

Blackside Dace

(Phoxinus (=Chrosomus) cumberlandensis)

Status Review:

Summary and Evaluation



Photo credit: J.R. Shute, Conservation Fisheries, Inc.

**U.S. Fish and Wildlife Service
South Atlantic Gulf and Mississippi Basin Regions
Kentucky Ecological Services Field Office
Frankfort, Kentucky**

June 2022

STATUS REVIEW
Blackside Dace (*Phoxinus (=Chrosomus) cumberlandensis*)

GENERAL INFORMATION

Current Classification: Threatened

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Date of original listing: June 12, 1987 (52 FR 22580)

Methodology used to complete the review: In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology, habitat, and threats of the blackside dace to inform this status review. A notice of the initiation of this 5-year review was published by the Service in the Federal Register (86 FR 32965) on June 23, 2021, and a 60-day comment period was opened (see Appendix A). The Service also sent a request for updated information on the current status of the species to individuals who are considered to be experts with regard to this species. These individuals included federal and state agency biologists who are responsible for monitoring and

managing the species and knowledgeable members of the academic community who have conducted research on its status, distribution, and ecology.

FR Notice citation announcing the species is under active review:

June 23, 2021 (86 FR 32965)

Species' Recovery Priority Number at start of 5-year review (48 FR 43098): 11, indicating that the blackside dace is taxonomically categorized as a species, has a moderate degree of threat, and has a low recovery potential.

Review History:

Each year, the Service reviews and updates listed species information for inclusion in the required Recovery Report to Congress. Through 2013, we did a recovery data call that included status recommendations such as “Stable, Decreasing or Increasing” for this fish. We continue to use these species status recommendations as part of our 5-year reviews. The most recent evaluation for this fish was completed in 2015.

Five-Year Review: A five-year review was completed on November 6, 1991. In this review (56 FR 56882), different species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors as they pertained to the different species' recovery. In particular, no changes were proposed for the status of this fish in the review.

Five-Year Review: An additional five-year review for the blackside dace was completed in 2015 (Service 2015). This comprehensive review incorporated all survey records and new biological information gathered since publication of the species' recovery plan in 1988. The review determined that the species continues to be threatened by three of the five listing factors identified in the Act: the present or threatened destruction, modification, or curtailment of its habitat or range; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. The review recommended no change in status for the species.

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature:

All the North American *Phoxinus* (subgenus *Chrosomus*) were placed in the genus *Chrosomus* in 2009 (Strange and Mayden 2009). The accepted revised classification for blackside dace is *Chrosomus cumberlandensis* (Starnes and Starnes), which is supported by the Service and corresponds to its use in the Integrated Taxonomic Information System (2022).

This change in taxonomy from the currently listed entity, *Phoxinus* (= *Chrosomus*), *cumberlandensis* (50 CFR 17.11), does not impact the species' status or interpretation of the species' distribution or threats, and the species is still considered a valid taxon by the Service.

Distinct Population Segment (DPS)

Endangered Species Act (ESA) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This species was not listed as a DPS, and we have no new information that would indicate the species should be listed as a DPS under the Service's 1996 DPS Policy.

Summary Valid Entity

This species is still considered a valid taxon by the Service.

Recovery Criteria

Recovery Plan or Outline:

Blackside Dace Recovery Plan (*Phoxinus cumberlandensis*). August 17, 1988 (Service 1988).

Recovery plans are not regulatory documents and are intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the ESA. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act (84 FR 45020). Below are the delisting criteria identified in the 1988 recovery plan (Service 1988).

Delisting Criteria. The blackside dace will be considered for removal from the Federal list of Endangered and Threatened Wildlife and Plants upon completion of the following criteria:

- 1. Each of the eight (8) sub-basins identified in Table 3 (of the recovery plan; see Figure 1 for sub-basins) has a viable population* comprised of at least three (3), protected, inhabited stream reaches per sub-basin.*

This criterion has not been met. Only four of the eight recovery units have at least three, protected, inhabited stream reaches.

- 2. Each of the 24 stream reaches is protected in some manner, either through public agency or private conservation organization ownership or some form of permanent easement, and a management plan has been implemented for each stream that provides for the species' long-term protection.*

This criterion has not been met. Only 17 of 24 stream reaches are protected through public ownership. Specific management plans have not been completed for these streams.

