4.13 Threatened and Endangered Species

4.13.1 Introduction

Resource Issues

- Occurrence patterns of threatened and endangered species

Information presented in Section 4.7 (Aquatic Resources), Section 4.8 (Wetlands), and Section 4.10 (Terrestrial Ecology) indicates that a wide variety of aquatic and terrestrial animal and plant species occur all across the Tennessee River Valley. As discussed in those sections, the southern Appalachian Mountain region is a major center of diversity for many types of plants and animals. Much of the original biological diversity in this region was associated with the wide variety of forest, grassland, and stream habitats that occurred here prior to human habitation.

More than likely, Native Americans made some modifications to the land and water in the Tennessee River region that, over several centuries, probably modified the abundance and distribution of some animal and plant species. Once Europeans began to establish farms, towns, and cities in this region, they cleared most of the remaining forests, hunted various types of plants and animals, and started modifying the streams to reduce flooding and make it easier to move cargo by water. Virtually all of the land in this region was "developed" in one way or another by the 1920s. Development of the river system proceeded somewhat more slowly, with the completion of the mainstem Tennessee River reservoirs by about 1945 and the completion of tributary reservoirs by about 1980. All of the various human-induced changes in the landscape and streams in this region were intended to improve the lives of the people who lived here. At the same time, however, many of those changes also degraded the habitats for a majority of the non-human species that existed in the region.

Today, the Tennessee Valley actually includes a wider variety of terrestrial and aquatic habitats than were present before the Native Americans arrived. Remnants or recovering patches of natural habitats still occur in some places, along with managed fields and pastures, cities and industrial sites, reservoirs, and stream channels controlled by upstream dams. All of these habitats support populations of plants and animals; however, only some of those species were part of the original communities, and very few of the original species are thriving in the modified habitats. This section focuses on the surviving native species that are not thriving in the modified Tennessee Valley region—the species that are considered to be endangered, threatened, or of special concern in this region.

The present status of many protected species occurring in the Tennessee Valley region is closely tied to habitat conditions along the reservoirs and regulated stream reaches. Changes in the ways the dams are operated could result in a variety of effects on those species, depending on how the changes would affect the flowing water, shoreline, and other types of habitats used by the endangered, threatened, or special-concern species that occur there.

4.13.2 Regulatory and TVA Management Activities

The federal Endangered Species Act (ESA) directs the USFWS to establish national lists of animals and plants that meet identified criteria for endangered or threatened species status. Laws in each of the Valley states direct or encourage wildlife resource or conservation agencies to establish similar state lists of species that meet endangered, threatened, or various levels of special-concern criteria. In each case, the intent of placing species on the lists is to recognize their risk of extinction and to focus attention on ways to help those species survive and recover at least part of their former abundance. Some states also have established legal penalties for actions that would adversely affect species on their protected lists.

Under the ESA, federal agencies are required to consider the potential effects of their proposed actions on species federal-listed as endangered and threatened, as well as areas designated as critical habitats for those species. In addition, NEPA requires federal agencies to consider the potential effects of proposed actions on the human environment, including rare and protected species. TVA, along with each of the seven valley states, maintains copies of the lists of federal- and state-listed endangered, threatened, or otherwise protected species. TVA also keeps track of where those species have been encountered in the region. This occurrence information is routinely stored in a Natural Heritage database, where a common format and compatible storage systems facilitate sharing data among agencies. For the 201-county area included in the TVA Power Service Area, the TVA Natural Heritage database includes occurrence information on about 2,200 federal- and state-protected species.

The federal and state protection requirements, accompanied by considerable public interest in at least some rare species, have resulted in a wide variety of monitoring and management activities focused on endangered and other protected species. Recovery plans prepared for each species on the federal endangered or threatened species lists describe monitoring and management activities that would lead to the enhancement and eventual recovery of each animal or plant. Federal agencies, state agencies, and other interested groups have modified habitats to improve conditions for protected species, and have augmented or reintroduced protected species populations with individuals produced in the laboratory or relocated from other areas. TVA has conducted or participated in many enhancement and management activities focused on protected species, including distribution and monitoring surveys, establishment and protection of natural areas, habitat improvement projects, and restocking programs. In particular, TVA's RRI Program (described more fully in Section 4.4.2) has enhanced aquatic habitats in several regulated stream reaches to the point that native populations have increased and some protected aquatic species have been reintroduced.

