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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2015–0132; 4500030113]

RIN 1018–AZ09

Endangered and Threatened Wildlife and Plants; Threatened Species Status for Kentucky Arrow Darter with 4(d) Rule

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine threatened species status under the Endangered Species Act of 1973 (Act), as amended, for Kentucky arrow darter (*Etheostoma spilotum*), a fish species from the upper Kentucky River basin in Kentucky. The effect of this regulation will be to add this species to the List of Endangered and Threatened Wildlife. We are also adopting a rule under section 4(d) of the Act (a "4(d) rule") to further provide for the conservation of the Kentucky

arrow darter.

DATES: This rule becomes effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: This final rule is available on the internet at *http://www.regulations.gov* and *http://www.fws.gov/frankfort/*. Comments and materials we received, as well as supporting documentation we used in preparing this rule, are available for public inspection at *http://www.regulations.gov*. Comments, materials, and documentation that we considered in this rulemaking will be available by appointment, during normal business hours at: U.S. Fish and Wildlife Service, Kentucky Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

FOR FURTHER INFORMATION CONTACT: Virgil Lee Andrews, Jr., Field Supervisor, U.S. Fish and Wildlife Service, Kentucky Ecological Services Field Office, 330 West Broadway, Suite 265, Frankfort, KY 40601; telephone 502–695–0468, x108; facsimile 502–695–1024. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Endangered Species Act (Act), we may

list a species if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

What this document does. This rule finalizes the listing of the Kentucky arrow darter *(Etheostoma spilotum)* as a threatened species. It also includes provisions published under section 4(d) of the Act that are necessary and advisable for the conservation of the Kentucky arrow darter.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. This decision to list the Kentucky arrow darter as threatened is based on three of the five factors (A, D, and E).

Under section 4(d) of the Act, the Secretary of the Interior has discretion to issue such regulations as she deems necessary and advisable to provide for the conservation of threatened species. The Secretary also has the discretion to prohibit by regulation, with respect to a threatened species, any act prohibited by section 9(a)(1) of the Act.

Summary of the major provisions of the 4(d) rule. The regulations in title 50 of the Code of Federal Regulations at 50 CFR 17.31(a) apply to threatened wildlife all the general prohibitions for endangered wildlife set forth at 50 CFR 17.21, and 50 CFR 17.31(c) states that whenever a 4(d) rule applies to a threatened species, the provisions of

§ 17.31(a) do not apply to that species. The regulations at 50 CFR 17.32 contain permit provisions for threatened species.

Some activities that would normally be prohibited under 50 CFR 17.31 and 17.32 will contribute to the conservation of the Kentucky arrow darter because habitat within some of the physically degraded streams must be improved before they are suitable for the species. Therefore, the Service has authorized certain species-specific exceptions for the Kentucky arrow darter under section 4(d) of the Act that may be appropriate to promote the conservation of this species. This 4(d) rule also exempts from the general prohibitions in 50 CFR 17.32 take that is incidental to the following activities when conducted within habitats currently occupied by the Kentucky arrow darter:

(1) Channel reconfiguration or restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers.

(2) Bank stabilization projects that use bioengineering methods specified by the Kentucky Energy and Environment Cabinet and the Kentucky Transportation Cabinet.

(3) Bridge and culvert replacement/removal projects that remove migration barriers (e.g., collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters.

(4) Repair and maintenance of U.S. Forest Service (USFS) concrete plank stream crossings in the Daniel Boone National Forest (DBNF).

Peer review and public comment. We sought comments from independent specialists to ensure that our listing determination is based on scientifically sound data, assumptions, and analyses. We invited these peer reviewers to comment on our listing

proposal. We also considered all comments and information received during the comment period.

Elsewhere in this **Federal Register**, we finalize designation of critical habitat for the Kentucky arrow darter under the Act.

Previous Federal Action

Please refer to the proposed listing rule for the Kentucky arrow darter (80 FR 60962, October 8, 2015) for a detailed description of previous Federal actions concerning this species.

Summary of Comments and Recommendations

In the proposed rule published on October 8, 2015 (80 FR 60962), we requested that all interested parties submit written comments on the proposal by December 7, 2015. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in the Lexington Herald-Leader and Louisville Courier Journal. We did not receive any requests for a public hearing. During the comment period, we received 47 comment letters in response to the proposed rule: 5 from peer reviewers, 1 from a State agency, and 41 from organizations or individuals. Two comment letters from organizations were accompanied by petitions containing a total of 15,388 signatures of persons supporting the proposed listing. Another organization submitted a separate comment letter on behalf of itself and 14 other organizations. None of the 47 comment letters objected to the proposed rule to

list the Kentucky arrow darter as threatened. All substantive information provided during the comment period has either been incorporated directly into this final determination or addressed below.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from seven knowledgeable individuals with scientific expertise that included familiarity with Kentucky arrow darter and its habitat, biological needs, and threats. We received responses from five of the peer reviewers.

We reviewed all comments received from the peer reviewers for substantive issues and new information regarding the listing of Kentucky arrow darter. The peer reviewers all generally concurred with our methods and conclusions and provided additional information on the taxonomy, life history, and threats; technical clarifications; and suggestions to improve the final rule. The comments and supplementary information provided by the peer reviewers improved the final version of this document, and we thank them for their efforts. Peer reviewer comments are addressed in the following summary and incorporated into the final rule as appropriate.

(1) Comment: One peer reviewer stated that the Service should include any new information on growth, feeding, reproduction, or spawning of the Kentucky arrow darter obtained from recent captive-propagation efforts by Conservation Fisheries, Inc. (CFI) in Knoxville, Tennessee.

Our Response: New observations on spawning behavior and the growth and viability of eggs and larvae were made by CFI during recent captive-propagation efforts

(2010 to present). We have incorporated language summarizing these findings under the *Background–Habitat and Life History* section of this final listing determination.

(2) Comment: Two of the peer reviewers asked that we discuss the detectability of the Kentucky arrow darter during survey efforts and how this could affect our conclusions regarding the status of the species. More specifically, the peer reviewers raised the issue of imperfect detection, which is the inability of the surveyor to detect a species (even if present) due to surveyor error, low-density or rareness of the target species, or confounding variables such as environmental conditions (e.g., stream flow). The peer reviewers asked the Service to explain how it accounted for imperfect detection when evaluating the species' current distribution and status.

Our Response: We recognize the importance and significance of imperfect detection when conducting surveys for rare or low-density species, and we agree that is possible a species can go undetected within a particular survey reach when it is actually present. However, we are also required, by statute and regulation, to base our determinations solely on the basis of the best scientific and commercial data available. We are confident that the survey data available to us at the time we prepared our proposed listing determination represented the best scientific and commercial data available. These data were collected by well-trained, professional biologists, who employed similar sampling techniques (single-pass electrofishing) across the entire potential range of the Kentucky arrow darter, which included historical darter locations, random locations, and locations associated with regulatory permitting, such as mining or transportation. Nearly 245 surveys were conducted for the species between 2007 and 2015, and the results of these surveys revealed a clear trend of habitat degradation and

range curtailment for the species. Kentucky arrow darters may have gone undetected at a few sites (i.e., our detection of the species may have been imperfect at a few collection sites), but the species' overall decline and pattern of associated habitat degradation (e.g., elevated conductivity) was clear based on our review of available survey data.

(3) Comment: One peer reviewer pointed out that some information we included on the reproductive behavior of the Kentucky arrow darter was actually based on research conducted on its closest relative, the Cumberland arrow darter (*Etheostoma sagitta*).

Our Response: We concur with the peer reviewer and have incorporated language to address this topic under the *Background–Habitat and Life History* section of this final listing determination.

(4) Comment: Two peer reviewers suggested we expand our discussion of the effects of elevated conductivity on aquatic communities by including additional information related to the vulnerability of salamanders or other aquatic organisms.

Our Response: We have added language to address this topic under the *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range–Water Quality Degradation* section of this final listing determination.

(5) Comment: One peer reviewer recommended we discuss the potential threat posed by anthropogenic barriers (e.g., perched culverts).

Our Response: We added language to address this topic under the *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence–Restricted Range and Population Size* section of this final listing determination.

(6) Comment: One peer reviewer suggested that the spatial degree of impacts facing the Kentucky arrow darter could be more accurately estimated using the Kentucky

Division of Water's probabilistic sampling data from the upper Kentucky River basin, as opposed to relying on data generated from fixed monitoring sites across the species' range.

Our Response: We agree with the peer reviewer and have added language to address this topic under the *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range* section of this final listing determination.

(7) Comment: One peer reviewer offered new information on gill parasites and sewage bacteria, suggesting that these organisms represent potential threats to the Kentucky arrow darter under *Factor C. Disease or Predation*.

Our Response: We agree with the peer reviewer that these organisms have the potential to adversely affect the Kentucky arrow darter, and we have added language to address this topic under the *Factor C. Disease or Predation* section of this final listing determination.

(8) Comment: One peer reviewer commented that generalized natural channel design projects (i.e., Rosgen) may not be sufficient under provisions of the proposed section 4(d) rule, and individual designs would be needed to benefit the Kentucky arrow darter.

Our Response: In the proposed listing determination, we proposed a species-specific section 4(d) rule to further promote the conservation of the Kentucky arrow darter. We concluded that activities such as stream reconfiguration/riparian restoration, bridge and culvert replacement or removal, bank stabilization, and stream crossing repair and maintenance would improve or restore physical habitat quality for the species and

would provide an overall conservation benefit to the species. We concur with the peer reviewer that, under the proposed 4(d) rule, generalized stream restoration designs may not be sufficient to benefit the species. For this reason, the Service provided references and detailed descriptions of stream reconfigurations in the proposed rule, with an emphasis on stability, ecological function, and reconnection with groundwater systems.

(9) Comment: One peer reviewer and one other commenter stated that the Service needed to clarify potentially conflicting statements regarding threats under Factor D (the inadequacy of the Surface Mining Control and Reclamation Act (SMCRA) as an existing regulatory mechanism) and our conclusion that surface coal mining and reclamation activities conducted in accordance with the 1996 biological opinion (1996 BO) between the Service and the Office of Surface Mining Reclamation and Enforcement (OSM) are unlikely to result in a violation of section 9 of the Act.

Our Response: The peer reviewer and commenter are correct in stating that we considered existing regulatory mechanisms such as SMCRA to be inadequate in protecting the Kentucky arrow darter and its habitats. Habitats across the species' range have been degraded by water pollution and sedimentation associated with coal mining (e.g., elevated conductivity), and there is evidence of recent extirpations in watersheds impacted by mining (16 historical streams since the mid-1990s).

In the *Provisions of the 4(d) Rule* section of the proposed listing rule, we also stated that surface coal mining and reclamation activities, if conducted in accordance with existing regulations and permit conditions, would not result in violations of section 9 of the ESA. The 1996 BO is the result of a formal section 7 consultation between OSM and the Service on OSM's approval of State regulatory programs (primacy) under

SMCRA. In Kentucky, the State has approved primacy under SMCRA and, therefore, operates under the 1996 BO to address adverse effects to federally listed species. Under the 1996 BO, SMCRA regulatory authorities are exempt from prohibitions of section 9 of the ESA if they comply with the terms and conditions of the 1996 BO. The terms and conditions of the 1996 BO require that each SMCRA regulatory authority implement and comply with species-specific protective measures for federally listed species as developed by the Service and the regulatory authority. These measures may not eliminate all adverse effects ("take") on the species or its habitat, but they are intended to minimize and avoid impacts to the greatest extent practical and to ensure that the proposed activity will not jeopardize the species' continued existence.

(10) Comment: One peer reviewer stated the Service needs to coordinate with other agencies on protective conductivity levels under Kentucky's narrative aquatic life standards in order to protect the species.

Our Response: We continue to share information with the Kentucky Department of Environmental Protection (KYDEP) on the species' status and threats; however, any future modifications to Kentucky's narrative aquatic life standards will be the responsibility of KYDEP and the U.S. Environmental Protection Agency (USEPA). We will continue to provide technical assistance when requested.

(11) Comment: One peer reviewer commented that the Service should explain if recorded Kentucky arrow darter movements in Elisha Branch, Long Fork, and Hector Branch represent simple movements within home ranges (intrapopulational movements from pool to pool) or dispersal events (interpopulational movements).

Our Response: We can only speculate as to whether the recorded movements in these streams represent simple movements within home ranges or dispersal events. Most are likely intrapopulational (pool to pool within the same stream), but a few observations on Elisha Creek and Long Fork may provide evidence of dispersal events (interpopulational). We have added language to address this topic under the *Background–Habitat and Life History* section of this final listing determination.

(12) Comment: One peer reviewer stated that the Service should explain how we estimated abundance and recruitment of Kentucky arrow darters.

Our Response: Kentucky arrow darter abundance per sampling reach was estimated based on observed captures during single-pass electrofishing surveys. As described in the proposed rule, these surveys typically involved qualitative searches of all available habitats within a 100- to 150-meter survey reach. Evidence of recruitment was based on the presence of multiple age-classes within a survey reach. All captured Kentucky arrow darters were measured (total length in millimeters), allowing for the discrimination of age classes.

