employees. Thus, under this size standard, the majority of firms can be considered small.

Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

14. There are no projected reporting, recordkeeping or other compliance requirements.

Steps Taken To Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

15. The RFA requires an agency to describe the steps it has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.

16. We believe the changes adopted in the *R&O* will promote flexibility and more efficient use of the spectrum, and allow licensees to better meet their communication needs. In this *R&O,* we will allow the certification, licensing, and use of foreign object debris detection radar in the 78–81 GHz band.

17. The Commission will send a copy of the *R&O* in WT Docket No. 11–202 including the Final Regulatory Flexibility Analysis, in a report to be sent to Congress pursuant to the Congressional Review Act. In addition, the Commission will send a copy of the *R&O,* including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the SBA. A copy of the *R&O* and the Final Regulatory Flexibility Analysis (or summaries thereof) will also be published in the **Federal Register**.

List of Subjects in 47 CFR parts 87 and 90

Communications equipment; Radio.

Federal Communications Commission.

Sheryl D. Todd,

Deputy Secretary.

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 87 and 90 as follows:

PART 87— AVIATION SERVICES

■ 1. The authority citation for part 87 continues to read as follows:

Authority: 47 U.S.C. 154, 303 and 307(e), unless otherwise noted.

■ 2. Section 87.5 is amended by adding a definition ''Air operations area'' in alphabetical order to read as follows:

§ 87.5 Definitions.

* * * * *

Air operations area. All airport areas where aircraft can operate, either under their own power or while in tow. The airport operations area includes runways, taxiways, apron areas, and all unpaved surfaces within the airport's perimeter fence. An apron area is a surface in the air operations area where aircraft park and are serviced (refueled, loaded with cargo, and/or boarded by passengers).

* * * * *

PART 90—PRIVATE LAND MOBILE RADIO SERVICES

■ 3. The authority citation for part 90 continues to read as follows:

Authority: Sections 4(i), 11, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 303(g), 303(r), 332(c)(7), and Title VI of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112–96, 126 Stat. 156.

■ 4. Section 90.103(b) is amended by adding a new entry at the end of the table in paragraph (b), and by adding paragraph (c)(30) to read as follows:

§ 90.103 Radiolocation Service.

* * * * *

(b) * * *

RADIOLOCATION SERVICE FREQUENCY TABLE

Frequency or band	Class of stations	Limitations
* *	*	* *
78,000–81,000	.....do	30

(c) * * *

(30) Use is limited to foreign object debris detection in airport air operations areas (see section 87.5 of this chapter). The radar must be mounted and utilized so when in use it does not, within the main beamwidth of the antenna (azimuth or elevation), illuminate a public roadway near the airport.

* * * * *

[FR Doc. 2013–18013 Filed 7–25–13; 8:45 am]

BILLING CODE 6712–01–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R5–ES–2012–0045; 4500030113]

RIN 1018–AY12

Endangered and Threatened Wildlife and Plants; Endangered Species Status for Diamond Darter

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for diamond darter (*Crystallaria cincotta*), a fish species from Kentucky, Indiana, Ohio, Tennessee, and West Virginia. The effect of this regulation will be to add this species to the Lists of Endangered and Threatened Wildlife.

DATES: This rule becomes effective August 26, 2013.

ADDRESSES: This final rule is available on the Internet at *http://www.regulations.gov* and at the West Virginia Field Office. Comments and materials we received, as well as supporting documentation used in preparing this rule, are available for public inspection at *http://www.regulations.gov.* All of the comments, materials, and documentation that we considered in this rulemaking are available, by appointment, during normal business hours at: U.S. Fish and Wildlife Service, West Virginia Field Office, 694 Beverly Pike, Elkins, WV 26241, by telephone (304) 636–6586 or by facsimile (304) 636–7824.

FOR FURTHER INFORMATION CONTACT: John Schmidt, Acting Field Supervisor, West Virginia Fish and Wildlife Office (see **ADDRESSES** section). If you use a telecommunications device for the deaf (TDD), 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), a species may warrant protection through listing if it is endangered 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. We will also be finalizing a designation of critical habitat for the diamond darter under the Act in the near future.

This rule will finalize the listing of the diamond darter (*Crystallaria cincotta*) as an endangered species.

The basis for our action. Under the Act, we can 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 regulations; or (E) Other natural or manmade factors affecting its continued existence. The Act also requires that we designate critical habitat concurrently with listing determinations, if designation is prudent and determinable. We have determined that the diamond darter is endangered by water quality degradation; habitat loss; a small population size that makes the species vulnerable to the effects of the spread of invasive species; loss of genetic fitness; and catastrophic events, such as toxic spills.

Peer review and public comment. We sought comments from independent specialists to ensure that our designation 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 periods.

Previous Federal Actions

Please refer to the proposed listing rule for the diamond darter (77 FR 43906, July 26, 2012) for a detailed description of previous Federal actions concerning this species.

We will also finalize a designation of critical habitat for the diamond darter under the Act in the near future.

Background

Please refer to the proposed listing rule for the diamond darter (77 FR 43906, July 26, 2012) for a complete summary of the species' information.

Summary of Biological Status and Threats

The diamond darter, a fish species in the perch family, inhabits medium to large, warmwater streams with moderate current and clean sand and gravel substrates (Simon and Wallus 2006, p. 52). In the Elk River of West Virginia, the diamond darter has been collected from riffles and pools where swift currents result in clean-swept, predominately sand and gravel substrates that lack silty depositions (Osier 2005, p. 11).

Historical records of the species indicate that the diamond darter was distributed throughout the Ohio River Basin and that the range included the Muskingum River in Ohio; the Ohio River in Ohio, Kentucky, and Indiana; the Green River in Kentucky; and the Cumberland River Drainage in Kentucky and Tennessee. The species is currently known to exist only within the lower Elk River in Kanawha and Clay Counties, West Virginia, where it was rediscovered in 1980 (Cincotta and Hoeft 1987, p. 133), and is considered extirpated from the remainder of the Ohio River Basin (Cicerello 2003, p. 3; Welsh and Wood 2008, pp. 62, 68). The species has not been collected since 1899 in Ohio, 1929 in Kentucky, and 1939 in Tennessee (Grandmaison *et al.* 2003, p. 6).

Despite extensive surveys using multiple gear types, including many specifically targeting the diamond darter, no diamond darters have been found anywhere besides the Elk River, West Virginia, in more than 70 years. The diamond darter has been extirpated from most of its historical range, and is currently known to occur only within a single reach of the Elk River in West Virginia. Extirpation from these historical habitats likely resulted from a progression of habitat degradation and subsequent reductions in fish populations; this started with a significant increase in siltation due to land use changes beginning in the mid 1800s and continuing into the early 1900s, followed by water quality degradation associated with increases in sewage, industrial discharges, and mining effluents entering the water, and then finally the impoundment of rivers that inundated riffle habitat and further increased the amount of siltation (Preston and White 1978, pp. 2–4; Trautman 1981, pp. 21–29; Pearson and Pearson 1989, pp. 181–184). The combination of these factors, culminating in the impoundment of rivers, likely led to population reductions and then eventual extirpations of the diamond darter from historical habitats.

A number of factors have likely allowed the Elk River to continue to support this species. The Elk River watershed is dominated by steep, relatively inaccessible terrain. As a result, the area was not easy to settle or develop, and large-scale land use changes, industrial development, and human population increases, along with the resultant siltation and reductions in water quality, did not begin in this area until much later and were much less pervasive than in many other portions of the species' range (Northern and Southern West Virginia Railroad Company 1873, pp. 9–32; Brooks 1910, p. 1; West Virginia Agricultural Experiment Station 1937, p. 1; Trautman 1981, pp. 13–35; Strager 2008, p. 9). In addition, the Elk River is located adjacent to the main Appalachian Plateau, with steep valleys and underlying porous soils. This allows for the absorption of a considerable portion of rainfall, which tends to retard runoff and maintain the flow of larger streams in the watershed even in periods of low rainfall (Baloch *et al.* 1970, p. 3). Finally, the Elk River is still free flowing and largely unimpounded for much of its length. These factors likely reduced the duration and severity of historical water quality degradation and siltation experienced in this watershed compared to other portions of the species' range. Other species, such as the Western sand darter, show a similar pattern to the diamond darter of extirpation in other Ohio River watersheds, while retaining populations within the Elk River (Cincotta and Welsh 2010, pp. 318–325).

Very little information is available on the reproductive biology and early life history of the diamond darter (Welsh *et al.* 2008, p. 1; Ruble and Welsh 2010, p. 1), but spawning likely occurs mid-April to May, and larvae hatch within 7 to 9 days afterward (Ruble *et al.* 2010, pp. 11–12). If the diamond darter's reproductive behavior is similar to crystal darters in the wild, then females may be capable of multiple spawning events and producing multiple clutches of eggs in one season (George *et al.* 1996, p. 75). Crystal darters lay their eggs in side channel riffle habitats over sand and gravel substrates in moderate current. Adult crystal darters do not guard their eggs (Simon and Wallus 2006, p. 56). Embryos develop in the clean interstitial spaces of the coarse substrate (Simon and Wallus 2006, p. 56).

After hatching, the larvae are pelagic and drift within the water column (Osier 2005, p. 12; Simon and Wallus 2006, p. 56; NatureServe 2008, p. 1). The larva may drift downstream until they reach slower water conditions such as pools, backwaters, or eddies (Lindquist and Page 1984, p. 27). Darter larva may be poorly developed skeletally and unable to hold position or swim upstream where stronger currents exist (Lindquist and Page 1984, p. 27). It is not known how long diamond darters or crystal darters remain in this pelagic phase, but the pelagic phase of other darters adapted to larger rivers lasts for 15 to 30 days (Rakes 2013, p.

1). The duration of time that larvae drift in the current (the drift interval) differs between species based on the size of the stream the larvae use and the food that the larvae eat (Lindquist and Page 1984, pp. 27–28). Species with smaller drift intervals may have reduced genetic exchange as less mixing may occur between stocks in upstream and downstream populations, and, therefore, they may be more susceptible to genetic isolation (Lindquist and Page 1984, pp. 28–29). Downstream movement of young during larval drift must be offset by upstream migration of juveniles and adults, so species with longer drift intervals likely undertake more extensive spawning migrations than those without (Lindquist and Page 1984, p. 27). The life expectancy and age of first reproduction of diamond darters is unknown in the wild, but has been reported to range from two to four years, although some authors have suggested the potential to live up to seven years (Osier 2005, Simon and Wallus 2006). Individual diamond darters have been maintained in captivity for 2 years.

Although there are currently insufficient data available to develop an overall population estimate for the species, the results of numerous survey efforts confirm that the species is extremely rare. Fish surveys have been conducted in the Elk River in 1936, 1971, 1973, 1978 to 1983, 1986, 1991, 1993, 1995, 1996, and every year since 1999 (Welsh *et al.* 2004, pp. 17–18; Welsh 2008, p. 2; Welsh 2009a, p. 1). Survey methods included backpack and boat electrofishing, underwater observation, kick seines, bag seines, benthic trawls, and spotlights (Welsh *et al.* 2004, p. 4; Welsh *et al.* 2012, 1–18). Starting in early 1990s, the timing of sampling and specific methods used were targeted towards those shown to be effective at capturing *Crystallaria* and similar darter species during previous efforts (Welsh *et al.* 2004, pp. 4–5; Hatch 1997, Shepard *et al.* 1999, and Katula 2000 in Welsh *et al.* 2004, p. 9; Ruble 2011a, p. 1). Despite extensive and targeted survey efforts within the species' known range and preferred habitat in the Elk River, fewer than 125 individuals have been collected in the more than 30 years since the species was first collected in the Elk River (SEFC 2008 p. 10; Cincotta 2009a, p. 1; Cincotta 2009b, p. 1; Welsh 2009b, p. 1, Ruble and Welsh 2010, p. 2). Over 80 percent of these collections occurred in the past 5 years. The increased capture rates in recent years are most likely a direct result of more focused conservation efforts, including recent research on the species' habitat requirements, coupled with the availability of habitat maps for the entire Elk River, which has allowed survey efforts to concentrate on specific areas of the Elk River where diamond darters are most likely to be found. Also, the development and use of new survey techniques that have a higher detection rate for diamond darters have resulted in more comprehensive surveys (Ruble 2011a, p. 1; West Virginia Division of Natural Resources (WVDNR) 2012, p. 83; Welsh *et al.* 2012, pp. 8–10).

For example, previous research documented that diamond darters are most likely to be captured in shoals and concentrate in these areas to forage. In 2012, additional focused survey efforts were conducted in selected shoals that had previously been mapped, and either had previous diamond darter captures or appeared to be highly suitable habitat for the species based on visual assessments (Ruble 2011a, p. 1; Welsh *et al.* 2012, pp. 8–10). Habitat evaluations were conducted within these shoals to refine the delineation areas that appeared to have the most likely foraging habitat for the species; areas were then sampled using survey techniques that have been most successful at locating diamond darters (Welsh *et al.* 2012, pp. 1–18). Surveys were conducted during low water conditions and during the time of night when diamond darters were expected to be active and foraging, so that most diamond darters present should be visible. Transects were spaced across the surveyed areas so that the entire delineated habitat area was sampled (Welsh *et al.* 2012, p. 9). Ten of the 28 shoals within the range of the species were sampled. The number of diamond darters located at each shoal ranged from 0 to 20. A total of 82 diamond darters were documented. Four additional shoals located upstream of King Shoals, outside the currently known range of the diamond darter, were also sampled. No diamond darters were located in these upstream areas (Welsh *et al.* p. 10). These recent numbers provide a sense of the potential distribution and total abundance of the species present in the Elk River in 1 year.

Summary of Comments and Recommendations

In the proposed rule to list the diamond darter as endangered and designate critical habitat that published on July 26, 2012 (77 FR 43906), we requested that all interested parties submit written comments by September 25, 2012. 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 Charleston Gazette and the Courier Journal, which in combination cover all affected counties in West Virginia and Kentucky. We did not receive any requests for a public hearing. The second comment period opened on March 29, 2013, and closed on April 29, 2013 (78 FR 19172), and requested comments on the proposed rule and a draft economic analysis (DEA) prepared in support of the proposed critical habitat designation.

