Post-Delisting Monitoring Plan for the Roanoke Logperch (*Percina rex*)
July 23, 2025

Introduction

Section 4(g) of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 et seq.) requires the U.S. Fish and Wildlife Service (Service) to implement a system in cooperation with the States to monitor, for not less than five years, the status of all species that have recovered and been removed from the Federal List of Endangered and Threatened Wildlife (List). Section 4(g)(2) of the Act directs the Service to make prompt use of its emergency listing authorities under section 4(b)(7) of the Act to prevent a significant risk to the well-being of any recovered species. While not specifically mentioned in section 4(g), authorities to list species following the process prescribed in sections 4(b)(5) and 4(b)(6) may also be used to reinstate species on the List, if warranted. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery remains secure from risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the delisted species to ensure the status does not deteriorate, and if a substantial decline in the species (numbers of individuals or populations) or an increase in threats is detected, to take measures to halt the decline so that re-proposing it as an endangered or threatened species is not necessary.

Review Summary

This plan was developed with help from members of the Virginia and North Carolina state wildlife agencies and an academic partner.

We have coordinated with all cooperators identified in the plan and all agree that the methods provide adequate information to monitor the delisted species to enable accurate assessment of the status of the species.

Roles of all cooperators in PDM planning and implementation

Service (Virginia Field Office, Raleigh Field Office)

The mission of the Service is working with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service implements the provisions of the Act. The Virginia Field Office will retain the primary responsibilities for coordinating monitoring with the states and assessing species status.

Service Roles:

- Coordinate monitoring and estimate budget requirements for PDM implementation.
- Coordinate PDM actions with all cooperators and continue to provide input on restoration actions and conservation planning.
- Implement the PDM through monitoring, research activities, or restoration actions conducted by cooperators.
- Coordinate and convene an annual call or meeting, and other calls or meetings as necessary, to discuss monitoring results and management activities.

State Wildlife Agencies

Virginia Department of Wildlife Resources (Mike Pinder)
North Carolina Wildlife Resources Commission (NCWRC; TR Russ)

All of the state wildlife agencies have missions to conserve natural resources. Part of these missions include assessing the condition and distribution of at-risk and other species of interest in their states. Each state agency has a representative with expertise related to the monitoring, condition of Roanoke logperch (RLP), and threats in the watersheds where the species occurs. These experts will provide review and coordination throughout the PDM process.

State Roles:

- Support the implementation of the PDM plan.
- Provide annual monitoring summaries of any surveys or threats assessments in the range of Roanoke logperch in their corresponding states.
- Perform/participate in monitoring at sites under the agency's jurisdiction.
- Participate in annual call or meeting to discuss PDM effectiveness and conditions at monitoring sites.
- Coordinate any future modifications of the monitoring with the Service and other cooperators.

Dr. Jamie Roberts, University of Southern Georgia

Dr. Roberts was contracted to complete the Species Status Assessment (SSA) report for the Roanoke logperch and has extensive experience conducting research on the species throughout its range.

Academic Roles:

- Support the preparation of the PDM plan and contribute to sampling design and site selection.
- Provide review of monitoring summaries.
- Participate in annual call or meeting to discuss PDM effectiveness and conditions at monitoring sites.
- Coordinate any future modifications of the monitoring with the Service and other cooperators.

Summary of Species' Status at time of Delisting

Table 1: Geographic grouping of waterbodies into the management units (MUs) and metapopulations from Table 3 in the Roanoke logperch SSA (Service 2022). Potential, but not occupied, MUs are in italics.

Metapopulation	**Basin and primary ecoregion(s)**	**Management unit**	**Presumed status**	**Constituent waterbodies where Roanoke logperch observed**
Roanoke Mountain	Roanoke basin; Ridge and Valley/Blue Ridge ecoregions	Upper Roanoke	Occupied	Roanoke River, South Fork Roanoke River, North Fork Roanoke River, Elliott Creek, Mason Creek, Tinker Creek, Glade Creek, Smooth Mountain Lake
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	*Blackwater*	Unoccupied	None – never observed
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	Pigg	Occupied	Pigg River, Big Chestnut Creek, Snow Creek, Leesville Lake
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	Goose	Occupied	Goose Creek
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	Otter	Occupied	Big Otter River, Little Otter River
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	Middle Roanoke	Occupied	Roanoke (Staunton) River
Roanoke Piedmont	Roanoke basin; Piedmont ecoregion	*Falling*	Unoccupied	None – never observed
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	Upper Smith	Occupied	Smith River, Rock Castle Creek, Otter Creek, Runnett Bag Creek
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	Middle Smith	Occupied	Smith River, Town Creek
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	Lower Smith	Occupied	Smith River
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	*Upper Mayo*	Unoccupied	None – never observed
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	Lower Mayo	Occupied	May River
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	*Upper Dan*	Unoccupied	None – never observed
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	Middle Dan	Occupied	Dan River, Cascade Creek, Wolf Island Creek, Big Beaver Island Creek