(13) Comment: One peer reviewer stated that the Service did not mention or discuss the relationship between land use and instream habitat conditions.

Our Response: We do not specifically mention the influence of land use and how it relates to instream habitat conditions; however, the Factor A discussion offers multiple examples of how differing land uses (e.g., resource extraction, residential development) can affect water quality and physical habitat conditions.

(14) Comment: One peer reviewer asked us to clarify whether the Kentucky arrow darter was sensitive to high light conditions (loss of riparian vegetation and stream canopy).

Our Response: Increased light conditions have been shown to be a threat to other aquatic organisms, but its impact on the Kentucky arrow darter is unknown. We have added language to address this topic under the *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range* section of this final listing determination.

(15) Comment: One peer reviewer commented that nonnative rainbow trout may compete with Kentucky arrow darters for food resources and space.

Our Response: Within Big Double Creek, the only stream occupied by both species, nonnative rainbow trout and Kentucky arrow darters could complete for food and space as both feed on aquatic insects and both occupy similar habitats (pools). However, we do not believe that competition from nonnative trout represents a widespread, high-magnitude threat to the species across its range. Potential competition from nonnative trout is limited to Big Double Creek, and recent surveys in Big Double Creek demonstrate that the Kentucky arrow darter population is healthy and stable (see *Factor C: Disease or Predation*).

(16) Comment: One peer reviewer, the Kentucky Division of Forestry, and several other commenters provided comments on the effectiveness of best management practices (BMP) and compliance issues related to the Kentucky Forest Conservation Act. In general, the peer reviewers and commenters stated that BMPs were effective at preventing sediment runoff from logging sites, thereby protecting water quality and

instream habitats. They also explained that BMP implementation rates in the upper Kentucky River basin were higher than those reported in the proposed listing determination. Based on these factors, the reviewers stated the Service should reconsider its claim that the Kentucky Forest Conservation Act is an ineffective regulatory mechanism. To support their request, the reviewers provided updated and revised inspection data and new information related to BMP elements designed to improve BMP effectiveness.

Our Response: We agree with the commenters that BMP implementation rates are relatively high in the upper Kentucky River basin (greater than 70 percent), and forestry BMPs are effective in protecting water quality and instream habitats. However, as we discuss in the *Factor D. The Inadequacy of Existing Regulatory Mechanisms* section of this final listing determination, BMP compliance at inspected sites in the upper Kentucky River basin was only 73 percent between May 2014 and October 2015. Remedial actions were implemented at most noncompliant sites (74 percent) within a few months, but 26 percent of these sites remained noncompliant. The primary reason for noncompliance was related to the inadequate control of sediment laden runoff from skid trails, roads, and landings. Therefore, we agree with the commenters that forestry BMPs are effective in protecting water quality and preventing sedimentation; however, these impacts continue to occur within the upper Kentucky River basin due to BMP noncompliance. We have incorporated new compliance information provided by the commenters under the *Factor D–The Inadequacy of Existing Regulatory Mechanisms* section of this final listing determination. We have also included additional text regarding recent changes to Kentucky's BMP standards, which will be more protective of

stream habitats. We agree with the peer reviewer and other commenters that BMP compliance rates were higher than those reported in the proposed listing rule, and recent changes to Kentucky's BMP standards will be more protective of stream habitats. However, BMP noncompliance continues to occur at some sites (about 26 percent), remedial actions at these sites sometimes take several months to complete, and some of these sites (6.5 percent) are never remediated.

(17) Comment: One peer reviewer recommended that the Service modify the discussion regarding genetic variation and gene flow because a detailed study of these factors is lacking.

Our Response: We concur with the peer reviewer and have modified our text accordingly in the *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence–Restricted Range and Population Size* section of this final listing determination.

Public Comments

(18) Comment: One commenter stated that the Service failed to consider how the Kentucky arrow darter's habitat is affected by the surrounding human population. This same commenter also suggested that mountaintop mining and fracking were not considered as potential threats to the species in the proposed rule, but should have been.

Our Response: We discussed a variety of human-induced habitat threats under the *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range* section of this listing determination. In that section, we also provided a detailed summary of threats related to fracking and described specific impacts associated with a spill of chemicals used during the drilling process. Mountaintop coal mining is not

mentioned within the proposed rule, but any potential impacts associated with mountaintop mining are addressed in our detailed discussion of impacts associated with surface coal mining in the *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range* section of this listing determination. Surface coal mining is a broad category of coal mining that includes a variety of methods, such as area, auger, contour, and mountaintop mining.

(19) Comment: One commenter had concerns over perceived regulatory gaps associated with oil and gas development (and related infrastructure) on the Redbird Ranger District of the DBNF. Because some oil and gas resources within the Redbird Ranger District are privately owned, the commenter believed resource extraction activities in these areas would be exempt from National Environmental Policy Act (NEPA) requirements, and these projects would not be evaluated as closely for potential adverse effects to natural resources as activities occurring in areas under public ownership.

Our Response: The commenter is correct that mineral resources (i.e., coal, natural gas, oil) underlying much of the Redbird District of the DBNF are in private ownership, and that no Federal nexus exists with regard to actions associated with these minerals (including coal, oil/gas) in the DBNF. Because these mineral resources are in private ownership, oil and gas exploration activities taking place within them would not be subject to NEPA, and there would be no requirement for the DBNF to consult with the Service under section 7 of the ESA or apply standards of the DBNF's Land and Resource Management Plan (Forest Plan) to these privately held areas. The Service recognizes these regulatory gaps (with respect to privately held minerals) on the DBNF and has

added language to the *Factor D. The Inadequacy of Existing Regulatory Mechanisms* section in this final listing determination.

(20) Comment: One commenter stated that the recently signed Candidate Conservation Agreement (CCA) between the Service and U.S. Forest Service fails to create new conservation measures that will be implemented on the DBNF to protect the Kentucky arrow darter.

Our Response: The CCA involves several new conservation measures that will benefit the species. Some of these measures include (1) the development and implementation of a long-term management and monitoring program for Kentucky arrow darter populations on the DBNF; (2) an inventory and mapping project of natural gas lines, oil wells, roads, other facilities, land ownership, and mineral ownership within Kentucky arrow darter watersheds on the DBNF; (3) the identification of restoration or enhancement opportunities for Kentucky arrow darter streams in coordination with Forest Plan standards, implementing those opportunities as funding and other resources allow; and (4) the initiation of an annual Kentucky arrow darter conservation meeting between the Service and DBNF to discuss the results of implementing the CCA. These and other conservation measures included in the CCA will benefit the species; however, these actions did not influence our final listing determination. The actions outlined in the CCA apply only to portions of Kentucky arrow streams located within the DBNF. The majority of Kentucky arrow populations (streams) and about 74 percent of the species' occupied habitat are located in areas outside of the DBNF that are not covered by the CCA. These populations will not benefit from specific conservation measures described in the CCA and will continue to be vulnerable to a variety of threats (see *Factor A: The*

Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range).

(21) Comment: One commenter disagreed with our description of roads on Robinson Forest, a 59.9-km^2 (14,800-acre (ac)) experimental forest owned and managed by the University of Kentucky (UK). The commenter stated that the roads on Robinson Forest are used for forest access and management and should not be described as logging roads. The same commenter also stated that, in addition to protection from mining provided through the Lands Unsuitable for Mining designation in the Kentucky Administrative Regulations (405 KAR 24:040), habitats within Robinson Forest are protected from potential habitat disturbance associated with private or recreational all-terrain vehicle (ATV) use.

Our Response: We agree with the commenter that roads on Robinson Forest should not be described as logging roads, and we have revised the corresponding text under the *Population Estimates and Status* section of this final rule. Under the *Factor D. The Inadequacy of Existing Regulatory Mechanisms* section of this final listing determination, we have added a description of UK's management guidelines for Robinson Forest. Under these guidelines, public access to Robinson Forest is controlled, and potential impacts from such activities as recreational ATV use are avoided.

Summary of Changes from the Proposed Rule

We have considered all comments and information received during the open comment period for the proposed rule to list the Kentucky arrow darter as threatened. In this final rule, we have added species description and life-history information to the

background section, and we have revised and updated the threats discussion (**Summary of Factors Affecting the Species** section). We added new information on spawning behavior and the development and viability of eggs, based on observations made during captive-propagation efforts by CFI. We also clarified information related to darter movements, discussing the difference between dispersal (intertributary movement) and simple movements within the same stream (intratributary movement). We added a more detailed description of feeding behavior, relying on observations made for the closely related Cumberland arrow darter in Tennessee. With regard to threats, we:

–Used new probabilistic data generated by the Kentucky Division of Water (KDOW) to demonstrate the spatial degree of threats across the species' range,

–Added new information summarizing the vulnerability of salamanders and other aquatic organisms to elevated conductivity,

–Briefly discussed the potential impact of high light conditions (stream canopy loss),

–Discussed the potential threat posed by sewage bacteria and parasites,

–incorporated new forestry BMP compliance information and descriptions of new BMP standards in Kentucky, and

–Added text summarizing the threat posed by anthropogenic barriers (e.g., perched culverts).

Background

Species Information

Species Description and Taxonomy

A thorough account of Kentucky arrow darter life history is presented in the preamble to the proposed rule (October 8, 2015, 80 FR 60962), and that information is incorporated here by reference. The following is a summary of that information. We have incorporated new information into the final rule, as appropriate (see **Summary of Changes from the Proposed Rule**).

The Kentucky arrow darter, *Etheostoma spilotum* Gilbert, is a small and compressed fish, with a background color of straw yellow to pale greenish and a body covered by a variety of stripes and blotches. During the spawning season, breeding males exhibit vibrant coloration. Most of the body is blue-green in color, with scattered scarlet spots and scarlet to orange vertical bars laterally.

The Kentucky arrow darter belongs to the Class Actinopterygii (ray-finned fishes), Order Perciformes, and Family Percidae (perches) (Etnier and Starnes 1993, pp. 18–25; Page and Burr 2011, p. 569). A similar darter species, the Cumberland arrow darter, *E. sagitta* (Jordan and Swain), is restricted to the upper Cumberland River basin in Kentucky and Tennessee, and the Kentucky arrow darter is restricted to the upper Kentucky River basin in Kentucky.

Habitat and Life History

Kentucky arrow darters typically inhabit pools or transitional areas between riffles and pools (glides and runs) in moderate- to high-gradient, first- to third-order streams with rocky substrates (Thomas 2008, p. 6). The species is most often observed near some type of cover in depths ranging from 10 to 45 centimeters (cm) (4 to 18 in) and in streams ranging from 1.5 to 20 meters (m) (4.9 to 65.6 feet (ft)) wide. During spawning (April to

June), the species utilizes riffle habitats with moderate flow (Kuehne and Barbour 1983, p. 71). Kentucky arrow darters typically occupy streams with watersheds of 25.9 square kilometers (km^2) (10 square miles (mi^2)) or less, and many of these habitats, especially in first-order reaches, can be intermittent in nature (Thomas 2008, pp. 6–9). During drier periods (late summer or fall), some Kentucky arrow darter streams may cease flowing, but the species appears to survive these conditions by retreating into shaded, isolated pools or by dispersing into larger tributaries (Lotrich 1973, p. 394; Lowe 1979, p. 26; Etnier and Starnes 1993, p. 523; ATS 2011, p. 7; Service unpublished data).

Little information is available on the reproductive behavior of the Kentucky arrow darter; however, general details were provided by Kuehne and Barbour (1983, p. 71), and more specific information can be inferred from studies of the closely related Cumberland arrow darter conducted by Bailey (1948, pp. 82–84) and Lowe (1979, pp. 44–50). Male Kentucky arrow darters establish territories over riffles and defend a fanned out depression in the substrate. After spawning, it is assumed the male continues to defend the nest until the eggs have hatched. The spawning period extends from April to June, but peak activity occurs when water temperatures reach 13 degrees Celsius (^{o}C) (55 degrees Fahrenheit (^{o}F)), typically in mid-April. Females produce between 200 and 600 eggs per season, with tremendous variation resulting from size, age, condition of females, and stream temperature (Rakes 2014, pers. comm.).

Captive-propagation efforts by CFI (2010-present) have yielded observations related to spawning behavior and the development and viability of eggs and larvae (Petty *et al.* 2015, pp. 4–7). The spawning period is dependent on several factors, but laboratory observations suggest that water temperature is likely a significant determinant of when

spawning begins and how long it continues (Petty *et al.* 2015, p. 7). The appearance of larvae in the laboratory appeared to be delayed by cool water temperatures (less than 10 ^{o}C), suggesting that cooler temperatures may (1) affect egg viability and/or larval survivorship or (2) simply increase development times of eggs and/or larvae. Another potential factor related to spawning period is the age and size of breeding darters. In the laboratory, large, older individuals spawned earlier and terminated earlier, while smaller, younger individuals matured and spawned later. Petty *et al.* (2015, p. 7) cautioned that hatchery observations are necessarily biased by the selection and use of mostly larger individuals in attempts to maximize production, so these larger individuals may not reflect the natural variation in wild populations with greater demographic (and environmental) diversity.