During the first comment period, we received 14 comment letters, 1 of which was a duplicate, from 13 individuals or entities directly addressing the proposed listing of the diamond darter as endangered. During the second comment period, we received 10 additional comment letters, 1 of which bulk-submitted approximately 4,840 form letters, from 9 individuals or entities. General, nonsubstantive comments of an editorial nature were incorporated in the final rule as appropriate. Substantive comments regarding the proposed listing are summarized and addressed below. Comments addressing the proposed designation of critical habitat and the associated DEA, rather than the proposed listing, are discussed and addressed under a separate rulemaking finalizing a designation of critical habitat for the diamond darter under the Act, that we intend to publish in the near future.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from five knowledgeable individuals with scientific expertise on the diamond darter and its habitat, biological needs, and threats. We received individual responses from three of the peer reviewers. One peer reviewer's response was incorporated into comments submitted by his employer, the WVDNR. Those comments are addressed under *Comments from States.*

We reviewed all comments received from the peer reviewers for substantive issues and new information regarding the listing of the diamond darter. The peer reviewers all generally concurred with our conclusions and provided supporting information on the taxonomy, distribution, and threats described in the proposed rule. Two peer reviewers explicitly concurred that threats to the only remaining population of the diamond darter in the Elk River, West Virginia, were accurately described, and that scientific evidence supported listing the species as endangered. One peer reviewer also commented about the similarities between the diamond darter and the only other species in the genus, the crystal darter, and described how that species has also been extirpated from much of its historic range. Minor edits as a result of these peer reviewer comments were incorporated into the final rule as appropriate. We received one additional substantive comment as described below.

(1) *Comment:* The extent of potential larval drift should be considered when describing potential diamond darter distribution. Additional research is needed to determine how far larval drift occurs and what larvae are eating in the wild.

Our Response: We concur that it is important to consider requirements of larval life stages and the potential for larval drift. We have added information to the life history section about potential larval movements. We also concur that additional species-specific research on this topic is needed so we can more accurately describe the life history of this species. However, the Act requires that the Secretary shall make determinations solely on the basis of the best available scientific and commercial data available. Because further information about the diamond darter's larval stage is not available and the current data supports our endangered status determination for the species, we have determined that larval drift information is not required to finalize the listing of the diamond darter.

Federal Agency Comments

The only Federal agency comments we received were from the Natural Resources Conservation Service (NRCS). The NRCS submitted comment letters during each of the two comment periods.

(2) *Comment:* The NRCS acknowledged its responsibility under section 7(a)(1) of the Act to conserve listed species and its numerous programs that focus on aquatic restoration that could benefit the diamond darter. The agency indicated a willingness to work with us to concentrate implementation of its programs in the areas that support the diamond darter. The agency also indicated that it has already incorporated programmatic measures to ensure many of its activities avoid adverse effects to the diamond darter and include implementation of species-specific conservation measures. The agency recommended that the Service work with the NRCS to update these programmatic agreements and develop mutually acceptable avoidance measures and beneficial practices for the diamond darter. The programmatic approach will reduce regulatory burdens on landowners who are working with the NRCS and will expedite conservation of the species.

Our Response: The Service concurs that the NRCS has acted proactively to protect the diamond darter and other sensitive aquatic species and that the NRCS has many programs that can benefit this species. We appreciate its support and recognize that partnerships are essential for the conservation of the diamond darter and other federally listed or imperiled species. We fully support developing and updating programmatic approaches to recover this species and look forward to continued work with the NRCS.

Comments From States

Section 4(i) of the Act states, ''the Secretary shall submit to the State agency a written justification for his failure to adopt regulations consistent with the agency's comments or petition.'' We received comments from two State agencies, the WVDNR and the West Virginia Department of Environmental Protection (WVDEP). Comments received from the State agencies are summarized below, followed by our responses to their additional substantive comments.

The WVDNR concurred with the proposed designation and stated that the Service has ''conclusively substantiated that the only known population of this species . . . is vulnerable to destruction, modification, or curtailment of its habitat or range, and is without adequate existing regulations to assist its continued survival.'' The agency further stated that the Service has provided an ''overwhelming amount of data'' that the species meets the criteria for endangered status, and that the only known population of this species could be extirpated by a single adverse event or from chronic pollution or sedimentation. The agency provided additional comments supportive of our description of the species' taxonomy, and of our descriptions of habitats used by the species.

The WVDNR agreed with our assessment of the threats to the species' habitat and range as listed under the Summary of Factors Affecting the Species—Factor A, including sedimentation, mining, and oil and gas development. The agency stated that the documentation provided demonstrates conclusively that the threats described may either independently or cumulatively impact the existence of the diamond darter in the Elk River. The agency particularly noted the threats associated with sedimentation, and described it as one of the most underrated impacts to aquatic environments in the State. The agency suggested that increased inspections and enforcement of regulations at mining, gas, and forestry sites to control sedimentation within the Elk River watershed should occur. The WVDNR concurred that there were no major threats associated with overutilization or disease or predation as described under the Summary of Factors Affecting the Species—Factors B and C, respectively, but expressed a willingness to develop additional protections for this species through the West Virginia scientific collecting or fishing permit process, if this is deemed necessary. In regard to Factor D, the WVDNR concurred that existing regulatory mechanisms are often vague and are not directly applicable to the needs of the diamond darter. Existing laws such as the Clean Water Act, Surface Mining Control and Reclamation Act, and State natural resource laws may indirectly mitigate threats, but protections under the Act may be necessary to provide for the continued maintenance and preservation of the last remaining population. Finally, the WVDNR expressed a willingness to work with us on developing a recovery plan.

The WVDEP concurred that the diamond darter's small remaining population is susceptible to the effects of diminished genetic variability and invasive species such as *Didymosphenia geminate,* but questioned the significance of various threats to the species, as well as our description of embeddedness and sedimentation in relation to the species' habitat requirements. A summary of additional substantive comments received from State agencies and our responses are provided below.

(3) *Comment:* The WVDNR does not concur with Woolman (1892) that the diamond darter was probably always uncommon throughout its range. Rather, based on recent sampling efforts, the WVDNR suggested that the species is evasive to standard collecting methods that were common during Woolman's time period. The agency, therefore, concurs with Trautman (1981) that the species was probably common before 1900 and suggests that diamond darter populations must be of a certain size before their presence can be detected with traditional collecting methods. The agency submits that the diamond darter was first detected in the Elk River in the 1980s because the diamond darter

population had increased in response to water quality improvements resulting from environmental regulations enacted in the late 1970s. The agency provided additional data regarding similar population increases seen in other fish in the Ohio, Monongahela, Kanawha, and Little Kanawha Rivers.

Our Response: We have reexamined the original text from Woolman (1892, pp. 249–288). His statement about the species being ''not widely distributed, nor common anywhere'' appears to refer specifically to the results of his surveys within selected streams in Kentucky, and does not apply to the species' entire range. Woolman does not provide detailed descriptions of the methods used during his collection, but based on references to seines in several places of the document, and the description of the conditions experienced at sampling sites, it appears his collections were made during the day using seines. Based on our review of recent captures and survey techniques used and the biology of the species, we concur that diamond darters are not likely to be frequently captured by the sampling techniques used by Woolman. In addition, Woolman captured multiple diamond darters with relatively little effort (time spent sampling) while conducting surveys using seine nets during the day when the species is likely to be buried in the sand. Woolman's sampling method is in comparison to the level of effort recently required to collect multiple diamond darters using seine nets at night when the species is likely more active and not buried in the sand. This discrepancy in sampling methodology would indicate that diamond darters were likely more abundant and thus more likely to be captured, during the time of Woolman's sampling. It therefore seems reasonable and logical to infer that diamond darters were historically more widespread and abundant than would be indicated by the results of surveys conducted by Woolman and others of his time period who were using methods now known to be not well suited to documenting the species and during times of day when the species is less likely to be active.

It is also reasonable to assume that water quality improvements since the late 1970s may have had a positive effect on diamond darter populations, similar to the effect on populations of other fish species. In addition to the data cited by the WVDNR, surveys on the Ohio River mainstem between 1957 and 2001 documented a general improvement in abundance and diversity of fish populations over that time. Of the 56 species whose population trends could be analyzed, 35 (62 percent) showed an increase (Thomas *et al.* 2004, p. 436). In addition, 11 out of 13 fish species listed as of special concern, threatened, or endangered by one or more of the Ohio River border States showed population increases (Thomas *et al.* 2004, p. 439). These improvements were attributed to improved water quality in the Ohio River mainstem and its tributaries (Pearson and Pearson 1989, p. 186; Thomas *et al.* 2004, pp. 440–442). This may be one factor that allowed the diamond darter to be detected in the Elk River in the late 1980s. Another factor may be that, before the 1950s, the West Virginia fish fauna were poorly sampled due to difficult terrain and limited roads, so few surveys took place historically in the Elk River and other relatively inaccessible West Virginia watersheds, while there are more extensive records from watersheds in other States that were more accessible and, thus, more frequently sampled (Cincotta and Welsh 2010, p. 323).

Therefore, we concur that the diamond darter was likely more abundant and widespread than may be indicated by historical surveys, and also may have responded positively to previous water quality improvements. However, we lack empirical data on which to base historical estimates of population or distribution beyond the actual results of collections as described in the *Species Distribution and Status* section of the proposed listing rule, and we cannot speculate on historical distribution or actual historical abundances of the diamond darter in those areas, including in the Elk River. Current survey methods using multiple gear types, or using methods targeted toward capturing the diamond darter, provide a more accurate indication of the current potential abundance and distribution of the species.

(4) *Comment:* The WVDNR commented that the only record for the Western sand darter in the State is from the same area as the diamond darter, and that the Western sand darter shares a pattern of extirpation within Ohio River drainages similar to that seen in the diamond darter. The Elk River likely functioned as a refugium for these two species because of the fairly large size of the watershed, the free-flowing nature of much of the Elk River, and its position adjacent to the montane, high-gradient flows of the main Appalachian Plateau, all of which kept the habitats sufficiently clean.

Our Response: We concur that these factors allowed the Elk River to serve as a refugium for many aquatic species, including both the diamond darter and the Western sand darter. Of the watersheds that either currently or were historically known to support the species, the Elk River is unique in having this combination of factors, and this combination of factors likely allowed this river to continue to support these species despite historical perturbations. Cincotta and Welsh (2010, pp. 318–325) provide additional documentation of the Western sand darter's similar pattern of historical rangewide distribution and extirpation, as well as subsequent rediscovery in the Elk River in the mid-1980s. We have added a discussion in the final rule about additional factors that may have allowed the Elk River to retain populations of the diamond darter, and referenced similar trends in distribution and abundance seen in the Western sand darter.

(5) *Comment:* The WVDEP suggests that the primary and most direct cause of the diamond darter's decline was from habitat loss and population isolation associated with historical impoundment of streams that the species inhabited, rather than water quality degradation or inadequate regulatory mechanisms. The agency suggested that the diamond darter likely has persisted in the Elk River because it is largely unimpounded, and that the impacts of impoundment are understated in the proposed rule.

Our Response: We concur that impoundment was one of the most direct and dramatic historical causes of diamond darter habitat loss. Impoundment of rivers for navigation may have been the final factor resulting in extirpation of the diamond darter from many of its historical habitats. However, most citations that discuss historical conditions within the previous range of the diamond darter mention a progression of habitat degradation and subsequent reductions in fish populations; this progression started with a significant increase in siltation due to land use changes in the mid-1800s and continued into the early 1900s, followed by water quality degradation associated with increases in sewage, industrial discharges, and mining effluents entering the water, and then, finally, the impoundment of rivers that inundated riffle habitat and further increased the amount of siltation (Preston and White 1978, pp. 2–4; Trautman 1981, pp. 21–29; Pearson and Pearson 1989, pp. 181–184). Consistent with the discussions in these references, we conclude that the combination of these factors, culminating in the impoundment of rivers, likely led to population reductions and then eventual extirpations of the fish species. We have thus retained discussions of siltation and the various sources of water quality degradation as threats to the diamond darter discussed under the Summary of Factors Affecting the Species—Factor A. We have also included a statement about the significance of impoundment in extirpating the species from much of its historical range. See our response to comment #4 for further discussion of factors that may have allowed the species to survive in the Elk River, including the river's relatively free-flowing condition, and our response to comment #3 for discussion of the potential effects of historical water quality degradation and regulatory mechanisms.

(6) *Comment:* The WVDEP commented that the concept of embeddedness described in the proposed rule is inconsistent with the species' habitat requirements. The agency stated that, if the diamond darter occupies habitats with ample sand, some embeddedness of the larger particles in these areas is expected and necessary. If diamond darters are captured on sand, they are likely not being collected from substrates with 'sparse to low embeddedness.' The agency further suggested that the concepts of siltation versus sedimentation be clarified since it would appear that the diamond darter is susceptible to the effects of siltation, which is the accumulation of fines (e.g., particles smaller than sand), while being dependent upon a relative abundance of sand to fulfill life history functions.

Our Response: Embeddedness is generally described as a measure of the degree that cobble, gravel, and boulder substrates are surrounded, impacted in, or covered by fine materials (Shipman 2000, p. 12). As substrates become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased (Barbour *et al.* 1999, pp. 5–13; Sylte and Fischenich 2007, p. 12). Researchers use at least five methods for measuring embeddedness, but sampling methods are not standardized and ''fines'' are not consistently defined (Sylte and Fischenich 2007, p. 12). As noted by WVDEP, many methodologies include sands as ''fines'' that increase embeddedness (Barbour *et al.* 1999, pp. 5–13). However, other methods are more ambiguous. For example, Shipman (2000, p. 12) explains that ''naturally sandy streams are not considered embedded; however, a sand predominated stream that is the result of anthropogenic activities that have buried the natural course substrates is considered embedded.'' These inconsistent definitions may make use of the term embeddedness confusing, particularly for a species such as the diamond darter that requires substrates with a high natural percentage of sands.

