	A	B	C	D	E	F	G	H	L	P	T	U	V
1	**Scientific_Name**	**Common_Name**	**Grouping**	**Type**	**Tier**	**COR**	**Habitats**	**Threat_Code**	**Threat_Description**	**Threat_Long**	**Actions**	**Working_Lands**	**Notes**
2	Pisidium adamsi	Adam peaclam	Aquatic Mollusk	Clam	IV	b	Creeks and Rivers	11.3.3, 9.3.1, 9.3.3	Gradual Temperature Change / Nutrient Loads / Herbicides and Pesticides	e.g., altered sex-ratio in species relying upon a temperature dependent sex determination, reduction of dissolved oxygen that is available to fish species, earlier ice-free dates, thawing of permafrost affecting bird breeding sites. / e.g., manure, compost, chemical fertilizers. / Includes the use of inputs for controlling crop pests. E.g., herbicides, insecticides, fungicides.	Continue efforts to reduce CO2 and other greenhouse gas emissions to approximately 50% below 2005 levels by 2030; attain 100% carbon pollution-free electricity by 2035; achieve a net-zero emissions economy by 2050. Increase riparian buffer shading and aquatic plants of smaller water bodies. Deliver a percentage of the benefits from federal investments in climate and clean energy to conservation and recovery of SGCNs. (11.3.3), Increase partnerships with federal and state authorities, and stakeholders to eliminate loads of manure (organic enrichment), and chemical ferilizers (P, N, C). Organic enrichment causes low [O2], high hydrogen sulfide and methane gas contents, toxic to P. adamsi. (9.3.1), "Increase partnerships with end users to eliminate or reduce discharges of toxic effluents. Populations in small lakes, pools or eddies, rivers, and creeks are particularly at risk due to smaller dilution effects. " (9.3.3)		**Temperture Change** - Most sphaeriids have temperature-dependent reproductive strategies. P. adamsi is a hermaphrodite with temperature-dependent sex determination, maturation, and brood size. P. adamsi prefers small bodies of water, which are subject to rapid changes in temperature, dissolved oxygen, droughts and even permanent loss of habitat. **Nutrient Loads** - A large species for Pisidium, up to 8 mm long. Species is a filter feeder of suspended single-celled algae, and deposit feeder, feeding on fine organic detritus. Excess [P], [N], [C] leads to high total suspended loads and could clog gills and pedal feeding processes, as well as buildup of toxic sediment gases. **Pesticides, herbicides** - these are toxic, especially if they have long half lives in sediments. Living in small bodies of water adjacent to agricultural lands with either overland runoff or effluents from drainage tiles, which increases the risk of habitat loss and population declines or even elimination. A predilection for organic, muddy substrates of quiet bodies of water (small lakes, pools or eddies, rivers, creeks). Also lives in larger lakes down to 1.5 m depth. Most common in mesotrophic waters (total chlorophyll = ~3-7 µg/L, total P = ~10-30 µg/L, total N = ~300-600 µg/L, Secch depth = ~2.5-4 m).
3	Utterbackiana implicata	Alewife floater	Aquatic Mollusk	Mussel	IV	a	Creeks and Rivers	11.2.2, 9.1, 5.4.2	Changes in salinity / Domestic and Urban Wastewater / Commercial Fishing	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Harvesting of aquatic species for commercial purposes that is governed by management measures for which the environmental impact is primarily on the species (as opposed to habitat damage from sea bottom trawling, Threat 7.3.6). Includes bycatch but excludes ghost fishing gear entangling wildlife (Threat 9.4.4). E.g., commercial fisheries, use of nets and fishing gear for eels, factory ships, marine mammals caught in industrial fishing nets.	Implement large-scale management and conservation actions to minimize and reverse climate change. (11.2.2), Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Coordinate with NMFS to implement regulations that will minimize take of river herring and shad such that benefits will be seen in annual freshwater runs. DWR also continue to restrict take of river herring and shad in inland waters. Current river herring and shad popualtions are at such levels that natural recrutiment of existing Alewife Floater populations is difficult even with no other impacts to the species. (5.4.2)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
4	Theliderma sparsa	Appalachian monkeyface	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop, implement, and enforce meaningful biological standands for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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5	Fusconaia masoni	Atlantic pigtoe	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers, Large Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