Kentucky arrow darters can reach 50 mm (2 in) in length by the end of the first year (Lotrich 1973, pp. 384–385; Lowe 1979, pp. 44–48; Kuehne and Barbour 1983, p. 71). One-year-olds are generally sexually mature and participate in spawning with older age classes (Etnier and Starnes 1993, p. 523). Juvenile Kentucky arrow darters can be found throughout the channel but are often observed in shallow water along stream margins near root mats, rock ledges, or some other cover. As stream flow lessens and riffles begin to shrink, most Kentucky arrow darters move into pools and tend to remain there even when late autumn and winter rains restore stream flow (Kuehne and Barbour 1983, p. 71).

Limited information exists with regard to upstream or downstream movements of Kentucky arrow darters; however, a movement study at Eastern Kentucky University (EKU) and a reintroduction project in the DBNF suggest that Kentucky arrow darters can

move considerable distances (Baxter 2015, entire; Thomas 2015a, pers. comm.), which we summarize below.

The EKU study used PIT-tags (electronic tags placed under the skin) and placed antenna systems (installed in the stream bottom) to monitor intra- and inter-tributary movement of Kentucky arrow darters in Gilberts Big Creek and Elisha Creek, two second-order tributaries of Red Bird River in Clay and Leslie Counties (Baxter 2015, pp. 9-11). PIT-tags were placed in a total of 126 individuals, and Kentucky arrow darter movements were tracked from May 2013 to May 2014 (Baxter 2015, pp. 15, 19-21, 35-36). Recorded movements ranged from 134 m (439 ft) (upstream movement) to 4,078 m (13,379 ft or 2.5 mi) (downstream movement by a female in Elisha Creek). Intermediate recorded movements included 328 m (1,076 ft) (downstream), 351 m (1,151 ft) (upstream), 900 m (2,952 ft) (upstream/downstream), 950 m (3,116 ft) (downstream), 1,282 m (4,028 ft) (downstream), and 1,708 m (5,603 ft) (downstream). Based on this research, we believe it is likely that most of these documented movements could best be described as intrapopulational and represent individual darters moving between stream pools of Elisha Creek. In the case of the female arrow darter that moved unidirectionally from the headwaters of Elisha Creek to its mouth (a distance of more than 4,000 m (2.5 mi)), this documented movement could represent an interpopulational event (dispersal), where an individual leaves one population and travels to another population (or stream). Further research is needed to differentiate these behaviors.

Since August 2012, the Kentucky Department of Fish and Wildlife Resources (KDFWR) and CFI have been releasing captive-bred Kentucky arrow darters into a 1.5-km (0.9 mi) reach of Long Fork, a DBNF stream and first-order tributary to Hector

Branch in eastern Clay County, Kentucky, where the species formerly occurred but has been extirpated. Researchers have tagged and released a total of 1,447 Kentucky arrow darters (about 50–55 mm TL) and have conducted monitoring on 14 occasions since the initial release using visual searches and seining methods. Tagged darters have been observed throughout the Long Fork mainstem, and some individuals have moved considerable distances (up to 1.0 km (0.4 mi)) downstream into Hector Branch. Based on these results, it is clear that young Kentucky arrow darters can disperse both upstream and downstream from their place of origin and can move considerable distances.

Kentucky arrow darters feed primarily on mayflies (Order Ephemeroptera), with larger darters also feeding on small crayfishes. Other food items include larval blackflies, midges, caddisfly larvae, stonefly nymphs, beetle larvae, microcrustaceans, and dipteran larvae (Lotrich 1973, p. 381; Etnier and Starnes 1993, p. 523).

Historical Range and Distribution

A thorough account of the Kentucky arrow darter's historical range is presented in the preamble to the proposed rule (October 8, 2015, 80 FR 60962), and that information is incorporated here by reference. The following is a summary of that information with new information added as appropriate (see **Summary of Changes from the Proposed Rule**).

The Kentucky arrow darter occurred historically in at least 74 streams in the upper Kentucky River basin of eastern Kentucky (Gilbert 1887, pp. 53–54; Woolman 1892, pp. 275–281; Kuehne and Bailey 1961, pp. 3–4; Kuehne 1962, pp. 608–609; Branson and Batch 1972, pp. 507–514; Lotrich 1973, p. 380; Branson and Batch 1974,

pp. 81–83; Harker *et al.* 1979, pp. 523–761; Greenberg and Steigerwald 1981, p. 37; Branson and Batch 1983, pp. 2–13; Branson and Batch 1984, pp. 4–8; Kornman 1985, p. 28; Burr and Warren 1986, p. 316; Measel 1997, pp. 1–105; Kornman 1999, pp. 118–133; Stephens 1999, pp. 159–174; Ray and Ceas 2003, p. 8; Kentucky State Nature Preserves Commission (KSNPC) unpublished data). Its distribution spanned portions of 6 smaller sub-basins or watersheds (North Fork Kentucky River, Middle Fork Kentucky River, South Fork Kentucky River, Silver Creek, Sturgeon Creek, and Red River) in 10 Kentucky counties (Breathitt, Clay, Harlan, Jackson, Knott, Lee, Leslie, Owsley, Perry, and Wolfe) (Thomas 2008, p. 3) (figure 1).

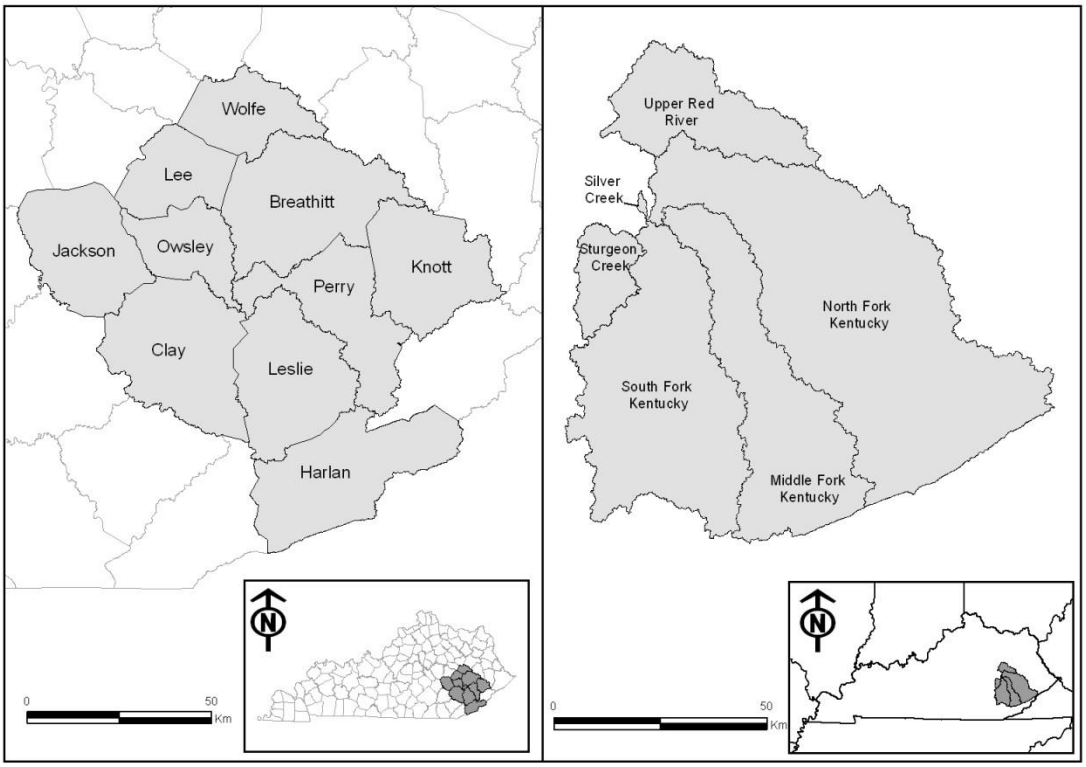

Figure 1. Kentucky counties within the Kentucky arrow darter's historical range (left) and upper Kentucky River sub-basins with historical records of the species (right).

Current Range and Distribution

Based on surveys completed since 2006, extant populations of the Kentucky arrow darter are known from 47 streams in the upper Kentucky River basin in eastern Kentucky. These populations are scattered across 6 sub-basins (North Fork Kentucky River, Middle Fork Kentucky River, South Fork Kentucky River, Silver Creek, Sturgeon Creek, and Red River) in 10 Kentucky counties: Breathitt, Clay, Harlan, Jackson, Knott, Lee, Leslie, Owsley, Perry, and Wolfe Counties (Thomas 2008, pp. 3–6; Service unpublished data). Populations in eight of these streams have been discovered since

2006, and one additional population (Long Fork, Clay County) was reestablished through a reintroduction project led by KDFWR. Current populations occur in the following Kentucky River sub-basins (and smaller watersheds):

- North Fork Kentucky River (Troublesome, Quicksand, Frozen, Holly, Lower Devil, Walker, and Hell Creek watersheds);
- Middle Fork Kentucky River (Big Laurel, Rockhouse, Hell For Certain Creek, and Squabble Creek watersheds);
- South Fork Kentucky River (Red Bird River, Hector Branch, and Goose, Bullskin, Buffalo, and Lower Buffalo Creek watersheds);
- Silver Creek;
- Sturgeon Creek (Travis, Wild Dog, and Granny Dismal Creek watersheds); and
- Red River (Rock Bridge Fork watershed).

Population Estimates and Status

The species' status in all streams of historical or recent occurrence is summarized in table 1, below, which is organized by sub-basin, beginning at the southeastern border (upstream end) of the basin (North Fork Kentucky River) and moving downstream. In this final rule, the term "population" is used in a geographical context and not in a genetic context, and is defined as all individuals of the species living in one stream at a given time. Using the term in this way allows the status, trends, and threats to be discussed comparatively across streams where the species occurs. In using this term, we do not imply that the populations are currently reproducing and recruiting or that they are distinct genetic units. We considered populations of the Kentucky arrow darter as extant

if live specimens have been observed or collected since 2006, and habitat conditions are favorable for reproduction (e.g., low siltation, water chemistry at normal levels).

We are using the following generalized sets of criteria to categorize the relative status of populations of 83 streams (74 historical and 9 nonhistorical, discovered or established since 2006) included in table 1. Similar criteria have been used by the Service in previous proposed listing rules (76 FR 3392, January 19, 2011; 77 FR 63440, October 16, 2012):

The status of a population is considered "stable" if: (1) There is little evidence of significant habitat loss or degradation; (2) darter abundance has remained relatively constant or increased during recent surveys; or (3) evidence of relatively recent recruitment has been documented since 2006.

The status of a population is considered "vulnerable" if: (1) There is ample evidence of significant habitat loss or degradation since the species' original capture; (2) there is an obvious decreasing trend in abundance since the historical collection; or (3) no evidence of relatively recent recruitment (since 2006) has been documented.

The status of a population is considered "extirpated" if: (1) All known suitable habitat has been destroyed or severely degraded; (2) no live individuals have been observed since 2006; or (3) live individuals have been observed since 2006, but habitat conditions do not appear to be suitable for reproduction to occur (e.g., elevated conductivity, siltation) and there is supporting evidence that the observed individuals are transients (fishes originating from another stream that occupy a particular habitat for only a short time).

TABLE 1—KENTUCKY ARROW DARTER STATUS IN ALL STREAMS OF HISTORICAL (74) OR RECENT OCCURRENCE[1] (9; NOTED IN BOLD) IN THE UPPER KENTUCKY RIVER BASIN.

