Roanoke Logperch

Percina rex

5-Year Review:
Summary and Evaluation

Prepared by

William Hester
Kimberly Smith
U.S. Fish and Wildlife Service
Virginia Field Office
Gloucester, Virginia

Summer 2007

5-YEAR REVIEW
Species reviewed: Roanoke logperch (*Percina rex*)
Summer 2007

TABLE OF CONTENTS

TABLES

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW OF
Roanoke logperch / *Percina rex*

Summer 2007

1.0 GENERAL INFORMATION

1.1 Reviewers:

David Byrd
Eric Davis
Diane Lynch
Karen Mayne
John McCloskey
Martin Miller
Mary Parkin
Jamie Roberts

Lead Regional Office: Region 5, Ms. Mary Parkin, (617) 876-6173, mary_parkin@fws.gov

Lead Field Office: Virginia Field Office, Mr. William Hester or Ms. Kimberly Smith, (804) 693-6694, william_hester@fws.gov or kimberly_smith@fws.gov

1.2 Methodology Used to Complete the Review:

This review has been a team effort of the Virginia Field Office. Portions of the review were contracted to Dr. Amanda Rosenberger.

1.3 Background

1.3.1 FR Notice announcing initiation of this review: April 21, 2006 (Vol. 71, No. 77, Page 20717)

1.3.2 Listing history:

FR notice: August 18, 1989 (Vol. 54, No. 159, Page 34468)
Date listed: September 18, 1989
Entity listed: Species
Classification: Endangered

1.3.3 Associated rulemakings: None

1.3.4 **Review history:** Although the Roanoke logperch was included in a cursory 5-year review of all species listed before 1991 (announced in 56 FR 56882, published on November 6, 1991, this document constitutes the first detailed 5-year review completed on the species. In 2006, the Service funded a species update (Rosenberger 2007) to comprehensively review research regarding the ecology, conservation, and status of this species to provide the most up-to-date information on the Roanoke logperch.

1.3.5 **Species' Recovery Priority Number at start of review:** 5c

1.3.6 **Recovery plan:**

Name of plan: Roanoke Logperch (*Percina rex*) Recovery Plan
Date issued: March 20, 1992

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) Policy

2.1.1 **Is the species under review listed as a DPS?** No.

2.1.2 **Was the DPS listed prior to 1996?** N/A

2.1.3 **Is there relevant new information that would lead you to re-consider the classification of this species with regard to designation of DPSs?** No.

2.2 Recovery Criteria

2.2.1 **Does the species have a final, approved recovery plan containing recovery criteria?** Yes.

2.2.2 **Adequacy of recovery criteria:**

2.2.2.1 **Do the criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** No. Much has been learned about the distribution and threats to this species since completion of the Recovery Plan in 1992.

2.2.2.1 **Are the criteria objective and measurable, and do they address all of the five listing factors?** The criteria are objective; however, more explicit quantification of both population and habitat protection targets is needed to make the criteria sufficiently measurable. Aside from habitat-related conservation (factor A), the criteria address the five listing factors only through a blanket statement about protecting the species from threats that may interfere with its survival.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

Objective 1. Reclassify the Roanoke logperch from endangered to threatened status when the likelihood of extinction in the foreseeable future has been eliminated by meeting the following criteria:

A. Populations of *Percina rex* are shown to be stable or expanding and reproducing (as evidenced by sustained recruitment) in each of the following river systems: upper Roanoke River, Pigg River, Smith River, and Nottoway River. Achievement of this criterion will be determined by population monitoring over at least a 10-year period.

The present understanding of the Roanoke logperch range and densities indicate that all populations extend further and are denser than previously assumed by Burkhead (1983) or Simonson and Neves (1986). Populations in the upper Roanoke and Nottoway show comparably high densities (Rosenberger and Angermeier 2002) and high genetic diversity compared to other populations (George and Mayden 2003). The Pigg River population may be slowly expanding, due to recovery from a 1975 chemical spill (Rosenberger 2007). The species appears to be reproducing throughout its range. While additional populations have been discovered in three locations in recent years, these populations were discovered in locations with little or no historic survey data.

A poor understanding of abundance at the time of listing makes it difficult to determine whether populations are increasing, stable, or declining over the long term. Over the last 200 years, all populations have probably decreased in range size and densities. This is likely due to the loss of habitat from widespread siltation from human development and agricultural practices, and the creation of large reservoirs. If additional populations are discovered during new surveys and/or existing populations expand, downlisting to threatened should be considered.

Although, based on barriers such as major dams, there are currently considered to be eight discrete populations of Roanoke logperch (see section 2.3.1.5), the following discussion of population status is based on the five major rivers/river reaches that support these populations.

Upper Roanoke River

The population of Roanoke logperch in the upper Roanoke River is probably the largest, most important population in this species' range. It has also been studied and monitored more than any other population. It contains the longest contiguous segment of occupied river kilometers and has a number of tributaries that host logperch. Recent data indicate that this population is dynamic but shows no signs of decline (Roberts and Angermeier 2006). Known threats to logperch continue to exist in the Roanoke River drainage.

Middle Roanoke River
Recent discoveries of the logperch in the Big and Little Otter Rivers and Goose Creek are expansions of the known range of this species. Due to the limited survey data from these waterbodies, it is unknown whether these populations are increasing, declining, or stable (Lahey and Angermeier 2006a).