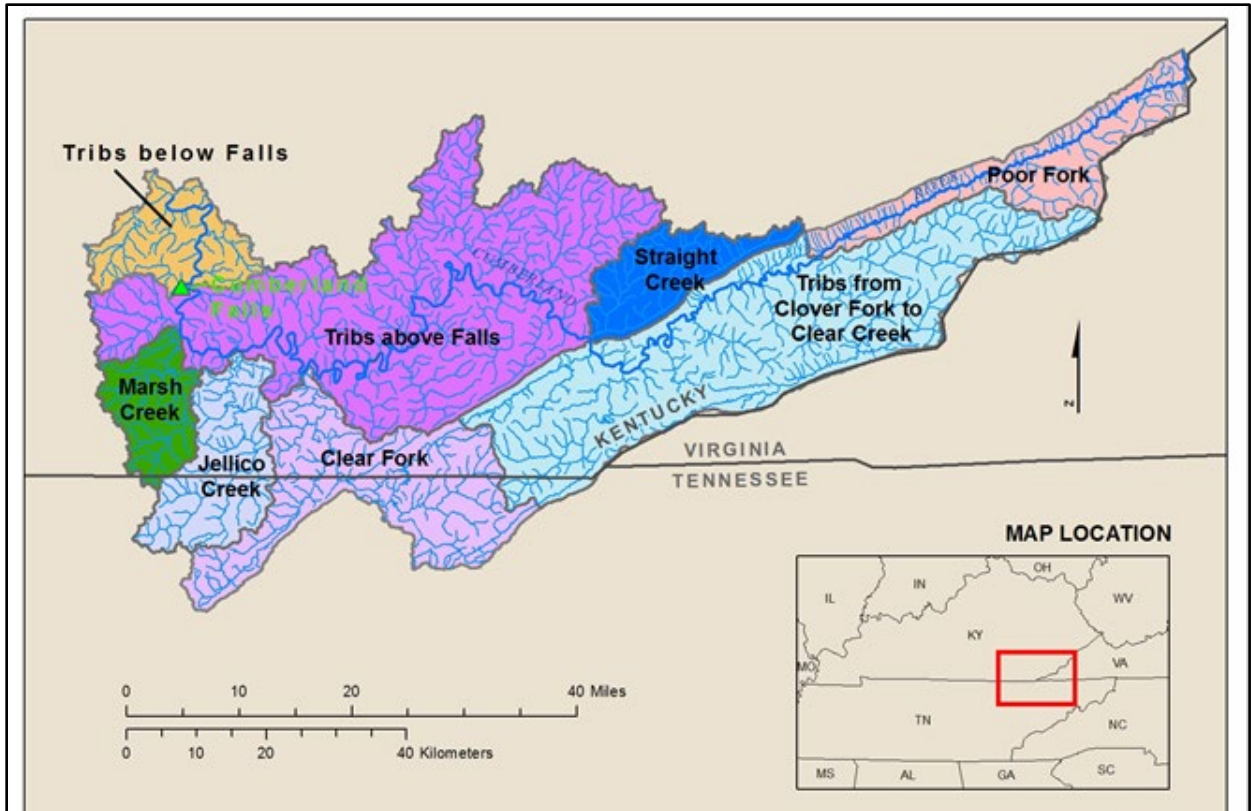


Figure 1. Blackside dace recovery units (sub-basins) identified in the species' recovery plan (Service 1988).

3. *No foreseeable threats exist that would threaten survival of the species in any of the sub-basins.*

This criterion has not been met. The species continues to face multiple threats across its range, especially in those systems under private ownership.

4. *Noticeable improvements in coal-related problems and substrate quality have occurred to the species' habitat throughout the upper Cumberland River basin, and the species has responded through natural means or with human assistance to successfully recolonize other streams and stream reaches within the upper Cumberland River basin.*

This criterion has not been met. Widespread improvements in coal-related problems and habitat have not been observed in the upper Cumberland River basin, and there is no evidence the species has responded via natural recolonization.

*Viable population – A reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes (as defined in the recovery plan). Movement of animals within some sub-basins may be required to maintain genetic viability. The number of individuals needed and the length of stream reaches required to meet this criterion will be determined for the species as one of the recovery tasks.

Biology and Habitat Summary

New information on biology and habitat is summarized below; see Appendices B and C for detailed information on the species' current distribution (Figure B-1) and results of range-wide surveys completed during 2021 (Table C-1).