Sub-Basin	Sub-Basin Tributaries	Stream[1]	County	Current Status	Date of Last Observation
North Fork	Lotts Creek	Lotts Creek	Perry	Extirpated	1890
	Troublesome Creek	Left Fork	Knott	Extirpated	1890
		Troublesome Creek	Perry	Extirpated	1890
		Mill Creek	Knott	Extirpated	1995
		Laurel Fork (of Balls Fork)	Knott	Extirpated	1995
		Buckhorn Creek (Prince Fork)	Knott	Vulnerable	2011
		Eli Fork[1]	Knott	Vulnerable	2011
		Boughcamp Branch	Knott	Extirpated	2011
		Coles Fork	Breathitt, Knott	Stable	2011
		Snag Ridge Fork	Knott	Stable	2008
		Clemons Fork	Breathitt	Stable	2013
		Millseat Branch	Breathitt	Extirpated	1976
		Lewis Fork	Breathitt	Extirpated	1959
		Long Fork	Breathitt	Extirpated	1959
		Bear Branch	Breathitt	Extirpated	2015
		Laurel Fork (of Buckhorn)	Breathitt	Extirpated	1976
		Lost Creek	Breathitt	Extirpated	1997
	Quicksand Creek	Laurel Fork	Knott	Stable	2014
		Baker Branch	Knott	Extirpated	1994
		Middle Fork	Knott	Stable	2015
		Spring Fork[1]	Breathitt	Vulnerable	2013
		Wolf Creek	Breathitt	Extirpated	1995
		Hunting Creek	Breathitt	Vulnerable	2013
		Leatherwood Creek	Breathitt	Extirpated	1982
		Bear Creek	Breathitt	Extirpated	1969
		Smith Branch	Breathitt	Extirpated	1995
	Frozen Creek	Frozen Creek	Breathitt	Stable	2013
		Clear Fork	Breathitt	Vulnerable	2008
		Negro Branch	Breathitt	Vulnerable	2008
		Davis Creek	Breathitt	Vulnerable	2008
		Cope Fork	Breathitt	Extirpated	1995
		Boone Fork	Breathitt	Extirpated	1998
	Holly Creek	Holly Creek	Wolfe	Vulnerable	2007
	Lower Devil Creek	Lower Devil Creek	Lee, Wolfe	Extirpated	1998
		Little Fork[1]	Lee, Wolfe	Vulnerable	2011
	Walker Creek	Walker Creek	Lee, Wolfe	Stable	2013
	Hell Creek	Hell Creek	Lee	Vulnerable	2013
Middle Fork	Greasy Creek	Big Laurel Creek	Harlan	Vulnerable	2009
		Greasy Creek	Leslie	Extirpated	1970
	Cutshin Creek	Cutshin Creek	Leslie	Extirpated	1890
	Middle Fork	Middle Fork	Leslie	Extirpated	1890
	Rockhouse Creek	**Laurel Creek[1]**	Leslie	Vulnerable	2013
	Hell For Certain Creek	Hell For Certain Creek	Leslie	Stable	2013
	Squabble Creek	Squabble Creek	Perry	Vulnerable	2015
South Fork	Red Bird River	Blue Hole Creek	Clay	Stable	2008
		Upper Bear Creek	Clay	Stable	2013
		Katies Creek	Clay	Stable	2007
		Spring Creek	Clay	Stable	2007
		Bowen Creek	Leslie	Stable	2009
		Elisha Creek	Leslie	Stable	2014
		Gilberts Big Creek	Clay, Leslie	Stable	2013
		Sugar Creek[1]	Clay, Leslie	Stable	2008
		Big Double Creek	Clay	Stable	2014
		Little Double Creek	Clay	Stable	2008
		Big Creek	Clay	Extirpated	1890
		Jacks Creek	Clay	Vulnerable	2009
		Hector Branch	Clay	Extirpated	2015
		Long Fork (of Hector Br.)[1]	Clay	Stable	2014
	Goose Creek	Horse Creek	Clay	Vulnerable	2013
		Laurel Creek	Clay	Extirpated	1970
	Bullskin Creek	Bullskin Creek	Clay, Leslie	Vulnerable	2014
	Buffalo Creek	Laurel Fork	Owsley	Stable	2014
		Cortland Fork[1]	Owsley	Vulnerable	2014
		Lucky Fork	Owsley	Stable	2014

		Left Fork	Owsley	Stable	2014
		Right Fork	Owsley	Vulnerable	2009
		Buffalo Creek	Owsley	Vulnerable	1969
	Sexton Creek	Bray Creek	Clay	Extirpated	1997
		Robinsons Creek	Clay	Extirpated	1997
		Sexton Creek	Owsley	Extirpated	1978
	Lower Island Creek	Lower Island Creek	Owsley	Extirpated	1997
	Cow Creek	Right Fork Cow Creek	Owsley	Extirpated	1997
	Buck Creek	Buck Creek	Owsley	Extirpated	1978
	Lower Buffalo Creek	Lower Buffalo Creek	Lee, Owsley	Vulnerable	2007
Silver Creek			Lee	Vulnerable	2008
Sturgeon Creek		**Travis Creek**[1]	Jackson	Vulnerable	2008
		Brushy Creek	Jackson, Owsley	Extirpated	1996
		Little Sturgeon Creek	Owsley	Extirpated	1996
		Wild Dog Creek	Jackson, Owsley	Stable	2007
		Granny Dismal Creek[1]	Lee, Owsley	Vulnerable	2013
		Cooperas Cave Branch	Lee	Extirpated	1996
		Sturgeon Creek	Lee	Extirpated	1998
Red River	Swift Camp Creek	Rockbridge Fork	Wolfe	Vulnerable	2013

[1]Non-historical occurrence discovered or established since 2006.

In the period 2007–2012, the Service, KSNPC, and KDFWR conducted a status review for the Kentucky arrow darter (Thomas 2008, pp. 1–33; Service 2012, pp. 1–4). Surveys were conducted qualitatively using single-pass electrofishing techniques (Smith-Root backpack electrofishing unit) within an approximate 100-m (328-ft) reach. During these efforts, fish surveys were conducted at 69 of 74 historical streams, 103 of 119 historical sites, and 40 new (nonhistorical) sites (sites correspond to individual sampling reaches and more than one may be present on a given stream). Kentucky arrow darters were observed at 36 of 69 historical streams (52 percent), 53 of 103 historical sites (52 percent), and 4 of 40 new sites (10 percent). New sites were visited in an effort to locate additional populations and were specifically selected based on habitat suitability and the availability of previous collection records (sites lacking previous collections were chosen).

From June to September 2013, KSNPC and the Service initiated a study that included quantitative surveys at 80 randomly chosen sites within the species' historical range (Service unpublished data). Kentucky arrow darters were observed at only seven

sites, including two new localities (Granny Dismal Creek in Owsley County and Spring Fork Quicksand Creek in Breathitt County) and one historical stream (Hunting Creek, Breathitt County) where the species was not observed during status surveys by Thomas (2008, pp. 1–33) and Service (2012, pp. 1–4).

During 2014–2015, additional qualitative surveys (single-pass electrofishing) were completed at more than 20 sites within the basin. Kentucky arrow darters were observed in Bear Branch, Big Double Creek, Big Laurel Creek, Bullskin Creek, Clemons Fork, Coles Fork, Cortland Fork, Laurel Fork Buffalo Creek, and Squabble Creek. Based on the poor habitat conditions observed in Bear Branch (e.g., elevated conductivity, siltation, and embedded substrates) and its close proximity to Robinson Forest, we suspect that the few individuals observed in Bear Branch were transients originating from Clemons Fork.

Based on historical records and survey data collected at more than 200 sites since 2006, the Kentucky arrow darter has declined significantly rangewide and has been eliminated from large portions of its former range, including 36 of 74 historical streams (figure 2) and large portions of the basin that would have been occupied historically by the species (figure 3). Forty-four percent of the species' extirpations (16 streams) have occurred since the mid-1990s, and the species has disappeared completely from several watersheds (e.g., Sexton Creek, South Fork Quicksand Creek, Troublesome Creek headwaters). Of the species' 47 extant streams, we consider half of these populations (23) to be "vulnerable" (table 1), and most remaining populations are isolated and restricted to short stream reaches.

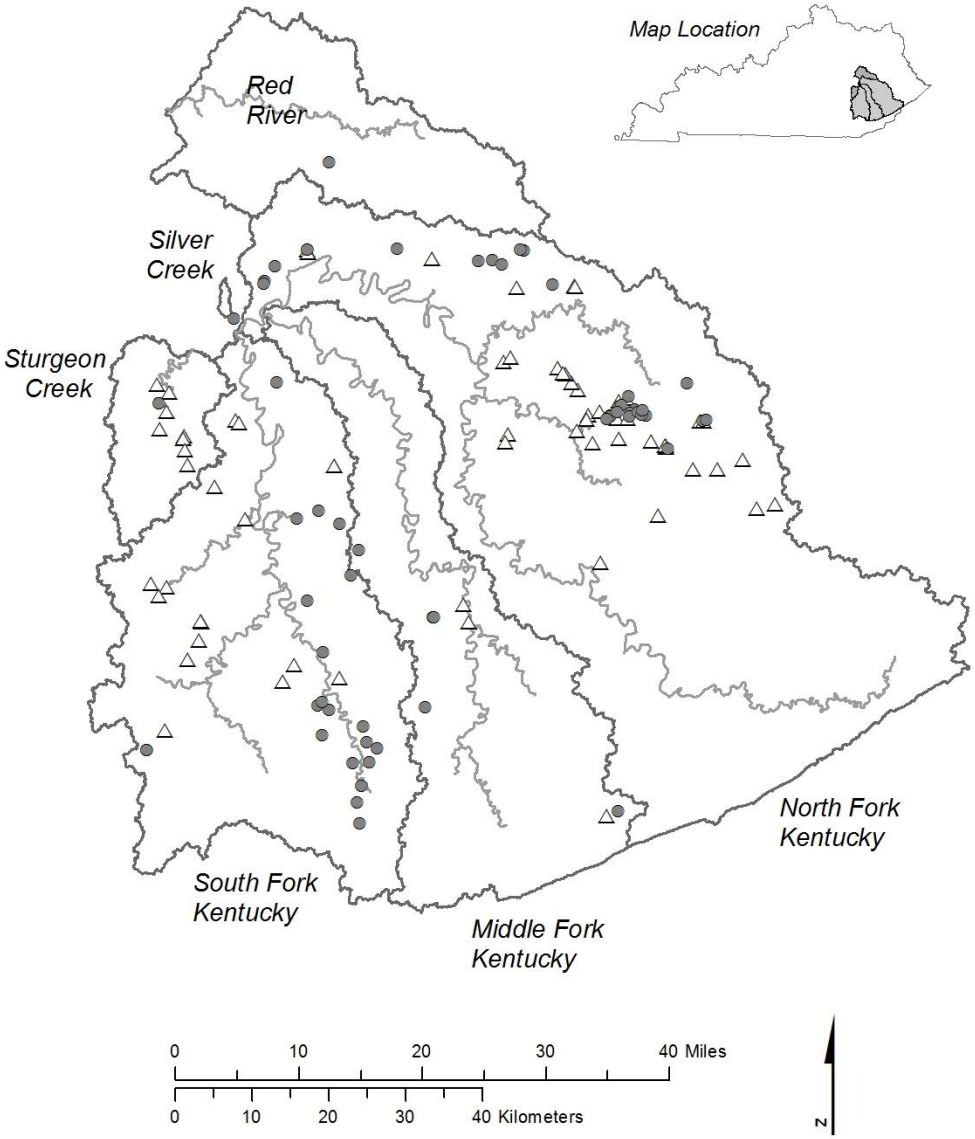

Figure 2. A summary of Kentucky arrow darter survey results at all historical sites visited between 2007 and 2015. Circles indicate survey sites (reaches) where the species was observed. Triangles indicate survey sites (reaches) where the species was not observed. Black lines indicate sub-basin boundaries; grey lines indicate 4th to 6th order streams.

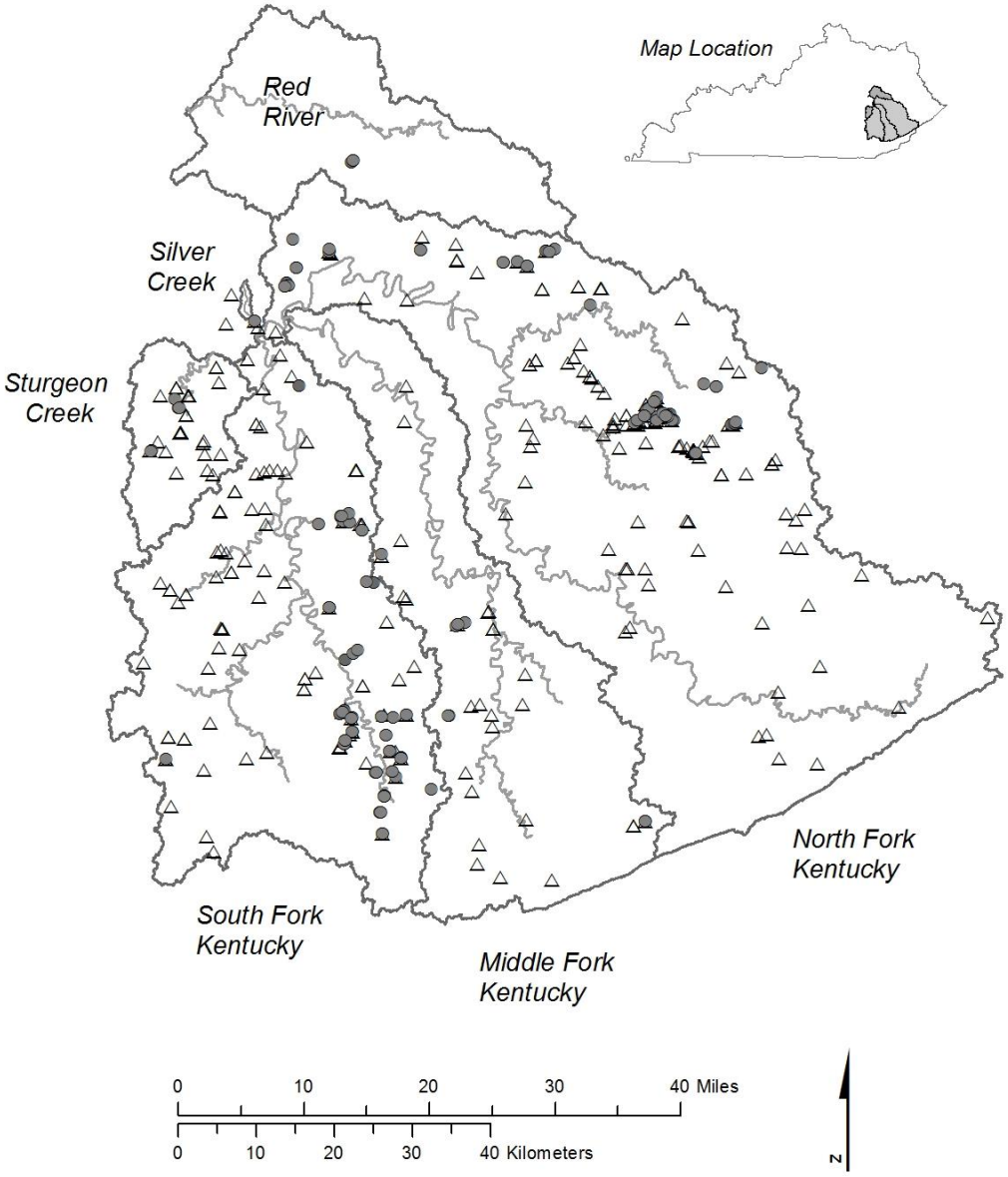

Figure 3. A summary of Kentucky arrow darter survey results at all historical and new sites visited between 2007 and 2014. Circles indicate survey sites (reaches) where the species was observed. Triangles indicate survey sites (reaches) where the species was not observed. Black lines indicate sub-basin boundaries; grey lines indicate 4th to 6th order streams.