6	Lemiox rimosus	Birdwing pearlymussel	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
7	Ligumia recta	Black sandshell	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.

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8	Alasmidonta varicosa	Brook floater	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers, Large Rivers	9.1, 9.3, 1.1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Dense Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Medium- to high-density development for residential use and buildings for related services. Allows very little to no maintenance of ecological functions. E.g., urban areas, suburbs, villages, schools, libraries, seniors' housing, hospitals	Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. Focus should be in northern VA, the Shenandoah Valley, and along the mainstem James River where populations of Brook Floater have been historically documented. (1.1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
9	Elliptio congaraea	Carolina slabshell	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers, Tidal Creeks and Rivers	11.2.2, 9.2, 9.1	Changes in salinity / Industrial and Military Effluents / Domestic and Urban Wastewater	/ Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant "cocktails" that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Implement large-scale management and conservation actions to minimize and reverse climate change. (11.2.2) , Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
10	Hemistena lata	Cracking pearlymussel	Aquatic Mollusk	Mussel	I	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant "cocktails" that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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11	Strophitus undulatus	Creeper	Aquatic Mollusk	Mussel	IV	a	Creeks and Rivers, Large Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
12	Medionidus conradicus	Cumberland moccasinshell	Aquatic Mollusk	Mussel	II	a	Headwater Streams, Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
13	Theliderma intermedia	Cumberland monkeyface	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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14	Epioblasma brevidens	Cumberlandian combshell	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
15	Truncilla truncata	Deertoe	Aquatic Mollusk	Mussel	I	b	Creeks and Rivers	9.2, 9.3, 3.3.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Hydroelectric Dams	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) /	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Fish passage or dam removal to allow for passage of host fishes. (3.3.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
16	Dromus dromas	Dromedary pearlymussel	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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17	Alasmidonta heterodon	Dwarf wedgemussel	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Develop propagation techniques to augment remaining populations and reintroduce extirpated popualtions in areas which are suitable.
18	Lampsilis radiata	Eastern lampmussel	Aquatic Mollusk	Mussel	IV	a	Creeks and Rivers, Large Rivers, Tidal Creeks and Rivers, Large Tidal Rivers	11.2.2, 9.2, 9.1	Changes in salinity / Industrial and Military Effluents / Domestic and Urban Wastewater	/ Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Implement large-scale management and conservation actions to minimize and reverse climate change. (11.2.2) , Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standands for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
19	Sagittunio nasutus	Eastern pondmussel	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers, Large Rivers, Tidal Creeks and Rivers, Large Tidal Rivers, Lakes, Ponds	11.2.2, 9.2, 9.1	Changes in salinity / Industrial and Military Effluents / Domestic and Urban Wastewater	/ Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Implement large-scale management and conservation actions to minimize and reverse climate change. (11.2.2) , Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standands for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.

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20	Elliptio crassidens	Elephantear	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers	9.2, 9.3, 3.3.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Hydroelectric Dams	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) /	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Fish passage or dam removal to allow for passage of host fishes. (3.3.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
21	Alasmidonta marginata	Elktoe	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
22	Cyprogenia stegaria	Fanshell	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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23	Fusconaia cuneolus	Finerayed pigtoe	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
24	Ptychobranchus subtentus	Fluted kidneyshell	Aquatic Mollusk	Mussel	II	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
25	Lasmigona costata	Flutedshell	Aquatic Mollusk	Mussel	IV	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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26	Potamilus fragilis	Fragile papershell	Aquatic Mollusk	Mussel	II	c	Creeks and Rivers	9.2, 9.3, 3.3.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Hydroelectric Dams	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) /	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Fish passage or dam removal to allow for passage of host fishes. (3.3.1)		Develop propagation techniques and conduct reintroductions into waterways that are suitable.