Population Genetics. Cashner and Johansen (2018) conducted the first population genetics study for the species. Fin clips from across the species' range revealed a high degree of contemporary genetic isolation among collection sites, despite the species being a mid-column swimmer with the ability to make intertributary movements of up to 4 km (2.5 mi) (Detar and Mattingly 2013). The mitochondrial data set (genetic information obtained from DNA located in the cell's mitochondria) indicated widespread historical connectivity among study streams that has been disrupted in modern times. This disruption was evident even between streams in the same tributary system (*e.g.*, Mill Branch and Moore Creek, Stinking Creek system, Kentucky). Suspected causes of genetic isolation were the species' wide-scale population loss, habitat degradation, and continued habitat loss across the species' range. The mitochondrial dataset also revealed three major lineages, with evidence of longstanding isolation of blackside dace populations in the Jellico Creek system compared to the rest of the range. Cashner and Johansen (2018) investigated the origin of recently discovered, isolated populations in Right Fork Maces Creek (North Fork Kentucky River system) and Perkins Creek (South Fork Cumberland River system) and determined that both populations were likely the result of recent bait bucket transfer. A second phase of the project was initiated in 2018 and included tissue collections from 14 additional streams. Analyses associated with the second phase are ongoing.

Distribution. In 2021, the Service (Kentucky Ecological Services Field Office) worked with the Office of Kentucky Nature Preserves, Tennessee Wildlife Resources Agency, and Biological Systems Consultants, LLC, to complete backpack electrofishing surveys across the species' range in Kentucky and Tennessee (Figure 2). Survey locations and sampling methods followed those of Black *et al.* (2013a), who observed blackside dace at 78 of 119 200-m reaches during field surveys in 2003, 2005, and 2006. We randomly selected and visited a subset (37) of these reaches from June to September 2021. Blackside dace were observed at 27 of 37 reaches, with a total abundance of 655 individuals (range: 1-171 dace per reach) (see Table C-1, Appendix C).

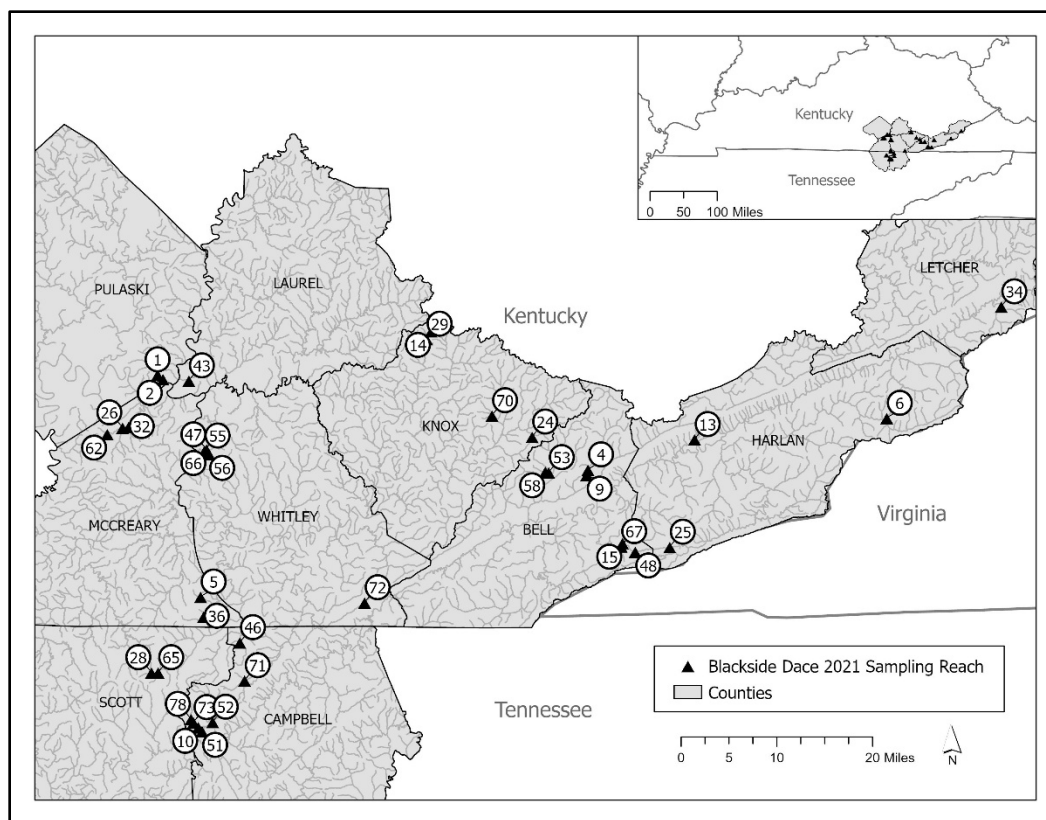


Figure 2. 2021 survey locations previously visited by Black *et al.* (2013a); see Appendix C for a summary of sampling results.