We concur with the WVDEP that the diamond darter is susceptible to the effects of siltation, which is the accumulation of fines, or particles smaller than sand, while being dependent upon a relative abundance of natural sand to fulfill certain life-history functions. We have therefore clarified in the final rule that the diamond darter requires substrates that are not embedded with fine silts or clays, and removed references to measures of embeddedness that are not consistently defined.

We have also clarified our use of the terms siltation and sedimentation. We note that many publications use these two terms interchangeably and do not define or differentiate between the terms. For the final rule, we have used the term siltation to specifically refer to the pollution of water by fine particulate terrestrial material, with a particle size dominated by silt or clay. It refers both to the increased concentration of suspended sediments and to the increased accumulation (temporary or permanent) of fine sediments on stream bottoms; whereas, sedimentation refers to the deposition of suspended soil particles of various sizes from large rocks to small particles (Wikipedia 2013a, p. 1; Wikipedia 2013b, p. 1). Sedimentation is used as the opposite of erosion, is often caused by land use changes or disturbances, and is a common source of siltation in a stream (Wikipedia 2013b, p. 1). However, while we have clarified terminology, the best available data illustrate that the diamond darter requires low levels of siltation and substrates with naturally high percentages of sands that are not embedded with silts and clays. Excess sedimentation can degrade diamond darter habitat by both increasing siltation resulting in increased substrate embeddedness and by destabilizing stream channels, banks, and substrates.

(7) *Comment:* The WVDEP commented that the impacts of coal mining activities may not be a leading threat to the species. Less than four percent of the watershed has been subjected to coal mining activities. Coal mining activities that are compliant with the State's water quality standards are less likely to affect the diamond darter than other historical activities such as impoundment. The WVDEP stated it is unlikely that any constituents commonly associated with mining, including conductivity, emanating from permitted, compliant activities will adversely affect the persistence of the diamond darter. The agency suggests that, because the species has persisted through time periods with little or no water quality regulation, when water quality conditions were more polluted than they are now, the species may not be overly sensitive to water quality degradation associated with mining.

Our Response: The Service has identified numerous activities that are cumulatively contributing to the present or threatened destruction, modification, or curtailment of the diamond darter's habitat or range, as described in the Summary of Factors Affecting the Species—Factor A. The Service concurs that current coal mining activities that are fully compliant with all existing State and Federal regulatory requirements, when compared to historical activities such as impoundment and unregulated mining, are certainly less likely to be a threat to the diamond darter and its habitats. However, impacts from historical mining, such as acid mine drainage from abandoned mined lands, continue to be a significant source of water quality degradation in the Elk River watershed (WVDEP 2011b, p. 41). The WVDEP has also identified active mining as one source of selenium, metals, and sedimentation, which are currently impairing biological conditions in Elk River watersheds (WVDEP 2011b, pp. 29, 37, 63). While the overall percentage of the entire Elk River watershed subjected to mining activities may be small, watersheds of some Elk River tributaries, such as Leatherwood Creek, are highly dominated by mining activity and include mining permits encompassing 81 to 100 percent of the subwatersheds (WVDEP 2011b, p. 37). Mining is likely a significant factor affecting the water quality of streams, such as Leatherwood Creek, that are principle tributaries to the Elk River. The effects of these mining activities conducted both within the Elk River mainstem and in Elk River tributaries, coupled with the effects from other activities described in Factor A, are continuing threats to the diamond darter.

As discussed in the proposed rule (77 FR 43906) and below, the diamond darter has already been extirpated from most of its historical range. As described in our response to comment #5, these extirpations were likely a result of the cumulative effects of siltation, water quality degradation, and impoundment. Our response to comment #3 provides more information on how other fish populations in the Ohio River basin have responded to water quality improvements since major environmental regulations were enacted, and how the diamond darter population may have had a similar response. We have no information to suggest that the diamond darter is less sensitive to water quality degradation than these other more common species; rather the diamond darter's pattern of extirpation in other watersheds suggests they may be more sensitive to water quality degradation and cumulative effects.

(8) *Comment:* The WVDEP commented that, although mining-associated water quality impacts have been noted in the Elk River, the WVDNR considers the Elk River a ''high quality stream,'' and WVDEP benthic macroinvertebrate surveys indicate good biological conditions in the stream. Similar comments were received from members of the public including the West Virginia Chamber of Commerce (WVCC) and other industry and trade groups. The commenters all suggested the stream classification and results of macroinvertebrate studies are evidence that threats from mining, forestry, and oil and gas may be overstated, and that existing regulatory mechanisms are adequately protecting the diamond darter.

Our Response: The Elk River's listing as a ''high quality stream'' by the WVDNR does not indicate that there is a lack of threats to the species or water quality degradation in the watershed. As noted in the proposed rule (77 FR 43906) and below, criteria for placement on the high-quality streams list are based solely on the presence of significant fisheries populations and the use of those populations by the public (WVDNR 2001, p. 36). Water quality or threats to the watershed are not included as criteria for determining whether a stream should be added to the list (Brown 2009, p. 1). The WVDEP previously identified some streams listed on both the WVDNR high-quality streams list and the WVDEP impaired waterways list under section 303(d) of the Clean Water Act (CWA). The WVDEP explains that the dual listing indicates both that the streams support game fisheries and that the game fisheries therein may be threatened (WVDEP 2005, p. 31). The Elk River simultaneously occurred on both lists in 2010.

The WVDEP reports detailing the results of the Elk River benthic macroinvertebrate surveys state that larger rivers, as opposed to smaller rivers, offer a wider variety of microhabitats, and, therefore, the high benthic macroinvertebrate scores may mask some degradation in water quality (WVDEP 1997, p. 41). These WVDEP reports also identify coal mining, oil and gas development, erosion and sedimentation, timber harvesting, water quality degradation, and poor wastewater treatment as threats to the Elk River watershed (WVDEP 1997, p. 15; WVDEP 2008b, pp. 1–2; WVDEP 2011b, pp. viii–ix). We conclude that the Elk River's listing as a high-quality stream and high benthic macroinvertebrate scores are insufficient evidence to conclude that there are no significant threats to the watershed.

Public Comments

We received public comments from 12 individuals or organizations. Four individuals provided letters supporting the listing, and one of these individuals provided substantive information corroborating our threats analysis. Three organizations, The Nature Conservancy (TNC), the West Virginia Rivers Coalition (WVRC), and Kentucky Waterways Alliance, also supported the proposed rule and provided substantive comments or additional supporting information corroborating our threats analysis. The Center for Biological Diversity (CBD), on behalf of 16 additional organizations, submitted comments in support of the proposed listing and reiterated information presented in the proposed rule. In addition, approximately 4,840 individuals associated with CBD provided form letters supporting the proposed listing that reiterated the comments provided by CBD. The WVRC, CBD, and associated individuals urged the Service to act quickly to finalize the listing of the species, with the WVRC suggesting that protection is needed now while there still may be a viable breeding population of diamond darters. Four organizations, the WVCC, the West Virginia Oil and Natural Gas Association (WVONGA), the West Virginia Coal Association (WVCA), and the West Virginia Forestry Association (WVFA), did not support the proposed rule and provided additional substantive comments. These four organizations each submitted separate comments during both of the comment periods, and all urged the Service to delay listing of the species until a more thorough record regarding the proposal was developed. A summary of the substantive comments we received regarding the proposed listing and our responses are provided below.

(9) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all commented that listing the diamond darter is not warranted because the proposed rule underestimates the effectiveness of existing regulatory mechanisms. These commenters suggest that coal, oil and gas, and forestry activities are effectively regulated by a comprehensive network of overlapping Federal and State laws such that threats from these industries are not significant. They cite the requirements and protections provided by the Clean Water Act, the West Virginia Pollution Control Act, the West Virginia Oil & Gas Act, the 2011 West Virginia Horizontal Well Act, the West Virginia Abandoned Well Act, the WVDEP Erosion and Sediment Control Manual, and the mandatory use of best management practices (BMPs) for timbering activities. The commenters state that many of these regulations and requirements were specifically designed with protection of water quality and reduction of sedimentation as their primary goals, and the commenters suggest that these regulatory mechanisms have been documented to be effective at reducing sedimentation, pollution, and metals in waterways.

Our Response: We concur that the network of existing regulatory mechanisms cited above has resulted in improvements in water and habitat quality when compared to conditions prior to enactment of these laws (See our response to comment #2). Many of these regulations were designed to protect water quality, reduce the amount of erosion and sedimentation occurring in streams, or both. When these regulations are fully complied with and vigorously enforced, they can be effective at reducing adverse effects from the regulated activities. We have made reference to these additional laws in our discussion of the Summary of Factors Affecting the Species—Factor D, and cited some examples of where compliance with these regulatory mechanisms has been shown to reduce potential threats. However, as discussed in the Summary of Factors Affecting the Species—Factor A, degradation of the diamond darter's habitat is continuing despite these regulatory mechanisms.

In addition, there are a number of threats that are not addressed by any existing regulatory mechanisms. Unregulated threats include geographic isolation, invasive species, accidental spills and catastrophic events, and non-forestry-related activities occurring on private lands that contribute sediments and other non-point-source pollutants to the Elk River watershed. Because the only remaining population of this species is restricted to one small reach of one stream, these unregulated threats alone make listing the diamond darter warranted. The cumulative effects of all the threats listed under the Summary of Factors Affecting the Species—Factors A, B, C, and E, including ongoing habitat degradation, coupled with the effects of other natural and manmade factors affecting the species' continued existence, further justify listing the diamond darter as endangered.

(10) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all commented that the only evidence the proposed rule cites to support the claim that existing regulatory mechanisms are inadequate is the small size of the current diamond darter population. They suggest there is no evidence that a sizable diamond darter population ever existed in the Elk or any other river and that, without evidence of a once-thriving population, the proposed rule's conclusion that existing regulatory mechanisms are to blame for the species' low population is unsupported. They further state that the adverse effects of inbreeding and small population size are not merely an ongoing threat to the diamond darter, but have been affecting the species for many decades. This factor alone could explain why the population has not increased despite relatively high water quality in the mainstem Elk River. They concluded that until genetic robustness of the population is evaluated, the claim that existing regulatory mechanisms are inadequate is unsupported and is arbitrary and capricious.

Our Response: We concur that adverse effects of inbreeding and small population size have likely been affecting the last remaining population of the diamond darter for many years. However, the small size of the diamond darter population is not cited as evidence of the inadequacy of existing regulatory mechanisms as described under the Summary of Factors Affecting the Species—Factor D. Rather, the small size and restricted range are cited as separate and distinct threats to the species under the Summary of Factors Affecting the Species—Factor E (Other Natural or Manmade Factors Affecting Its Continued Existence). The Act requires that the Secretary shall make determinations solely on the basis of the best available scientific and commercial data available. Because further information about the diamond darter's genetic robustness is not available and the current data supports our endangered status determination for the species, we disagree that additional research on the genetic robustness of the population is required prior to finalizing the listing of the diamond darter.

(11) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all commented that the increased capture rates of the diamond darter in the last 5 years compared to when surveys began indicate that the population, while admittedly small, is benefitting from, rather than being failed by, existing regulatory mechanisms. These organizations further assert that WVDNR's comments about the species' historical abundance and susceptibility to sampling methods raises significant questions about our current estimation of the abundance of the diamond darter, as detailed in the proposed rule.

Our Response: The increased capture rates in the last few years are most likely a direct result of the increased survey and research efforts by the Service and our partners. These efforts include (1) recent research on the species' habitat requirements, coupled with the availability of habitat maps for the entire Elk River, that has allowed survey efforts to focus on specific areas of the Elk River where diamond darters are most likely to be concentrated, and (2) the development and use of new species-specific survey techniques over the past three survey seasons that resulted in more comprehensive and effective surveys (Ruble 2011a, p. 1; WVDNR 2012, p. 83; Welsh 2012, pp. 8–10). See our responses to comments #3 and #9 for additional information on the relationship between current and historical survey methods and our estimation of potential population trends, as well as the benefits of existing regulatory mechanisms.

(12) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all commented that there are insufficient data to quantitatively define specific water quality standards required by the diamond darter, and noted that the proposed rule references water quality conditions seen at locations where the ''sister species,'' the crystal darter, is found. Commenters suggest that use of the crystal darter as a surrogate for the diamond darter is not justified because the ranges of these two species do not overlap and the two species are genetically distinct. The commenters suggest that water quality conditions should be observed where the diamond darter population currently exists, and that the crystal darter should not be used to establish water quality parameters.

Our Response: The Service would prefer to have species-specific data to be able to quantitatively describe the water quality conditions that the diamond darter needs to survive and thrive. However, these data are currently not available. In the absence of these data, we have described habitat and water quality conditions from locations where the diamond darter or the closely related crystal darter has been found. Surrogate species have long been used to establish water quality criteria or evaluate risks to a species (U.S. Environmental Protection Agency (USEPA) 1995, pp. 1–16; Dwyer *et al.* 2005, pp. 143–154). Because the crystal darter is in the same genus, shares many similar life-history traits, and was previously considered the same species as the diamond darter, information on this species can reasonably be used to infer factors or conditions that may also be important to the diamond darter. Additional research, while needed to determine whether existing water quality conditions at diamond darter capture sites are adequate to protect all life stages of the species, is not required before the Service can draw conclusions about the species' status based on the best available scientific and commercial data. The final rule does not establish specific numeric water quality parameters that are necessary for the diamond darter.