4.13.3 Occurrence Patterns

Existing Conditions

The geographic area that could be affected by the ROS includes only specific parts of the TVA Power Service Area that are affected by operation of the various dams. As an initial step in recognizing which protected species should be evaluated for this programmatic study, TVA

identified the 81 counties in which some type of ROS-related activity might have an effect, then used the Natural Heritage database to identify the protected species that occur (or once occurred) in those counties. The initial list was reviewed to identify protected species likely to still occur in areas that could be affected directly or indirectly by ROS-related activities. For most animal groups, this review typically included species that have been encountered alive within a 1-mile buffer around any affected waterbody during the last 30 years (since the early 1970s). With regard to plants, the potential for protected species to survive unnoticed for years suggested that all records from the 1-mile buffers should be included regardless of how old those records might be. With regard to wide-ranging protected birds and bats (such as the bald eagle and gray bat), the 1-mile outer boundary was not useful, but only records dating from the early 1970s were included because present distribution patterns of those species are fairly well known. The result of this review is a list of 526 endangered, threatened, or special concern species that are considered in this evaluation. The names and listing status of these species are presented in Appendix D6a.

Table 4.13-01 provides some basic statistics about the protected species known from the areas around the ROS waterbodies. Plants make up the majority of species on this list, about 59 percent of the total (311 of the 526 species), and the 66 fishes and 63 mollusks (each about 12 percent of the total) far outnumber the other animal groups. The 59 animals and plants protected as federal endangered, threatened, or identified candidate species comprise just over 11 percent of the total. With regard to state-level protection, the largest number of species on this list occur in Tennessee and Alabama (264 and 145 species, respectively), and the fewest occur in Virginia and Georgia (5 and 11 species, respectively). The state-level differences in the numbers of species on this list probably reflect more about how much or how little area in each state could be affected by ROS activities rather than the total number of species that are protected there.

Examining 1-mile buffers around the waterbodies serves as a conservative way to identify any federal- or state-protected species that might be affected directly or indirectly by ROS-related activities. Many of the species reported from the 1-mile buffers around the waterbodies, however, are not known to occur in the water or on the land immediately adjacent to the reservoirs or regulated stream reaches. TVA biologists also reviewed the site-specific information about these records in the Natural Heritage database to determine whether each species had been found in the waterbodies or within much more narrow (200-foot-wide) buffers around them. Species and the individual waterbodies where those direct contacts have been recorded are indicated by asterisks in Appendix D6a.

Table 4.13-01 Summary Protection Statistics about the Endangered, Threatened, and Special-Concern Species Known from within 1 Mile or (in parentheses) within 200 Feet around the Waterbodies Included in the ROS

Jurisdiction	Numbers of Species within Major Taxonomic Groups								1-Mile Buffers	200-Foot Buffers
	Plants	Mollusks	Arthropods	Fish	Amphibians	Reptiles	Birds	Mammals		
Federal	10 (3)	30 (21)	0 (0)	11 (6)	0 (0)	0 (0)	6 (5)	2 (2)	59	37
Alabama	61 (11)	46 (43)	13 (1)	8 (7)	4 (1)	4 (0)	4 (2)	5 (3)	145	68
Georgia	3 (1)	0 (0)	0 (0)	6 (2)	1 (1)	0 (0)	1 (1)	0 (0)	11	5
Kentucky	28 (7)	12 (12)	0 (0)	8 (3)	5 (1)	6 (2)	10 (3)	3 (2)	72	30
Mississippi	81 (13)	2 (2)	0 (0)	14 (3)	8 (1)	4 (1)	3 (1)	3 (2)	115	23
North Carolina	2 (1)	9 (6)	1 (0)	6 (2)	5 (1)	0 (0)	1 (0)	4 (2)	28	12
Tennessee	171 (45)	27 (21)	1 (0)	34 (18)	3 (1)	4 (1)	12 (4)	12 (4)	264	94
Virginia	0 (0)	3 (2)	0 (0)	1 (0)	0 (0)	1 (0)	0 (0)	0 (0)	5	2
Total species in 1-mile buffers	311	63	15	66	18	14	23	16	526	
Total species in 200-foot buffers	72	53	1	29	2	3	8	4		172
Percent of 1-mile totals in 200-foot buffers	23.2	84.1	6.7	43.9	11.1	21.4	34.7	25.0		32.7