Threats Summary (Five-Factor Analysis)

A detailed review of the species’ threats can be found in the previous 5-year review (Service 2015). Under the Act, a species’ status must be determined through consideration of the following five factors:

- A. present or threatened destruction, modification, or curtailment of its habitat or range;
- B. over-utilization of the species for commercial, recreational, scientific, or educational purposes;
- C. disease or predation;
- D. inadequacy of existing regulatory mechanisms; and
- E. other natural or manmade factors affecting its continued existence.

Factor A continues to be the primary threat category for the blackside dace. The primary stressors associated with this factor are water quality degradation (pollution), siltation (excess sediments suspended or deposited in a stream), and channel disturbance associated with surface coal mining, logging, agriculture, road construction and maintenance, and other human development activities in the upper Cumberland River drainage (KDOW 2018a, 2018b; TDEC 2014, 2017). The effects of habitat and water quality degradation from historic, current, and proposed surface coal mining activities represent a high magnitude and imminent threat to blackside dace recovery. These activities have the potential to introduce high concentrations of

dissolved metals and other substances (*e.g.*, sediment) that can increase stream conductivity and alter stream water quality. Hitt *et al.* (2016) provided new information on the species' sensitivity to elevated conductivity by modeling occurrence and abundance data at 294 historical sites in the upper Cumberland River drainage. Their results indicated a sharp decrease in blackside dace abundance when conductivity levels exceeded 343 $\mu\text{S}/\text{cm}$ (95% confidence interval of 123-563). These results generally agreed with those of Black *et al.* (2013b), who demonstrated that the blackside dace tends to be absent at conductivity levels above 240 $\mu\text{S}/\text{cm}$. Although coal production has been declining since 2000, there is still a significant amount of coal production in the eastern half of the species' range (Commonwealth of Kentucky 2021). At present, mining is active or under permit review in multiple blackside dace watersheds in Kentucky: Breedens Creek (Harlan County), Brownies Creek (Harlan County), Buffalo Creek (Whitley County), Kelly Branch (Harlan County), Left Fork Caney Creek (Bell County), Little Poplar Creek (Knox County), Meadow Branch (Letcher County), and Mill Creek (Bell County) (Service unpublished data).

Siltation also continues to be a major stressor of aquatic systems in the upper Cumberland River drainage (KDOW 2018a, 2018b; TDEC 2014, 2017). Excessive stream siltation is typically caused by soil erosion and stormwater runoff associated with upland land use activities (*e.g.*, agriculture, forestry, mining, road or pipeline construction, and general urbanization), but it can also be caused by activities that directly destabilize stream channels and remove riparian vegetation (*e.g.*, dredging or channelization, construction projects, land development). Siltation can affect fishes through abrasion of gill tissues, suffocation of eggs or larvae, reductions in disease tolerance, degradation of spawning habitats, modification of migration patterns, and reductions in food availability (Berkman and Rabeni 1987, Waters 1995, Wood and Armitage 1997, Meyer and Sutherland 2005). Stream habitat changes caused by the American Beaver (*Castor canadensis*) continue to pose a moderate threat to blackside dace habitats. Dam-building activities by beavers inhibit stream flows, increase siltation, reduce availability of suitable instream habitat, and allow for encroachment of potential predatory species (Compton *et al.* 2013, Service 2015).

Unintentional collection by anglers (for use as bait) likely occurs in some portions of the species' range; however, overutilization of the species for commercial, recreational, scientific, or educational purposes (Factor B) is not considered to be a significant threat. The species is undoubtedly consumed by predators (*e.g.*, sunfishes), but we consider this to be a normal aspect of the species' population dynamics. Disease or predation (Factor C) is not considered to be a threat to the species.