(13) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all commented that conductivity was cited as a threat to the diamond darter even though an appropriate conductivity range for the diamond darter has not yet been established and scientific studies have not conclusively shown that elevated conductivity causes harm to fish species. Two overall concerns were detailed in support of this comment: (1) None of the studies cited in the rule conclude that conductivity, independent of the dissolved metals and sediment observed at the test sites, caused the observed scarcity of fish; and (2) conductivity varies naturally from region to region due to the availability of different ionic constituents, so that data from potential effects of conductivity from one region of the country should not be applied to other regions. They expressed concern that the proposed rule could impede industries from acquiring permits if their discharges would elevate conductivity. They suggested that until a causal relationship between elevated conductivity and harm to fish species is scientifically established, conductivity should not be listed as a threat to the diamond darter, and industries should not face increased scrutiny for this water quality parameter. They further recommended that, if an ideal conductivity range for the diamond darter was included in the final rule, it should be based on sampling from the Elk River or direct testing on the diamond darter.

Our Response: We concur that none of the studies cited in the proposed rule definitively conclude that conductivity, independent of the dissolved metals and sediment observed at the test sites, caused the observed scarcity of fish. However, these studies found a strong correlation between increased conductivity levels and the absence or reduction of sensitive fish populations (Mattingly *et al.* 2005, pp. 59–62; Thomas 2008, pp. 3–6; Service 2009, pp. 1–4). Furthermore, basic chemistry and physiology provide information on how increased conductivity may affect fish populations. Conductivity is an estimate of the ionic strength of a salt solution (USEPA 2011, p. 1). High ionic salt concentrations impede effective osmoregulation in fish and other aquatic organisms and impair their physiological systems that extract energy from food, regulate internal pH and water volume, excrete metabolic wastes, guide embryonic development, activate nerves and muscles, and fertilize eggs (Pond *et al.* 2008, p. 731; USEPA 2011, p. 27). Thus, there is a strong physiological and chemical basis to suggest that high conductivity levels can adversely affect the fitness and survival of fish species such as the diamond darter. In addition, the diamond darter forages on benthic macroinvertebrates. Studies have demonstrated a causal relationship between high conductivity levels and impairment of benthic macroinvertebrate populations (Pond *et al.* 2008, pp. 717–737; USEPA 2011, pp. A1–40). A recent USEPA study evaluated the potential confounding effects of metals, sediments, and other water quality parameters and still found that biological impairment of benthic macroinvertebrate populations was a result of increased conductivity (USEPA 2011, pp. B1–37). Thus, high conductivity levels could also adversely affect the availability of foods that the diamond darter needs to survive. We therefore conclude that increased conductivity could pose a threat to the diamond darter's ability to feed, breed, and survive, and have retained and enhanced the discussion of this topic in the final rule.

We also concur that conductivity varies naturally from region to region due to the availability of different ionic constituents, so that data on conductivity from one region of the country may not be applicable to other regions. Studies from West Virginia (that included data from watersheds immediately adjacent to the Elk River) and Kentucky found that an aquatic conductivity level of 300 microSiemans/cm (μS/cm) should avoid the local extirpation of 95 percent of native stream macroinvertebrate species. The study noted that, because 300 μS/cm would only protect against total extirpation rather than just a reduction in abundance, conductivity level was not fully protective of sensitive species or higher quality, exceptional waters (USEPA 2011, p. xiv). These data, coupled with the information provided on fish species such as the Cumberland darter and the Kentucky arrow darter (*Etheostoma sagitta spilotum*) that occur within the historic range of the diamond darter in Kentucky, provide applicable regional information pertinent to the diamond darter. However, it is outside the scope of this final rule to establish water quality criteria for permitted discharges. Water quality criteria and permit conditions are established by appropriate State and Federal regulatory agencies and under consultation with the Service, if required. The Service would willingly work with industry groups and regulatory agencies to develop additional research to fully evaluate conductivity limits to species in the Elk River, including the diamond darter.

(14) *Comment:* The WVCC, WVCA, WVFA, and WVONGA all suggested that listing the diamond darter under the Act will do nothing to ensure the species' long-term survival, but will place a regulatory burden on a wide range of human activities. The organizations note that little is known about the diamond darter's reproductive techniques, water quality parameters, or food choices, and that the genetic fitness of the diamond darter's remaining population has not been evaluated. The organizations therefore conclude that using species-specific conservation measures would be more efficient and cost effective than using a broad legal mechanism like the Act to improve the long-term survival of the diamond darter.

Our Response: The Act requires that the Service make listing determinations solely on the basis of the best scientific and commercial data available regarding the status of the species and the presence of existing conservation efforts. The Act does not allow listing to be avoided based on the potential for perceived benefits or burdens that will result from the listing, or the potential to develop future conservation efforts in the absence of listing. However, the Service would welcome assistance from these groups to develop additional conservation measures targeted toward diamond darter recovery.

(15) *Comment:* The Nature Conservancy commented that the diamond darter is one of the most critically endangered aquatic species in the United States. The organization supports the Service's efforts to list the species now while a sufficient population may be available from which to restore the species to a nonthreatened status. The organization also noted that it is working on a watershed assessment of the Elk River that will assess cumulative effects contributing to degradation of aquatic resources, and help identify priority areas for restoration and protection.

Our Response: We appreciate TNC's support of conservation of the diamond darter and have discussed the results of the draft watershed assessment with the organization. The draft supports our assessment of threats to the diamond darter, as detailed in Factor A, and also will be useful in planning future recovery efforts for the diamond darter and other listed species in the watershed. We look forward to enhancing our partnerships with TNC and other organizations so that we can work toward the recovery of listed species.

(16) *Comment:* The Nature Conservancy concurred with our assessment of threats to the species and commented that coal mining, oil and gas development and infrastructure, sedimentation, water quality degradation, and poor wastewater treatment all pose significant threats to the diamond darter. The organization noted that many of these land use changes in the Elk River watershed are occurring on large, previously undeveloped, and privately owned forestland tracts along tributaries that were once managed primarily as forestland and that contributed to maintaining this river's ecological condition.

Our Response: We have reviewed additional information developed by TNC (see comment #17) that supports our assessment of threats. We concur that degradation of water quality in tributaries directly affects the ecological condition of the mainstem Elk River. Our discussion of threats under Factor A notes many examples of water quality degradation occurring within tributaries to the Elk River.

(17) *Comment:* The Nature Conservancy commented that Japanese knotweed (*Fallopia japonica*) and other invasive, nonnative plants associated with riparian areas are infesting the banks of the Elk River. These invasive species reduce stream bank stability and alter vegetation communities and the types of detritus, insects, and other natural inputs that enter the aquatic system and, therefore, pose a threat to the diamond darter.

Our Response: Japanese knotweed has already been found in the upstream portions of the Elk River watershed (Schmidt 2013, p. 1). We concur that this and other invasive riparian plants could pose an additional threat, particularly if they occur along the portion of the Elk River that supports the diamond darter, and we have added text under Factor E to that regard.

Summary of Changes From Proposed Rule

We fully considered comments from peer reviewers, State and Federal agencies, and the public on the proposed rule to develop this final listing of the diamond darter. This final rule incorporates appropriate changes to our proposed listing based on the received comments discussed above and newly available scientific and commercial data. Substantive changes include new or additional information on: (1) Why the species was extirpated from most of its historical range and why it has survived in the Elk River; (2) the results of survey efforts and research conducted since the proposed rule; (3) threats from invasive riparian plants; (4) definitions for substrate embeddedness and siltation and the threat that they pose; (5) potential threats from increased conductivity; and (6) conservation measures and cumulative effects. Although our analysis of these threats is somewhat different from that in our proposed rule, the analysis and our conclusions are a logical outgrowth on the proposed rule commenting process, and none of the information changes our determination that listing this species as endangered is warranted.

In addition, we added Indiana to the diamond darter's historical range column of the § 17.11 endangered and threatened wildlife table in the regulatory section of the final rule. Although Indiana was included in the Historical Range/Distribution discussion of the proposed rule, we inadvertently left it out of the § 17.11 endangered and threatened wildlife table in the regulatory section of the proposed rule. Inclusion of Indiana in the historical range column of the § 17.11 endangered and threatened wildlife table in the regulatory section of the final rule corrects that error.

Summary of Factors Affecting the Species

Section 4 of the Act and its implementing regulations (50 CFR 424) set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (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 actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

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

As indicated by the continued persistence of the diamond darter, the Elk River in West Virginia currently provides overall high-quality aquatic habitat. The Elk River is one of the most ecologically diverse rivers in the State (Green 1999, p. 2), supporting more than 100 species of fish and 30 species of mussels, including 5 federally listed mussel species (Welsh 2009a, p. 1). The river, including those portions that are within the range of the diamond darter, is listed as a ''high quality stream'' by the WVDNR (WVDNR 2001, pp. 1, 2, 5). Streams in this category are defined as having ''significant or irreplaceable fish, wildlife, and recreational resources'' (WVDNR 2001, p. iii). In an evaluation of the watershed, the WVDEP noted that all four sampling sites tested within the mainstem of the Elk River scored well for benthic macroinvertebrates on the West Virginia Stream Condition Index, with results of 77 or higher out of a potential 100 points (WVDEP 1997, p. 41).

Criteria for placement on the high-quality streams list are based solely on the quality of fisheries populations and the utilization of those populations by the public and do not include water quality or threats to the watershed (WVDNR 2001, p. 36; Brown 2009, p. 1). Despite the high quality of the fishery populations, continuing and pervasive threats exist within the watershed. In fact, the WVDEP evaluation also noted that because larger rivers offer a wider variety of microhabitats, the high benthic macroinvertebrate scores may mask some degradation in water quality (WVDEP 1997, p. 41). Noted threats to the Elk River watershed include sedimentation and erosion, coal mining, oil and gas development, timber harvesting, water quality degradation, and poor wastewater treatment (WVDEP 1997, p. 15; Strager 2008, pp. 1–39; WVDEP 2008b, pp. 1–2). Significant degradation to the water quality has also been documented in the Elk River's tributaries (WVDEP 2011b, p.viii). Water quality in these tributaries directly contributes to and affects the ecological condition of the mainstem Elk River. Water quality degradation of tributaries is also important because diamond darters congregate and forage in shoals that are often located near tributary mouths (Welsh *et al.* 2012, p. 3).

Many sources have recognized that *Crystallaria* species appear to be particularly susceptible to habitat alterations and changes in water quality. Threats similar to those experienced in the Elk River watershed have likely contributed to the extirpation of *Crystallaria* within other watersheds (Clay 1975, p. 315; Trautman 1981, pp. 24–29, 646; Grandmaison 2003, pp. 16–19). In addition, the current range of the diamond darter is restricted and isolated from other potential and historical habitats by impoundments.

Siltation (Sedimentation)

Many publications use the terms siltation and sedimentation interchangeably, and do not define or differentiate between the terms. For this rule, we have used the term siltation specifically to refer to the pollution of water by fine particulate material, with a particle size dominated by silt or clay. It refers both to the increased concentration of fine-sized suspended sediments and to the increased accumulation (temporary or permanent) of fine sediments on stream bottoms, whereas sedimentation refers to the deposition of suspended soil particles of various sizes from large rocks to small particles. Sedimentation is used as the opposite of erosion, is often caused by land use changes or disturbances, and is a common source of siltation in a stream.

The USEPA has identified excess sediment as the leading cause of impairment to the Nation's waters (USEPA 2013, p. 1). Excess sediment in streams and resulting sedimentation can degrade fish habitat by altering the stability of the stream channel, scouring stream banks and substrates, destabilizing the substrates and habitats that fish such as the diamond darter rely on, and aggrading the stream bottom, which covers the substrates with excess sediments and buries, crushes, or suffocates benthic invertebrates, fish eggs, and fish larvae (Waters 1995, pp. 114–115; USEPA 2013, pp. 1–6). Excess sediment in streams can also lead to siltation.

Siltation has long been recognized as a pollutant that alters aquatic habitats by reducing light penetration, changing heat radiation, increasing turbidity, and covering the stream bottom (Ellis 1936 in Grandmaison *et al.* 2003, p. 17). Increased siltation has also been shown to abrade and suffocate bottom-dwelling organisms, reduce aquatic insect diversity and abundance, and, ultimately, negatively affect fish growth, survival, and reproduction (Berkman and Rabeni 1987, p. 285). Siltation directly affects the availability of food for the diamond darter by reducing the diversity and abundance of aquatic invertebrates on which the diamond darter feeds (Powell 1999, pp. 34–35), and by increasing turbidity, which reduces foraging efficiency (Berkman and Rabeni 1987, pp. 285–294). Research has found that when the percentage of fine substrates increases in a stream, the abundance of benthic insectivorous fishes decreases (Berkman and Rabeni 1987, p. 285). Siltation also affects the ability of diamond darters to successfully breed by filling the small interstitial spaces between sand and gravel substrates with smaller particles. Diamond darters lay their eggs within these interstitial spaces. The complexity and abundance of interstitial spaces is reduced dramatically with increasing inputs of silts and clays. Siltation results in an increase in substrate embeddedness. As substrates become more embedded by silts and clays, the surface area available to fish for shelter, spawning, and egg incubation is decreased (Barbour *et al.* 1999, pp. 5–13; Sylte and Fischenich 2007, p. 12). Consequently, the amount and quality of breeding habitat for species such as the diamond darter is reduced (Bhowmik and Adams 1989, Kessler and Thorp 1993, Waters 1995, and Osier and Welsh 2007 all in Service 2008, pp. 15–16).

Many researchers have noted that *Crystallaria* species are particularly susceptible to the effects of siltation, and Grandmaison *et al.* (2003, pp. 17–18) summarize the information as follows: ''Bhowmik and Adams (1989) provide an example of how sediment deposition has altered aquatic habitat in the Upper Mississippi River system, where the construction of locks and dams has resulted in siltation leading to a successional shift from open water to habitats dominated by submergent and emergent vegetation. This successional process is not likely to favor species such as the crystal darter, which rely on extensive clean sand and gravel raceways for population persistence (Page 1983). For example, the crystal darter was broadly distributed in tributaries of the Ohio River until high silt loading and the subsequent smothering of sandy substrates occurred (Trautman 1981). In the Upper Mississippi River, the relative rarity of crystal darters has been hypothesized as a response to silt deposition over sand and gravel substrates (Hatch 1998)''. Although the Trautman (1981) citation within the above quote mentions the crystal darter, we now know that he was referring to individuals that have since been identified as diamond darters. In summary, *Crystallaria* species, including both the diamond darter and the crystal darter, are known to be particularly susceptible to the effects of siltation, and populations of these species have likely become extirpated or severely reduced in size as a result of this threat.