Pigg River
The Pigg River population appears to be rebounding in both size and extent since the 1975 chemical spill that killed most of the individuals in the mainstem Pigg River (James 1979, Rosenberger and Angermeier 2002, Lahey and Angermeier 2006a).

Smith River
The Smith River populations are vulnerable to fragmentation from Philpott Dam, Martinsville Dam, and small population sizes, but they have probably remained stable since the time this species was listed. The continuing operation of Philpott Dam and continued siltation from upstream agriculture indicate that threats have not been eliminated or reduced.

Nottoway River
The Nottoway River population was once considered highly vulnerable due to widespread siltation from agricultural and silvicultural activity in its watershed (USFWS 1992). Recent surveys indicate that these threats have declined, and the population is increasing in range and in density (Rosenberger and Angermeier 2002). This population should remain stable if siltation is managed appropriately during agricultural and silvicultural activities and impacts to riparian areas are avoided along the fall zone of the Nottoway River.

B. Each of the known populations is protected from present and foreseeable threats that may interfere with the species' survival.

Based on limited monitoring information, it is difficult to determine whether protection from threats for each population has improved since the species was listed. (See section 2.3.2.1 for known and potential threats to Roanoke logperch).

Objective 2. Remove *Percina rex* from the Federal list of endangered and threatened species when the following criterion has been met in addition to A and B above:

C. Habitat improvement measures have been developed and successfully implemented, as evidenced by a sustained increase in logperch population size and/or length of river reach inhabited within the upper Roanoke River

drainage and a similar increase in at least two of the other three *P. rex* populations (Pigg River, Smith River, or Nottoway River).

Since 2000, the Service and its partners have restored approximately 31 miles of riparian habitat. Other habitat improvement measures have likely been accomplished by other entities but a compilation of such data is not available. We are unable to quantify whether these habitat restoration efforts have resulted in partial logperch recovery. We are not aware of a sustained increase in population size anywhere within the species range, with a possible exception of the Pigg River population re-growth that has occurred since the 1975 chemical spill.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history: Basic biology and life history requirements are found in the Roanoke Logperch Recovery Plan that was published in 1992.

The following new information was provided by Rosenberger and Angermeier (2002). Logperch observed in winter appear to use habitat with slower mean and bottom water velocities than in summer. Logperch in winter tended to select less silted habitat than in the summer. In the Roanoke and Pigg Rivers, logperch were primarily observed in runs, occasionally riffles, and rarely in pools. In the Nottoway River, logperch were primarily observed in pools, occasionally in runs, and rarely in riffles. In the Roanoke River, logperch selected deep, high velocity microhabitats with exposed, silt free gravel substrate. Logperch in the Roanoke, Pigg, and Nottoway Rivers were consistently observed over small to large gravel in areas dominated by large gravel and boulders.

2.3.1.2 Abundance, population trends, demographic features and/or trends:

Densities and abundance

Upper Roanoke River
The largest population of Roanoke logperch is found in the upper Roanoke River. The presence of logperch in multiple river tributaries, including the North and South Forks of the Roanoke River and Tinker Creek, could act as sources in the event of an extirpation of the species along a length of the occupied mainstem river (Ensign et al. 1997). There are no trend data available and the upper Roanoke River watershed is being urbanized relatively rapidly. This urbanization threatens the existing population density and abundance in this portion of the logperch range.

Middle Roanoke River

Goose Creek and the nearby Little and Big Otter Rivers appear to be sparsely populated. These waterways have not been surveyed extensively enough to determine relative population densities (Lahey and Angermeier 2006a) or trends.

Pigg River

Although previous surveys have indicated that logperch are rare in the Pigg River (James 1979, Jenkins and Burkhead 1993), more recent surveys indicate that Age 1+ logperch are found at only slightly lower densities in occupied sites in the Pigg River than in the upper Roanoke River (Lahey and Angermeier 2006b). Low densities and rarity in past surveys may be due to a 1975 chemical spill in the middle portion of the Pigg River at Rocky Mount, Virginia, which caused a catastrophic fish kill that extended 36 kilometers downstream (James 1979). Most of the length of the Pigg River known to be occupied by logperch was affected by this spill, and it is believed that only one tributary (Big Chestnut Creek) and/or a small stretch of the Pigg River could have served as a source for recolonization. Both population density and abundance appear to be increasing in the Pigg River watershed.

Smith River Populations

Roanoke logperch in the Smith River are separated into three populations by Philpott and Martinsville Dams and their associated reservoirs. In the Smith River population upstream of Philpott Reservoir, one site had comparable densities to sites in the Roanoke River. The remaining sites contained comparable densities to the Pigg River (Lahey and Angermeier 2006c; J. Roberts, Virginia Tech, pers. comm. 2006) or only single or no logperch (A. Rosenberger, Univ. of Alaska, pers. comm. 2006). Downstream of Philpott Dam, logperch are found at low densities in Town Creek (D. Orth and M. Anderson, Virginia Tech, pers. comm. 2006; S. Smith, VDGIF, pers. comm. 2006) and in the Smith River downstream of Martinsville Dam to the North Carolina border (Orth 2001; S. Smith, VDGIF, pers. comm. 2006). Overall, the population in the Smith River appears to be stable.