Note: Entries in the columns are not additive because many species are protected in more than one jurisdiction.

Source: TVA Natural Heritage database.

Protection status information about the 172 species known from within the 200-foot buffers along the waterbodies also is presented (in parentheses) in Table 4.13-01. Within these narrow buffers, plants still make up a majority of the protected species (72 of the 172 species, almost 42 percent of the total), and mollusks and fish (53 and 29 species, 31 and 17 percent of the total, respectively) still far outnumber the other animal groups. The 37 federal endangered, threatened, or identified candidate species known from the immediate vicinity of the waterbodies constitute 22 percent of the total, twice their representation within the full 1-mile buffers. With regard to state-level protection, the largest number of species within the narrow buffers again occur in Tennessee and Alabama (94 and 68 species, respectively), and the fewest still occur in Virginia and Georgia (2 and 5 species, respectively). Once more, these state-by-state numbers probably reflect more about how much or how little area within each state would be affected by ROS activities rather than anything about the total number of species that are protected in each state. As indicated in the last row of Table 4.13-01, the overall effect of focusing on the 200-foot buffers instead of the 1-mile buffer widths appears to be increased emphasis on mollusks and fish, and decreased emphasis on plants, arthropods, and other groups or species not as closely associated with stream habitats.

The summary information about each federal- or state-protected species presented in Appendix D6a includes two additional entries, both of which relate to the habitats in which each species occurs. One of the columns in that extended table indicates the type(s) of habitats in which each species is typically found. TVA biologists developed those entries from a variety of literature sources and from personal observations of these species in the wild. The 13 broad habitat types, representing a wide range of very wet to very dry conditions, were included specifically because each was important to one or more protected species included in this evaluation.

Table 4.13-02 presents a summary of this habitat characterization information, both for the area within the 1-mile buffers and (in parentheses) for the 200-foot buffers around the waterbodies. As indicated in this table, moist woodlands is the habitat within the 1-mile buffer in which the most species typically occur (131 of the 526 species, or about 25 percent of the total). Other important habitats for protected species within the 1-mile buffers are small rivers and large creeks (98 species, 19 percent); ponds and riparian areas along creeks (93 species, almost 18 percent); caves, boulders, and cliff faces (81 species, 15 percent); and big rivers (75 species, 14 percent). When only the 200-foot buffers are considered, big rivers (62 of the 172 species) and small rivers and large creeks (61 species) become the most typical habitats (both about 36 percent), followed by ponds and riparian areas (35 species, 20 percent), non-forested wetlands (27 species, 16 percent), and moist woodlands (20 species, 12 percent). (All of these numbers add up to more than 100 percent of the totals because some species typically occur in more than one habitat type.)

Table 4.13-02 Summary Statistics about the Typical Habitats of the Endangered, Threatened, and Special-Concern Species that Exist within 1 Mile or (in parentheses) 200 Feet around the Waterbodies Included in the ROS

