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1	Scientific_Name	Common_Name	Grouping	Type	Tier	COR	Habitats	Threat_Co	Threat_Description	Threat_Long	Actions	Working_Lands	Notes
2	Faxonius obscurus	Allegheny crayfish	Aquatic Crustacean	Decapod	IV	b	Creeks and Rivers, Large Rivers	8.1.3, 5.3,	Aquatic Animals / Logging and Wood Harvesting /	/ Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) /	Coordinate with regulatory and conservation agencies to implement and enforce regulations to prevent and minimize the spread of invasive crayfish. Routine checks of pet and bait shops to ensure live crayfish are not being sold. Education and outreach with anglers about release of bait bucket. (8.1.3), Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (5.3)		Very tolerant of lower water quality standards with invasives species being the most significant threat, plus lack of shade and cover.
3	Cambarus fetzneri	Allegheny Mountain mudbug	Aquatic Crustacean	Decapod	I	b	Boreal Forests, Riparian and Floodplains, Headwater Streams	7.2.5, 7.2.7	Drainage in Forest Environments / Withdrawal of Groundwater / Logging and Wood Harvesting	Construction and maintenance of channels that drain surface waters in forest environments. Excludes erosion/sedimentation that is associated with this drainage system (Threat 9.3.2). / Withdrawal of groundwater for human consumption, crop production or other purposes. E.g., pumping water from the water table. / Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3)	Coordinate with the Virginia Department of Environmental Quality to minimize and avoid draining of areas where crayfish is present. (7.2.5), Coordinate with the Virginia Department of Environmental Quality to minimize and avoid draining and use of groundwater where crayfish is present. (7.2.7), Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.). Where avoidance is not possible, develop relocation techniques to reestablish colonies in suitable habitat. (5.3)		Maintenance of springs and seeps in wooded areas of northwest VA is critical for this species.
4	Cambarus cattaianus	Big Sandy crayfish (Guyandotte river crayfish)	Aquatic Crustacean	Decapod	I	a	Creeks and Rivers	1.2.1, 3.2.1	Commercial and Industrial Areas / Underground Mines / Domestic and Urban Wastewater	industrial parks, manufacturing plants, offices, shopping centers, all military base facilities, power plants, seaports, shipyards, airports / / Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.	Coordinate with appropriate regulatory agencies and localities to develop, meaningful biological standards for commercial and industrial development, including implementation of BMPs to minimize and avoid impacts. (1.2.1), Coordinate with the Virginia Department of Environmental Quality and Virginia to develop meaningful biological standards for coal and gas extraction. (3.2.1), 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)		Another important conservation action is continued development of propagation techniques and augmentation and reintroduction of the species throughout its range, particularly in Levisa Fork and tributaries where the crayfish has been extirpated, or near so.
5	Cambarus magerae	Big stone crayfish	Aquatic Crustacean	Decapod	I	b	Headwater Streams	5.3, 7.2.6,	Logging and Wood Harvesting / Withdrawal of Surface Water / Storms and Severe Weather	Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) / Withdrawal of fresh surface water for human consumption, crop production or other purposes. E.g., withdrawal by municipalities, spring water bottling companies and farmers; reservoirs for firefighting, creation of man-made lakes. / e.g., thunderstorms, tropical storms, hurricanes, cyclones, tornadoes, hailstorms, ice storms, blizzards, dust storms.	Avoid forestry of the land around Big Cherry Reservoir, including downstream, as this is the only known location of the Big Stone crayfish (5.3), Manage drawdowns of Big Cherry Reservoir is such a way that minimizes impacts to the South Fork Powell River and associated tributaries. Coordinate these activities with the Town of Big Stone Gap (7.2.6), Implement large-scale management and conservation actions to minimize and reverse climate change. Maintain ark populations to avoid loss of the species if climate change threatens the existence of the species, given its narrow range. (11.5.1)		