A synopsis of the Kentucky arrow darter's current range and status is provided in the preamble to the proposed rule, and that information is incorporated here by reference.

Our recent survey data (Thomas 2008, pp. 25–27; Service 2012, pp. 1–4) indicate that Kentucky arrow darters occur in low densities. Sampling reaches where arrow darters were observed had an average of only 3 individuals per 100-m (328-ft) reach and a median of 2 individuals per reach (range of 1 to 10 individuals). ATS (2011, pp. 4–6) observed similar densities at occupied sampling reaches in the Buckhorn Creek watershed. Surveys in 2011 by the DBNF from Laurel Fork and Cortland Branch of Left Fork Buffalo Creek (South Fork Kentucky River sub-basin) produced slightly higher capture rates (an average of 5 darters per 100-m (328-ft) sampling reach) (Mulhall 2014, pers. comm.). The low abundance values (compared to other darters) are not surprising since Kentucky arrow darters generally occur in low densities, even in those streams where disturbance has been minimal (Thomas 2015b, pers. comm.).

Detailed information on population size is generally lacking for the species, but estimates have been completed for three streams: Clemons Fork (Breathitt County), Elisha Creek (Clay and Leslie Counties), and Gilberts Big Creek (Clay and Leslie Counties) (Service unpublished data). Based on field surveys completed in 2013 by EKU, KSNPC, and the Service, population estimates included 986–2,113 individuals (Clemons Fork), 592–1,429 individuals (Elisha Creek), and 175–358 individuals (Gilberts Big Creek) (ranges reflect 95 percent confidence intervals) (Baxter 2015, pp. 14-15, 18-19).

Based on observed catch rates and habitat conditions throughout the upper Kentucky River basin, the most stable and largest populations of the Kentucky arrow

darter appear to be located in the following streams:

- Hell For Certain Creek, Leslie County;
- Laurel and Middle Forks of Quicksand Creek, Knott County;
- Frozen and Walker Creeks, Breathitt and Lee Counties;
- Clemons Fork and Coles Fork, Breathitt and Knott Counties;
- Several direct tributaries (e.g., Bowen Creek, Elisha Creek, and Big Double Creek) of the Red Bird River, Clay and Leslie Counties; and
- Wild Dog Creek, Jackson and Owsley Counties.

The Kentucky arrow darter is considered "threatened" by the State of Kentucky and has been ranked by KSNPC as a G2G3/S2S3 species (imperiled or vulnerable globally and imperiled or vulnerable within the State) (KSNPC 2014, p. 40). Kentucky's Comprehensive Wildlife Conservation Strategy (KDFWR 2013, pp. 9–11) identified the Kentucky arrow darter as a Species of Greatest Conservation Need (rare or declining species that requires conservation actions to improve its status).

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its

continued existence. Listing may be warranted based on any of the above threat factors, singly or in combination.

Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

A thorough discussion of Kentucky arrow darter habitat destruction or modification is presented in the preamble to the proposed rule (October 8, 2015, 80 FR 60962), and that information is incorporated here by reference. The following is a summary of that information.

The Kentucky arrow darter's habitat and range have been destroyed, modified, and curtailed due to a variety of anthropogenic activities in the upper Kentucky River drainage. Resource extraction (e.g., coal mining, logging, oil/gas well development), land development, agricultural activities, and inadequate sewage treatment have all contributed to the degradation of streams within the range of the species (Branson and Batch 1972, pp. 513–516; Branson and Batch 1974, pp. 82–83; Thomas 2008, pp. 6–7; KDOW 2010, pp. 70–84; KDOW 2013a, pp. 189–214, 337–376; KDOW 2013b, pp. 88–94). These land use activities have led to chemical and physical changes to stream habitats that have adversely affected the species. Specific stressors have included inputs of dissolved solids and elevation of instream conductivity, sedimentation/siltation of stream substrates (excess sediments deposited in a stream), turbidity, inputs of nutrients and organic enrichment, and elevation of stream temperatures (KDOW 2010, p. 84; KDOW 2013a, pp. 189–214, 337–376). KDOW (2013a, pp. 337–376) provided a summary of specific threats within the upper Kentucky River drainage, identifying

impaired reaches in 21 streams within the Kentucky arrow darter's historical range (table 2). Six of these streams continue to support populations of the species, but only one of these populations (Frozen Creek) is considered to be stable (see table 1, above). Results of probabilistic surveys (i.e., surveys conducted at randomly selected sites with sites selected in a statistically valid way) by KDOW demonstrate the spatial degree of threats across the species' range. Out of 22 probabilistic sites (streams) visited within the upper Kentucky River basin in 2003, 18 were considered to be impaired (Payne 2016, pers. comm.), suggesting habitats across the species' range are impacted by the specific stressors identified above.

TABLE 2—SUMMARY OF 303(D) LISTED STREAM SEGMENTS WITHIN THE HISTORICAL RANGE OF THE KENTUCKY ARROW DARTER (KDOW 2013A, PP. 337–376).

Stream	County	Impacted Stream Segment(s)–stream km (stream mi)	Pollutant Source	Pollutant
Buckhorn Creek	Breathitt	0–10.0 (0–6.8)	Abandoned Mine Lands, Unknown Sources	Fecal Coliform (FC), Sediment/Siltation, Total Dissolved Solids (TDS)
Cope Fork (of Frozen Creek)	Breathitt	0–3.0 (0–1.9)	Channelization, Riparian Habitat Loss, Logging, Agriculture, Stream Bank Modification, Surface Coal Mining	Sediment/Siltation, TDS
Cutshin Creek	Leslie	15.6–17.2 (9.7–10.7)	Riparian Habitat Loss, Stream Bank Modification, Surface Coal Mining	Sediment/Siltation
Frozen Creek*	Breathitt	0–22.4 (0–13.9)	Riparian Habitat Loss, Post-Development Erosion and Sedimentation	Sediment/Siltation
Goose Creek	Clay	0–13.4 (0–8.3)	Septic Systems	FC
Hector Branch	Clay	0–8.8 (0–5.5)	Unknown	Unknown

Holly Creek*	Wolfe	0–9.8 (0–6.2)	Agriculture, Riparian Habitat Loss, Stream Bank Modification, Surface Coal Mining	Sediment/Siltation, Unknown
Horse Creek*	Clay	0–13.4 (0–8.3)	Riparian Habitat Loss, Managed Pasture Grazing, Surface Coal Mining	Sediment/Siltation
Laurel Creek	Clay	6.1–7.7 (3.8–4.8)	Managed Pasture Grazing, Crop Production	Nutrients/Eutrophication
Left Fork Island Creek	Owsley	0–8.0 (0–5.0)	Crop Production	Sediment/Siltation
Long Fork	Breathitt	0–7.4 (0–4.6)	Surface Coal Mining	Sediment/Siltation, TDS
Lost Creek	Breathitt	0–14.3 (0–8.9)	Coal Mining, Riparian Habitat Loss, Logging, Stream Bank Modification	FC, Sedimentation, TDS, Turbidity
Lotts Creek	Perry	0.6–1.6, 1.9–9.6 (0.4–1.0, 1.2–6.0)	Riparian Habitat Loss, Land Development, Surface Coal Mining, Logging, Stream Bank Modification	Sediment/Siltation, TDS, Turbidity
Quicksand Creek	Breathitt	0–27.4, 34.9–49.6 (0–17.0, 21.7–30.8)	Surface Coal Mining, Riparian Habitat Loss, Logging, Stream Bank Modification	FC, Turbidity, Sediment/Siltation, TDS
Sexton Creek	Clay, Owsley	0–27.7 (0–17.2)	Crop Production, Highway/Road/Bridge Runoff	Sediment/Siltation, TDS
South Fork Quicksand Creek	Breathitt	0–27.2 (0–16.9)	Riparian Habitat Loss, Petroleum/Natural Gas Production Activities, Surface Coal Mining	Sediment/Siltation, TDS
Spring Fork (Quicksand Creek) *	Breathitt	5.0–11.1 (3.1–6.9)	Abandoned Mine Lands (Inactive), Riparian Habitat Loss, Logging, Stream Bank Modification	Sediment/Siltation, TDS, Turbidity
Squabble Creek*	Perry	0–7.6 (0–4.7)	Land Development, Surface Coal Mining	Sediment/Siltation, TDS
Sturgeon Creek	Lee	12.9–19.6 (8.0–12.2)	Riparian Habitat Loss, Crop Production, Surface Coal Mining	Sediment/Siltation
Swift Camp Creek	Wolfe	0–22.4 (0–13.9)	Unknown	Unknown

Troublesome Creek	Breathitt	0–72.6 (0–45.1)	Surface Coal Mining, Municipal Point Source Discharges, Petroleum/Natural Gas Activities	Sediment/Siltation, Specific Conductance, TDS, Turbidity

*Stream segment still occupied by Kentucky arrow darters.

Water Quality Degradation

One threat to the Kentucky arrow darter is water quality degradation caused by a variety of nonpoint-source pollutants (contaminants from many diffuse and unquantifiable sources). Within the upper Kentucky River drainage, coal mining has been the most significant historical source of these pollutants, and this activity continues to occur throughout the drainage.

Activities associated with coal mining have the potential to contribute high concentrations of dissolved salts, metals, and other solids that (1) elevate stream conductivity (a measure of electrical conductance in the water column that increases as the concentration of dissolved solids increases), (2) increase sulfates (a common dissolved ion with empirical formula of SO_4^{-2}), and (3) cause wide fluctuations in stream pH (a measure of the acidity or alkalinity of water) (Curtis 1973, pp. 153–155; Dyer and Curtis 1977, pp. 10–13; Dyer 1982, pp. 1–16; Hren *et al.* 1984, pp. 5–34; USEPA 2003, pp. 77–84; Hartman *et al.* 2005, p. 95; Pond *et al.* 2008, pp. 721–723; Palmer *et al.* 2010, pp. 148–149; USEPA 2011, pp. 27–44). The coal mining process also results in leaching of metals and other dissolved solids that can result in elevated conductivity, sulfates, and hardness in the receiving stream. Stream conductivity in mined watersheds can be significantly higher compared to unmined watersheds, and conductivity values can remain high for decades (Merricks *et al.* 2007, pp. 365–373; Johnson *et al.* 2010, pp. 1–2).

Elevated levels of metals and other dissolved solids (i.e., elevated conductivity) in Appalachian streams have been shown to negatively impact biological communities, including losses of mayfly and caddisfly taxa (Chambers and Messinger 2001, pp. 34–51; Pond 2004, p. 7; Hartman *et al.* 2005, p. 95; Pond *et al.* 2008, pp. 721–723; Pond 2010, pp. 189–198), reduced occupancy and conditional abundance of salamanders (Price *et al*. 2015, pp. 6–9), and decreases in fish diversity (Kuehne 1962, pp. 608–614; Branson and Batch 1972, pp. 507–512; Branson and Batch 1974, pp. 81–83; Stauffer and Ferreri 2002, pp. 11–21; Fulk *et al.* 2003, pp. 55–64; Mattingly *et al.* 2005, pp. 59–62; Thomas 2008, pp. 1–9; Service 2012, pp. 1–4; Black *et al.* 2013, pp. 34–45; Hitt 2014, pp. 5–7, 11–13; Hitt and Chambers 2014, pp. 919–924; Daniel *et al.* 2015, pp. 50–61; Hitt *et al*. 2016, pp. 46-52).

There is a pattern of increasing conductivity and loss of arrow darter populations that is evident in the fish and water quality data from the Buckhorn Creek basin (1962 to present) in Breathitt and Knott Counties.