Metapopulation	Basin and primary ecoregion(s)	Management unit	Presumed status	Constituent waterbodies where Roanoke logperch observed
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	*Lower Dan*	Unoccupied	None – never observed
Dan	Dan basin; Piedmont/Blue Ridge ecoregions	*Banister*	Unoccupied	None – never observed
Chowan	Chowan basin; Piedmont/Southeastern Plains ecoregions	*Meherrin*	Unoccupied	None – never observed
Chowan	Chowan basin; Piedmont/Southeastern Plains ecoregions	Nottoway	Occupied	Nottoway River, Stony Creek, Sappony Creek, Waqua Creek, Butterwood Creek

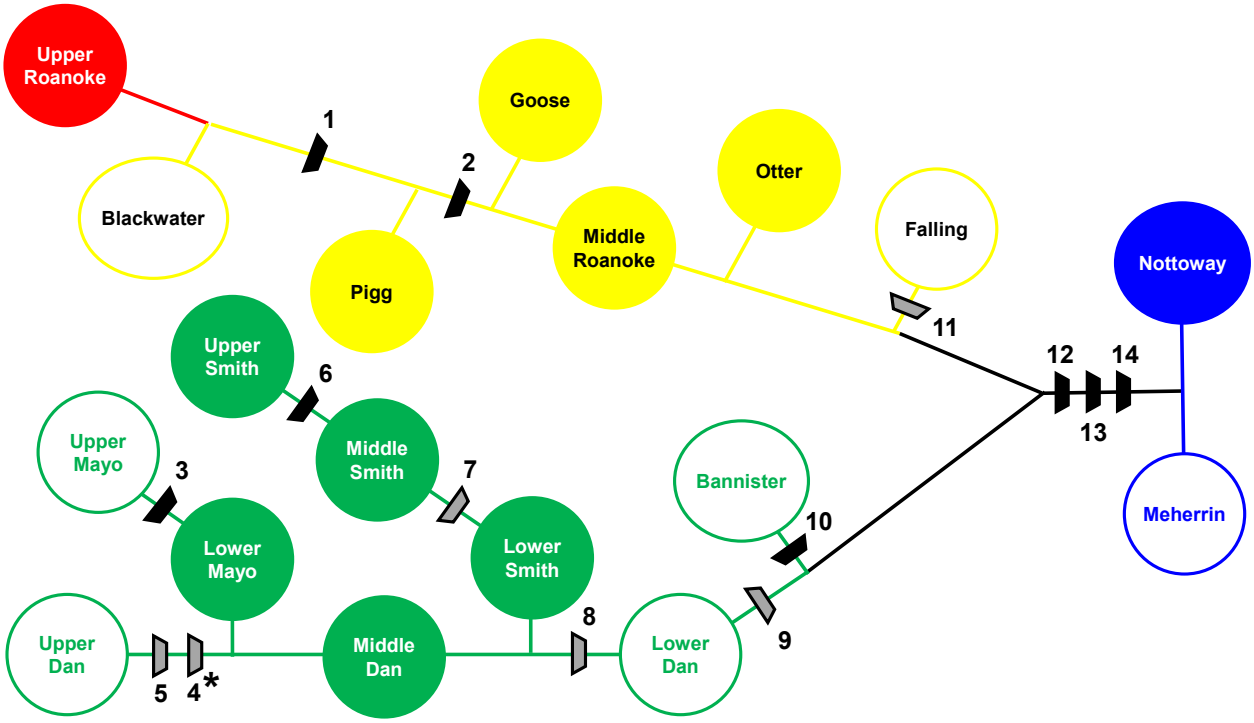

Figure 1: Schematic representation of spatial relationships among the management units (MUs; circles) and metapopulations assessed in the SSA (Figure 6 in the SSA (Service 2022)). Filled circles indicate occupied MUs; open circles indicate habitats that are presently unoccupied but potentially suitable for future occupancy by Roanoke logperch. Color-coding indicates membership in the Roanoke Mountain (red), Roanoke Piedmont (yellow), Dan (green), or Chowan (blue) metapopulation. Black and gray trapezoids represent dams presumed to allow either no passage or one-way (upstream to downstream) passage, respectively. Lindsey Bridge Dam, trapezoid number 4 and indicated with an asterisk, was removed in 2020.