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6	Callinectes sapidus	Blue crab	Aquatic Crustacean	Crustacean	III	a	Tidal Rivers and Streams, Tidal Wetlands, Estuaries	5.4.2, 8.1.3	Commercial Fishing / Aquatic Animals / Shoreline Alteration	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. / / e.g., shoreline hardening, riprap along shorelines, breakwaters, concrete walls, shoreline filling	Develop, promote, and enforce sustainable fishing practices (5.4.2). Mitigate impacts from invasive species by promoting harvest (e.g., blue catfish) or other control measures. (8.1.3) Replace existing shoreline structures with living shorelines and restrict new projects to living shorelines only. (7.3.1)		
7	Cambarus davidi	Carolina ladle crayfish	Aquatic Crustacean	Decapod	IV	b	Forests and Woodlands, Headwater Streams, Creeks and Rivers, Non-tidal Wetlands	5.3, 9.3.2, 1	Logging and Wood Harvesting / Soil Erosion, Sedimentation / Dense Housing and Urban Areas	Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) / 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). / 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	Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (5.3), 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), Minimize development in areas where the crayfish occurs due to degradation and destruction of instream habitat. Where avoidance is not possible, implement BMPs to minimize instream impacts (minimize impervious surfaces, install SWMPs, maximize riparian buffers, minimize runoff, etc.). (1.1.1)		
8	Faxonius virginienensis	Chowanoke crayfish	Aquatic Crustacean	Decapod	III	b	Creeks and Rivers, Large Rivers, Tidal Creeks and Rivers, Large Tidal Rivers	2.1.1, 5.3, 5	Annual Cropping Systems (field crops) / Logging and Wood Harvesting / Soil Erosion, Sedimentation	Wide-row crops that require the most intensive agricultural practices and which has the most significant impacts. E.g., maize (corn), soybean, barley, vegetable crops, oat, wheat, canola, hemp. / Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) / 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).	Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to crop production to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (2.1.1), Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (5.3), 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)		Development of propagation techniques should be considered as a conservation action
9	Creaserinus fodiens	Digger crayfish	Aquatic Crustacean	Decapod	II	a	Riparian and Floodplains, Ponds, Non-tidal Wetlands	7.2.5, 2.3, 1	Drainage in Forest Environments / Livestock and Poultry Farming / Housing and Urban Areas	Construction and maintenance of channels that drain surface waters in forest environments. Excludes erosion/sedimentation that is associated with this drainage system (Threat 9.3.2). / Farming of various domestic (cow, pigs, chickens, sheep, goats, turkeys, ducks, etc.) or semi-domesticated animals (llamas, alpacas, etc.); livestock rearing in outdoor pens (farms) or extensive rearing in natural habitat (pastures, ranching). Productivity is measured in terms of animal units. / 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.	Coordinate with the Virginia Department of Environmental Quality to minimize and avoid draining of areas where crayfish is present. (7.2.5), Minimize livestock farming in areas where the crayfish occurs due to trampling and destruction of habitat (2.3), Minimize housing development in areas where the crayfish occurs due to destruction of habitat. Where avoidance is not possible, develop relocation techniques to reestablish colonies in suitable habitat. (1.1)		

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10	Limulus polyphemus	Horseshoe crab	Aquatic Crustacean	Crustacean	IV	a	Shorelines, Beaches and Dunes, Tidal Wetlands, Estuaries, Marine Nearshore, Marine Offshore and Oceanic	7.3.4, 5.4.2	Beach Development / Commercial Fishing / Hiking	Creation of beaches, their nourishment (substrate replenishment) and maintenance. / 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. / Walking, cycling or horseback riding on or off trails in natural environments. Includes opportunistic observation of nature but excludes disturbance by intensive observation/photography that is oriented towards one of several target species (Threat 6.1.8). E.g., walking, logging, running, dirt biking, geocaching, orienteering, disturbance from users or their domestic animals.	Restrict beach renourishment to time of year where impacts are nonexistent (7.3.2). Maintain strict controls on harvest of horseshoe crab for medical purposes (5.4.2). Continue restricted access to known nesting beaches (6.1.2).		Efforts should be made to review use of this species for biomedical uses and promote the use of synthetic substitutes. Additional research is needed to determine impacts to this species from bleeding and releasing activities.