Existing regulatory mechanisms (Factor D) have provided for some improvements in water quality and habitat conditions in the upper Cumberland River drainage, but existing regulatory mechanisms have been inadequate in fully protecting streams inhabited by the species. Sedimentation and non-point source pollutants continue to represent an imminent threat of low to moderate magnitude across the species' range. Further, the information available to us at this time does not indicate that the magnitude or imminence of this threat is likely to be appreciably reduced in the foreseeable future.

The species' fragmented distribution and the disjunct nature of many of its populations (Factor E) has reduced its contemporary gene flow (Cashner and Johansen 2018). This restricts the

natural interchange of genetic material between populations and makes natural repopulation following localized extirpations virtually impossible without human intervention. The small size of many blackside dace populations also makes them vulnerable to extirpation from intentional or accidental toxic chemical spills, habitat modification, progressive degradation from runoff (non-point source pollutants), natural catastrophic changes to their habitat (*e.g.*, flood scour, drought), and other stochastic disturbances, such as loss of genetic variation and inbreeding.

Synthesis

The blackside dace continues to occupy portions of its historical range in the upper Cumberland River drainage (Kentucky and Tennessee); introduced populations also occur in small portions of the upper Kentucky River drainage in Kentucky and the Clinch and Powell River drainages in Virginia (see Figure B-1, Appendix B). The species has been reported from over 100 streams across its range, but individual populations are often small and isolated, and the species has been extirpated from at least 20 streams across its range.

Three of the five listing factors continue to pose threats to the blackside dace: the present or threatened destruction, modification, or curtailment of its habitat or range (Factor A); the inadequacy of existing regulatory mechanisms (Factor D); and other natural or manmade factors affecting its continued existence (Factor E). Factor A continues to be the most significant threat to the species. The species' habitat continues to be altered chemically and physically by anthropogenic activities such as surface coal mining, oil and gas exploration, logging, agriculture, and development. Current regulatory mechanisms, such as the Federal Clean Water Act, have contributed to some improvements in water quality and habitat conditions, especially on public lands; however, these mechanisms have been inadequate in fully protecting the blackside dace and its habitats. The species' fragmented distribution and small population size restricts the natural interchange of genetic material and increases the vulnerability of populations to extirpation.

Based on the best available scientific and commercial information available to the Service regarding the species' current status and past, present, and future threats, the species continues to be impacted by poor water quality and habitat deterioration resulting from resource extraction activities, siltation caused by poor land use practices, reductions in riparian cover, and by other nonpoint-source pollutants. The species' patchy distribution limits the natural genetic exchange between and within its populations. Because of its restricted distribution and continued vulnerability to these threats, and our uncertainty with regard to the viability of individual populations across the range, we believe that the species continues to meet the definition of threatened (likely to become endangered within the foreseeable future throughout all or a significant portion of its range) and should remain classified as such.

RESULTS

**U.S. FISH AND WILDLIFE SERVICE
Status Review of blackside dace**

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species' status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the ESA.

Downlist to Threatened

Uplist to Endangered

Delist (*Indicate reasons for delisting per 50 CFR 424.11*):

The species is extinct

The species does not meet the definition of an endangered or threatened species.

The listed entity does not meet the statutory definition of a species.

No change needed

FIELD OFFICE APPROVAL:

Field Supervisor, Kentucky Ecological Services Field Office, U.S. Fish and Wildlife Service

Approve _____

** Since 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.*

COOPERATING REGIONAL OFFICE APPROVAL:

We emailed this 5-year review to the North Atlantic-Appalachian Regional Office for their concurrence prior to finalizing the document. We will retain any comments that we received, as well as verification of concurrence from other regions, in the administrative record for this 5-year review.

RECOMMENDATIONS FOR FUTURE ACTIONS

- Continue to utilize existing legislation and regulations to protect the species and its habitats (*e.g.*, ESA, federal and state surface mining laws, Clean Water Act, state water quality regulations).
- Continue to protect, restore, and enhance habitat quality across the species' range. Federal, state, and private parties should continue to work cooperatively (through Farm Bill programs, Partners for Fish and Wildlife projects, Kentucky Wild Rivers Program, etc.) to restore and protect habitats for the species.
- Conduct periodic monitoring (five-year intervals) of extant populations and search for new populations following methods used by Black *et al.* (2013).
- Consult with agency partners and species experts to determine what biological or ecological studies are needed to better understand the species' life history and sensitivity to threats (*e.g.*, elevated conductivity). Using this information, determine what management strategies are needed to improve the species' status across its range.
- Continue research on population genetics; evaluate gene flow and genetic diversity across the species' range.