Monitoring Methods and Locations

Monitoring Framework

Sampling intensity has varied throughout the known range of Roanoke logperch and efforts are underway to augment existing and establish additional populations. Sampling techniques have included snorkeling, electrofishing, and environmental DNA (eDNA). Post-delisting monitoring will use eDNA to provide a non-invasive, economical approach to sampling a larger number of sites. The use of eDNA will require less intensive field work, allowing field costs to be reduced, and samples to be collected over a shorter duration within a given year due to the comparatively reduced field time needed. Additionally, Roanoke logperch has low detectability using traditional survey methods (e.g., seining, electrofishing, and snorkeling), therefore, a technique not reliant on visual confirmation will be beneficial. Within the first 1-2 years of sampling each metapopulation will be sampled by selecting a variety of sites within watersheds to ensure comprehensive coverage across its geographic area, providing a baseline of comparison for future sampling efforts.

Within each metapopulation, sample sites will include streams, creeks, and rivers that are known to be occupied or had a historical detection, areas without a previous positive detection that contain suitable habitat, and/or where introductions have been attempted. These detections have been grouped by the USGS 12-digit hydrologic unit codes (HUC12s) in which they occurred. HUC12s are a smaller geographical area than the metapopulations and MUs, to provide for replicated occurrence data within each MU. For purposes of the PDM plan, HUC12s have been classified as Tier 1, 2, or 3 (Figure 2) based on expert input from Mike Pinder, T.R. Russ, and Dr. Jamie Roberts.

Tier 1 = expect to be continuously occupied by Roanoke logperch (n=35 HUCs)
Tier 2 = expect to be often occupied for Roanoke logperch (n=18 HUCs)
Tier 3 = potentially occupied by Roanoke logperch (n=28 HUCs)
Tier 0 = within metapopulation, potential for suitable habitat

Each metapopulation contains additional HUC 12s that may provide suitable habitat (e.g., Tier 0), but have not had a historical observation and, therefore, are not the primary PDM sampling focus but may be included in some sampling efforts.