Siltation, along with excess sedimentation, has been identified as a threat to the Elk River system. Portions of the lower Elk River were listed as impaired due to elevated levels of iron and, previously, aluminum (USEPA 2001b, p. 1–1; Strager 2008, p. 36; WVDEP 2008a, p. 18; WVDEP 2008b, p. 1; WVDEP 2012, pp. 14–15). The WVDEP has since revised the water quality criteria for aluminum to address bioavailability of that metal, and established maximum amounts of pollutants allowed to enter the waterbody (known as Total Maximum Daily Loads (TMDL)) (WVDEP 2008a, p. A–2; WVDEP 2010, p. 26). The WVDEP identified that impairment due to metals, including iron, usually indicates excess sediment conditions (WVDEP 2008b, p. 5), and identified coal mining, oil and gas development, timber harvesting, all-terrain vehicle usage, and stream bank erosion as sources of increased sediment entering the Elk River watershed (USEPA 2001b, pp. 1–1, 3–4 and 6; WVDEP 2008b, p. 1). Within two subwatersheds that make up approximately 11 percent of the total Elk River watershed area, the WVDEP identified 433 kilometers (km) (269 miles (mi)) of unimproved dirt roads and 76 km (47 mi) of severely eroding stream banks (WVDEP 2008b, p. 5). An estimated 1,328 hectares (ha) (3,283 acres (ac)) of lands were actively timbered in those two watersheds in 2004 (WVDEP 2008b, p. 6). A review of the West Virginia Department of Forestry (WVDOF) inventory of registered logging sites estimated 16,381 ha (40,479 ac) of harvested forest, 1,299 ha (3,209 ac) of land disturbed by forestry-related roads and landings, and 518 ha (1,281 ac) of burned forest within portions of the Elk River watershed that are impaired by excess sediment and metals (WVDEP 2011c, pp. 34–35).

Coal Mining

Coal mining occurs throughout the entire Elk River watershed. Most of the active mining occurs in the half of the watershed on the south side of the Elk River, which flows east to west (Strager 2008, p. 17). The most recent summarized data, as of January 2008, indicates more than 5,260 ha (13,000 ac) of actively mined areas including 91 surface mine permits, 79 underground mine permits, 1,351 ha (3,339 ac) of valley fills, 582 km (362 mi) of haul roads, 385 km (239 mi) of mine drainage structures, 473 National Pollutant Discharge Elimination System (NPDES) discharge points associated with mines, and 3 mining related dams (Strager 2008, pp. 19–21). There are also 615 ha (1,519 ac) of abandoned mine lands and 155 mine permit sites that have forfeited their bonds and have not been adequately remediated (Strager 2008, p. 18). Approximately 47 percent of the entire Elk River watershed is within the area that the USEPA has identified as potentially being subject to mountaintop removal mining activities (Strager 2008, p. 17).

Coal mining can contribute significant amounts of sediment to streams and degrade their water quality. Impacts to instream water quality (chemistry) occur through inputs of dissolved metals and other solids that elevate stream conductivity, increase sulfate levels, alter stream pH, or a combination of these (Curtis 1973, pp. 153–155; Pond 2004, pp. 6–7, 38–41; Hartman *et al.* 2005, p. 95; Mattingly *et al.* 2005, p. 59; Palmer *et al.* 2010, pp. 148–149). As rock strata and overburden (excess material) are exposed to the atmosphere, precipitation leaches metals and other solids (e.g., calcium, magnesium, sulfates, iron, and manganese) from these materials and carries them in solution to receiving streams (Pond 2004, p. 7). If valley fills are used as part of the mining activity, precipitation and groundwater percolate through the fill and dissolve minerals until they discharge at the toe of the fill as surface water (Pond *et al.* 2008, p. 718). Both of these scenarios result in elevated conductivity, sulfates, hardness, and increased pH in the receiving stream. Increased levels of these metals and other dissolved solids have been shown to exclude other sensitive fish species and darters from streams, including the federally threatened blackside dace (*Chrosomus cumberlandensis*) in the upper Cumberland River Basin (Mattingly *et al.* 2005, pp. 59–62). The Kentucky arrow darter was found to be excluded from mined watersheds when conductivity exceeded 250 μS/cm (Thomas 2008, pp. 3–6; Service 2009, pp. 1–4).

High ionic salt concentrations associated with increased conductivity impede effective osmoregulation in fish and other aquatic organisms and impair their physiological systems that extract energy from food, regulate internal pH and water volume, excrete metabolic wastes, guide embryonic development, activate nerves and muscles, and fertilize eggs (USEPA 2011, p. 27; Pond *et al.* 2008 p. 731). Thus, high conductivity levels could adversely affect the fitness and survival of fish species such as the diamond darter. In addition, high conductivity levels could also adversely affect the availability of forage populations of benthic macroinvertebrates that the diamond darter needs to survive. Studies have demonstrated a causal relationship between high conductivity levels and impairment of benthic macroinvertebrate populations (USEPA 2011, pp. A1–40; Pond *et al.* 2008, pp. 717–737). Studies from West Virginia (that included data from watersheds immediately adjacent to the Elk River) and Kentucky found that an aquatic conductivity level of 300 µS/cm was expected to avoid the local extirpation of 95 percent of native stream macroinvertebrate species. The study noted that, because this level was developed to protect against extirpation rather than reduction in abundance, it was not fully protective of sensitive species or higher quality, exceptional waters (USEPA 2011, p. xiv).

Water quality impacts from both active and historical mining have been noted in the Elk River watershed (WVDEP 2011b, pp. 29, 37, 41, 63). For example, in the Jacks Run watershed, a tributary to the Elk River, one-third of the entire watershed had been subject to mining-related land use changes that cleared previously existing vegetation. In a sampling site downstream of mining, the WVDEP documented substrates embedded with dark silt, most likely from manganese precipitate or coal fines, and benthic scores that indicated severe impairment (WVDEP 1997, p. 60). Another Elk River tributary, Blue Creek, had low pH levels associated with contour mining and acid drainage, and three sample sites had pH values of 4.2 or less (WVDEP 1997, p. 47; WVDEP 2008b, p. 6). At pH levels of 5.0 or less, most fish eggs cannot hatch (USEPA 2009, p. 2).

Sampling sites below a large mining reclamation site in the Buffalo Creek drainage of the Elk River watershed had violations of the West Virginia water quality criteria for acute aluminum and manganese, poor habitat quality, and substrates that were heavily embedded with coal fines and clay (WVDEP 1997, pp. 4, 56–57). Other sites in the watershed, where topographic maps showed extensive surface mining, had pH readings of 4.7, elevated aluminum levels, and benthic communities that were dominated by acid-tolerant species (WVDEP 1997, pp. 4, 56–57).

A U.S. Geological Survey (USGS) study of the Kanawha River Basin, which includes the Elk River, found that streams draining basins that have been mined since 1980 showed increased dissolved sulfate, decreased median bed-sediment particle size, and impaired benthic invertebrate communities when compared to streams not mined since 1980. Stream-bottom sedimentation in mined basins was also greater than in undisturbed basins (USGS 2000, p. 1). In streams that drained areas where large quantities of coal had been mined, the benthic invertebrate community was impaired in comparison to rural parts of the study area where little or no coal had been mined since 1980 (USGS 2000, p. 7). That report notes that benthic invertebrates are good indicators of overall stream water quality and that an impaired invertebrate community indicates that stream chemistry or physical habitat, or both, are impaired, causing a disruption in the aquatic food web (USGS 2000, p. 8).

In another study that specifically evaluated fish data, the Index of Biotic Integrity (IBI) scores at sites downstream of valley fills were significantly reduced by an average of 10 points when compared to unmined sites, indicating that fish communities were degraded below mined areas (Fulk *et al.* 2003, p. iv). In addition, that study noted a significant correlation between the number of fishes that were benthic invertivores and the amount of mining in the study watershed: The number of those types of fish species decreased with increased mining (Fulk *et al.* 2003, pp. 41–44). As described above in the Life History section, the diamond darter is a benthic invertivore. The effects described above are often more pronounced in smaller watersheds that do not have the capacity to buffer or dilute degraded water quality (WVDEP 1997, p. 42; Fulk *et al.* 2003, pp. ii–iv). Because the mainstem Elk River drains a relatively large watershed, these types of adverse effects are more likely to be noticed near the confluences of tributaries that are most severely altered by mining activities such as Blue Creek, which occurs within the known range of the diamond darter, and Buffalo Creek, which is upstream of the known diamond darter locations.

Threats from coal mining also include the potential failure of large-scale mine waste (coal slurry) impoundment structures contained by dams constructed of earth, mining refuse, and various other materials, which could release massive quantities of mine wastes that could cover the stream bottoms. There are currently two coal slurry impoundments within the Elk River watershed. These impoundments have a capacity of 6,258,023 and 1,415,842 cubic meters (m^3) (221,000,000 and 50,000,000 cubic feet (cf)). The larger structure covers 19 ha (48 ac) and is considered a ''class C'' dam whose failure could result in the loss of human life and serious damage to homes and industrial and commercial facilities (Strager 2008, pp. 21–22). A third coal refuse disposal impoundment is permitted and planned for construction with an additional 54,821 m^3 (1,936,000 cf) of capacity (Fala 2009, p. 1; WVDEP 2012, p. 1). These three impoundments are on tributaries of the Elk River upstream of the reach of river known to support the diamond darter. In October 2000, a coal slurry impoundment near Inez, Kentucky, breached, releasing almost 991,090 m^3 (35,000,000 cf) of slurry into the Big Sandy Creek watershed. ''The slurry left fish, turtles, snakes and other aquatic species smothered as the slurry covered the bottoms of the streams and rivers and extended out into the adjacent floodplain'' (USEPA 2001a, p. 2). Over 161 km (100 mi) of stream were impacted by the spill (USEPA 2001a, p. 2). If a similar dam failure were to occur in the Elk River watershed, it could have detrimental consequences for the entire diamond darter population.

Abandoned underground mines also have potential to fill with water and ''blow out,'' causing large discharges of sediment and contaminated water. Similar events have happened in nearby areas, including one in Kanawha County, West Virginia, in April 2009 that discharged ''hundreds of thousands of gallons of water'' onto a nearby highway, and caused a ''massive earth and rock slide'' (Marks 2009, p. 1). A second situation occurred in March 2009 in Kentucky where water from the mine portal was discharged into a nearby creek at an estimated rate of 37,854 liters (l) (10,000 gallons (ga)) a minute (Associated Press 2009, p. 1). In addition to the increased levels of sediment and potential smothering of stream habitats, discharges from abandoned mine sites often have elevated levels of metals and low pH (Stoertz *et al.* 2001, p. 1). In 2010, a fish kill occurred in Blue Creek, a tributary of the Elk River in Kanawha County, when a contractor working for WVDEP attempted to clean up an abandoned mine site. When the contractor breached an impoundment, the mine discharged highly acidic water that then flowed into the stream. Approximately 14.5 km (9 mi) of Blue Creek was affected by the fish kill (McCoy 2010, p. 1). The effects of the fish kill were stopped by response crews 9.5 km (5.9 mi) upstream from where Blue Creek enters the Elk River within the known range of the diamond darter.

Oil and Gas Development

The Elk River watershed is also subject to oil and gas development, with more than 5,800 oil or gas wells in the watershed according to data available through January 2011 (WVDEP 2011a, p. 1). The lower section of the Elk River, which currently contains the diamond darter, has the highest concentration of both active and total wells in the watershed, with more than 2,320 active wells and 285 abandoned wells (WVDEP 2011a, p. 1).

Although limited data are available to quantify potential impacts, development of oil and gas resources can increase sedimentation rates in the stream and degrade habitat and water quality in a manner similar to that described for coal mining. Oil and gas wells can specifically cause elevated chloride levels through discharge of brine and runoff from materials used at the site, and the erosion of roads associated with these wells can contribute large amounts of sediment to the streams (WVDEP 1997, p. 54). For example, WVDEP sampling sites within Summers Fork, a tributary to the Elk River with a ''high density of oil and gas wells,'' had elevated chloride and conductivity levels, as well as impaired benthic invertebrate scores, despite ''good benthic substrate'' (WVDEP 1997, p. 52). Within the Buffalo Creek watershed, another Elk River tributary, the impaired benthic invertebrate scores at sample sites were attributed to oil compressor stations next to the creek, pipes running along the bank parallel to the stream, and associated evidence of past stream channelization (WVDEP 1997, p. 55).

High levels of siltation have been noted in the impaired sections of the Elk River (USEPA 2001b, pp. 3–6). Oil and gas access roads have been identified as a source that contributes ''high'' levels of sediment to the Elk River (USEPA 2001b, pp. 3–7). The WVDEP estimates the size of the average access road associated with an oil or gas well to be 396 meters (m) (1,300 feet (ft)) long by 7.6 m (25 ft) wide or approximately .30 ha (0.75 ac) per well site (WVDEP 2008b, p. 10). If each of the wells in the watershed has this level of disturbance, there would be more than 1,821 ha (4,500 ac) of access roads contributing to increased sedimentation and erosion in the basin. Lack of road maintenance, improper construction, and subsequent use by the timber industry and all-terrain vehicles can increase the amount of erosion associated with these roads (WVDEP 2008b, pp. 5–6).