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Appendix A. Summary of comments received during the 60-day open comment period.

We received two public responses during the 60-day open comment period (84 FR 28850). The first commenter expressed concern for the species and the general threats of climate change and pollution to plants and animals. No specific data or information was supplied with the public comment.

The National Council for Air and Stream Improvement (NCASI) provided information regarding the use and effectiveness of forestry best management practices (BMPs) and their importance in protecting aquatic species and stream habitats in the United States. NCASI explained that BMPs are implemented at high rates in the range of species such as the blackside dace, and these BMPs are effective at protecting water quality, instream habitats, and aquatic biota. The commenter supported these assertions by briefly summarizing the results of multiple references that describe the use and effectiveness of BMPs in protecting aquatic species. The commenter asked that the Service consider these references when completing its status review for the blackside dace. The commenter provided no specific information related to silvicultural BMPs and the species, but we agree with the commenter that BMP implementation rates are relatively high for commercial timber-harvest operations across the southeast, including forested watersheds in Kentucky, and properly implemented BMPs are effective in protecting water quality and instream habitats when consistently and properly implemented.

Appendix B. Current Distribution

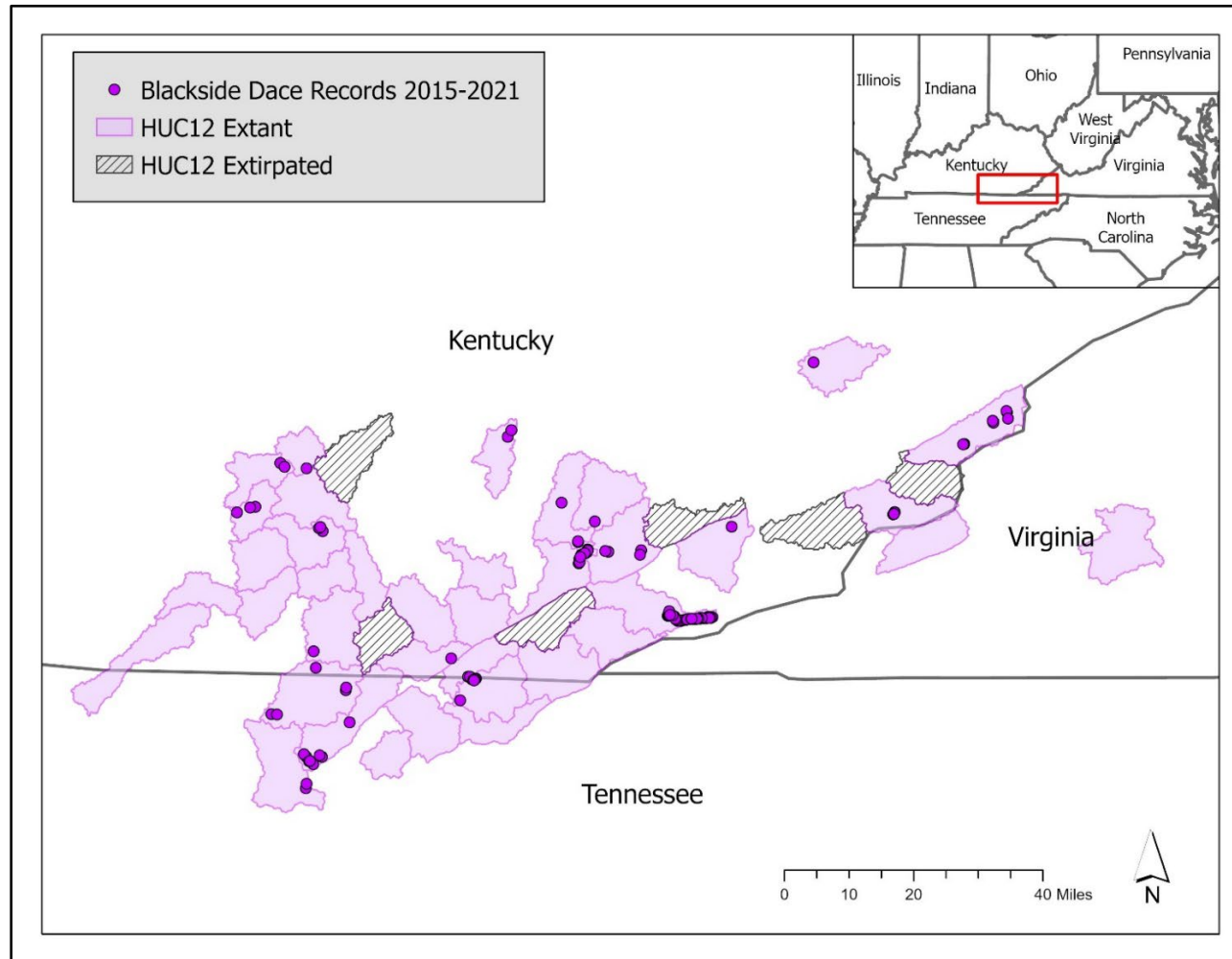


Figure B-1. Current distribution of the blackside dace based on positive HUC 12 occurrence records (2000-present) from Kentucky, Tennessee, and Virginia (Sources: Office of Kentucky Nature Preserves (Kentucky Natural Heritage Database), Service 2015, and unpublished occurrence records obtained in 2021 by the Service’s Kentucky Ecological Services Field Office – see Appendix C).

Appendix C. Summary of 2021 Surveys

Table C-1. Summary of Summer 2021 blackside dace field data obtained by the Service (Kentucky Ecological Services Field Office), the Office of Kentucky Nature Preserves, the Tennessee Wildlife Resources Agency, and Biological Systems Consultants, LLC. Survey reaches represent a subset of survey reaches originally surveyed by Tennessee Technological University (Black *et al.* 2013a).