Nottoway River

Jenkins and Burkhead (1993) asserted that the highest densities of Roanoke logperch were found in the Roanoke River; however, the population in the Nottoway River may occur at equal or greater densities (Rosenberger and Angermeier 2002). Young-of-year (YOY) logperch have been observed at high densities in the Nottoway River (Rosenberger and Angermeier 2002). YOY prefer the relatively pristine condition of low velocity habitats found in the Nottoway River (Burkhead 1983; Rosenberger and Angermeier 2002). This abundance

of juvenile habitat may explain the strong juvenile production in the Nottoway River. Logperch in Stony Creek, a Nottoway River tributary, probably occur at similar densities to the Pigg River (A. Rosenberger, Univ. of Alaska, pers. comm. 2006). Logperch in other Nottoway River tributaries – including Butterwood, Sappony, and Waqua Creeks – are probably sparsely distributed, but these streams have not been well surveyed (Lahey and Angermeier 2006a). The Nottoway River population is unusual because it contains high densities of Age 1+ individuals and YOY, has tributaries with comparable densities, contains pristine conditions in low-velocity habitats, and does not have large dams. The Nottoway River population appears to be stable.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation: Low genetic divergence occurs between the Roanoke, Pigg, Smith, and Nottoway River populations (George and Mayden 2003), supporting the concept that the reduction in range occurred within the last 200 years with the construction of dams and agricultural expansion in the region. The highest genetic diversity is in the Roanoke and Nottoway River populations. The Pigg and Smith River populations have low genetic diversity and a relatively high potential for inbreeding depression (George and Mayden 2003). Additional genetic information is needed to confirm these results or to reveal small-scale genetic structuring in logperch populations.

2.3.1.4 Taxonomic classification or changes in nomenclature: There has been no change in nomenclature since the species was listed.

2.3.1.5 Spatial distribution, trends in spatial distribution, and/or historic range:

Known present distribution

Knowledge of the distribution of Roanoke logperch has grown since it was first listed as endangered in 1989, but its geographic range remains small (Lahey and Angermeier 2006b). The species is now disjunctly distributed in the Roanoke watershed in the Roanoke, Pigg, and Smith River drainages. It is also present in the Chowan watershed in the Nottoway River drainage. Logperch within each of these river drainages can be further subdivided among various tributaries and mainstem sections that are isolated from one another to varying degrees by man-made barriers and/or reaches of unsuitable habitat. The resulting population structure of this species is complex, thus complicating determination of the number of "populations" for describing logperch ecology, setting recovery objectives, and assessing whether recovery goals have been met.

For purposes of this document, occupied areas not separated by a major dam are considered a "population." Based on this criterion, there are approximately eight total populations of Roanoke logperch including: (1) the upper Roanoke River drainage downstream to Niagara Dam, (2) the middle Roanoke River drainage downstream of Leesville Lake, (3) the Upper Pigg River drainage upstream of Power Dam, (4) the Middle Pigg River drainage downstream of Power Dam, (5) the Smith River drainage upstream of Philpott Reservoir, (6) the Smith River drainage downstream of Philpott Reservoir to the headwaters of Martinsville Dam, (7) the Smith River drainage below Martinsville Dam, and (8) the Nottoway River drainage.

Occupied habitat within these eight populations may be isolated by other man-made barriers and/or unsuitable habitat. Designation as separate populations will require further investigation (e.g., genetic analysis).

Unoccupied but suitable locations

Potential Roanoke logperch habitat within its probable range prior to European development of the region has been identified in the Dan, Mayo, Blackwater, Falling, and Meherrin River drainages (Lahey and Angermeier 2006b). To date, no individuals have been found in surveys in these rivers (Lahey and Angermeier 2006a, Devine Tarbell and Associates 2006).

Upper Roanoke River

The upper Roanoke River population of logperch is relatively large and continuously distributed throughout the North Fork, South Fork, and mainstem Roanoke River above Niagara Dam. A detailed report of logperch distribution in the North Fork Roanoke River indicates that logperch can extend approximately 36 km upstream of the confluence of the North and South Fork Roanoke River (Ferguson et al. 1994). Logperch have also been found in Mason and Tinker Creeks, tributaries to the Roanoke River in the City of Roanoke (Burkhead 1983, Simonson and Neves 1986), but no logperch have been found during recent surveys in Mason Creek. Niagara Dam in Roanoke County is generally considered to be the downstream extent of logperch in the upper Roanoke River (Lahey and Angermeier 2006a), but several individuals have been captured in the Niagara Dam tailwater above Smith Mountain Lake (B. LaRoche, VDGIF, pers. comm. 2006). Individuals have also been found in Beaverdam Creek Cove and Moorsman's Cove of Smith Mountain Lake and in the Roanoke (Staunton) River in Campbell County near the Brookneal Hatchery (Miller and Morton 2000).

Middle Roanoke River

In the middle Roanoke River drainage below Leesville Dam, logperch have been captured in Goose Creek, Bedford County, close to the

Huddleston Gauging Station (Lahey and Angermeier 2006a), Little Otter River (Lahey and Angermeier 2006a), and Big Otter River close to its confluence with the Little Otter River (J. Roberts pers. comm. 2006). The close proximity of the confluences of Goose Creek and Big Otter River with the Roanoke River implies a potential connection between these populations. While logperch have not been found in the middle Roanoke River mainstem, there are populations in Goose Creek and the Big Otter River that could potentially repopulate the mainstem if habitat was/is suitable.

