned night-heron, black-crowned night-heron, king rail, dickcissel, common tern.

State threatened: bald eagle, osprey, northern harrier, long-eared owl.

Extirpated: greater prairie chicken, Bachman's sparrow (both globally rare), brown-headed nuthatch, Eskimo curlew.

Extirpated as breeding species: piping plover (globally rare), Bewick's wren, olive-sided flycatcher.

Extinct: passenger pigeon, Carolina parakeet.

Pennsylvania-responsibility: wood thrush, cerulean warbler, worm-eating warbler, Louisiana waterthrush, golden-winged warbler, blue-winged warbler, scarlet tanager, Henslow's sparrow, tundra swan (migrant only).

Non-native & reproducing: mute swan, ring-necked pheasant, rock pigeon, European starling, house sparrow.

Suggested reading: A. M. Wilson, D. W. Brauning & R. S. Mulvihill, 2010, *Second Atlas of Breeding Birds in Pennsylvania*, Pennsylvania State University Press, University Park, 612 pp.; G. M. McWilliams & D. W. Brauning, 2006, *The Birds of Pennsylvania*, Cornell University Press, Ithaca, New York, 479 pp.

MAMMALS—Source: PABS Mammals Technical Committee.

Downlisted due to population increase: fisher, 2006, from E to "special concern."

State endangered: Indiana myotis (globally imperiled), least shrew, northern flying squirrel, eastern spotted skunk, little brown bat, northern long-eared bat, tricolored bat.

State threatened: southern water shrew, eastern small-footed myotis (both globally rare), Allegheny woodrat.

Extirpated: marten, mountain lion, lynx, gray wolf, wolverine, moose, bison, rice rat, Delmarva fox squirrel.

Pennsylvania-responsibility: eastern small-footed bat, northern long-eared bat, Allegheny woodrat, Appalachian cottontail.

Nonnative & reproducing: Norway rat, house mouse, feral swine, feral cat.

Suggested reading: J. F. Merritt, 1987, *Guide to the Mammals of Pennsylvania*, University of Pittsburgh Press, Pittsburgh, 448 pp.

TURTLES—Source: PABS Amphibians & Reptiles Technical Committee.

State endangered: bog turtle (globally rare), mud turtle.

State threatened: redbelly turtle.

Extirpated: smooth softshell.

Pennsylvania-responsibility: spotted turtle, bog turtle, wood turtle.

Nonnative & reproducing: red-eared slider, yellow-bellied slider.

Suggested reading: A. C. Hulse, C. J. McCoy & E. J. Censky, 2001, *Amphibians & Reptiles of Pennsylvania & the Northeast*, Cornell University Press, Ithaca, New York, 419 pp.

SNAKES, LIZARDS—Source: PABS Amphibians & Reptiles Technical Committee.

State endangered: Kirtland's snake (globally imperiled), rough green snake, eastern massasauga.

Pennsylvania-responsibility: timber rattlesnake, northern coal skink, shorthead garter snake, mountain earth snake.

Suggested reading: A. C. Hulse, C. J. McCoy & E. J. Censky, 2001, *Amphibians & Reptiles of Pennsylvania & the Northeast*, Cornell University Press, Ithaca, New York, 419 pp.

AMPHIBIANS—Source: PABS Amphibians & Reptiles Technical Committee.

Downlisted due to population increase: eastern spadefoot, 2013, from E to T.

State endangered: mud salamander, blue-spotted salamander, New Jersey chorus frog, northern cricket frog, coastal plain leopard frog.

State threatened: green salamander, eastern spadefoot.

Extirpated: tiger salamander.

Pennsylvania-responsibility: Jefferson salamander, hellbender, mountain chorus frog.

Suggested reading: A. C. Hulse, C. J. McCoy & E. J. Censky, 2001, *Amphibians & Reptiles of Pennsylvania & the Northeast*, Cornell University Press, Ithaca, New York, 419 pp.

FISHES, LAMPREYS—Source: PABS Fishes Technical Committee. Several known hybrids are excluded. "Non-breeding migrants" are estuarine species, some of whose reproducing status in the state is unknown.

Downlisted due to population increase: smallmouth buffalo, channel darter, longhead darter, 2009, PT to no special status; silver chub, 2010, PE to no special status; mooneye, skipjack herring, 2010, PT to no special status.

Extinct: blue pike.

Pennsylvania-responsibility: shortnose sturgeon, Atlantic sturgeon, eastern sand darter, longnose sucker, checkered sculpin, streamline chub, spotted darter, tongue-tied minnow, northern madtom, Chesapeake logperch, longhead darter, Ohio lamprey, mountain brook lamprey.

Suggested reading: E. L. Cooper, 1983, *Fishes of Pennsylvania & the Northeastern United States*, Pennsylvania State University Press, University Park, 183 pp.; L. Steiner, 2000, Pennsylvania Fishes, Pennsylvania Fish & Boat Commission, Harrisburg, 170 pp.