| Table 1* | Stream | County | State | Tennessee Tech Survey (2003-2006) | | | | Summer 2021 | | | |
|----------|-------------------------|----------|-------|-----------------------------------|-------|------|------|-------------|-------|------|------|
| | | | | Date | # BSD | Cond | Temp | Date | # BSD | Cond | Temp |
| 53 | Caney Creek R Fork 1 | Bell | KY | 06/27/03 | 6 | 81 | 18.0 | 09/07/21 | 0 | 234 | 17.8 |
| 58 | Caney Creek L Fork 1 | Bell | KY | 06/26/03 | 5 | 134 | 21.5 | 09/07/21 | 37 | 138 | 17.8 |
| 67 | Brownies Creek 1 | Bell | KY | 07/17/03 | 3 | 140 | 18.6 | 09/15/21 | 12 | 115 | 18.0 |
| 15 | Blacksnake Branch 1 | Bell | KY | 07/15/03 | 46 | 509 | 21.6 | 09/15/21 | 4 | 393 | 17.0 |
| 4 | Mill Creek 3 | Bell | KY | 06/25/03 | 108 | 104 | 21.2 | 08/12/21 | 62 | 121 | 21.7 |
| 48 | Brownies Creek 2 | Bell | KY | 07/17/03 | 8 | 76 | 18.3 | 09/28/21 | 65 | 75 | 15.0 |
| 9 | Mill Creek 2 | Bell | KY | 06/25/03 | 72 | 97 | 20.2 | 07/22/21 | 24 | 71 | 19.0 |
| 6 | Breedens Creek 1 | Harlan | KY | 08/10/05 | 96 | 204 | 20.2 | 09/30/21 | 171 | 172 | 14.4 |
| 25 | Brownies Creek 4 | Harlan | KY | 07/17/03 | 25 | 76 | 20.0 | 09/15/21 | 15 | 79 | 15.0 |
| 13 | Watts Creek 2 | Harlan | KY | 08/10/05 | 60 | 22 | 21.0 | 09/20/21 | 45 | 25 | 19.4 |
| 70 | Hale Fork 1 | Knox | KY | 06/23/03 | 2 | 46 | 21.0 | 07/07/21 | 0 | 68 | 20.3 |
| 29 | Richland Creek 2 | Knox | KY | 07/21/05 | 20 | 74 | 21.6 | 07/07/21 | 25 | 57 | 21.1 |
| 24 | Grubb Branch 1 | Knox | KY | 07/26/05 | 29 | 96 | 22.1 | 07/07/21 | 0 | 61 | 18.9 |
| 14 | Richland Creek 4 | Knox | KY | 07/19/05 | 58 | 56 | 19.9 | 07/07/21 | 4 | 49 | 20.2 |
| 43 | Ned Branch 2 | Laurel | KY | 06/30/03 | 10 | 26 | 17.8 | 07/28/21 | 0 | 25 | 19.1 |
| 34 | Smith Creek 1 | Letcher | KY | 07/29/03 | 16 | 260 | 18.9 | 09/14/21 | 16 | 226 | 19.4 |
| 36 | John Anderson Branch 1 | McCreary | KY | 08/06/03 | 19 | 36 | 19.7 | 07/19/21 | 3 | 30 | 18.0 |
| 62 | Little Hurricane Fork 3 | McCreary | KY | 07/24/05 | 4 | 70 | 18.2 | 07/27/21 | 0 | 87 | 20.2 |
| 32 | Little Hurricane Fork 1 | McCreary | KY | 07/24/03 | 18 | 35 | 17.4 | 07/27/21 | 0 | 28 | 20.4 |
| 5 | Ryans Creek 4 | McCreary | KY | 08/06/03 | 107 | 62 | 20.4 | 07/19/21 | 24 | 46 | 18.6 |
| 26 | Little Hurricane Fork 2 | McCreary | KY | 07/24/03 | 25 | 39 | 17.9 | 07/27/21 | 5 | 27 | 20.5 |
| 1 | Big Lick Branch 3 | Pulaski | KY | 08/12/03 | 153 | 32 | 17.9 | 07/19/21 | 19 | 29 | 19.1 |
| 56 | Dogslaughter S Fork 2 | Whitley | KY | 08/7/03 | 6 | 31 | 18.6 | 07/20/21 | 9 | 50 | 18.7 |