Kentucky arrow darters tend to be less abundant in streams with elevated conductivity levels (Service 2012, pp. 1–4; Service 2013, p. 9), and are typically excluded from these streams as conductivity increases (Branson and Batch 1972, pp. 507–512; Branson and Batch 1974, pp. 81–83; Thomas 2008, pp. 3–6). Recent range-wide surveys of historical sites by Thomas (2008, pp. 3–6) and the Service (2012, pp. 1–4) demonstrated that Kentucky arrow darters are excluded from watersheds when conductivity levels exceed about 250 µS/cm. The species was observed at only two historical sites where conductivity values exceeded 250 µS/cm, and average conductivity values were much lower at sites where Kentucky arrow darters were observed (115

µS/cm) than at sites where the species was not observed (689 µS/cm). Hitt et al. (2016, entire) reported that conductivity was a strong predictor of Kentucky arrow darter abundance in the upper Kentucky River drainage, and sharp declines in abundance were observed at 258 µS/cm (95 percent confidence intervals of 155–590 µS/cm). Based on the research presented in the preamble to the proposed rule and incorporated by reference here, we believe it is clear that the overall conductivity level is important in determining the Kentucky arrow darter's presence and vulnerability, but the species' presence is more likely tied to what individual metals or dissolved solids (e.g., sulfate) are present. Determination of discrete conductivity thresholds or the mechanisms through which the Kentucky arrow darter is influenced will require additional study (KSNPC 2010, p. 3; Pond 2015, pers. comm.); however, conductivity thresholds have been evaluated for other aquatic species. Elevated specific conductance has been positively correlated with decreased macroinvertebrate abundance (Pond *et al*. 2008, pp. 725–726; Pond 2012, p. 111), and Johnson *et al*. (2015, pp. 170–171) showed that daily growth rates and development of a mayfly (*Neocleon triagnulifer*) declined with increasing ionic concentrations. Increased levels of specific conductance have been shown to influence the behavior (Karraker *et al*. 2008, pp. 728–732) and corticosterone levels (a hormone secreted by the adrenal cortex that regulates energy, immune reactions, and stress responses) of amphibians (Chambers 2011, pp. 220–222). Embryonic and larval survival of amphibians were reduced significantly at moderate (500 µS/cm) and high (3,000 µS/cm) specific conductance levels (Karraker *et al*. 2008, pp. 728–732).

Mine drainage can also cause chemical (and some physical) effects to streams as a result of the precipitation of entrained metals and sulfate, which become unstable in

solution (USEPA 2003, pp. 24–65; Pond 2004, p. 7). Precipitants accumulate on substrates, encrusting and cementing stream sediments, making them unsuitable for colonization by invertebrates and rendering them unsuitable as foraging or spawning habitat for the Kentucky arrow darter.

Oil and gas exploration and drilling activities represent another significant source of harmful pollutants in the upper Kentucky River basin (KDOW 2013a, pp. 189–214). Once used, fluid wastes containing chemicals used in the drilling and fracking process (e.g., hydrochloric acid, surfactants, potassium chloride) are stored in open pits (retention basins) or trucked away to treatment plants or some other storage facility. If spills occur during transport or releases occur due to retention basin failure or overflow, there is a risk for surface and groundwater contamination. Any such release can cause significant adverse effects to water quality and aquatic organisms that inhabit these watersheds (Wiseman 2009, pp. 127–142; Kargbo *et al.* 2010, pp. 5,680–5,681; Osborn *et al.* 2011, pp. 8,172–8,176; Papoulias and Velasco 2013, pp. 92–111).

Other nonpoint-source pollutants common within the upper Kentucky River drainage with potential to affect the Kentucky arrow darter include domestic sewage (through septic tank leakage or straight pipe discharges) and agricultural pollutants such as animal waste, fertilizers, pesticides, and herbicides (KDOW 2013a, pp. 189–214). Nonpoint-source pollutants can cause increased levels of nitrogen and phosphorus, excessive algal growths, oxygen deficiencies, and other changes in water chemistry that can seriously impact aquatic species (KDOW 2010, pp. 70–84; KDOW 2013a, pp. 189–214; KDOW 2013b, pp. 88–94). Nonpoint-source pollution may be correlated with impervious surfaces and storm water runoff (Allan 2004, pp. 266–267) and include

sediments, fertilizers, herbicides, pesticides, animal wastes, septic tank and gray water leakage, pharmaceuticals, and petroleum products.

Physical Habitat Disturbance

Sedimentation (siltation) has been listed repeatedly by KDOW as the most common stressor of aquatic communities in the upper Kentucky River basin (KDOW 2010, pp. 70–84; KDOW 2013a, pp. 189–214; KDOW 2013b, pp. 88–94). Sedimentation comes from a variety of sources, but KDOW identified the primary sources of sediment as loss of riparian habitat, surface coal mining, legacy coal extraction, logging, and land development (KDOW 2010, pp. 70–84; KDOW 2013b, pp. 88–94). All of these activities can result in canopy removal, channel disturbance, and increased siltation, thereby degrading habitats used by Kentucky arrow darters for both feeding and reproduction.

Resource extraction activities (e.g., surface coal mining, legacy coal extraction, logging, oil and gas exploration and drilling) are major sources of sedimentation in streams (Paybins *et al.* 2000, p. 1; Wiley *et al.* 2001, pp. 1–16; KDOW 2013a, pp. 189–214). Similarly, logging activities can adversely affect Kentucky arrow darters and other fishes through removal of riparian vegetation, direct channel disturbance, and sedimentation of instream habitats (Allan and Castillo 2007, pp. 332–333). Stormwater runoff from unpaved roads, ATV trails, and driveways represents a significant but difficult to quantify source of sediment that impacts streams in the upper Kentucky River basin.

Sediment has been shown to damage and suffocate fish gills and eggs, larval fishes, bottom-dwelling algae, and other organisms; reduce aquatic insect diversity and abundance; and, ultimately, negatively impact fish growth, survival, and reproduction (Berkman and Rabeni 1987, pp. 285–294; Waters 1995, pp. 5–7; Wood and Armitage 1997, pp. 211–212; Meyer and Sutherland 2005, pp. 2–3).

Invasion of Hemlock Wooly Adelgid

The hemlock woolly adelgid (*Adelges tsugae*), an aphid-like insect native to Asia, represents a potential threat to the Kentucky arrow darter because it has the potential to severely damage stands of eastern hemlocks (*Tsuga canadensis*) that occur within the species' range. Loss of hemlocks along Kentucky arrow darter streams has the potential to result in increased solar exposure and subsequent elevated stream temperatures, bank erosion, and excessive inputs of woody debris that will clog streams and cause channel instability and erosion (Townsend and Rieske-Kinney 2009, pp. 1–3). We expect these impacts to occur in some Kentucky arrow darter watersheds; however, we do not believe these impacts will be widespread or severe because eastern hemlocks are not abundant in all portions of the Kentucky arrow darter's range, and even where hemlocks are more common, we expect them to be replaced by other tree species.

In summary, habitat loss and modification represent threats to the Kentucky arrow darter. Severe degradation from contaminants, sedimentation, and physical habitat disturbance have contributed to extirpations of Kentucky arrow darter populations, and these threats continue to impact water quality and habitat conditions across the species' range. Contaminants associated with surface coal mining (metals, other dissolved solids),

domestic sewage (bacteria, nutrients), and agriculture (fertilizers, pesticides, herbicides, and animal waste) cause degradation of water quality and habitats through increased conductivity and sulfates, instream oxygen deficiencies, excess nutrification, and excessive algal growths. Sedimentation from surface coal mining, logging, agriculture, and land development negatively affect the Kentucky arrow darter by burying or covering instream habitats used by the species for foraging, reproduction, and sheltering. These impacts can cause reductions in growth rates, disease tolerance, and gill function; reductions in spawning habitat, reproductive success, and egg, larval, and juvenile development; modifications of migration patterns; decreased food availability through reductions in prey; and reduction of foraging efficiency. Furthermore, these threats faced by the Kentucky arrow darter are the result of ongoing land uses that are expected to continue indefinitely.

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The Kentucky arrow darter is not believed to be utilized for commercial, recreational, scientific, or educational purposes. Individuals may be collected occasionally in minnow traps by recreational anglers and used as live bait, but we believe these activities are practiced infrequently and do not represent a threat to the species. Our review of the available information does not indicate that overutilization is a threat to the Kentucky arrow darter now or likely to become so in the future.

Factor C: Disease or Predation

No specific information is available suggesting that disease is a threat to the Kentucky arrow darter; however, in marginal Kentucky arrow darter streams (those with impacts from industrial or residential development), the occurrence of sewage-bacteria (*Sphaerotilus*) may a pose a threat with respect to fish condition and health (Pond 2015, pers. comm.). These bacteria are prevalent in many eastern Kentucky streams where straight-pipe sewage discharges exist and can often affect other freshwater organisms. The presence of these bacteria could also indicate the presence of other pathogens. Gill and body parasites such as flukes (flatworms) and nematodes (roundworms) have been noted in other species of *Etheostoma* (Page and Mayden 1981, p. 8), but it is unknown if these parasites infest or harm the Kentucky arrow darter.

Although the Kentucky arrow darter is undoubtedly consumed by native predators (e.g., fishes, amphibians, and birds), this predation is naturally occurring and a normal aspect of the species' population dynamics. Nonnative rainbow trout (*Oncorhynchus mykiss*) represent a potential predation threat (Etnier and Starnes 1993, p. 346) in one Kentucky arrow darter stream, Big Double Creek (Clay County), because KDFWR stocks up to 1,000 trout annually in the stream, with releases occurring in March, April, May, and October. To assess the potential predation of rainbow trout on Kentucky arrow darters or other fishes, the Service and DBNF surveyed a 2.1-km (1.3-mile) reach of Big Double Creek on April 21, 2014, which was 17 days after KDFWR's April stocking event (250 trout). A total of seven rainbow trout were captured, and the gut contents of these individuals were examined. Food items were dominated by Ephemeroptera (mayflies), with lesser amounts of Plecoptera (stoneflies), Trichoptera (caddisflies), Diptera (flies), Decapoda (crayfish), and terrestrial Coleoptera (beetles). No fish remains

were observed. Based on all these factors and the absence of rainbow trout from the majority (98 percent) of Kentucky arrow darter streams demonstrates that predation by nonnative rainbow trout does not pose a threat to the species.

In short, our review of available information indicates that neither disease nor predation is currently a threat to the species or likely to become a threat to the Kentucky arrow darter in the future.

Factor D: The Inadequacy of Existing Regulatory Mechanisms

The Kentucky arrow darter has been identified as a threatened species within Kentucky (KSNPC 2014, p. 40), but this State designation conveys no legal protection for the species or its habitat. Kentucky law prohibits the collection of the Kentucky arrow darter (or other fishes) for scientific purposes without a valid State-issued collecting permit (Kentucky Revised Statutes (KRS) sec. 150.183). Kentucky regulations (301 KAR 1:130, sec. 1(3)) also allow persons who hold a valid Kentucky fishing license (obtained from KDFWR) to collect up to 500 minnows per day (a minnow is defined as any nongame fish less than 6 inches in length, with the exception of federally listed species). These existing regulatory mechanisms provide some protections for the species.

Streams within UK's Robinson Forest (Coles Fork, Snag Ridge Fork, and Clemons Fork) are currently protected from the effects of surface coal mining due to a 1990 "lands unsuitable for mining" designation (405 KAR 24:040). Streams within Robinson Forest (e.g., Clemons Fork and Coles Fork) are also protected from general disturbance by management guidelines approved by the UK's Board of Trustees in 2004 (Stringer 2015, pers. comm.). These guidelines provide general land use allocations,

sustainable allowances for active research and demonstration projects involving overstory manipulation, allocations of net revenues from research and demonstration activities, and management and oversight responsibilities (Stringer 2015, pers. comm.). Under these guidelines, public access to Robinson Forest is controlled and potential impacts from such activities as recreational ATV use are avoided.

A significant portion (about 47 percent) of the species' remaining populations are located on the DBNF and receive management and protection through DBNF's land and resource management plan (LRMP) (USFS 2004, pp. 7–16) and a recently signed CCA between the DBNF and the Service (see Comment and Response #20 in the *Summary of Comments and Recommendations* section). Both of these documents contain conservation measures and protective standards that are intended to conserve the Kentucky arrow darter on the DBNF. Populations within the DBNF have benefited from management goals, objectives, and protective standards included in the LRMP. Collectively, these streams contain some of the best remaining habitats for the species and support some of the species' most robust populations.

The Kentucky arrow darter and its habitats are afforded some protection from water quality and habitat degradation under the Federal Water Pollution Control Act of 1977, commonly referred to as the Clean Water Act (33 U.S.C. 1251 *et seq.*); the Federal Surface Mining Control and Reclamation Act (SMCRA) (30 U.S.C. 1201 *et seq.*) of 1977; Kentucky's Forest Conservation Act of 1998 (KRS secs. 149.330–355); Kentucky's Agriculture Water Quality Act of 1994 (KRS secs. 224.71–140); and additional Kentucky laws and regulations regarding natural resources and environmental protection (KRS secs. 146.200–360; KRS sec. 224; 401 KAR secs. 5:026, 5:031). While

these laws have undoubtedly resulted in some improvements in water quality and stream habitat for aquatic life, including the Kentucky arrow darter, sedimentation and other nonpoint-source pollutants continue to pose a threat to the species.

The KDOW has not established total maximum daily load (TMDLs) pursuant to the Clean Water Act for identified pollutants within portions of the upper Kentucky River basin historically occupied by the Kentucky arrow darter. TMDLs do not address chemical pollutants or sedimentation of aquatic habitats. The Service is also not aware of any other current or future changes to State or Federal water quality or mining laws that will substantially address the currently observed degradation of water quality.