Pigg River

The Pigg River supports Roanoke logperch (Rosenberger and Angermeier 2002) and a rich assemblage of native species (Lahey and Angermeier 2006a). The logperch population extends slightly upstream of the City of Rocky Mount and likely continues as far downstream as the confluence of the Pigg River and the headwaters of Leesville Reservoir. Only one Pigg River tributary, Big Chestnut Creek, is known to contain logperch (Lahey and Angermeier 2006a).

Smith River

A population of logperch, along with a rich native fish assemblage is found in the mainstem Smith River upstream of Philpott Dam (Lahey and Angermeier 2006c). Some of the larger tributaries of the Smith River upstream of the dam may also contain logperch, such as Rockcastle Creek (S. Smith, VDGIF, pers. comm. 2006); however, this population has not been extensively studied.

Logperch have been captured approximately 9 to 39 river kilometers below Philpott Dam (Orth 2001, S. Smith pers. comm. 2006) and logperch density appears to increase with distance from the dam (Orth 2001). Hydropeaking and cold water release from the dam in the summer months likely restrict logperch from persisting closer to Philpott Dam within the mainstem river. Logperch have been found in Town Creek, which enters the Smith River immediately downstream of Philpott Dam (Orth and Anderson, Virginia Tech, pers. comm. 2006; S. Smith pers. comm. 2006).

A population is also present in the Smith River, downstream of the Martinsville Dam located in the City of Martinsville, Virginia, and is found in low to moderate densities to the North Carolina border (S. Smith pers. comm. 2006). The logperch population may extend into North Carolina (S. Smith pers. comm. 2006), but to our knowledge survey information from the Smith River in North Carolina does not exist.

Nottoway River

A population of Roanoke logperch occurs in the Nottoway River and some of its tributaries in the Chowan drainage. The highest densities are found along the fall line between the Piedmont and Coastal Plain physiographic provinces. The most upstream record of logperch in this system is from Fort Pickett at the boundary between Dinwiddie and Brunswick Counties, Virginia. Surveys by McIninch and Garman (2002) and Lahey and Angermeier (2006a) between Fort Pickett and the more densely populated areas downstream infer that logperch may be continuously but sparsely distributed along the river between Brunswick and Dinwiddie Counties. Only three tributaries of the Nottoway River – Stony, Sappony, and Waqua Creeks – contain logperch (Lahey and Angermeier 2006b). Of these three tributaries, Stony Creek probably contains the highest densities (A. Rosenberger, Univ. of Alaska, pers. comm. 2006). Tributaries in this drainage that flow west to east over the fall zone are more likely to contain high-gradient habitat riffles and runs that may be necessary for logperch to complete their life cycle. Most of the tributaries of the Nottoway River flow north-south and are small, low gradient, swampy tributaries that do not contain suitable habitat.

Past Distribution

Based on the species present, disjunct distribution, Jenkins (1977) and Burkhead (1983) hypothesized that all populations of Roanoke logperch within the Roanoke drainage were historically larger and well connected. They suggested that fragmentation by large reservoirs and destruction of habitat due to massive siltation from agriculture and human development resulted in the current separation of logperch populations in the Roanoke drainage. Prior to European settlement and agricultural expansion in Virginia, the logperch range may have extended far into the Piedmont and occasionally connected the Nottoway River population with the Roanoke River population. Logperch may also have occurred in the Dan, Mayo, and Falling River watersheds. Limited data suggesting low genetic divergence among the Roanoke, Pigg, Smith, and Nottoway River populations support the idea of a relatively recent separation (George and Mayden 2003). More genetic data are needed to establish exact relationships among the four populations.

2.3.1.6 Habitat or ecosystem conditions:

Differences in habitat availability among rivers containing logperch

Mesohabitat characteristics refer to the characteristics of pools, riffles, and runs in these high- to medium- gradient small rivers and streams (Frissell et al. 1986). Microhabitat characteristics refer to the characteristics of habitat in small, 1-m^2 areas within mesohabitats.

For the Roanoke and Nottoway Rivers, both meso- and microhabitat characteristics vary in ways that could affect logperch habitat use and limit the similarity of habitat use and life history patterns among these rivers (Rosenberger and Angermeier 2002). There is presently little information available on mesohabitat characteristics of the Pigg, Smith, Big and Little Otter Rivers, and Goose Creek. Because these streams are within the Roanoke drainage, mesohabitat availability is probably most similar to the Roanoke River as described below. Microhabitat availability is presently unknown for the Smith River, but visual examination suggests that the upper Smith River above Philpott Reservoir is probably most like the Pigg River as described below, though perhaps less silted. The lower Smith River is probably most like the upper Roanoke River as described in microhabitat characteristics.

The following summaries are based on data collected from 1999 through 2000 (Rosenberger and Angermeier 2002). As human development patterns and management activities change through time, the relative difference in habitat characteristics may also change.