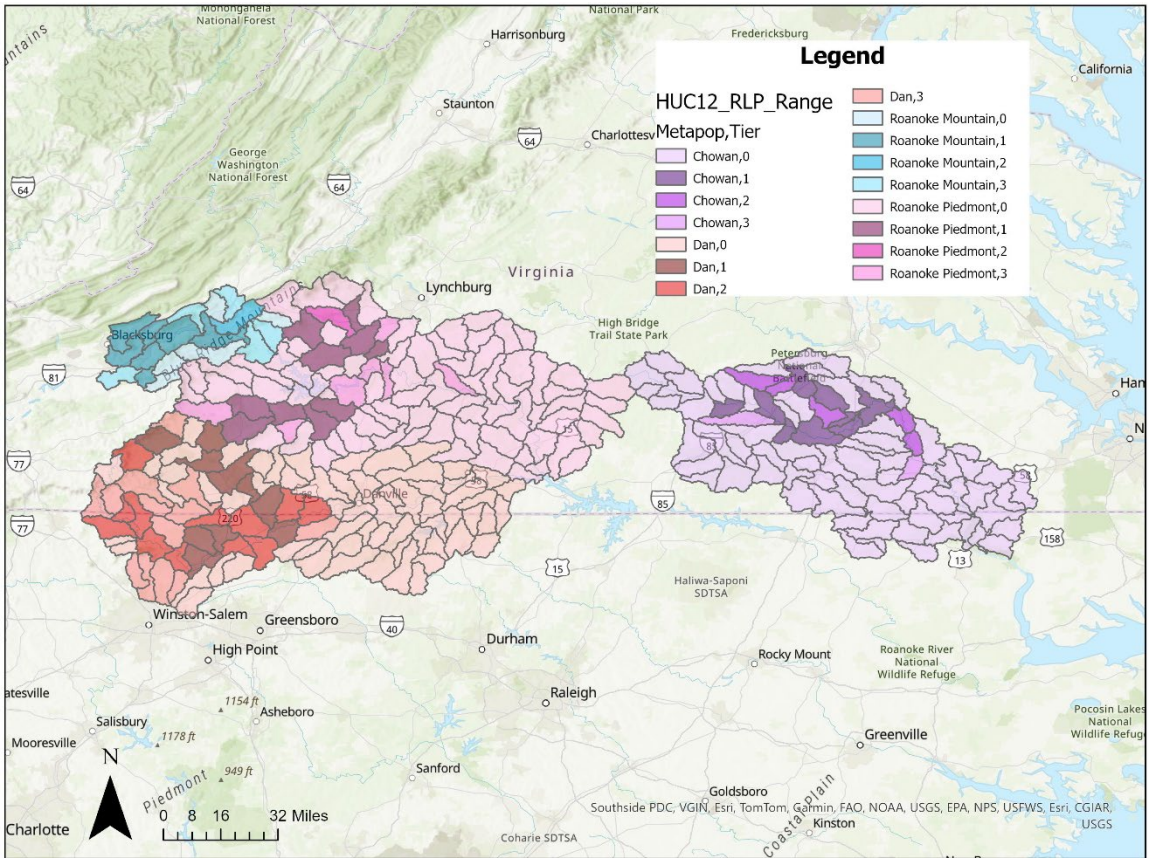

Figure 2. Roanoke logperch metapopulations (represented by unique colors) and Tier classifications (represented by color shading) for sampling.

Environmental DNA

The eDNA primers and methodology will follow Strickland and Roberts (2019). Samples will be processed by the NCWRC genetics lab located at the North Carolina Museum of Sciences in Raleigh, NC. The lab has previous experience in conducting eDNA analysis for Roanoke logperch, which will provide consistency in processing samples using the same equipment and facility.

Environmental DNA results will be provided at the HUC12 scale, which is a finer scale than the MUs presented in the SSA (Figure 1), but appropriate to the spatial scale over which eDNA detections/non-detections convey information. Multiple HUC12s will be sampled within an MU to evaluate detection of Roanoke logperch within an MU. One or more MUs make up metapopulations (Roanoke Mountain, Roanoke Piedmont, Dan, and Chowan) and this scaling will be taken into account when selecting sites and drawing conclusions about MUs and subsequent metapopulations.

Some MUs and metapopulations have apparently larger or more consistently detected Roanoke logperch populations and, therefore, it is expected that sampling at such MUs is more likely to result in a positive eDNA detection. HUC12s will be allocated to one of the 3 tiers, defined above, and then multiple stream reaches (“sites”) will be selected for eDNA sampling within each HUC12.

Tier 1 = prioritized sampling at least 2 sites in each HUC
Tier 2 = prioritized sampling at least 2 sites in each HUC

Tier 3 = secondary sampling, as needed
Tier 0 = opportunistic sampling

The sampling sites and time of year of collection will remain as consistent as possible across all years of sampling to allow for results to be more easily compared. The first year of baseline sampling will focus on the Tier 1 sites and the second year of baseline sampling will target Tiers 2 and 3. This approach will provide a more comprehensive baseline then would be provided by other eDNA studies, both ensure location and technique is kept consistent to allow species range inferences to be made.

Habitat Metrics

Basic habitat measurements (water temperature, turbidity, etc.) will be collected during eDNA sampling to characterize the site conditions at the time of sample collection, and potentially to statistically use these characteristics as covariates when probabilistically interpreting eDNA detections and non-detections.

Residual Factors Influencing Viability

We have identified six factors that may influence future Roanoke logperch viability: fine sediment deposition (Factor A), chronic chemical pollution (Factor A), dams and other barriers (Factor A), climate change (Factor E), management/ restoration activities aimed at improving habitat quality (Factor A), and existing legal and regulatory mechanisms (Factor D) (Service 2023). The most significant of these are catastrophic fish kills from chemical pollution or other events (e.g., train derailments, pipeline leaks, toxic algal blooms, sedimentation events). A catastrophic event would be identified by the impact to the Roanoke logperch for the purposes of this post-delisting monitoring plan. The impact of these events on Roanoke logperch will be documented and assessed as they occur. We expect other residual threats will show a response in Roanoke logperch occupancy and will be assessed through the eDNA assessments and habitat metrics described above.