Shale gas development is an emerging issue in the area. Although this is currently not the most productive area of the State, the entire current range of the diamond darter is underlain by the Marcellus and Utica Shale formation and potentially could be affected by well drilling and development (National Energy Technology Laboratory (NETL) 2010 pp. 6–10). The pace of drilling for Marcellus Shale gas wells is expected to increase substantially in the future, growing to about 700 additional wells per year in West Virginia starting in 2012 (NETL 2010, p. 27). This amount is consistent with what has been reported in the area around the Elk River. In March 2011, there were 15 Marcellus Shale gas wells reported within Kanawha County (West Virginia Geological and Economic Survey (WVGES) 2011, p. 1). As of January 2012, there were 188 completed Marcellus Shale gas wells within Kanawha County and an additional 27 wells that had been permitted (WVGES 2012, p. 1). Data specific to the Elk River watershed are not available for previous years, but currently at least 100 completed and 21 additional permitted Marcellus Shale gas wells are within the watershed (WVGES 2012, p. 1). The WVONGA suggests that the region where the diamond darter exists may experience a surge in oil and natural gas exploration and drilling above the levels experienced in the previous 5 years (WVONGA 2013).

Marcellus Shale gas wells require the use of different techniques than previously used for most gas well development in the area. When compared to more traditional methods, Marcellus Shale wells usually require more land disturbance and more water and chemicals for operations. In addition to the size and length of any required access roads, between 0.8 and 2.0 ha (2 and 5 ac) are generally disturbed per well (Hazen and Sawyer 2009, p. 7). Each well also requires about 500 to 800 truck trips to the site (Hazen and Sawyer 2009, p. 7). Construction of these wells in close proximity to the Elk River and its tributaries could increase the amount of siltation in the area due to erosion and subsequent sedimentation from the disturbed area, road usage, and construction.

Shale gas wells typically employ a technique called hydrofracking, which involves pumping a specially blended liquid mix of water and chemicals down a well, into a geologic formation. The pumping occurs under high pressure, causing the formation to crack open and form passages through which gas can flow into the well. During the drilling process, each well may use between 7 and 15 million liters (2 and 4 million ga) of water (Higginbotham *et al.* 2010, p. 40). This water is typically withdrawn from streams and waterbodies in close proximity to the location where the well is drilled. Excessive water withdrawals can reduce the quality and quantity of habitat available to fish within the streams, increase water temperatures, reduce dissolved oxygen concentrations, and increase the concentration of any pollutants in the remaining waters (Freeman and Marcinek 2006, p. 445; Pennsylvania State University 2010, p. 9). Increasing water withdrawals has been shown to be associated with a loss of native fish species that are dependent on flowing-water habitats. Darters were one group of species that were noted to be particularly vulnerable to this threat (Freeman and Marcinek 2006, p. 444).

In addition to water withdrawals, there is a potential for spills and discharges from oil and gas wells, particularly Marcellus Shale drilling operations. Pipelines and ponds used to handle brine and wastewaters from fracking operations can rupture, fail, or overflow and discharge into nearby streams and waterways. In Pennsylvania, accidental discharges of brine water from a well site have killed fish, invertebrates, and amphibians up to 0.4 mi (0.64 km) downstream of the discharge even though the company immediately took measures to control and respond to the spill (PADEP 2009, pp. 4–22). In 2011, the WVDEP cited a company for a spill at a well site in Elkview, West Virginia. Up to 50 barrels of oil leaked from a faulty line on the oil well site. The spill entered a tributary of Indian Creek, traveled into Indian Creek and then flowed into the Elk River (Charleston Gazette 2011, p. 1). This spill occurred within the reach of the Elk River known to be occupied by the diamond darter and, therefore, could have affected the species and its habitat.

Water Quality/Sewage Treatment

One common source of chemical water quality impairments is untreated or poorly treated wastewater (sewage). Municipal wastewater treatment has improved dramatically since passage of the 1972 amendments to the Federal Water Pollution Control Act (which was amended to become the Clean Water Act in 1977), but some wastewater treatment plants, especially smaller plants, continue to experience maintenance and operation problems that lead to discharge of poorly treated sewage into streams and rivers (OEPA 2004 in Service 2008, p. 23). According to the data available in 2008, there were a total of 30 sewage treatment plants within the Elk River watershed (Strager 2008, p. 30).

Untreated domestic sewage (straight piping) and poorly operating septic systems are still problems within the Elk River watershed (WVDEP 1997, p. 54; WVDEP 2008b, p. 3). Untreated or poorly treated sewage contributes a variety of chemical contaminants to a stream, including ammonia, pathogenic bacteria, nutrients (e.g., phosphorous and nitrogen), and organic matter, that can increase biochemical oxygen demand (BOD) (Chu-Fa Tsai 1973, pp. 282–292; Cooper 1993, p. 405). The BOD is a measure of the oxygen consumed through aerobic respiration of micro-organisms that break down organic matter in the sewage waste. Excessive BOD and nutrients in streams can lead to low dissolved oxygen (DO) levels in interstitial areas of the substrate where a high level of decomposition and, consequently, oxygen depletion takes place (Whitman and Clark 1982, p. 653). Low interstitial DO has the potential to be particularly detrimental to fish such as the diamond darter, which live on and under the bottom substrates of streams and lay eggs in interstitial areas (Whitman and Clark 1982, p. 653). Adequate oxygen is an important aspect of egg development, and reduced oxygen levels can lead to increased egg mortality, reduced hatching success, and delayed hatching (Keckeis *et al.* 1996, p. 436).

Elevated nutrients in substrates can also make these habitats unsuitable for fish spawning, breeding, or foraging and reduce aquatic insect diversity, which may impact availability of prey and ultimately fish growth (Chu-Fa Tsai 1973, pp. 282–292; Wynes and Wissing 1981, pp. 259–267). Darters are noted to be ''highly sensitive'' to nutrient increases associated with sewage discharges, and studies have demonstrated that the abundance and distribution of darter species decreases downstream of these effluents (Katz and Gaufin 1953, p. 156; Wynes and Wissing 1981, p. 259). Elevated levels of fecal coliform signal the presence of improperly treated wastes (WVDEP 2008a, p. 7) that can cause the types of spawning, breeding, and foraging problems discussed above.

The reach of the Elk River from the mouth to River Mile 102.5, which includes the area supporting the diamond darter, was on the State's list of impaired waters under section 303(d) of the CWA due to violations of fecal coliform levels in 2008 and 2010 (WVDEP 2008a, p. 18; WVDEP 2010, p. 26). There have been noticeable increases in fecal coliform near population centers adjacent to the Elk River, including the cities of Charleston, Elkview, Frametown, Gassaway, Sutton, and Clay (WVDEP 2008b, p. 8). Elk River tributaries near Clendenin also show evidence of organic enrichment and elevated levels of fecal coliform (WVDEP 1997, p. 48). The WVDEP notes that failing or nonexistent septic systems are prevalent throughout the lower Elk River watershed (WVDEP 2008b, p. 1). To address water quality problems, the WVDEP conducted a more detailed analysis of two major tributary watersheds to the lower Elk River. The agency found that all residences in these watersheds were ''unsewered'' (WVDEP 2008b, p. 7). The Kanawha County Health Department Sanitarians estimate that the probable failure rate for these types of systems is between 25 and 30 percent, and monitoring suggests it may be as high as 70 percent (WVDEP 2008b, p. 7).

In another study, it was noted that straight pipe and grey water discharges are often found in residences within the Elk River watershed because the extra grey water would overburden septic systems. These untreated wastes are discharged directly into streams. This grey water can contain many household cleaning and disinfectant products that can harm stream biota (WVDEP 1997, p. 54). Finally, there is the potential for inadvertent spills and discharges of sewage waste. In 2010, a section of stream bank along the Elk River near Clendenin failed and fell into the river, damaging a sewerline when it fell. The line then discharged raw sewage into the river (Marks 2010, p. 1). The diamond darter is known to occur in the Elk River near Clendenin; therefore, this discharge likely affected the species.

Impoundment

Impoundment of previously occupied rivers was one of the most direct and significant historical causes of range reduction and habitat loss for the diamond darter. One of the reasons the diamond darter may have been able to persist in the Elk River is because the river remains largely unimpounded. Although there is one dam on the Elk River near Sutton, an approximately 161-km (100-mi) reach of the river downstream of the dam, including the portion that supports the diamond darter, retains natural, free-flowing, riffle and pool characteristics (Strager 2008, p. 5; Service 2008). All the other rivers with documented historical diamond darter occurrences are now either partially or completely impounded. There are 4 dams on the Green River, 8 dams on the Cumberland River, and 11 locks and dams on the Muskingum River. A series of 20 locks and dams have impounded the entire Ohio River for navigation. Construction of most of these structures was completed between 1880 and 1950; however, the most recent dam constructed on the Cumberland River was completed in 1973 (Clay 1975, p. 3; Trautman 1981, p. 25; Tennessee Historical Society 2002, p. 4; American Canal Society 2009, p. 1; Ohio Division of Natural Resources 2009, p. 1).

These impoundments have permanently altered habitat suitability in the affected reaches and fragmented stream habitats, blocking fish immigration and emigration between the river systems, and preventing recolonization (Grandmaison *et al.* 2003, p. 18). Trautman (1981, p. 25) notes that the impoundment of the Muskingum and Ohio Rivers for navigation purposes almost entirely eliminated riffle habitat in these rivers, increased the amount of silt settling on the bottom, which covered former sand and gravel substrates, and affected the ability of the diamond darter to survive in these systems. In addition, almost the entire length of the Kanawha River, including the 53 km (33 mi) upstream of the confluence with the Elk River and an additional 93 km (58 mi) downstream to Kanawha's confluence with the Ohio River, has been impounded for navigation (U.S. Army Corps of Engineers (ACOE) 1994, pp. 1, 13, 19). The dams and impoundments on this system likely impede movement between the only remaining population of the diamond darter in the Elk River and the larger Ohio River watershed, including the other known river systems with historical populations. Range fragmentation and isolation (see Factor E below) is noted to be a significant threat to the persistence of the diamond darter (Warren *et al.* 2000 in Grandmaison *et al.* 2003, p. 18).

Direct Habitat Disturbance

There is the potential for direct disturbance, alteration, and fill of diamond darter habitat in the Elk River. Since 2009, at least three proposed projects had the potential to directly disturb habitat in the Elk River in reaches that are known to support the species. Plans for these projects have not yet been finalized. Project types have included bridges and waterline crossings. Direct disturbances to the habitat containing the diamond darter could kill or injure adult individuals, young, or eggs. Waterline construction that involves direct trenching through the diamond darter's habitat could destabilize the substrates, leading to increased sedimentation and erosion. Placement of fill in the river could result in the overall reduction of habitat that could support the species, and could alter flows and substrate conditions, making the area less suitable for the species (Welsh 2009d, p. 1).

In addition, the expansion of gas development in the basin will likely lead to additional requests for new or upgraded gas transmission lines across the river. The WVONGA suggests that the region where the diamond darter exists may experience a surge in oil and natural gas exploration and drilling above the levels experienced in the previous 5 years, and that new pipeline stream crossings are expected because the industry is working to provide new users with access to this expanded supply (WVONGA 2013).

Pipeline stream crossings can affect fish habitat; food availability; and fish behavior, health, reproduction, and survival. The most immediate effect of instream construction is the creation of short-term pulses of highly turbid water and total suspended solids (TSS) downstream of construction (Levesque and Dube 2007, pp. 399–400). Although these pulses are usually of relatively short duration and there is typically a rapid return to background conditions after activities cease, instream construction has been shown to have considerable effects on stream substrates and benthic invertebrate communities that persist after construction has been completed (Levesque and Dube 2007, pp. 396–397). Commonly documented effects include substrate compaction, as well as silt deposition within the direct impact area and downstream that fills interstitial spaces and reduces water flow through the substrate, increasing substrate embeddedness and reducing habitat quality (Reid and Anderson 1999, p. 243; Levesque and Dube 2007, pp. 396–397; Penkal and Phillips 2011, pp. 6–7). Construction also directly alters stream channels, beds, and banks resulting in changes in cover, channel morphology, and sediment transport dynamics. Stream bank alterations can lead to increased water velocities, stream degradation, and stream channel migrations. Removal of vegetation from the banks can change temperature regimes and increase sediment and nutrient loads (Penkal and Phillips 2011, pp. 6–7).

These instream changes not only directly affect the suitability of fish habitat, but also affect the availability and quality of fish forage by altering the composition and reducing the density of benthic invertebrate communities within and downstream of the construction area (Reid and Anderson 1999, pp. 235, 244; Levesque and Dube 2007, pp. 396–399; Penkal and Phillips 2011, pp. 6–7). Various studies have documented adverse effects to the benthic community that have been apparent for between 6 months and 4 years post-construction (Reid and Anderson 1999, pp. 235, 244; Levesque and Dube 2007, pp. 399–400). Stream crossings have also been shown to affect fish physiology, survival, growth, and reproductive success (Levesque and Dube 2007, p. 399). Studies have found decreased abundance of fish downstream of crossings, as well as signs of physiological stress such as increased oxygen consumption and loss of equilibrium in remaining fish downstream of crossings (Reid and Anderson 1999, pp. 244–245; Levesque and Dube 2007, pp. 399–401). Increased sediment deposition and substrate compaction from pipeline crossing construction can degrade spawning habitat, result in the production of fewer and smaller fish eggs, impair egg and larvae development, limit food availability for young-of-the-year fish, and increase stress and reduce disease resistance of fish (Reid and Anderson 1999, pp. 244–245; Levesque and Dube 2007, pp. 401–402).

The duration and severity of these effects depends on factors such as the duration of disturbance, the length of stream segment directly impacted by construction, and whether there are repeated disturbances (Yount and Niemi 1990, p. 557). Most studies documented recovery of the affected stream reach within 1 to 3 years after construction (Yount and Niemi 1990, pp. 557–558, 562; Reid and Anderson 1999, p. 247). However, caution should be used when interpreting results of short-term studies. Yount and Niemi (1990, p. 558) cite an example of one study that made a preliminary determination of stream recovery within 1 year, but when the site was reexamined 6 years later, fish biomass, fish populations, macroinvertebrate densities, and species composition were still changing. It was suspected that shifts in sediment and nutrient inputs to the site as a result of construction in and around the stream contributed to the long-term lack of recovery. In another study, alterations in channel morphology, such as increased channel width and reduced water depth, were evident 2 to 4 years post-construction at sites that lacked an intact forest canopy (Reid and Anderson 1999, p. 243).