Despite the current laws to prevent sediment and other pollutants from entering waterways, nonpoint-source pollution, originating from mine sites, unpaved roads, ATV trails, driveways, logging skid trails, and other disturbed habitats is considered to be a continuing threat to Kentucky arrow darter habitats.

Kentucky State laws and regulations regarding oil and gas drilling are generally designed to protect fresh-water resources like the Kentucky arrow darter's habitat, but these regulatory mechanisms do not contain specific provisions requiring an analysis of project impacts to fish and wildlife resources (Kentucky Division of Oil and Gas *et al.* 2012, entire). Current regulations also do not contain or provide any formal mechanism requiring coordination with, or input from, the Service or the KDOW regarding the presence of federally endangered, threatened, or candidate species, or other rare and sensitive species.

In July of 2015, the Office of Surface Mining Reclamation and Enforcement published in the **Federal Register** a notice of availability for a draft environmental

impact statement regarding a proposed Stream Protection Rule (80 FR 42535, July 17, 2015) and the proposed Stream Protection Rule itself (80 FR 44436, July 27, 2015). The preamble for that proposed rule stated that the rule would better protect streams, fish, wildlife, and related environmental values from the adverse impacts of surface coal mining operations and provide mine operators with a regulatory framework to avoid water pollution and the long-term costs associated with water treatment (80 FR 44436, July 27, 2015; see **SUMMARY**). While the OSM proposed rule may provide benefits for the Kentucky arrow darter in the future, until the rule is finalized and implemented, we are unable to evaluate its potential effectiveness with regard to the Kentucky arrow darter and its habitat.

In summary, degradation of habitat for the Kentucky arrow darter is ongoing despite existing regulatory mechanisms.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

Restricted Range and Population Size

The disjunct nature of some Kentucky arrow darter populations (figures 2 and 3, above) likely restricts the natural exchange of genetic material between populations and could make natural repopulation following localized extirpations of the species unlikely without human intervention. Populations can be further isolated by anthropogenic barriers, such as dams, perched culverts, and fords, which can limit natural dispersal and restrict or eliminate connectivity among populations (Eisenhour and Floyd 2013, pp. 82–83). Such dispersal barriers can prevent reestablishment of Kentucky arrow populations in reaches where they suffer localized extinctions due to natural or human-caused events.

The localized nature and small size of many populations also likely makes them vulnerable to extirpation from intentional or accidental toxic chemical spills, habitat modification, progressive degradation from runoff (nonpoint-source pollutants), natural catastrophic changes to their habitat (e.g., flood scour, drought), and other stochastic disturbances (Soulé 1980, pp. 157–158; Hunter 2002, pp. 97–101; Allendorf and Luikart 2007, pp. 117–146). Inbreeding and loss of neutral genetic variation associated with small population size can further reduce the fitness of the population (Reed and Frankham 2003, pp. 230–237), subsequently accelerating population decline (Fagan and Holmes 2006, pp. 51–60).

Species that are restricted in range and population size are more likely to suffer loss of genetic diversity due to genetic drift, potentially increasing their susceptibility to inbreeding depression, decreasing their ability to adapt to environmental changes, and reducing the fitness of individuals (Soulé 1980, pp. 157–158; Hunter 2002, pp. 97–101; Allendorf and Luikart 2007, pp. 117–146). It is likely that some of the Kentucky arrow darter populations are below the effective population size required to maintain long-term genetic and population viability (Soulé 1980, pp. 162–164; Hunter 2002, pp. 105–107). The long-term viability of a species is founded on the conservation of numerous local populations throughout its geographic range (Harris 1984, pp. 93–104). These separate populations are essential for the species to recover and adapt to environmental change (Noss and Cooperrider 1994, pp. 264–297; Harris 1984, pp. 93–104).

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) concluded that warming of the climate system is unequivocal (IPCC 2014, p. 3). Species that are dependent on specialized habitat types, limited in distribution, or at the extreme periphery of their range may be most susceptible to the impacts of climate change (see 75 FR 48911, August 12, 2010); however, while continued change is certain, the magnitude and rate of change is unknown in many cases.

Climate change has the potential to increase the vulnerability of the Kentucky arrow darter to random catastrophic events (McLaughlin *et al.* 2002, pp. 6060–6074; Thomas *et al.* 2004, pp. 145–148) associated with an expected increase in both severity and variation in climate patterns with extreme floods, strong storms, and droughts becoming more common (Cook *et al.* 2004, pp. 1015–1018; Ford *et al.* 2011, p. 2065; IPCC 2014, pp. 58–83). Estimates of the effects of climate change using available climate models typically lack the geographic precision needed to predict the magnitude of effects at a scale small enough to discretely apply to the range of a given species. However, data on recent trends and predicted changes for Kentucky (Girvetz *et al.* 2009, pp. 1–19), and, more specifically, the upper Kentucky River drainage (Alder and Hostetler 2013, entire), provide some insight for evaluating the potential threat of climate change to the Kentucky arrow darter. These models provide estimates of average annual increases in maximum and minimum temperature, precipitation, snowfall, and other variables.

There is uncertainty about the specific effects of climate change (and their magnitude) on the Kentucky arrow darter; however, climate change is almost certain to affect aquatic habitats in the upper Kentucky River drainage of Kentucky through

increased water temperatures and more frequent droughts (Alder and Hostetler 2013, entire), and species with limited ranges, fragmented distributions, and small population size are thought to be especially vulnerable to the effects of climate change (Byers and Norris 2011, p. 18). Thus, we consider climate change to be a threat to the Kentucky arrow darter.

In summary, we have determined that other natural and manmade factors, such as geographical isolation, small population size, and climate change, are threats to remaining populations of the Kentucky arrow darter across its range. The severity of these threats is high because of the species' reduced range and population size, which result in a reduced ability to adapt to environmental change. Further, our review of the best available scientific and commercial information indicates that these threats are likely to continue or increase in the future.

Determination

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Kentucky arrow darter. As described in detail above, the Kentucky arrow darter has been extirpated from about 49 percent of its historical range (36 of 74 historical streams), 16 of these extirpations have occurred since the mid-1990s, populations in nearly half of the species' occupied streams are ranked as vulnerable (see table 1, above), and remaining populations are fragmented and isolated. Despite existing regulatory mechanisms (Factor D) and conservation efforts, the species continues to be at risk throughout all of its range due to the immediacy, severity, and scope of threats from habitat degradation and range curtailment

(Factor A and other natural or manmade factors affecting its continued existence (Factor E).

Anthropogenic activities such as surface coal mining, logging, oil/gas development, land development, agriculture, and inadequate sewage treatment have all contributed to the degradation of stream habitats within the species' range (Factor A). These land use activities have led to chemical and physical changes to stream habitats that continue to affect the species. Specific stressors include inputs of dissolved solids and elevation of instream conductivity, sedimentation/siltation of stream substrates, turbidity, and inputs of nutrients and organic enrichment. These high-magnitude stressors, especially the inputs of dissolved solids and sedimentation, have had profound negative effects on Kentucky arrow darter populations and have been the primary factor in the species' decline. Existing regulatory mechanisms (e.g., the Clean Water Act) have provided for some improvements in water quality and habitat conditions across the species' range; however, recent extirpations have occurred (16 streams since the 1990s), and 21 streams within the species' historical range have been added to Kentucky's 303(d) list of impaired streams. The Kentucky arrow darter's vulnerability to these threats is even greater due to its reduced range, fragmented populations, and small or declining population sizes (Factor E) (Primack 2012, pp. 146–150). The effects of certain threats, particularly habitat degradation and loss, increase in magnitude when population size is small (Primack 2012, pp. 150–152).

The Act defines an endangered species as any species that is "in danger of extinction throughout all or a significant portion of its range" and a threatened species as any species "that is likely to become endangered throughout all or a significant portion of

its range within the foreseeable future." We find that the Kentucky arrow darter meets the definition of a threatened species based on the immediacy, severity, and scope of the threats identified above. The species' overall range has been reduced substantially, most of the species' historical habitat has been degraded, and much of the remaining habitat exists primarily in fragmented patches. Despite existing regulatory mechanisms and conservation efforts, current Kentucky arrow darter habitats continue to be lost or degraded due to surface coal mining, logging, oil/gas development, land development, agriculture, and inadequate sewage treatment, and it appears this trend will continue in the future. Extant populations are known from 47 streams, but these populations continue to be threatened by small population size, isolation, fragmentation, climate change, and the habitat degradation summarized above. All of these factors make the species particularly susceptible to extinction in the future.

We find that endangered status is not appropriate for the Kentucky arrow darter because we do not consider the species' threats to be so severe that extinction is imminent. Although threats to the species are ongoing, often severe, and occurring across the range, populations continue to occupy 47 scattered streams, 23 of which appear to support stable populations (see table 1, above). Additionally, a significant number of extant Kentucky arrow darter populations (49 percent) occur primarily on public lands (i.e., DBNF and Robinson Forest) that are at least partially managed to protect habitats used by the species. For example, the CCA with the U.S. Forest Service (USFS) for DBNF should provide an elevated level of focused management and conservation for portions of 20 streams that support populations of the Kentucky arrow darter. Based on all these factors, the Kentucky arrow darter does not meet the definition

of an endangered species. Therefore, on the basis of the best available scientific and commercial information, we are listing the Kentucky arrow darter as a threatened species in accordance with sections 3(19) and 4(a)(1) of the Act.

Under the Act and our implementing regulations, a species may warrant listing if it is an endangered or threatened species throughout all or a significant portion of its range. Because we have determined that the Kentucky arrow darter is a threatened species throughout all of its range, no portion of its range can be "significant" for purposes of the definitions of "endangered species" and "threatened species." See the Final Policy on Interpretation of the Phrase "Significant Portion of Its Range" in the Endangered Species Act's Definitions of "Endangered Species" and "Threatened Species" (79 FR 37577, July 1, 2014).

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such

conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act calls for the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. The plan may be revised to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for reclassification from endangered to threatened or for delisting and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (*http://www.fws.gov/endangered*), or from our Kentucky Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

Following publication of this final rule, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, pursuant to section 6 of the Act, the State of Kentucky would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Kentucky arrow darter. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Please let us know if you are interested in participating in recovery efforts for the Kentucky arrow darter. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section

7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require consultation as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the USFS; issuance of section 404 Clean Water Act permits by the U.S. Army Corps of Engineers; construction and maintenance of gas pipeline and power line rights-of-way by the Federal Energy Regulatory Commission; USEPA pesticide registration; construction and maintenance of roads or highways by the Federal Highway Administration; and projects funded through Federal loan programs, which may include, but are not limited to, roads and bridges, utilities, recreation sites, and other forms of development.

The Service, in cooperation with KDFWR, KSNPC, the U.S. Geological Survey (USGS), KDOW, DBNF, CFI, and The Appalachian Wildlife Foundation, Inc., completed a conservation strategy for the Kentucky arrow darter in 2014 (Service 2014, entire). The strategy was developed as a guidance document that would assist the Service and its partners in their conservation efforts for the species. The strategy is divided into four major sections: (1) biology and status, (2) listing factors/current threats, (3) current conservation efforts, and (4) conservation objectives/actions. The strategy's first conservation objective addresses current informational needs on the species' biology,

ecology, viability, and survey methods, while the remaining three conservation objectives address specific threats facing the species (Factors A and E, respectively).

Several conservation efforts have been completed or are ongoing for the Kentucky arrow darter, and some of these efforts have been described previously in this listing determination. Previously mentioned efforts include the development of a CCA with the USFS (see *Public Comments*, Comment 20), a propagation and reintroduction study by KDFWR and CFI (see *Background–Habitat and Life History*), field investigations to determine the predatory risk posed by nonnative trout (see *Factor C: Disease or Predation*), and a movement and ecological study by EKU, KDFWR, and the Service (Baxter 2015, entire). Other important conservation actions include studies on the species' distribution, status, and population size; movement and microhabitat characteristics; genetics; and response to changes in water quality (e.g., conductivity). Details of these efforts are provided below.

In 2013, KSNPC and the Service initiated a study to investigate the distribution, status, population size, and habitat use of the Kentucky arrow darter within the upper Kentucky River basin. One important aspect of the study was to account for imperfect detection when surveying for the species. Studies that do not account for imperfect detection can often lead to an underestimation of the true proportion of sites occupied by a species and can bias assessments and sampling efforts (MacKenzie *et al.* 2002, entire; MacKenzie *et al.* 2005, entire). From June to September 2013, KSNPC and the Service visited 80 randomly chosen sites (ranging from first- to third-order) across the upper Kentucky River basin in order to address these concerns and meet project objectives. As expected, Kentucky arrow darters were rare during the study and were observed at only 7

of the 80 sites, including two new localities (Granny Dismal Creek in Owsley County and Spring Fork Quicksand Creek in Breathitt County) and one historical stream (Hunting Creek, Breathitt County) where the species was not observed during status surveys by Thomas (2008, pp. 1–33) and the Service (2012, pp. 1–4). Presently, KSNPC and the Service are in the data analysis stage of this project.