Thresholds

The post-delisting monitoring period is set at five years, with sampling occurring during four of the five years. This period includes approximately 1 generation of Roanoke logperch and will allow for assessment of population shifts, occurrence changes, and assess any new or residual threats. The following thresholds have been developed to assess the status of the Roanoke logperch post-delisting.

Stable

Roanoke logperch remains secure without protection of being listed under the Act.

This would be true if **all** of the following conditions are met:

1. All expected occupied HUC12s sampled within all 11 occupied MUs (see Table 3) return at least 1 positive site-level detection for Roanoke logperch eDNA. Expected occupied HUC12s are mostly likely to be in Tier 1 or 2, but a Tier 3 could be added over the course of the monitoring period.
2. There is no detectable negative trend in the total number of expected occupied HUC12s and/or sites sampled within HUC12s over the monitoring period.

3. No new significant barriers are constructed that are expected to significantly reduce resiliency from conditions at the time of delisting through loss of access to available habitat area and/or reduction of dispersal and gene flow among MUs (occupied or not).
4. No catastrophic event(s), such as a fish kill, have occurred within suitable habitat in a Tier 1, 2, or 3 HUC12, regardless of whether a dead Roanoke logperch has been found.
5. No new threats have been identified that would be reasonably expected to negatively impact Roanoke logperch to an extent that the species may be in danger of extinction now or in the future.

If all of the conditions for stable are met, PDM would be concluded at the end of the 5-year timeframe.

Uncertain

Roanoke logperch may be less demographically stable than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered under the Act.

This would be true if **any** of the following occurs:

1. There is a reduction in the number of occupied MUs based on eDNA detection results.
    a. Loss of 1 expected occupied HUC12 (no sites sampled within the HUC12 returned a positive eDNA result for Roanoke logperch or a reduction in the number of positive sites in any HUC12) within an MU means the MU can no longer be considered occupied.
    b. If the MU is the Nottoway or Upper Roanoke and/or more than 1 MU in the same metapopulation meets this criterion see *Declining* threshold.
    c. Expected occupied HUC12s are mostly likely to be in Tier 1 or 2, but a Tier 3 could be added over the course of the monitoring period.
2. A new significant barrier is constructed that is expected to significantly reduce resiliency from conditions at the time of delisting through loss of access to available habitat area and/or reduction of dispersal and gene flow among MUs (occupied or not).
3. A catastrophic event(s), such as a fish kill, occurred within suitable habitat in a Tier 1, 2, or 3 HUC12, regardless of whether a dead Roanoke logperch has been found.
4. A new threat has been identified in an occupied MU that could be reasonably expected to negatively impact Roanoke logperch to an extent that the species may be in danger of extinction now or in the future.

If any of the conditions for uncertain are met, the monitoring period should be extended five years or for a period that is sufficient to assess the trigger. During this time additional assessment should occur including, but not limited to additional eDNA collection, surveys, such as snorkel or electrofishing, to collect additional information on population estimates. In the event of the construction of a significant barrier, the potential impact on Roanoke logperch should be evaluated using criteria from the SSA to determine whether such barriers are likely to substantially affect resiliency, redundancy, or representation. The Service will coordinate with all cooperators and determine any updates to the monitoring protocols and document the extension of the PDM period.

Declining

PDM yields substantial information indicating that threats are causing a decline of Roanoke logperch since the time of delisting such that listing the species as threatened or endangered under the Act may be warranted.

This would be true if **any** of the following occurs:

1. There is a reduction in the number of occupied metapopulations (Table 1) based on eDNA detection results.
    a. More than 1 MU in the Roanoke Piedmont or Dan metapopulation has 1 expected occupied HUC12 sampled return a negative result.
    b. The MU in the Roanoke Mountain or Chowan metapopulation has less than 75% of expected occupied HUCs sampled within it return a positive result.
    c. Expected occupied HUC12s are mostly likely to be in Tier 1 or 2, but a Tier 3 could be added over the course of the monitoring period.
2. More than 1 significant barrier is constructed that is expected to significantly reduce resiliency from conditions at the time of delisting through loss of access to available habitat area and/or reduction of dispersal and gene flow among MUs (occupied or not).
3. A catastrophic event, such as a fish kill within suitable habitat in a Tier 1, 2, or 3 HUC12, regardless of whether a dead Roanoke logperch has been found.
4. A new threat has been identified in 2 or more MUs that could be reasonably expected to negatively impact Roanoke logperch to an extent that the species may be in danger of extinction now or in the future.