11	Cambarus buntingi	Longclaw crayfish	Aquatic Crustacean	Decapod	III	b	Creeks and Rivers	5.3, 9.3.2, §	Logging and Wood Harvesting / Soil Erosion, Sedimentation / Domestic and Urban Wastewater	Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) / 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.	Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (5.3), 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)		
12	Cambarus chasmodactylus	New River crayfish	Aquatic Crustacean	Decapod	II	b	Creeks and Rivers	8.1.3, 9.1, §	Aquatic Animals / Domestic and Urban Wastewater / Soil Erosion, Sedimentation	/ Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc. / 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).	Coordinate with regulatory and conservation agencies to implement and enforce regulations to prevent and minimize the spread of invasive crayfish. Routine checks of pet and bait shops to ensure live crayfish are not being sold. Education and outreach with anglers about release of bait bucket. (8.1.3), 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. (9.3.2)		

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13	Faxonius erichsonianus	Reticulate crayfish	Aquatic Crustacean	Decapod	III	b	Creeks and Rivers	9.3, 9.1, 9.2	Agricultural and Forestry Effluents / Domestic and Urban Wastewater / Industrial and Military Effluents	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. / 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	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), 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 for industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2)		
14	Cambarus jezerinaci	Spiny scale crayfish	Aquatic Crustacean	Decapod	II	b	Headwater Streams, Creeks and Rivers	9.3.2, 5.3, 11.4.2	Soil Erosion, Sedimentation / Logging and Wood Harvesting / Droughts	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). / Harvesting trees/other forest species in natural environments for timber or fiber outside of plantations (Threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (Threat 4.1) and associated erosion (Threat 9.3) /	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), Coordinate with appropriate regulatory and natural resource agencies to implement BMPs in regards to forestry to reduce sediment inputs and other impacts (lack of riparian buffer, etc.) (5.3), Implement large-scale management and conservation actions to minimize and reverse climate change. (11.4.2)		
15	Faxonius limosus	Spinycheek crayfish	Aquatic Crustacean	Decapod	III	b	Headwater Streams, Creeks and Rivers	8.1.3, 9.1, 11.4.2	Aquatic Animals / Domestic and Urban Wastewater / 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. / 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	Coordinate with regulatory and conservation agencies to implement and enforce regulations to prevent and minimize the spread of invasive crayfish. Routine checks of pet and bait shops to ensure live crayfish are not being sold. Education and outreach with anglers about release of bait bucket. (8.1.3), 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), Minimize development in areas where the crayfish occurs due to degradation and destruction of instream habitat. Where avoidance is not possible, implement BMPs to minimize instream impacts (minimize impervious surfaces, install SWMPs, maximize riparian buffers, minimize runoff, etc.). (1.1.1)		

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										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. / 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	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), 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 for industrial discharges. Mixing zones need to be eliminated in areas where rare species occur, or sufficient mitigation implemented to offset known impacts. (9.2)		
16	Faxonius forceps	Surgeon crayfish	Aquatic Crustacean	Decapod	IV	b	Creeks and Rivers	9.3, 9.1, 9.2	Agricultural and Forestry Effluents / Domestic and Urban Wastewater / Industrial and Military Effluents				
17	Cambarus hatfieldi	Tug Valley crayfish	Aquatic Crustacean	Decapod	II	b	Headwater Streams, Creeks and Rivers	1.1.2, 9.3.2	Low-Density Housing Areas / Soil Erosion, Sedimentation / Domestic and Urban Wastewater	Extensive development that is residential (including resorts), where the spacing allows ecological functions to continue to some extent. This type of development is seen particularly in rural and agroforestry areas. E.g., residential buildings in agricultural areas, cottages, vacation homes near water bodies, ecotourism lodges, fishing resorts, backcountry ski lodges. / 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.	Education and outreach with landowners and localities to minimize small-scale, but direct impacts to the crayfish (e.g., dumping) (1.1.2), Increase partnerships to implement best management practices such as alternate water sources for cattle and protecting/establishing vegetated stream buffers for agriculture and forestry. (9.3.2), 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)		