There is also the potential for cumulative effects. While a single crossing may have only short-term or minor effects, multiple crossings or multiple sources of disturbance and sedimentation in a watershed can have cumulative effects on fish survival and reproduction that exceed the recovery capacity of the river, resulting in permanent detrimental effects (Levesque and Dube 2007, pp. 406–407). Whether or how quickly a stream population recovers depends on factors such as the life-history characteristics of the species and the availability of unaffected populations upstream and downstream as a source of organisms for recolonization (Yount and Niemi 1990, p. 547). Species such as the diamond darter that are particularly susceptible to the effects of siltation and resulting substrate embeddedness, and that have limited distribution and population numbers, are likely to be more severely affected by instream disturbances than other more common and resilient species. The WVONGA suggests that the region where the diamond darter exists may experience a surge in oil and natural gas exploration and drilling above the levels experienced in the previous 5 years (WVONGA 2013).

Conservation Efforts To Reduce Habitat Destruction, Modification, or Curtailment of Its Range

The NRCS and the Federal Highway Administration/West Virginia Department of Transportation have worked with the Service to develop programmatic agreements on how their agencies will address federally listed species for many of their routine project types. After the diamond darter became a candidate species in 2009, both agencies voluntarily agreed to update their programmatic agreements to address protection of the diamond darter. These agreements now include a process to determine when the species may be affected by projects, avoidance measures that can be used to ensure their projects are not likely to adversely affect the species, conditions describing when additional consultation with the Service shall occur, and, in some cases, other measures that can be incorporated into projects to benefit the species. These programmatic agreements, which were completed in 2011, should help reduce or avoid effects from small-scale highway construction projects and NCRS conservation practices, and can help these agencies design and implement projects to benefit the species.

Summary of Factor A

In summary, there are significant threats to the diamond darter from the present and threatened destruction, modification, or curtailment of its habitat. Threats include sedimentation and siltation from a variety of sources, discharges from activities such as coal mining and oil and gas development, pollutants originating from inadequate wastewater treatment, habitat changes and isolation caused by impoundments, and direct habitat disturbance. These threats are ongoing and severe and occur throughout the species' entire current range. We have no information indicating that these threats are likely to be appreciably reduced in the future, and in the case of gas development and associated instream disturbances associated with gas transmission lines, we expect this threat to increase over the next several years as shale gas development continues to intensify.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Due to the small size and limited distribution of the only remaining population, the diamond darter is potentially vulnerable to overutilization. Particular care must be used to ensure that collection for scientific purposes does not become a long-term or substantial threat. It is possible that previous scientific studies may have impacted the population. Of the fewer than 50 individuals captured through 2011, 14 either died as a result of the capture or were sacrificed for use in scientific studies. Nineteen were removed from the system and were used for the establishment of a captive breeding program. Two have died in captivity. It should be noted that there were valid scientific or conservation purposes for most of these collections. To verify the identification and permanently document the first record of the species in West Virginia, the specimen captured in 1980 was preserved as a voucher specimen consistent with general scientific protocols of the time. Subsequent surveys in the 1990s were conducted for the specific purpose of collecting additional specimens to be used in the genetic and morphological analyses required to determine the taxonomic and conservation status of the species. The extent and scope of these studies were determined and reviewed by a variety of entities including the WVDNR, the Service, USGS, university scientists, and professional ichthyologists (Tolin 1995, p. 1; Wood and Raley 2000, pp. 20–26; Lemarie 2004, pp. 1–57; Welsh and Wood 2008, pp. 62–68).

In addition, when these collections were initiated, insufficient data were available to establish the overall imperiled and unique status of the species. Because these studies are now complete, there should be limited need to sacrifice additional individuals for scientific analysis, and thus, this potential threat has been reduced. The captive-breeding program was established after a review of the conservation status of the species identified imminent threats to the last remaining population, and species experts identified the need to establish a captive ''ark'' population to avert extinction in the event of a spill or continued chronic threats to the species. The establishment of this program should contribute to the overall conservation of the species and may lead to the eventual augmentation of populations. However, caution must still be used to ensure that any additional collections do not affect the status of wild populations.

It is possible that future surveys conducted within the range of the species could inadvertently result in mortality of additional individuals. For example, during some types of inventory work, fish captured are preserved in the field and brought back to the lab for identification. Young-of-the-year diamond darters are not easily distinguished from other species, and their presence within these samples may not be realized until after the samples are processed. This was the case during studies recently conducted by a local university (Cincotta 2009a, p. 1). Future surveys should be designed with protocols in place to minimize the risk that diamond darters will be inadvertently taken during nontarget studies. The WVDNR currently issues collecting permits for all surveys and scientific collections conducted within the State and incorporates appropriate conditions into any permits issued for studies that will occur within the potential range of the species. This limits the overall potential for overutilization for scientific purposes.

We know of no recreational or educational uses for the species. Although the species has no present commercial value, it is possible that live specimens may be collected for the aquarium trade or for specimen collections (Walsh *et al.* 2003 in Grandmaison *et al.* 2003 p. 19) and that once its rarity and potential collection locations become more widely known, it may become attractive to collectors. At this time, this is not known to be a widespread threat, although there is some evidence of individuals attempting to collect other darters and rare fish in West Virginia and other States for personal or academic collections (North American Native Fishes Association 2007, pp. 1–5). Uncontrolled collection from the remaining diamond darter population could have deleterious effects on the reproductive and genetic viability of the species.

Conservation Efforts To Reduce Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In response to the proposed listing of the diamond darter, the WVDNR has incorporated wording into State fishing regulations to clarify that collection of the diamond darter for any purpose is not authorized unless conducted under a valid State scientific collecting permit (WVDNR 2013, p. 8).

Summary of Factor B

We find that overutilization for commercial, recreational, scientific, or educational purposes is a minor threat to the diamond darter at this time. For a species like the diamond darter, with a small range and population size, there is the potential that overutilization for scientific purposes or personal collections could have an effect on the viability of the species. However, there is limited need for additional research that would require the sacrifice of individuals. Based on our review of the best available scientific and commercial data, the threat of overutilization is not likely to increase in the future.

C. Disease or Predation

There is no specific information available to suggest that disease or predation presents a threat to diamond darters. Although some natural predation by fish and wildlife may occur, darters usually constitute only an almost incidental component in the diet of predators (Page 1983, p. 172). This incidental predation is not considered to pose a threat to the species.

Commonly reported parasites and diseases of darters, in general, include black-spot disease, flukes, nematodes, leeches, spiny-headed worms, and copepods (Page 1983, p. 173). None of the best available data regarding diamond darters captured to date, or reports on the related crystal darter, note any incidences of these types of issues. As a result, we find that disease or predation does not currently pose a threat to the species, and we have no available data that indicate disease or predation is now or likely to become a threat to the diamond darter in the future.

Conservation Efforts To Reduce Disease or Predation

Since neither disease nor predation currently present threats to the diamond darter, no conservation efforts are being conducted to reduce these threats.

D. The Inadequacy of Existing Regulatory Mechanisms

Few existing Federal or State regulatory mechanisms specifically protect the diamond darter or its aquatic habitat where it occurs. The diamond darter and its habitats are afforded some protection from water quality and habitat degradation under the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)(CWA), the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1234–1328), the West Virginia Logging and Sediment Control Act (WVSC § 19–1B), the West Virginia Pollution Control Act (WVSC § 22–11–1.), the West Virginia Horizontal Well Act (WVSC § 22–6A), the West Virginia Abandoned Well Act (WVSC § 22–10–1), and additional West Virginia laws and regulations regarding natural resources and environmental protection (WVSC § 20–2–50; § 22–6A; § 22–26–3). Many of these regulations and requirements were specifically designed with protection of water quality and the reduction of sedimentation as their primary goals. However, as demonstrated under Factor A, degradation of habitat for this species is ongoing despite the protection afforded by these existing laws and corresponding regulations. These laws have resulted in some improvements in water quality and stream habitat for aquatic life, including the diamond darter, but water quality degradation, sedimentation and siltation, non-point-source pollutants, and habitat alteration continue to threaten the species.

Although water quality has generally improved since major environmental regulations like the CWA and Surface Mining Control and Reclamation Act (30 U.S.C. 1234–1328) were enacted or amended in the late 1970s, degradation of water quality within the range of the diamond darter continues. In 2010, a total of 102 streams within the Elk River watershed totaling 1,030 km (640 mi) were identified as impaired by the WVDEP and were placed on the State's CWA 303(d) list (WVDEP 2010, p. 16). Identified causes of impairment that were identified include existing mining operations, abandoned mine lands, fecal coliform from sewage discharges, roads, oil and gas operations, timbering, land use disturbance (urban, residential, or agriculture), and stream bank erosion (WVDEP 2011b, pp. viii–ix).

For water bodies on the CWA 303(d) list, States are required to establish a TMDL for the pollutants of concern that will improve water quality to meet the applicable standards. The WVDEP has established TMDLs for total iron, dissolved aluminum, total selenium, pH, and fecal coliform bacteria in the Elk River watershed (WVDEP 2012, pp. viii–x). The total iron TMDL is used as a surrogate to address impacts associated with excess sediments (WVDEP 2011b, p. 47). The TMDLs for the Elk River watershed were approved in 2012, and address 165 km (102.5 mi) of Elk River from Sutton Dam to the confluence with the Kanawha River, including the entire reach known to support the diamond darter, and 214 other impaired tributaries in the watershed. The draft 2012 WVDEP CWA 303(d) report places these impaired streams in a category where TMDLs have been developed but where water quality improvements are not yet documented (WVDEP 2012, pp. 14–15). An additional six streams, totaling 63 km (39 mi) within the Elk River watershed, were listed as having impaired biological conditions due to mining, but TMDLs for these streams were not developed (WVDEP 2012, p. 9).

Because these TMDLs for some of these impaired streams have just recently been established, it is not known how effective they will be at reducing the levels of these pollutants, or how long streams within the Elk River watershed will remain impaired. The TMDLs apply primarily to point-source discharge permits, not the non-point sources that may also contribute to sediment loading in the watershed. The Service is not aware of any other current or future changes to State or Federal laws that will substantially affect the currently observed degradation of water quality from point-source pollution that is considered to be a continuing threat to diamond darter habitats.

When existing laws that regulate some of these activities are fully complied with and vigorously enforced they can be effective at reducing the scope of threats from the regulated activity. For example, when forestry BMPs are fully and correctly applied they can be effective at reducing sedimentation into waterways. Studies have found a strong correlation between BMP application and prevention of sediment movement into surface water (Schuler and Briggs 2000 p. 133). However, these same studies also found that imperfect application of BMPs reduced their effectiveness and that logging operations can increase sediment loading into streams if they do not have properly installed BMPs (Schuler and Briggs 2000 p. 133; WVDEP 2011b, p. 35). One study evaluating the effects of forestry haul roads documented that watershed turbidities increased significantly following road construction and that silt fences installed to control erosion became ineffectual near stream crossings, allowing substantial amounts of sediment to reach the channel (Wang *et al.* 2010, p. 1).

The WVDOF periodically evaluates compliance with BMPs; this evaluation indicates a trend of increasing compliance with BMPs (Wang *et al.* 2002, p. 1). The most recently available survey of randomly selected logging operations throughout West Virginia estimated that overall compliance with these BMPs averaged 74 percent, and compliance with specific categories of BMPs ranged from 81 percent compliance with BMPs related to construction of haul roads, to only 55 percent compliance with BMPs related to the establishment and protection of streamside management zones (Wang *et al.* 2007, p. 60). In addition, the WVDOF estimates that illicit logging operations represent approximately 2.5 percent of the total harvested forest area throughout West Virginia (WVDEP 2011c, pp. 34–35). These illicit operations most likely do not have properly installed BMPs and can contribute excessive sediment to streams.

West Virginia State laws regarding oil and gas drilling, including recently enacted changes to West Virginia State Code § 22–6A, are generally designed to protect fresh water resources like the diamond darter's habitat, but the laws do not contain specific provisions requiring an analysis of project impacts to fish and wildlife resources. They also do not contain or provide any formal mechanism requiring coordination with, or input from, the Service or the WVDNR regarding the presence of federally threatened, endangered, or candidate species or other rare and sensitive species. They also do not contain any provisions that would avoid or minimize direct loss of diamond darters.

West Virginia State Code § 20–2–50 prohibits taking fish species for scientific purposes without a permit. The WVDNR issues collecting permits for surveys conducted within the State and incorporates appropriate conditions into any permits issued for studies that will occur within the potential range of the species. This should limit the number of individuals impacted by survey and research efforts. Current West Virginia fishing regulations prohibit collecting any diamond darter specimens in the State without a West Virginia scientific collecting permit, and further specify that the diamond darter cannot be collected as bait (WVDNR 2013, p. 8).

The diamond darter is indirectly provided some protection from Federal actions and activities through the Act because the Elk River also supports five federally endangered mussel species. The reach of the Elk River currently known to support the diamond darter also supports the pink mucket (*Lampsilis abrupta*), the northern riffleshell (*Epioblasma torulosa rangiana*), the rayed bean (*Villosa fabalis*), and the snuffbox (*Epioblasma triquetra*). The clubshell mussel (*Pleurobema clava*) occurs in the reach of the Elk River upstream of the diamond darter. Many of the same management recommendations made to avoid adverse effects during consultations for endangered mussels, such as avoiding instream disturbances and controlling sedimentation, would also benefit the diamond darter. However, protective measures for listed freshwater mussels in the Elk River have generally involved surveys for mussel species presence and development of minimization measures in areas with confirmed presence. The diamond darter is more mobile and, therefore, is likely to be present within a less restricted area than most mussel species. Surveys for mussels will not detect diamond darters. As a result, these measures provide some limited protection for the diamond darter in the Elk River, but only in specific locations where it co-occurs with these mussel species. Currently, no requirements within the scope of Federal or State environmental laws specifically consider the diamond darter during Federal or State-regulated activities, or ensure that projects will not jeopardize the diamond darter's continued existence.