Mesohabitat availability differences between the Roanoke and Nottoway Rivers

Differences between the Roanoke and Nottoway Rivers in mesohabitat characteristics reflect differences between the rivers in physiography, gradient, and anthropogenic disturbance. Pool habitat is dominant, runs are uncommon, and riffles are rare in the Nottoway River relative to the Roanoke River. Runs and riffles tend to be deeper in the Nottoway River. Within mesohabitats, the most consistent and dramatic differences between the two rivers are embeddedness, silt cover, and frequency of woody debris. The Nottoway River has less anthropogenic disturbance in its watershed than the Roanoke River, and its riparian zone is relatively intact and almost completely lined with trees through the fall zone. This vegetation contributes woody debris and stabilizes banks in the Nottoway River, which reduces sediment loads that are likely to cover and embed substrate. Past studies indicate that logperch avoid areas with heavy silt loads and substrate embeddedness.

Microhabitat availability differences between the Roanoke, Pigg, and Nottoway Rivers

Differences among the Roanoke, Pigg, and Nottoway Rivers reflect their relative size and gradient as well as differences among the systems in human development. The Roanoke and Pigg Rivers are experiencing heavy sedimentation from nearby agriculture and construction activities, more so than the Nottoway River system. The Nottoway River is the largest and deepest of the rivers and the Pigg River the smallest and shallowest. The Roanoke River, with the highest gradient, has the

largest substrates and highest bottom velocities in riffle microhabitats. The most dramatic differences among the rivers are in embeddedness and silt characteristics. For all mesohabitat types, the Nottoway River has the least silted and embedded microhabitats, and the Pigg River is most heavily embedded with silt.

2.3.2 Five-Factor Analysis

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

This section includes a discussion of known and potential threats to Roanoke logperch and the implications and degree of risk associated with each threat for each logperch population (summarized in Table 1). These threats include the following: 1) large dams and reservoirs, 2) small dams/barriers, 3) watershed urbanization, 4) agricultural and silvicultural activities, 5) channelization, 6) roads, 7) toxic spills, 8) riparian/woody debris loss, and 9) water withdrawals.

Table 1. A summary of threats under Factor A and the degree to which each Roanoke logperch population is at risk based on the particular threat.
(N = Not a present threat; L = Exists as a low threat; M = Significantly threatens a subset of the range occupied by logperch; H = Significantly threatens the known range of the population; U = Unknown).

Threat	Upper Roanoke River	Middle Roanoke River	Pigg River	Upper Smith River	Lower Smith River	Nottoway River
Large dams	M	M	M	H	H	N
Urbanization	H	U	M	L	M	L
Ag./ Forestry	H	U	M	M	M	L
Channelization	M	U	N	N	U	N
Road Building	H	U	H	L	M	L
Toxic Spills	L	U	H	M	H	L
Riparian Loss	M	U	M	M	H	L
Small Barriers	L	U	M	U	U	U
Water Withdrawals	L	U	U	U	U	L

Large dams and reservoirs

Perhaps the greatest overall loss of logperch habitat and reduction in this species' range occurred when construction of the Smith Mountain and Leesville Dams was completed in 1963. The construction of these hydropower dams likely destroyed over 150 kilometers of habitat within the Piedmont section of the Roanoke River drainage. This dam construction also isolated the Pigg River and Roanoke River logperch populations. The dams increased the vulnerability of logperch to extirpation and eliminated the possibility of recolonization from downstream.

On the Smith River, Philpott Dam was constructed in 1952 and started generating electricity in 1953. Upstream of Philpott Reservoir, the stretch of occupied river is small, isolated, and therefore, vulnerable to other human impacts that affect instream habitat or cause local extirpation. Downstream of the reservoir, hydropeaking and coldwater releases render at least eight river kilometers unsuitable for logperch and potentially isolate the Town Creek population. Logperch in Town Creek could possibly be connected to logperch found 8 to 20 km downstream of the dam, but the connection between these two locales has not been investigated and cannot be assumed. Daily flooding from hydropeaking and unsuitably cold temperatures characterize the Smith River at its confluence with Town Creek. Any additional dam development upstream of Philpott, including the proposed but presently stalled Charity Reservoir (Jenkins and Burkhead 1993), could extirpate the logperch population upstream of Philpott Reservoir.

The Nottoway River is among the few rivers in Virginia located in the Piedmont and Coastal Plain physiographic provinces that does not have major barriers to fish movement in the form of lowhead dams or reservoirs.

Small dams/barriers

At least three smaller dams – Martinsville Dam on the Smith River, Power Dam on the Pigg River, and Niagara Dam on the upper Roanoke River – have separated populations and displaced logperch habitat, albeit at a much smaller scale than Smith Mountain, Leesville, or Philpott Dams. There are numerous additional dams/barriers within the logperch range, many of which are poorly understood. The extent to which these dams flood potential logperch habitat, prevent the connectivity of logperch populations, or restrict the distribution of logperch is largely unknown and deserves further investigation.

Watershed urbanization

The human population in and around the City of Roanoke area, including Blacksburg and Salem, Virginia, is continuing to expand. This is accompanied by the usual symptoms of watershed urbanization, including expanding impervious surfaces, increased urban sprawl, and loss of open areas and farmland. This could negatively affect all logperch populations within the Roanoke River drainage, including ones in the Pigg and Smith Rivers.