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|----|-----------------------|----------|----|----------|------------|-----|------|----------|-----------|-----|------|
| 55 | Dogslaughter N Fork 1 | Whitley | KY | 08/07/03 | 6 | 16 | 17.9 | 07/20/21 | 0 | 21 | 18.6 |
| 66 | Dogslaughter N Fork 2 | Whitley | KY | 08/07/03 | 3 | 17 | 17.8 | 07/20/21 | 3 | 24 | 18.3 |
| 72 | Mud Creek 2 | Whitley | KY | 06/21/03 | 2 | 73 | 14.6 | 09/07/21 | 0 | 176 | 17.2 |
| 47 | Little Dogslaughter 1 | Whitley | KY | 08/07/03 | 8 | 16 | 17.9 | 07/20/21 | 2 | 19 | 18.6 |
| 2 | Big Lick Branch 1 | Pulaski | KY | 08/12/03 | 131 | 34 | 18.4 | 07/28/21 | 37 | 32 | 20.0 |
| 73 | Terry Creek 3 | Campbell | TN | 06/20/03 | 2 | 79 | 17.6 | 07/27/21 | 10 | 65 | 22.8 |
| 78 | Terry Creek 4 | Campbell | TN | 06/03/03 | 1 | 131 | 17.9 | 07/27/21 | 3 | 74 | 24.4 |
| 46 | Hatfield Creek 1 | Campbell | TN | 08/02/05 | 9 | 323 | 22.8 | 07/28/21 | 29 | 215 | 24.1 |
| 51 | Elk Fork Creek 2 | Campbell | TN | 08/04/05 | 6 | 274 | 20.4 | 07/27/21 | 0 | 167 | 27.6 |
| 52 | Elk Fork Creek 1 | Campbell | TN | 06/28/05 | 6 | 225 | 22.4 | 07/28/21 | 0 | 210 | 23.9 |
| 71 | Little Elk Creek 1 | Campbell | TN | 06/28/05 | 2 | 330 | 23.2 | 07/15/21 | 2 | 362 | 24.5 |
| 10 | Terry Creek 2 | Campbell | TN | 06/20/03 | 65 | 108 | 17.7 | 06/24/21 | 9 | 69 | 18.4 |
| 28 | Jellico Creek Trib 5 | Scott | TN | 06/21/06 | 21 | 127 | 21.6 | 06/04/21 | 8 | 58 | 17.0 |
| 65 | Jellico Creek 4 | Scott | TN | 06/22/06 | 3 | 79 | 18.2 | 07/15/21 | 12 | 59 | 21.1 |

*Numbers correspond to order of placement in Table 1 of Black *et al.* (2013a); a subset (37) of reaches from Table 1 were randomly selected for 2021 surveys.