In July 2013, EKU, the Service, and KSNPC initiated a population estimate and microhabitat characterization study on Clemons Fork, Breathitt County. The study was designed to estimate the Kentucky arrow darter's current population size and average density within Clemons Fork and to compare current densities with historical densities reported by Lotrich (1973). Additionally, population densities and habitat parameters will be compared to data from Gilberts Big Creek and Elisha Creek (both DBNF) to aid in delineation of essential habitat characteristics and development and implementation of conservation efforts. Field surveys were completed in August 2013. Data analyses are incomplete, but initial results include a mean density of 9.69 Kentucky arrow darters per sampling reach and a population estimate of 986 to 2,113 darters in Clemons Fork (95 percent confidence intervals). Preliminary findings of this study were presented at the 2013 Southeastern Fishes Council Meeting, Lake Guntersville, Alabama (November 14–15, 2013).

Austin Peay State University is currently working with KDFWR and the Service on the first comprehensive assessment of genetic variation and gene flow patterns across the range of the Kentucky arrow darter (Johansen *et al.* 2013, pp. 1–3). Approximately 25 individuals per population from up to 12 populations across the range of the species will be genotyped using microsatellite markers. Resulting data will be used to generate

robust estimates of effective population sizes and overall population and species' variability. This information is essential to the development of effective conservation and recovery measures to ensure the long-term persistence of the species. Funding for this project is being provided through the Service's section 6 program.

Through Service-USGS Quick Response funding, the USGS Leetown Science Center evaluated the relationship between Kentucky arrow darter abundance and stream conductivity in the upper Kentucky River basin (Hitt 2014, entire). Nonlinear regression techniques were used to evaluate significant thresholds and associated confidence intervals for Kentucky arrow darter abundance related to conductivity levels. As a contrast to Kentucky arrow darter, Dr. Hitt also evaluated blackside dace occurrence in this regard. Data for the study were supplied by the Service's Kentucky and Tennessee field offices, KDFWR, and KSNPC. Nonlinear regressions indicated a distinct decline in Kentucky arrow darter abundance at 258 µS/cm (95 percent confidence intervals 155–590 µS/cm), above which abundances were negligible. Nonlinear threshold declines for blackside dace were observed at 343 µS/cm, and 95 percent confidence intervals bounded this relationship between 123–632 µS/cm. Boosted regression results indicated that stream conductivity was the strongest predictor in separate analyses of Kentucky arrow darter and blackside dace abundance. Hitt (2014, pp. 7–8) concluded that the similar responses of these ecologically distinct taxa suggest the general importance of this water quality attribute for stream fish ecology in central Appalachia.

4(d) Rule

Under section 4(d) of the Act, the Service has discretion to issue regulations that we find necessary and advisable to provide for the conservation of threatened wildlife. We may also prohibit by regulation, with respect to threatened wildlife, any act that is prohibited by section 9(a)(1) of the Act for endangered wildlife. Exercising this discretion, the Service has developed general prohibitions that are appropriate for most threatened species at 50 CFR 17.31 and exceptions to those prohibitions at 50 CFR 17.32. While most of the prohibitions of §§ 17.31 and 17.32 are appropriate for the Kentucky arrow darter, we find that some activities that would normally be prohibited under §§ 17.31 and 17.32 are necessary for the conservation of this species because the species could benefit from habitat improvements in first- to third-order streams that are physically degraded (e.g., unstable stream channels, eroding banks, no canopy cover). Therefore, the Service has determined that a species-specific section 4(d) rule is appropriate to promote the conservation of the Kentucky arrow darter. As discussed in the **Summary of Factors Affecting the Species** section of this rule, the primary threat to the species is the continuing loss and degradation of habitat. Physical habitat degradation is widespread within the species' range, and sediment has been identified as the most common stressor (KDOW 2013a, pp. 189–214; KDOW 2013b, pp. 88–94). Sedimentation may originate from areas outside of the stream channel as a result of land use activities associated with surface coal mining, legacy coal extraction, logging, land development, channel relocations, and riparian clearing. All of these activities can cause sedimentation, but they may also lead to canopy removal, clearing of riparian vegetation, and elevation of stream temperatures, thereby degrading habitats used by Kentucky arrow darters for feeding, sheltering, and reproduction. Sedimentation may also originate from

areas within the stream channel as a result of channel instability and bank or stream bed erosion. Numerous streams within the species' current range have been identified as impaired (primarily due to siltation) and have been included on Kentucky's 303(d) list of impaired waters (see table 2, above). Activities such as stream reconfiguration/riparian restoration, bridge and culvert replacement or removal, bank stabilization, and stream crossing repair and maintenance that follow the provisions of the species-specific 4(d) rule below will improve or restore physical habitat quality for the Kentucky arrow darter and will provide an overall conservation benefit to the species.

The 4(d) rule will not remove or alter in any way the consultation requirement under section 7 of the Act. However, we expect the 4(d) rule to provide greater certainty to Federal agencies and any third parties (e.g., permit applicants) in the consultation process for activities conducted in accordance with the provisions of the 4(d) rule. The consultation process may be further streamlined through programmatic consultations between Federal agencies and the Service for these activities.

Provisions of the 4(d) Rule

This 4(d) rule exempts from the general prohibitions in 50 CFR 17.32 take that is incidental to the following activities when conducted within habitats currently occupied by the Kentucky arrow darter. All of the activities listed below must be conducted in a manner that (1) maintains connectivity of suitable Kentucky arrow darter habitats, allowing for dispersal between streams; (2) minimizes instream disturbance by conducting activities during low-flow periods when possible; and (3) maximizes the amount of instream cover that is available for the species:

(1) Channel reconfiguration or restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers (Parola and Biebighauser 2011, pp. 8–13; Parola and Hansen 2011, pp. 2–7; Floyd *et al.* 2013, pp. 129–135). These projects can be accomplished using a variety of methods, but the desired outcome is a natural, sinuous channel with low shear stress (force of water moving against the channel); low bank heights and reconnection to the floodplain; a reconnection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands. First- to third-order, headwater streams reconstructed in this way would offer suitable habitats for the Kentucky arrow darter and contain stable channel features, such as pools, glides, runs, and riffles, which could be used by the species for spawning, rearing, growth, feeding, migration, and other normal behaviors.

(2) Bank stabilization projects that utilize bioengineering methods outlined by the Kentucky Energy and Environment Cabinet and Kentucky Transportation Cabinet (Kentucky Environmental and Public Protection Cabinet and Kentucky Transportation Cabinet 2005, pp. 116–128) to replace pre-existing, bare, eroding stream banks with vegetated, stable stream banks, thereby reducing bank erosion and instream sedimentation and improving habitat conditions for the species. Following these methods, stream banks may be stabilized using live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), live fascines (live branch cuttings, usually willows, bound together into long,

cigar-shaped bundles), or brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). These methods would not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures.

(3) Bridge and culvert replacement/removal projects that remove migration barriers (e.g., collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters while maintaining normal stream flows, preventing bed and bank erosion, and improving habitat conditions for the species.

(4) Repair and maintenance of USFS concrete plank stream crossings in the DBNF that allow for safe vehicle passage while maintaining instream habitats, reducing bank and stream bed erosion and instream sedimentation, and improving habitat conditions for the species. These concrete plank crossings have been an effective stream crossing structure in the DBNF and have been used for decades. Over time, the planks can be buried by sediment or undercut during storm events, or simply break down and decay. If these situations occur, the DBNF must make repairs or replace the affected plank.

We believe that these actions and activities, while they may have some minimal level of mortality, harm, or disturbance to the Kentucky arrow darter, are not expected to adversely affect the species' conservation and recovery efforts. In fact, we believe that they would have a net beneficial effect on the species. Across the species' range, instream habitats have been degraded physically by sedimentation and by direct channel disturbance. The activities identified in this rule will correct some of these problems, creating more favorable habitat conditions for the species.

Based on the rationale above, the provisions included in this 4(d) rule are necessary and advisable to provide for the conservation of the Kentucky arrow darter. Nothing in this 4(d) rule would change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the Kentucky arrow darter.

We may issue permits to carry out otherwise prohibited activities involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32. With regard to threatened wildlife, a permit may be issued for scientific purposes, to enhance the propagation or survival of the species, economic hardship, zoological exhibition, educational purposes, and for incidental take in connection with otherwise lawful activities. There are also certain statutory exemptions from the prohibited activities, which are found in sections 9 and 10 of the Act.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act (for this species, those section 9 prohibitions adopted through the 4(d) rule). The intent of this policy is to increase public awareness of the effect of a final listing on proposed and ongoing activities within the range of a listed species. Based on the best available information, the following actions are unlikely to result in a violation of section 9, if these activities are carried out in accordance with existing regulations and permit requirements, although this list is not comprehensive:

(1) Normal agricultural and silvicultural practices, including herbicide and pesticide use, which are carried out in accordance with any existing regulations, permit and label requirements, and best management practices; and

(2) Surface coal mining and reclamation activities conducted in accordance with the 1996 BO between the Service and OSM.

However, we believe the following activities may potentially result in a violation of section 9 of the Act, although this list is not comprehensive:

(1) Unauthorized collecting or handling of the species.

(2) Destruction or alteration of the habitat of the Kentucky arrow darter (e.g., unpermitted instream dredging, impoundment, water diversion or withdrawal, channelization, discharge of fill material) that impairs essential behaviors such as breeding, feeding, or sheltering, or results in killing or injuring a Kentucky arrow darter.

(3) Discharges or dumping of toxic chemicals, contaminants, or other pollutants into waters supporting the Kentucky arrow darter that kills or injures individuals, or otherwise impairs essential life-sustaining behaviors such as breeding, feeding, or sheltering.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Kentucky Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Required Determinations

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act, need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination With Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. No tribal lands or other interests are affected by the rule.

References Cited

A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* in Docket No. FWS–R4–ES–2015–0132 and upon request

from the Kentucky Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this final rule are the staff members of the Kentucky Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. Amend § 17.11(h) by adding an entry for "Darter, Kentucky arrow" to the List of Endangered and Threatened Wildlife in alphabetical order under FISHES to read as set forth below:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common Name	Scientific Name	Where Listed	Status	Listing Citations and Applicable Rules
* * * * * * *				
FISHES				
* * * * * * *				
Darter, Kentucky arrow	*Etheostoma spilotum*	Wherever found	T	81 FR [Insert **Federal Register** page where the document begins]; [Insert date of publication in the **Federal Register**], 50 CFR 17.44(p)[4d], 50 CFR 17.95(e)[CH].
* * * * * * *				

3. Amend § 17.44 by adding paragraph (p) to read as follows:

§ 17.44 Special rules—fishes.

* * * * *

(p) Kentucky arrow darter (*Etheostoma spilotum*).

(1) *Prohibitions*. Except as noted in paragraph (p)(2) of this section, all prohibitions and provisions of 50 CFR 17.31 and 17.32 apply to the Kentucky arrow darter.

(2) *Exceptions from prohibitions*.

(i) All of the activities listed in paragraph (p)(2)(ii) of this section must be conducted in a manner that:

(A) Maintains connectivity of suitable Kentucky arrow darter habitats, allowing for dispersal between streams;

(B) Minimizes instream disturbance by occurring during low-flow periods when possible; and

(C) Maximizes the amount of instream cover that is available for the species.

(ii) Incidental take of the Kentucky arrow darter will not be considered a violation of section 9 of the Act if the take results from any of the following when conducted within habitats currently occupied by the Kentucky arrow darter:

(A) Channel reconfiguration or restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers. These projects can be accomplished using a variety of methods, but the desired outcome is a natural, sinuous channel with low shear stress (force of water moving against the channel); low bank heights and reconnection to the floodplain; a reconnection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands. First- to third-order headwater streams reconstructed in this way would offer suitable habitats for the Kentucky arrow darter and contain stable channel features, such as pools, glides, runs, and riffles, which could be used by the species for spawning, rearing, growth, feeding, migration, and other normal behaviors.

(B) Bank stabilization projects that use State-approved bioengineering methods (specified by the Kentucky Energy and Environment Cabinet and the Kentucky Transportation Cabinet) to replace preexisting, bare, eroding stream banks with vegetated, stable stream banks, thereby reducing bank erosion and instream sedimentation and improving habitat conditions for the species. Following these methods, stream banks may be stabilized using live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), live fascines (live branch cuttings, usually willows, bound together into long,

cigar-shaped bundles), or brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). These methods would not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures.

(C) Bridge and culvert replacement/removal projects that remove migration barriers (e.g., collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters while maintaining normal stream flows, preventing bed and bank erosion, and improving habitat conditions for the species.

(D) Repair and maintenance of U.S. Forest Service concrete plank stream crossings on the Daniel Boone National Forest (DBNF) that allow for safe vehicle passage while maintaining instream habitats, reducing bank and stream bed erosion and instream sedimentation, and improving habitat conditions for the species. These concrete plank crossings have been an effective stream crossing structure on the DBNF and have been used for decades. Over time, the planks can be buried by sediment, undercut during storm events, or simply break down and decay. If these situations occur, the DBNF must make repairs or replace the affected plank.

* * * * *

Dated**:** September 19, 2016

Stephen Guertin

Acting Director, U.S. Fish and Wildlife Service

Billing Code 4333–15

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