The area around the Nottoway River inhabited by Roanoke logperch is primarily used for agricultural or silvicultural purposes. The only areas that could be considered urban occur near the headwaters of the Nottoway River in and around the Town of Blackstone. Urbanization is not one of the primary threats to logperch in this system at this time.

Agricultural and silvicultural activities

The most widespread current threat to Roanoke logperch is non-point source pollution in the form of fine sediment from both urban and agricultural activities. Particularly in the Roanoke drainage, crop and livestock farming contributes deposits of fine sediment and silt into the upper Roanoke, Pigg, and Smith Rivers. In upstream reaches, cattle often have unrestricted access to the stream channels, which often results in failing and highly eroded streambanks. Widespread restoration activities and improved farming practices in these areas have a strong potential for dramatically reducing silt loads and improving logperch habitat. Habitat restoration activities in agricultural areas are much more likely to be successful than in urban areas.

Historically, the Nottoway River was impacted by excessive siltation generated by poor agriculture and farming practices. Recent surveys indicate that both agriculture and silviculture practices have improved along the Nottoway River. Siltation is less of an issue in this system than it is in the Roanoke drainage (Rosenberger and Angermeier 2002).

Channelization

As stated in the Roanoke logperch recovery plan (USFWS 1992), the morphology of rivers in the Roanoke drainage, particularly the upper Roanoke River, have been altered in many locations due to filling and small-scale channelization.

The ongoing Roanoke River Flood Reduction Project could have major negative impacts on the logperch population in the upper Roanoke River. Located in the City of Roanoke, construction began in 2005 with the

purpose of reducing flooding in downtown Roanoke. The Roanoke River Flood Reduction Project will involve earth-moving activities that will likely temporarily increase sediment input into the river, and may, therefore, negatively affect the Roanoke logperch.

Roads

Urbanization and continued economic growth around the Cities of Roanoke and Salem and the Town of Blacksburg have resulted in an increase in new highway construction, highway improvement, and paved road projects. The Virginia Department of Transportation proposes to construct Interstate 73, which could potentially impact all populations of Roanoke logperch in the Roanoke drainage. The impacts of the proposed I-73 corridor through the City of Roanoke on logperch should be minimal. The current corridor follows the existing roads I-81 and U.S. Route 58, following the present Route 220 through the community of Clearbrook, east of where 220 crosses the Blue Ridge Parkway. After passing through Clearbrook, the proposed path cuts northeast again to presently unpaved ground in Franklin County. This route traverses areas that are already highly urbanized and developed, follows existing roads, and is near the downstream limit of Roanoke logperch in the upper Roanoke River, thus lessening the potential for impacts to the logperch.

The population of Roanoke logperch in the Pigg River appears to be the most fragile and sensitive to the proposed Interstate. The proposed corridor crosses the Pigg River 3 km east of Rocky Mount, and thus the majority of Roanoke logperch in the Pigg River are downstream of the crossing, where they could be directly impacted by any chemical spills on highway or road crossings or sedimentation during and after construction. Watershed urbanization is also a substantial threat to Roanoke logperch in the Pigg River.

Toxic spills

It is difficult to obtain solid information on the frequency and extent of recent chemical spills on Roanoke logperch populations in Virginia; however, limited information indicates that spills are common and should be considered a persistent threat (Burkhead 1983, USFWS 1992, Wheeler et al. 2002).

The most severe of these incidents in the logperch range occurred in the Pigg River in 1975, when an accidental discharge of copper sulfate in Rocky Mount (upstream of most of the logperch habitat in the Pigg River) caused a kill of an estimated 28,704 fish (many species, including logperch) over 36 km of river (James 1979). The Pigg River is still the most likely population to be extirpated from a toxic spill because the

population occurs over a very short length of river, has only one tributary locale that could serve as a source for recolonization, and is located downstream of a major thoroughfare in Rocky Mount and the proposed crossing of I-73. However, any Roanoke logperch downstream of any potential storage facilities for toxic chemicals or manure or major road crossings (e.g., Stony Creek tributary of the Nottoway River, Town Creek tributary of the Smith River) should be considered at risk. Even if these locales are not completely extirpated by a chemical spill, resulting genetic bottlenecks could reduce the adaptive potential of logperch populations, cause inbreeding depression, and decrease resilience to demographic and environmental stochasticity.

Riparian/woody debris loss

Within the Fall Zone of the Nottoway River, woody debris, including large tree falls and snags, are a common sight (Rosenberger and Angermeier 2002). Roanoke logperch in this river are commonly observed in and around woody debris in low flow areas (Rosenberger and Angermeier 2002), which may serve as cover from predators and a source of food (Angermeier 1985). Wood removal practices and the deforestation of the streambanks in the Roanoke River basin have greatly reduced the availability of wood in these systems due to loss of riparian vegetation and intentional debris removal in urban areas (e.g., Roanoke River Flood Reduction project). In addition to the silt cover, the lack of woody debris in Roanoke River pools may reduce pool suitability for Roanoke logperch.

Water withdrawals

The extent to which water withdrawals affect logperch populations in the species range is currently unknown. We are aware of one water withdrawal project on the Nottoway River: a titanium mining operation (Iluka Resources) in Dinwiddie and Sussex Counties withdraws water for their processing facility in Sussex County. This withdrawal is minimal and strictly regulated (C. Saunders, Marshall Miller & Assoc., pers. comm. 2006).