Habitat Types	Numbers of Species within Major Taxonomic Groups								1-Mile Buffers	200-Ft Buffers
	Plants	Mollusks	Arthropods	Fish	Amphibians	Reptiles	Birds	Mammals		
Big rivers	7 (6)	38 (38)	0 (0)	13 (9)	1 (1)	4 (2)	11 (5)	1 (1)	75	62
Small rivers and large creeks	0 (0)	47 (40)	1 (0)	45 (18)	1 (1)	4 (2)	0 (0)	0 (0)	98	61
Small creeks	0 (0)	12 (5)	2 (0)	33 (8)	5 (1)	1 (0)	0 (0)	0 (0)	53	14
Underground aquifers	0 (0)	0 (0)	5 (1)	2 (2)	1 (0)	0 (0)	0 (0)	0 (0)	8	3
Ponds and riparian areas along creeks	56 (26)	0 (0)	0 (0)	0 (0)	14 (2)	4 (1)	11 (4)	8 (2)	93	35
Gravel bars or boulders in large creeks or rivers	8 (4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	10	6
Nonforested seeps, wetlands, or wet meadows	56 (25)	0 (0)	0 (0)	0 (0)	1 (0)	2 (0)	8 (2)	2 (0)	69	27
Forested seeps or wetlands	38 (12)	0 (0)	0 (0)	0 (0)	10 (1)	1 (1)	1 (1)	3 (0)	53	15
Moist woodlands	113 (16)	1 (0)	0 (0)	0 (0)	3 (0)	1 (0)	2 (1)	11 (3)	131	20
Xeric hardwood or coniferous forests, or mountain woods	42 (2)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0)	3 (0)	2 (1)	52	3
Prairies, fields, roadsides, fencerows, or early successional woodlands	40 (1)	0 (0)	0 (0)	0 (0)	1 (0)	3 (0)	1 (1)	2 (0)	47	2
Limestone, sandstone, or granite outcrops (including cedar glades)	32 (2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	33	2

Table 4.13-02 Summary Statistics about the Typical Habitats of the Endangered, Threatened, and Special-Concern Species that Exist within 1 Mile or (in parentheses) 200 Feet around the Waterbodies Included in the ROS (continued)

Habitat Types	Numbers of Species within Major Taxonomic Groups								1-Mile Buffers	200-Ft Buffers
	Plants	Mollusks	Arthropods	Fish	Amphibians	Reptiles	Birds	Mammals		
Caves, sinkholes, rock houses, boulders, bluffs, and cliff faces	56 (10)	0 (0)	8 (0)	0 (0)	6 (0)	0 (0)	3 (0)	8 (4)	81	14
Total species in 1-mile buffers	311	63	15	66	18	14	23	16	526	
Total species in 200-foot buffers	72	53	1	29	2	3	8	4		172

Note: Entries in the columns are not additive because some species occur in more than one habitat type.

Source: TVA Natural Heritage database.

Information presented in Section 4.1 indicates that TVA aquatic biologists developed a system to identify all of the river reaches that could be affected by ROS activities and to associate similar impounded and tailwater habitat types. This waterbody classification identifies eight types of waterbodies, ranging from pooled mainstem reaches to warm tributary tailwaters. The eight categories reflect several important differences among the waterbodies, including physiographic relationships, whether the reaches are pooled or flowing, and predominant thermal characteristics.

The last column in the Appendix D6a table indicates the waterbodies in which each of these species occurs where it is protected (some species are protected in one state but not in others). The waterbody reference numbers used in this column are the same numbers identified in Section 4.1.2, Reservoir and Waterbody Classifications. Table 4.13-03 presents a summary of the occurrence information for the five taxonomic groups of protected species associated with the waterbodies (mollusks, fish, amphibians, reptiles, and birds), sorted by waterbody categories. Plants, arthropods, and mammals are excluded from this table because most species in those taxonomic groups are not distributed based on stream-related habitat characteristics—the characteristics used to establish the waterbody categories.

Within the 1-mile buffers, most of these protected species occur in or around pooled mainstem reaches (86 species, almost 47 percent of the total), followed by warm tributary tailwaters (77 species, 42 percent), flowing mainstem reaches (66 species, 36 percent), and cool-to-warm tributary tailwaters (34 species, 18 percent). Within the 200-foot buffers, the same four categories are most important; however, the largest number of protected species occur in or along warm tributary tailwaters (51 of 94 species, 54 percent of the total), followed by flowing mainstem reaches (48 species, 51 percent), pooled mainstem reaches (33 species, 35 percent), and cool-to-warm tributary tailwaters (21 species, 22 percent). The major reason for the shift in importance among these waterbody categories is the substantial number of species within four groups (most amphibians, reptiles, and birds and about half of the fishes) that occur within the 1-mile buffers but do not occur in or immediately adjacent to the waterbodies. This shift suggests that many protected species in these four groups occur in habitats that can be found near the reservoirs or regulated stream reaches, while the other species occur in habitats that may not be closely associated with the waterbody categories.