27	Epioblasma aureola	Golden rifflefleshell	Aquatic Mollusk	Mussel	I	c	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		
28	Pisidium dubium	Greater Eastern peaclam	Aquatic Mollusk	Clam	IV	b	Creeks and Rivers, Tidal Creeks and Rivers, Lakes	11.3.3, 9.3.1, 9.3.3	Gradual Temperature Change / Nutrient Loads / Herbicides and Pesticides	e.g., altered sex-ratio in species relying upon a temperature dependent sex determination, reduction of dissolved oxygen that is available to fish species, earlier ice-free dates, thawing of permafrost affecting bird breeding sites. / e.g., manure, compost, chemical fertilizers. / Includes the use of inputs for controlling crop pests. E.g., herbicides, insecticides, fungicides.	Continue efforts to reduce CO2 and other greenhouse gas emissions to approximately 50% below 2005 levels by 2030; attain 100% carbon pollution-free electricity by 2035; achieve a net-zero emissions economy by 2050. Increase riparian buffer shading and aquatic plants of smaller water bodies. Deliver a percentage of the benefits from federal investments in climate and clean energy to conservation and recovery of SGCNs. (11.3.3), Increase partnerships with federal and state authorities, and stakeholders to eliminate loads of manure (organic enrichment), and chemical ferilizers (P, N, C). Organic enrichment causes low [O2], high hydrogen sulfide and methane gas contents, toxic to P. adamsi. (9.3.1), "Increase partnerships with end users to eliminate or reduce discharges of toxic effluents. Populations in small lakes, pools or eddies, rivers, and creeks are particularly at risk due to smaller dilution effects. " (9.3.3)		**Temperture Change** - Most sphaeriids have temperature-dependent reproductive strategies. P. dubium is a hermaphrodite with a temperature-dependent sex determination, maturation, and brood size. This species has one of the largest brood sizes of all sphaeriids, with up to 20 young/brood for 10 mm-long specimens. Species living in shallow water bodies are subject to rapid changes in temperature, dissolved oxygen, droughts and even permanent loss of habitat. **Nutrient Loads** - A large species for Pisidium, up to 10 mm long. Species is a filter feeder of suspended single-celled algae, and deposit feeder, feeding on fine organic detritus. Accumulations of total suspended solids due to excess [P], [N], [C] could clog gills and pedal feeding processes, and buildup of toxic sediment gases. **Pesticides, herbicides** - these are toxic, especially if they have long half lives in sediments, particularly in habitats with fine sand and shallow water adjacent to agricultural lands with either overland runoff or effluents from drainage tiles, which hightens the risk of habitat loss and population declines or eliminations. Probably less tolerant of pollution because it is a species of cleaner, clear waters. This is a large Pisidium spp (up to 10 mm long). Has an apparent preference for large, muddy creeks, but also common in fine sand in shallow water (< 5 m) in bays of large rivers and lakes. Has been recorded from 10 m depths. Most common in mesotrophic waters (total chlorophyll = ~3-7 µg/L, total P = ~10-30 µg/L, total N = ~300-600 µg/L, Secch depth = ~2.5-4 m).

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29	Lasmigona subviridis	Green floater	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers, Large Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
30	Parvaspina collina	James spinymussel	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers, Large rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
31	Pegias fabula	Littlewing pearlymussel	Aquatic Mollusk	Mussel	I	c	Heawater Streams, Creeks and Rivers	11.3, 9.3, 9.1	Changes in Temperature Regimes / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Periods in which temperatures of the air, water or soil either exceed or fall below the normal range of variation. Events that may or may not be related to climate change. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Promote land use practices that ensure suitable riparian buffers, minimize impervious surfaces and maintain natural groundwater inputs. (11.3), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		

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32	Fusconaia subrotunda	Longsolid	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
33	Venustaconcha constricta	Notched rainbow	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers, Large Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
34	Pleurobema cordatum	Ohio pigtoe	Aquatic Mollusk	Mussel	II	c	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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35	Epioblasma capsaeformis	Oyster mussel	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
36	Actinonaias pectorosa	Pheasantshell	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers	9.2, 9.3, 8.4	Industrial and Military Effluents / Agricultural and Forestry Effluents / Pathogens	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Diseases caused by various taxa of pathogenic micro-organisms living within hosts.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3),Improved cleaning and sterilization of aquatic gear and prohibiting discharge of foreign waters to minimize introduction and spread of pathogens. (8.4)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
37	Cyclonaias pustulosa	Pimpleback	Aquatic Mollusk	Mussel	III	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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1	**Scientific_Name**	**Common_Name**	**Grouping**	**Type**	**Tier**	**COR**	**Habitats**	**Threat_Code**	**Threat_Description**	**Threat_Long**	**Actions**	**Working_Lands**	**Notes**
38	Potamilus alatus	Pink heelsplitter	Aquatic Mollusk	Mussel	III	b	Creeks and Rivers	9.2, 9.3, 3.3.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Hydroelectric Dams	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) /	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Fish passage or dam removal to allow for passage of host fishes. (3.3.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
39	Lampsilis abrupta	Pink mucket	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and reintroduction into waterways that are suitable.