If any of the conditions for declining are met, the Service should initiate a status review to assess changes in threats to the species, its abundance, population structure, and distribution to determine if a proposal for relisting under the Act is appropriate. As the status review is being conducted, the Service will coordinate with all cooperators and determine any additional monitoring needs.

Data Compilation and Reporting

Microsoft Excel spreadsheets containing all data collected and copies of all completed field data sheets will be submitted to the Service's Virginia Ecological Services Field Office as a report appendix, in a format collaboratively designed with PDM plan contributors. The data and report should be submitted by the end of each calendar year to ensure that adequate data are being collected and analyzed, to allow evaluation of the efficacy of the monitoring program, and to provide a periodic assessment of the status of Roanoke logperch. The Service will review these data within the context of the thresholds outlined above to determine whether additional action is necessary. After 5 years of data are available, the field collection data will be reviewed to determine overall population change and status with respect to threats. The Service will prepare a final monitoring report that will be made available to the public, which will include a description of the geographic areas surveyed, the survey protocol, and updated population metrics for each population surveyed.

The Service will coordinate with state agencies and other partners to determine whether to conclude the PDM process or to pursue alternative actions as described above under each threshold.

Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state, tribal, and foreign governments; other Federal agencies; and other non-governmental partners under the Act. Although the Act authorizes expenditures of both recovery funds and Section 6 grants to the states to plan and implement PDM, Congress has not allocated nor earmarked any special funds for this purpose. To the extent feasible, the Service intends to provide funding for PDM efforts from annual Endangered Species general appropriations. Nonetheless, nothing in this PDM plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act (31 U.S.C. 1341) or any other law or regulation.

The primary entity conducting the PDM and preparing reports will be NC and VA state agencies with cooperation from the Service. Based on costs associated with sample collection, processing, and report writing PDM expenditures are not expected to exceed $50,000. The Service will provide assistance as resources permit, but funds will be sought via NC and VA Section 6 agreements.

Cost estimate for sample collection and processing

Water samples: $40/bottle x 4 bottles/site = $160/site

Tier 1 sites: 35 HUC12s x 2 sites = 70 sites x $160/site = $11,200

Tier 2 sites: 18 HUC12s x 2 sites = 36 sites x $160/site = $5,760

Tier 3 sites: 28 HUC12s x 2 sites = 56 sites x $160/site = $8,960

+ $500 for report writing =

$26,420 + technician time for collection

Filter samples: $25/filter x 4 filters/site = $100/site

Tier 1 sites: 35 HUC12s x 2 sites = 70 sites x $100/site = $7,000

Tier 2 sites: 18 HUC12s x 2 sites = 36 sites x $100/site = $3,600

Tier 3 sites: 28 HUC12s x 2 sites = 56 sites x $100/site = $5,600

+ $500 for report writing =

$16,700 + technician time for collection (*increased technician cost compared to water samples*)

PDM Implementation Schedule

Table 2. Proposed implementation schedule for eDNA sampling. Sampling to occur in all four metapopulations (Roanoke Mountain, Roanoke Piedmont, Dan, and Chowan) in MUs with known occupancy (Upper Roanoke, Goose, Otter, Pigg, Middle Dan, Lower Mayo, Lower Smith, Middle Smith, Upper Smith, and Nottoway) based on tier classification.

Year	Tier 1 HUCs	Tier 2 HUCs	Tier 3 HUCs	Sampling will occur if needed as funding/personnel available
2026	X			
2027		X	X	
2028				X
2029	X			
2030		X	X	

Literature Cited

Strickland, G.J. and J.H. Roberts. 2019. Utility of eDNA and occupancy models for monitoring an endangered fish across diverse riverine habitats. Hydrobiologia. 826:129–144.

U.S. Fish and Wildlife Service. 2022. Species Status Assessment Report for the Roanoke Logperch (*Percina rex*), Version 1.1. April 2022. Gloucester, VA. https://iris.fws.gov/APPS/ServCat/DownloadFile/225534

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Removal of Roanoke Logperch from the List of Endangered and Threatened Wildlife. Federal Register 89(64):22649-22662.