Considered together, the information presented in Tables 4.13-02 and 4.13-03 leads to two general conclusions about the occurrence of protected species as it relates to the evaluation of the ROS alternatives. Most protected species known from within or immediately adjacent to the waterbodies where ROS activities could take place typically occur in aquatic habitats along the least modified stream habitats (warm tributary tailwaters, flowing mainstem reaches, some pooled mainstem reaches, and cool-to-warm tributary tailwaters). Very few protected species occur in or adjacent to any tributary reservoir, in cold/cool tributary tailwaters, or in the drier terrestrial habitats that exist within 200 feet of any waterbody. These observations indicate that warm tributary tailwaters, flowing mainstem reaches, and some pooled mainstem reaches and cool-to-warm tributary tailwaters are the waterbody categories where any direct effects of the ROS alternatives on protected species would be most likely to occur.

The information presented in Tables 4.13-02 and 4.13-03 also suggests that at least a few protected species could occur in just about any type of habitat within 1 mile around almost any reservoir or tailwater included in this evaluation. This observation indicates that all protected species known from the 1-mile buffers should be considered with regard to any indirect or cumulative effects associated with the policy alternatives.

Future Trends

If existing management activities and their present results are suitable indicators, future trends related to the protection of endangered, threatened, and rare species in the Tennessee Valley will include a few successes, more failures, and many unknowns. Some well known and widely appreciated species on the federal lists (such as the bald eagle and snail darter) appear to be responding to the recovery measures that have been conducted, so much so that they may not require federal ESA protection in the future. The vast majority of protected species in the region, however, are likely to remain extremely rare and virtually unknown to the general public. Efforts to enhance or recover those protected species may be more difficult than they are now, both because the species may not be viewed as being particularly important and because as the human population and human use of land and water resources in the region continue to increase, more natural habitats will be degraded and some protected species that exist only in those areas may be lost.

Table 4.13-03 Summary Statistics about the Known Occurrences of Endangered, Threatened, and Special-Concern Species within 1 Mile or (in parentheses) 200 Feet around the Waterbodies Included in the ROS Arranged by Waterbody Category

Waterbody Category	Numbers of Species within Major Taxonomic Groups					1-Mile Buffers		200-Foot Buffers	
	Mollusks	Fish	Amphibians	Reptiles	Birds	Number	Percent	Number	Percent
Flowing mainstem reaches	36 (36)	14 (8)	4 (1)	4 (0)	8 (3)	66	35.9	48	51.1
Pooled mainstem reaches	18 (15)	29 (8)	10 (2)	12 (3)	17 (5)	86	46.7	33	35.1
Blue Ridge-type reservoirs	6 (1)	13 (1)	2 (1)	0 (0)	1 (0)	22	12.0	3	3.2
Ridge and Valley-type reservoirs	4 (0)	5 (0)	1 (1)	1 (0)	3 (1)	14	7.6	2	2.1
Interior Plateau-type reservoirs	3 (0)	7 (2)	2 (0)	0 (0)	3 (1)	15	8.1	3	3.2
Cool/cold tributary tailwaters	5 (5)	4 (1)	1 (0)	1 (0)	1 (0)	12	6.5	6	6.4
Cool-to-warm tributary tailwaters	11 (10)	19 (9)	3 (1)	0 (0)	1 (1)	34	18.5	21	22.3
Warm tributary tailwaters	32 (30)	29 (18)	8 (1)	6 (1)	2 (1)	77	41.8	51	54.2
Total species in 1-mile buffers	63	66	18	14	23	184			
Total species in 200-foot buffers	53	29	2	3	8			95	
Percent of 1-mile totals in 200-foot buffers	84.1	43.9	11.1	21.4	28.6			51.6	

Note: Entries in the columns are not additive because some species occur in more than one category.

Source: TVA Natural Heritage database.