40	Tritogonia verrucosa	Pistolgrip	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers	9.1, 9.3, 3.3.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Hydroelectric Dams	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) /	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Fish passage or dam removal to allow for passage of host fishes. (3.3.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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41	Lampsilis ovata	Pocketbook	Aquatic Mollusk	Mussel	IV	a	Creeks and Rivers, Large Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
42	Toxolasma lividum	Purple liliput	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers, Lakes, Ponds	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		
43	Theliderma cylindrica	Rabbitsfoot	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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44	Paetulunio fabalis	Rayed bean	Aquatic Mollusk	Mussel	I	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Believed to be extirpated from VA. Must work with other states to obtain adults to translocate into VA, or to obtain broodstcok from which to propagate juveniles.
45	Elliptio roanokensis	Roanoke slabshell	Aquatic Mollusk	Mussel	II	b	Creeks and Rivers, Tidal Creeks and Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
46	Pleurobema plenum	Rough pigtoe	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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1	**Scientific_Name**	**Common_Name**	**Grouping**	**Type**	**Tier**	**COR**	**Habitats**	**Threat_Code**	**Threat_Description**	**Threat_Long**	**Actions**	**Working_Lands**	**Notes**
47	Plethobasus cyphyus	Sheepnose	Aquatic Mollusk	Mussel	II	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
48	Fusconaia cor	Shiny pigtoe	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
49	Pleuronaia dolabelloides	Slabside pearlymussel	Aquatic Mollusk	Mussel	I	a	Headwater Streams, Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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50	Alasmidonta viridis	Slippershell mussel	Aquatic Mollusk	Mussel	I	b	Headwater Streams, Creeks and Rivers	11.3, 9.3, 9.1	Changes in Temperature Regimes / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Periods in which temperatures of the air, water or soil either exceed or fall below the normal range of variation. Events that may or may not be related to climate change. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Promote land use practices that ensure suitable riparian buffers, minimize impervious surfaces and maintain natural groundwater inputs. (11.3), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
51	Epioblasma triquetra	Snuffbox	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
52	Cumberlandia monodonta	Spectaclecase	Aquatic Mollusk	Mussel	I	b	Creeks and Rivers	3.3.1, 9.3, 11.4.4	Hydroelectric Dams / Agricultural and Forestry Effluents / Increase in Fluctuations in the Precipitation Regime	/ Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Increase in the fluctuations that are related to the precipitation regime, which have impacts on the hydrology of natural habitats.	Fish passage or dam removal to allow for passage of host fishes. (3.3.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Reduce carbon emissions to help mitigate climate change that leads to rainfall regime alterations, which leads to hydrological/flow regime changes. (11.4.4)		Develop propagation techniques
53	Venustaconcha trabalis	Tennessee bean (purple bean)	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.

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54	Pleurobema oviforme	Tennessee clubshell	Aquatic Mollusk	Mussel	II	b	Headwater Streams, Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
55	Lasmigona holstonia	Tennessee heelsplitter	Aquatic Mollusk	Mussel	II	b	Headwater Streams, Creeks and Rivers	11.3, 9.3.2, 9.1	Changes in Temperature Regimes / Soil Erosion, Sedimentation / Domestic and Urban Wastewater	Periods in which temperatures of the air, water or soil either exceed or fall below the normal range of variation. Events that may or may not be related to climate change. / Erosion and sedimentation that are due to agricultural or silvicultural activities, regardless of the presence of local drainage systems (threat 7.2.4 and 7.2.5). / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Promote land use practices that ensure suitable riparian buffers, minimize impervious surfaces and maintain natural groundwater inputs. (11.3), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3.2), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
56	Pleuronaia barnesiana	Tennessee pigtoe	Aquatic Mollusk	Mussel	II	b	Headwater Streams, Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.

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57	Amblema plicata	Threeridge	Aquatic Mollusk	Mussel	III	b	Creeks and Rivers	9.2, 9.3, 9.1	Industrial and Military Effluents / Agricultural and Forestry Effluents / Domestic and Urban Wastewater	Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue to develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.
58	Atlanticoncha ochracea	Tidewater mucket	Aquatic Mollusk	Mussel	III	a	Creeks and Rivers, Large Rivers, Tidal Creeks and Rivers, Large Tidal Rivers	11.2.2, 9.2, 9.1	Changes in salinity / Industrial and Military Effluents / Domestic and Urban Wastewater	/ Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals. Among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed with Threat 9.2. This section excludes natural sources of contaminants that are found in the environment (e.g., mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched. / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Implement large-scale management and conservation actions to minimize and reverse climate change. (11.2.2) , Coordinate with the Virginia Department of Environmental Quality and Virginia Energy to develop meaningful biological standards for coal and gas extraction, and to develop, meaningful biological standards to improve industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2), develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
59	Alasmidonta undulata	Triangle floater	Aquatic Mollusk	Mussel	IV	a	Headwater Streams, Creeks and Rivers, Tidal Headwater Streams	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.