2.3.2.2 **Overutilization for commercial, recreational, scientific, or educational purposes:** There is no evidence to suggest that overutilization for any of these purposes has contributed to the decline of the logperch.

2.3.2.3 Disease or predation: Predation may constitute a significant portion of the mortality of the larval and post larval stages (Burkhead 1983), but there is no evidence to suggest that natural predators threaten this species. Burkhead (1983) noted that the principal parasite of *Percina rex* is the parasitic worm *Crassiphiala bulboglossa*. There is no evidence to suggest that disease or parasites are a significant threat to this species.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The Endangered Species Act (ESA) requires Federal permits for taking the Roanoke logperch and requires Federal agencies to consult with the Service when projects they fund, authorize, or conduct may affect this species.

The Fish and Wildlife Coordination Act requires the Federal regulatory and construction agencies to give consideration to fish and wildlife resources in their project planning and in the review of applications for Federal permits and licenses. These agencies must consult with State and Federal fish and wildlife agencies regarding the possible impacts of proposed actions and obtain recommendations for fish and wildlife protection and enhancement measures, but any recommendations are not binding.

Virginia State Law (Section 29.1-564) prohibits the taking, transportation, possession, sale, or offer for sale within the Commonwealth of threatened or endangered species of fish and wildlife. A State permit is required for the taking, exportation, transportation, or possession of any threatened or endangered species of fish and wildlife for zoological, educational, or scientific purposes and for propagation of such fish or wildlife in captivity for preservation purposes (Section 29/1-568). However, this law does not protect the species' habitat.

2.3.2.5 Other natural or manmade factors affecting its continued existence: The Service is not aware of other natural or manmade factors affecting the continued existence of the Roanoke logperch.

2.4 Synthesis

Although the number of known populations has increased since the species was listed in 1989, the geographic range of the Roanoke logperch remains small and threats continue. Insufficient data are available to accurately assess population abundance and trends in the face of continuing threats, but it is evident that all of the existing populations of Roanoke logperch are threatened by one or more of the following: road projects, water projects, catastrophic spills, and siltation from agricultural runoff. Populations in the Roanoke River drainage are further threatened by urbanization and industrial development.

Based on the best available information, including continuing uncertainties about population viability as well as the continuing effects of pervasive and, in some cases, catastrophic threats, the Roanoke logperch remains in danger of extinction throughout its range.

3.0 RESULTS

3.1 Recommended Classification:

Endangered. No change is warranted.

Rationale: Criteria for downlisting have not been fully met, and the five-factor analysis indicates that although the species is showing signs of improvement, threats to logperch populations are ongoing and, in some cases, accelerating.

3.2 Recommended Recovery Priority Number (RPN):

11c

Rationale: The RPN of 5c should be changed to 11c. The Roanoke logperch faces a moderate degree of threat with low recovery potential.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1. Maintain and increase the health and vigor of present populations through a watershed-level conservation approach that addresses sediment loading and preserves ecological processes that provide ephemeral, seasonal, and persistent types of habitat required over logperch ontogeny. Focus on stream restoration projects and projects to improve agricultural practices in three areas that are particularly degraded by agricultural activities: 1) the Pigg River upstream of the Town of Rocky Mount, 2) North Fork of the Roanoke River, and 3) the Smith River (upstream of Philpott Reservoir) and Town Creek. Continue to work with Franklin County on a Pigg River Watershed Management Plan. Continue to work with the Virginia Department of Environmental Quality on the Total Maximum Daily Loads Implementation Plan for the Pigg River.

2. Evaluate the feasibility of propagating logperch and determine whether a controlled propagation and reintroduction/augmentation plan should be developed.

3. Increase connectivity of Roanoke logperch populations by identifying major and minor artificial movement barriers and eliminating them when feasible. Continue to work on the removal of Power Dam on the Pigg River and the abandoned sewer line/low bridge crossings in the Roanoke River in the City of Roanoke.

4. Prevent and reduce the risk of catastrophic extirpation from toxic spills through identification, evaluation, and improvement of present and proposed road crossings, agricultural, and industrial facilities.

5. Survey streams with suitable habitat and continue to identify habitat that is potentially suitable for logperch reintroduction/augmentation.

6. Revise the recovery plan to include measurable criteria that specifically address each of the relevant listing factor and incorporate currently available information about population abundance and distribution.

5.0 LITERATURE CITED

Literature sources are on file at the U.S. Fish and Wildlife Service's Virginia Field Office, 6669 Short Lane, Gloucester, Virginia, 23061.

Anderson, M. 2006. Personal communication. Virginia Polytechnic Institute and State University. Blacksburg, VA.

Angermeier, P.L. 1985. Spatio-temporal patterns of foraging success for fishes in an Illinois stream. The American Midland Naturalist 114:342-359.

Burkhead, N.M. 1983. Ecological studies of two potentially threatened fishes (the orangefin madtom, *Noturus gilberti*, and the Roanoke logperch *Percina rex*) endemic to the Roanoke River drainage. Report to Wilmington District Corps of Engineers, Wilmington, NC.