BUTTERFLIES—Source: Betsy Leppo & PABS Terrestrial Arthropods Technical Committee.
Downlisted due to population increase: red-banded hairstreak, from S2S3 to S4 (most likely because of climatic warming). Extirpated: arogos skipper (globally imperiled).
State endangered: grizzled skipper, Persius duskywing (both globally imperiled), regal fritillary, mottled duskywing (both globally rare), columbine duskywing, Olympia marble, silvery blue, gold-banded skipper, salt marsh skipper, pink-edged sulphur, green comma.
State threatened: frosted elfin (globally rare), 38 other species.
Pennsylvania-responsibility: grizzled skipper, regal fritillary.

MOTHS—Source: Adapted from Rawlins, 2007 (see full citation under Other Animal & Protist Groups, below); to be revised by Betsy Leppo & PABS Terrestrial Arthropods Technical Committee.
Pennsylvania-responsibility: *Papaipema* sp. 1 (flypoison borer moth—globally imperiled), *Lemmeria digitalis*.

DRAGONFLIES, DAMSELFLIES—Source: Betsy Leppo & PABS Terrestrial Arthropods Technical Committee.
State endangered: septima clubtail, pygmy snaketail, Appalachian snaketail, skillet clubtail, elusive clubtail (all globally imperiled), 45 other species.
Pennsylvania-responsibility: green-faced clubtail (*Gomphus viridifrons*).

STONEFLIES—Source: Jane Earle & PABS Aquatic Arthropods Technical Committee.
Pennsylvania-responsibility: Powdermill forestfly (*Soyedina merritti*, Pennsylvania endemic & globally imperiled).
Suggested reading: J. I. Earle, 2004, New records & clarifications of the Pennsylvania stonefly (Plecoptera) fauna, with an annotated list of the stoneflies of Pennsylvania, *Entomological News* 115: 191-200; J. I. Earle, 2009, New state stonefly (Plecoptera) records for Pennsylvania, with additional records & information on rare species, *Illiesia* 5: 169-181.

DADDY-LONGLEGS—Source: L. J. Hribar, 1989, The opilionid fauna (Arachnida: Opiliones) of Pennsylvania. *Melzheimer Entomological Series* 37: 9-12.

CRAYFISHES—Source: Dr. David A. Lieb, Western Pennsylvania Conservancy & Pennsylvania Fish & Boat Commission.
Pennsylvania endangered: *Cambarus (Puncticambarus)* sp. (undescribed species in the *Cambarus acuminatus* complex; possibly globally imperiled & possibly Pennsylvania-endemic), devil crawfish (*Cambarus diogenes*), upland burrowing crayfish (*Cambarus dubius*), Monongahela crayfish (*Cambarus monongalensis*).
Pennsylvania-responsibility: *Cambarus (Puncticambarus)* sp. (possibly Pennsylvania-endemic), Monongahela crayfish (*Cambarus monongalensis*).
Nonnative & reproducing: rusty crayfish (*Orconectes rusticus*), northern crayfish (*Orconectes virilis*), red swamp crayfish (*Procambarus clarkii*), probably also papershell crayfish (*Orconectes immunis*).
Suggested reading: D. A. Lieb, R. W. Bouchard, R. F. Carline, T. R. Nuttall, J. R. Wallace & C. L. Burkholde, 2011, Conservation & management of crayfishes: lessons from Pennsylvania, *Fisheries* 36: 489-507.

SCUDS—Sources: Adapted from Rawlins & Bier, 1998; Rawlins, 2007 (see full citations under Other Animal & Protist Groups, below).
Pennsylvania-responsibility: Stellmack's cave amphipod (*Stygobromus stellmacki*—endemic to PA & globally imperiled), Allegheny cave amphipod (*Stygobromus allegheniensis*).

PILLBUGS, WOODLICE—Sources: Adapted from Rawlins & Bier, 1998; Rawlins, 2007 (see full citations under Other Animal & Protist Groups, below).
Pennsylvania-responsibility: an isopod (*Caecidotea kenki*—globally imperiled), Price's cave isopod (*Caecidotea pricei*).

MOLLUSKS—Source: PABS Mollusks Technical Committee.
Pennsylvania-responsibility: dwarf wedgemussel (*Alasmidonta heterodon*), northern riffleshell (*Epioblasma torulosa rangiana*), yellow lampmussel (*Lampsilis cariosa*), eastern pearlshell (*Margaritifera margaritifera*), clubshell (*Pleurobema clava*), rayed bean (*Villosa fabalis*).
Suggested reading: J. E. Rawlins, 2007, *Pennsylvania Comprehensive Wildlife Conservation Strategy: Invertebrates*, report submitted to the Pennsylvania Game Commission & Pennsylvania Fish & Boat Commission, 227 pp.