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60	Pisidum walkeri	Walker peaclam	Aquatic Mollusk	Clam	IV	b	Creeks and Rivers, Lakes	11.3.3, 9.3.1, 9.3.3	Gradual Temperature Change / Nutrient Loads / Herbicides and Pesticides	e.g., altered sex-ratio in species relying upon a temperature dependent sex determination, reduction of dissolved oxygen that is available to fish species, earlier ice-free dates, thawing of permafrost affecting bird breeding sites. / e.g., manure, compost, chemical fertilizers. / Includes the use of inputs for controlling crop pests. E.g., herbicides, insecticides, fungicides.	Continue efforts to reduce CO2 and other greenhouse gas emissions to approximately 50% below 2005 levels by 2030; attain 100% carbon pollution-free electricity by 2035; achieve a net-zero emissions economy by 2050. Increase riparian buffer shading and aquatic plants of smaller water bodies. Deliver a percentage of the benefits from federal investments in climate and clean energy to conservation and recovery of SGCNs. (11.3.3), Increase partnerships with federal and state authorities, and stakeholders to eliminate loads of manure (organic enrichment), and chemical ferilizers (P, N, C). Organic enrichment causes low [O2], high hydrogen sulfide and methane gas contents, toxic to P. adamsi. (9.3.1), "Increase partnerships with end users to eliminate or reduce discharges of toxic effluents. Populations in small lakes, pools or eddies, rivers, and creeks are particularly at risk due to smaller dilution effects. " (9.3.3)		**Temperture Change** - P. walkeri has a temperature-dependent reproductive strategy, is a hermaphrodite with a temperature-dependent growth, maturation, and brood size. It prefers small bodies of water, which are subject to rapid changes in temperature, dissolved oxygen, droughts and even permanent loss of habitat. Populations in large lakes and rivers are less at risk than populations in small water bodies. **Nutrient Loads** - Averages 4 mm long. Accumulations of total suspended solids due to excess [P], [N], [C] could clog gills and pedal feeding processes, and buildup of toxic sediment gases. **Pesticides, herbicides** - these are toxic, especially if they have long half lives in sediments. Living in small bodies of water adjacent to agricultural lands with either overland runoff or effluents from drainage tiles hightens the risk of habitat losses and population declines or eliminations. Found principally in slow-moving creeks and rivers with a soft bottom, or small lakes or ponds, creeks/rivers. Occassionally in large lakes and rivers. Most common in mesotrophic waters (total chlorophyll = ~3-7 µg/L, total P = ~10-30 µg/L, total N = ~300-600 µg/L, Secch depth = ~2.5-4 m).
61	Lampsilis cariosa	Yellow lampmussel	Aquatic Mollusk	Mussel	II	a	Creeks and Rivers, Large Rivers, Tial Creeks and Rivers, Large Tidal Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Continue propagation and augmentation and reintroduction into waterways that are suitable.
62	Elliptio lanceolata	Yellow lance	Aquatic Mollusk	Mussel	I	a	Creeks and Rivers	9.1, 9.3, 1.1	Domestic and Urban Wastewater / Agricultural and Forestry Effluents / Housing and Urban Areas	Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture and forestry (7.2) or oil spills from machinery (9.2) / Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.	Develop, biologically meaningful standards for the waste water effluent, including elimination of mixing zones where rare species are present, or provide sufficient mitigation for impacts. Implement best management practices to minimize impacts from residential areas such as nutrient and pesticide runoff. (9.1), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3), Work with localities and regulatory agencies to develop, biologically meaningful standards for impacts associated with urban and suburban development such as loss of riparian buffers and increased impervious surfaces, which lead to loss of instream habitat due to factors such as runoff and hydrological changes. Biologically-relevant riparian buffer rules must be put in place along all waterways, as well as limitations on impervious surfaces and properly handling runoff from these surfaces in order to help maintain the natural hydrograph. (1.1)		Develop propagation techniques and augment populations and conduct reintroductions into waterways that are suitable.