Devine Tarbell & Associates, Inc. December 12, 2006. Memorandum. Appalachian Power Company – Smith Mountain Project. Unpublished report. Charlotte, NC. 9 pp.

Ensign, W.E., K.N. Leftwich, P.L. Angermeier, and C.A. Dolloff. 1997. Factors influencing fish recovery following a large-scale disturbance. Transactions of the American Fisheries Society 126:895-907.

Frissell, C.A., W.J. Liss, C.E. Warren, and M.D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. Environmental Management 10:199-214.

Ferguson, M.T., S.A. Bruenderman, and P.S. Lookabaugh. 1994. A survey of the Roanoke logperch (*Percina rex*) in the North Fork Roanoke River. Nongame and Endangered Species Program Fisheries Division Report, Virginia Department of Game and Inland Fisheries, Blacksburg, VA.

George, A.L. and R.L. Mayden 2003. Conservation genetics of four imperiled fishes of the southeast. Final Report to the U.S. Forest Service.

James, D.L. 1979. Ecological studies of the fishes of the Pigg River system, southcentral Virginia, with special reference to threatened species. Master of Science thesis. Virginia Commonwealth University, Richmond, VA. 60pp.

Jenkins, R.E. 1977. Roanoke logperch *Percina rex* (Jordan and Evermann 1889) status report. U.S. Fish and Wildlife Service.

Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Lahey, A.M. and P.L. Angermeier. 2006a. A survey for Roanoke logperch in the Roanoke and Meherrin River drainages, Virginia. Report to U.S. Fish and Wildlife Service, Gloucester, VA.

Lahey, A.M. and P.L. Angermeier. 2006b. Range-wide assessment of habitat suitability for Roanoke logperch (*Percina rex*). Report prepared for Virginia Transportation Research Council, Charlottesville, VA.

Lahey, A.M. and P.L. Angermeier. 2006c. Habitat suitability for Roanoke logperch near Philpott Reservoir. Final report prepared for the U.S. Army Corps of Engineers, Wilmington District, Bassett, VA.

LaRoche, B. 2006. Personal communication. Virginia Department of Game and Inland Fisheries. Forest, VA.

McIninch, S. and G. Garman. 2002. Survey for Roanoke logperch, *Percina rex*, from the Nottoway River system, Chowan drainage, Virginia. Center of Environmental Studies, Virginia Commonwealth University, Richmond, VA.

Miller, S. and D. Morton. 2000. ARC GIS BOVA & T&E shape file – *Percina rex* distribution and stream attributes. Virginia Department of Game and Inland Fisheries, Richmond, VA.

Orth, D. 2001. Influences of fluctuating releases on stream habitats for brown trout in the Smith River below Philpott Dam. Final report to Virginia Department of Game and Inland Fisheries, Richmond, VA.

Orth, D. 2006. Personal communication. Virginia Polytechnic Institute and State University. Blacksburg, VA.

Roberts, J.H. and P.L. Angermeier. 2006. Assessing impacts of the Roanoke River Flood Reduction Project on the endangered Roanoke logperch. Final Report to the U.S. Army Corps of Engineers, Wilmington District, Wilmington, NC. 44pp.

Roberts, J.H. 2006. Personal communication. Virginia Polytechnic Institute and State University. Blacksburg, VA.

Rosenberger, A.E. 2007. An update to the Roanoke logperch recovery plan. Final report to the U.S. Fish and Wildlife Service.

Rosenberger, A.E. 2006. Personal communication. University of Alaska Fairbanks School of Fisheries and Ocean Sciences. Fairbanks, AK.

Rosenberger, A.E. and P.L. Angermeier. 2002. Roanoke logperch (*Percina rex*) population structure and habitat use. Final report to Virginia Department of Game and Inland Fisheries, Blacksburg, VA.

Saunders, C. 2006. Personal communication. Marshall Miller & Associates. Ashland, VA

Simonson, T.D., and R.J. Neves. 1986. A status survey of the orangefin madtom and Roanoke logperch. Report of the Virginia Cooperative Fish and Wildlife Research Unit, Virginia Polytechnic Institute and State University, Blacksburg, to Virginia Commission of Game and Inland Fisheries, Richmond, VA.

Smith, S. 2006. Personal communication. Virginia Department of Game and Inland Fisheries. Forest, VA.

USFWS. 1992. Roanoke logperch (*Percina rex*) Recovery Plan. Newton Corner, MA. 34pp.

Wheeler, A.P., A.E. Rosenberger, and P.L. Angermeier. 2002. Potential impacts of I-73 on stream habitat and biota, with emphasis on the endangered Roanoke logperch. Report submitted to Virginian's for Appropriate Roads.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of the Roanoke logperch, *Percina rex*

Current classification: Endangered

Recommendation resulting from the 5-Year Review:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
__x__ No change needed

Review conducted by: William Hester, Kimberly Smith, Virginia Field Office

FIELD OFFICE APPROVAL

Lead Field Supervisor, Fish and Wildlife Service

Approve Karen L. Mayne Date 6/5/2007
Karen L. Mayne, Supervisor, Virginia Field Office

REGIONAL OFFICE APPROVAL

Lead Regional Director, Fish and Wildlife Service

Approve Acting Date 9-19-07
Regional Director, Northeast Region