EARTHWORMS—Sources: J. W. Reynolds, 2008, The earthworms (Oligochaeta: Acanthodrilidae, Lumbricidae, Megascolecidae, & Sparganophilidae) of Pennsylvania, USA, *Megadriologica* 11: 131-146; J. W. Reynolds, personal communication, June 2012.
Suggested reading: C. Hale, 2007, *Earthworms of the Great Lakes*, Koliath+Stensaas Publishing, Duluth, Minnesota, 36 pp.

FLATWORMS—Sources: Adapted from Rawlins & Bier, 1998; Rawlins, 2007 (see full citations under Other Animal & Protist Groups, below).
Pennsylvania-responsibility: Refton Cave planarian (*Sphalloplana pricei*—endemic to PA & globally imperiled).

FUNGI—Source: Compiled by John Plischke III from Pennsylvania records in the Mycological Herbarium of Penn State University (PACMA) & data provided by Western Pennsylvania Mushroom Club, Eastern Pennsylvania Mushroomers, Susquehanna Valley Mycological Society, PABS bioblitzes in Erie County, North American Mycological Association, Mycological Society of America, Northeast Mycological Federation, Charles Horton Peck Annual New York State Mushroom Foray & New Jersey Mycological Association.
Suggested reading: B. Russell, 2006, *Field Guide to Wild Mushrooms of Pennsylvania and the Mid-Atlantic*, Penn State University Press, 248 pp.
Rarity ranking & determination of conservation status is complicated by uncertainty about the synonymy of many old records whose names are not found in global searches of current fungus taxonomy, comprising perhaps half of all species records from Pennsylvania. In later versions, box scores for fungi will be reported for each phylum, as they are for other major groups of organisms. Fungus phyla & examples or brief descriptions of their ecology are:

- SAC FUNGI or ASCOMYCETES**—include morels, truffles, brewer's & baker's yeast, dead-man's-fingers, cup fungi, fungal symbionts in most lichens, ectomycorrhizal & ericoid mycorrhizal fungi, powdery mildews, *Penicillium*
- CLUB FUNGI or BASIDIOMYCETES**—include puffballs, stinkhorns, bracket fungi & other polypores, jelly fungi, boletes, chanterelles, earth stars, ectomycorrhizal fungi, smuts, rusts
- ARBUSCULAR MYCORRHIZAL FUNGI**—live in soils where they form endosymbioses with the roots of most plant species
- CHYTRIDS**—decompose organic matter, including chitin & keratin, often in aquatic habitats
- MICROSPORIDIANS**—parasites of insects, crustaceans, fishes & other animals
- BLASTOCLADIOMYCOTA**—live in soils & freshwater habitats subsisting on decaying organic matter
- NEOCALLIMASTIGOMYCOTA**—anaerobic fungi found in the digestive tracts of mammalian herbivores
- PIN MOLDS & OTHER FUNGUS GROUPS OF UNCERTAIN CLASSIFICATION**—include parasites of insects & other arthropods, parasites & predators of protists, decomposers of fruit, dung & other organic matter, & others

LICHENS (composite organisms consisting of symbiotic associations between fungi & green algae or cyanobacteria)—**Source:** James Lendemer & PABS Bryophytes & Lichens Technical Committee. Figures are based only on examined vouchers; additional collecting as well as revision of herbarium specimens upon which historical reports have been based is expected to greatly increase the number of species.

Pennsylvania-responsibility: *Bacidia phyllopsoropsis*, *Chrysothrix susquehannensis*, *Opegrapha bicolor*, *Parmelia neodiscordans*, *Peltigera hydrothyria*.

Recommended reading: *Lichens & Lichenicolous Fungi of Pennsylvania*, New York Botanical Garden (sciweb.nybg.org/science2/hcol/lena/index.asp & click on the Pennsylvania link).

SLIME MOLDS (protists formerly classified as fungi)—**Source:** Compiled by John Plischke III (see FUNGI, above).

WATER MOLDS (protists formerly classified as fungi)—**Source:** Compiled by John Plischke III (see FUNGI, above).

OTHER ANIMAL & PROTIST GROUPS—Sources:

For estimated numbers of species: J. E. Rawlins & C. W. Bier, 1998, Invertebrates: review of status in Pennsylvania, pp. 85-120 in J. D. Hassinger, R. J. Hill, G. L. Storm & R. H. Yahner (tech. coords.), *Inventory and Monitoring of Biotic Resources in Pennsylvania*, Pennsylvania Biological Survey, University Park and Harrisburg.

For conservation status & Pennsylvania-responsibility status: J. E. Rawlins, 2007, *Pennsylvania Comprehensive Wildlife Conservation Strategy: Invertebrates* (version 1.1), Carnegie Museum of Natural History, Pittsburgh, for the Pennsylvania Game Commission & Pennsylvania Fish & Boat Commission, 227 pp.