Summary of Factor D

Few existing laws specifically protect the diamond darter. A number of existing Federal and State regulatory mechanisms are designed to protect water quality and reduce sedimentation, which could reduce threats to the diamond darter. However, degradation of water quality and habitat is ongoing throughout the current range of the diamond darter, despite these existing regulatory mechanisms governing some activities that contribute to this threat. We have no information indicating that these threats are likely to be appreciably reduced in the future.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Didymosphenia geminate

The presence of *Didymosphenia geminate,* an alga known as ''didymo'' or ''rock snot'' has the potential to adversely affect diamond darter populations in the Elk River. This alga, historically reported to occur in cold, northern portions of North America (e.g., British Columbia), has been steadily expanding its range within the last 10 to 20 years, and has now been reported to occur in watersheds as far east and south as Arkansas and North Carolina (Spaulding and Elwell 2007, pp. 8–21). The species has also begun occurring in large nuisance blooms that can dominate stream surfaces by covering 100 percent of the substrate with mats up to 20 cm (8 in) thick, extending over 1 km (0.6 mi) and persisting for several months (Spaulding and Elwell 2007, pp. 3, 6). Didymo can greatly alter the physical and biological conditions of streams in which it occurs and cause changes to algal, invertebrate, and fish species diversity and population sizes; stream foodweb structure; and stream hydraulics (Spaulding and Elwell 2007, pp. 3, 12). Didymo is predicted to have particularly detrimental effects on fish, such as the diamond darter, that inhabit stream bottom habitats or consume bottom-dwelling prey (Spaulding and Elwell 2007, p. 15).

While didymo was previously thought to be restricted to coldwater streams, it is now known to occur in a wider range of temperatures, and it has been documented in waters with temperatures that were as high as 27 °C (80 °F) (Spaulding and Elwell 2007, pp. 8, 10, 16). It can also occur in a wide range of hydraulic conditions including slow-moving, shallow areas and areas with high depths and velocities (Spaulding and Elwell 2007, pp. 16–17). Didymo can be spread large distances either through the water column or when items such as fishing equipment, boots, neoprene waders, and boats are moved between affected and unaffected sites (Spaulding and Elwell 2007, pp. 19–20). For example, in New Zealand, didymo spread to two sites over 100 km (62.1 mi) and 450 km (279.6 mi) away from the location of the first documented bloom within 1 year (Kilroy and Unwin 2011, p. 254).

Although didymo has not been documented to occur in the lower Elk River where the diamond darter occurs, in 2008 the WVDNR documented the presence of didymo in the upper Elk River, above Sutton Dam near Webster Springs, which is over 120 km (74.5 mi) upstream from known diamond darter locations (WVDNR 2008, p. 1). Anglers have also reported seeing heavy algal mats, assumed to be didymo, in the upstream reach of the river (WVDNR 2008, p. 1). Therefore, there is potential that the species could spread downstream to within the current range of the diamond darter in the future. If it does spread into the diamond darter habitat, it could degrade habitat quality and pose a significant threat to the species.

Invasive Riparian Plants

Invasive, nonnative plants associated with riparian areas, such as Japanese knotweed, have the potential to adversely affect diamond darter populations in the Elk River. Japanese knotweed is a species native to eastern Asia that was introduced in the United States as an ornamental landscape plant (Barney 2006, p. 704). The species forms dense, monotypic stands that exclude native vegetation (Urgenson 2006, p. 6). Once introduced into an area, it spreads rapidly through riparian areas as flood waters carry root and stem fragments downstream and these fragments then regenerate to form new populations (Urgenson 2006, p. 1).

Healthy, functioning, riparian forests are an essential component of maintaining water and habitat quality in streams, and streams are adversely affected when riparian areas are invaded by species such as Japanese knotweed (Urgenson 2006, p. 35). Streambanks dominated by Japanese knotweed populations are less stable and more prone to erosion because Japanese knotweed has shallower roots compared to native riparian trees and woody shrubs. Because Japanese knotweed dies back in winter, it also leaves streambanks more exposed to erosive forces (Urgenson 2006, pp. 35–36). Thus, knotweed can increase streambank erosion, increase sedimentation in streams, and alter channel morphology. In addition, riparian areas dominated by Japanese knotweed change the natural composition of leaf litter entering the stream. This change affects nutrient cycling and organic matter inputs into the aquatic food web, and can have long-lasting effects on microhabitat conditions and aquatic life of affected stream systems (Urgenson 2006, pp. i, 31). Because leaf litter from Japanese knotweed is of lower nutritional quality than native vegetation, it can negatively impact the productivity of aquatic macroinvertebrates, which are a primary food source for fishes like the diamond darter (Urgenson 2006, p. 32).

Japanese knotweed has already been found in the upstream portions of the Elk River watershed (Schmidt 2013, p. 1). In 2012, Service biologists and their partner organizations documented and initiated control measures on 25 Japanese knotweed populations on the mainstem Elk River and its tributaries. These populations were located near the Randolph-Webster County line approximately 161 km (100 mi) upstream of the range of the diamond darter. Some of these populations were over 0.1 ha (0.25 ac) in size and had doubled in size in the 2 years since first documented (Schmidt 2013, p. 1). Japanese knotweed is difficult to control and eradicate. Effective eradication requires many years of focused efforts, and often populations are discovered downstream before 100 percent mortality is achieved in the treated area (Urgenson 2006, p. 37).

Geographic Isolation and Loss of Genetic Variation

The one existing diamond darter population is small in size and range, and is geographically isolated from other areas that previously supported the species. The diamond darter's distribution is restricted to a short stream reach, and its small population size makes it extremely susceptible to extirpation from a single catastrophic event (such as a toxic chemical spill or storm event that destroys its habitat). Its small population size reduces the potential ability of the population to recover from the cumulative effects of smaller chronic impacts to the population and habitat such as progressive degradation from runoff (non-point-source pollutants) and direct disturbances.

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 and reducing the fitness of individuals (Soule 1980, pp. 157–158; Hunter 2002, pp. 97–101; Allendorf and Luikart 2007, pp. 117–146). Similarly, the random loss of adaptive genes through genetic drift may limit the ability of the diamond darter to respond to climate change and other changes in its environment and the catastrophic events and chronic impacts described above (Noss and Cooperrider 1994, p. 61). Small population sizes and inhibited gene flow between populations may increase the likelihood of local extirpation (Gilpin and Soulé 1986, pp. 32–34). 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 (Harris 1984, pp. 93–104; Noss and Cooperrider 1994, pp. 264–297). The current population of the diamond darter is restricted to one section of one stream. This population is isolated from other suitable and historical habitats by dams that are barriers to fish movement. The level of isolation and restricted range seen in this species makes natural repopulation of historical habitats or other new areas following previous localized extirpations virtually impossible without human intervention.

Climate Change

Climate change (as defined by the Intergovernmental Panel on Climate Change (2007, p. 78)) has the potential to increase the vulnerability of the diamond darter to random catastrophic events and to compound the effects of restricted genetic variation and population isolation. Current climate change predictions for the central Appalachians indicate that aquatic habitats will be subject to increased temperatures and increased drought stress, especially during the summer and early fall (Buzby and Perry 2000, p. 1774; Byers and Norris 2011, p. 20). There will likely be an increase in the variability of stream flow, and the frequency of extreme events, such as droughts, severe storms, and flooding, is likely to increase Statewide (Buzby and Perry 2000, p. 1774; Byers and Norris 2011, p. 20). While the available data on the effects of climate change are not precise enough to predict the extent to which climate change will degrade diamond darter habitat, species with limited ranges that are faced with either natural or anthropomorphic barriers to movement, such as the dams that fragmented and isolated the historical diamond darter habitat, have been found to be especially vulnerable to the effects of climate change (Byers and Norris 2011, p. 18). Thus, the small population size and distribution of the diamond darter makes the species particularly susceptible to risks from catastrophic events, loss of genetic variation, and climate change.

Conservation Efforts To Reduce Other Natural or Manmade Factors Affecting Its Continued Existence

The West Virginia Invasive Species Working Group (WVISWG) is a group of State and Federal agencies, nongovernmental organizations, and private stakeholders dedicated to working together on nonnative invasive species issues that affect West Virginia. The primary mission of the WVISWG is to maintain an inclusive Statewide group to facilitate actions for the prevention or reduction of negative impacts of invasive species on managed and natural terrestrial and aquatic communities through coordinated planning and communication, assessment and research, education, and control. The WVISWG is developing a Statewide invasive species strategic plan to provide guidance and coordination for invasive species management actions across the State. These voluntary efforts may help to reduce the spread of didymo and Japanese knotweed and other invasive riparian plants that are a threat to the diamond darter and its habitat.

The Service, WVDNR, USGS West Virginia Cooperative Fish and Wildlife Research Unit at West Virginia University, and Conservation Fisheries, Inc. (CFI) are working together to conduct research on the reproductive biology and life history of the diamond darter and are attempting to establish a captive population to avert extinction and preserve genetic diversity. Although diamond darters have successfully bred in captivity, no larvae have survived to adulthood. Additional research and funding is needed for this effort to be fully successful.

Summary of Factor E

In summary, because the diamond darter has a small geographic range and small population size, it is subject to several other ongoing natural and manmade threats. These threats include the spread of invasive, nonnative species such as *Didymosphenia geminate* and Japanese knotweed; loss of genetic fitness; and susceptibility to spills, catastrophic events, and impacts from climate change. The severity of these threats is high because the diamond darter's small range and population size reduces its 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.

Cumulative Effects From Factors A Through E

Some of the threats discussed in this rule could work in concert with one another to cumulatively create situations that potentially impact the diamond darter beyond the scope of the individual threats that we have already analyzed. As described in Factor A, the reach of the Elk River inhabited by the diamond darter is threatened by numerous sources of habitat and water quality degradation, including sedimentation and siltation from multiple sources, coal mining, oil and gas development, and inadequate sewage treatment. All these threats likely reduce the amount and quality of the diamond darter's remaining available habitat and are sources of chronic and continued degradation of its habitat. As described above, these threats also likely reduce the amount of forage available to the species, reduce the fitness of remaining individuals, and decrease breeding success and survival of young. These chronic threats likely affect the ability of the diamond darter population in the Elk River to grow and thrive, making it less resilient to potential acute threats such as accidental spills and catastrophic events. In a review of population and stream responses to various types of disturbances, Yount and Niemi (1990, pp. 547–555) found that populations or streams that were affected by multiple chronic sources of disturbance and degradation were less resilient and less likely to recover quickly from additional individual disturbances. In addition, they found that the availability of unaffected populations in nearby streams, tributaries, or upstream and downstream reaches that would provide a source of organisms for recolonization was one of the key factors that allowed affected populations to recover from disturbances (Yount and Niemi 1990, p. 547).

There are no unaffected populations or stream reaches available to the diamond darter. The diamond darter's current range is already severely restricted and isolated from other suitable habitats by dams and impoundments. The one remaining diamond darter population is small and occurs in one reach of a single river that is already affected by multiple chronic sources of degradation. Thus, the current remaining population has very little resiliency and a very limited ability to recover from additional individual disturbances. Cumulatively, these factors make the diamond darter particularly susceptible to extinction from additional threats such as direct disturbances, invasive species, spills, and long-term effects of climate change. These ongoing cumulative threats to the diamond darter are occurring throughout the species' entire current range. We have no information indicating that these threats are likely to be appreciably reduced in the future.

Summary of Factors

We have carefully assessed the best scientific and commercial data available regarding the past, present, and future threats to the diamond darter. The primary threats to the diamond darter are related to the present or threatened destruction, modification, or curtailment of its habitat or range (Factor A) and other natural or manmade factors affecting its continued existence (Factor E). The species is currently known to exist only in the lower Elk River, West Virginia. This portion of the watershed is impacted by ongoing water quality degradation and habitat loss from activities associated with coal mining and oil and gas development, sedimentation and siltation from these and other sources, inadequate sewage and wastewater treatment, and direct habitat loss and alteration. The impoundment of rivers in the Ohio River Basin, such as the Kanawha, Ohio, and Cumberland Rivers, has eliminated much of the species' habitat and isolated the existing population from other watersheds that the species historically occupied. The small size and restricted range of the remaining diamond darter population makes it particularly susceptible to extirpation from spills and other catastrophic events, the spread of invasive species, and effects of genetic inbreeding.

The species could be vulnerable to overutilization for scientific or recreational purposes (Factor B), but the significance of this threat is minimized through the State's administration of scientific collecting permits. There are no known threats to the diamond darter from disease or predation (Factor C). Although some regulatory mechanisms exist (Factor D), they do not succeed in alleviating these threats. In addition to the individual threats discussed under Factors A and E, each of which is sufficient to warrant the species' listing, the cumulative effect of these factors is such that the magnitude and imminence of threats to the diamond darter are significant throughout its entire current range.

Determination

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 diamond darter, which consists of only one population (occurrence), is presently in danger of extinction throughout its entire range, due to the immediacy, severity, and scope of the threats described above. Because the species is currently limited to one small, isolated population in an aquatic environment that is currently facing numerous, severe, and ongoing threats to its habitat and water quality, we find that the diamond darter does not meet the definition of a threatened species. Therefore, on the basis of the best available scientific and commercial data, we list the diamond darter as endangered in accordance with sections 3(6) and 4(a)(1) of the Act.

Under the Act and our implementing regulations, a species may warrant listing if it is threatened or endangered throughout all or a significant portion of its range. The diamond darter is highly restricted in its range and the threats to the survival of the species are not restricted to any particular significant portion of that range. Therefore, we assessed the status of the species throughout its entire range. Accordingly, our assessment and determination apply to the species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species 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 requires that recovery actions be carried out for all listed species. The protections 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 requires 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. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, 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 (comprising 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 Web site (*http://www.fws.gov/endangered*), or from our West Virginia Fish and Wildlife 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, Tribal, 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.

Once this species is listed, 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 States of Kentucky, Ohio, Tennessee, and West Virginia will be eligible for Federal funds to implement management actions that promote the protection or recovery of the diamond darter. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened 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)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they carry out, authorize, or fund 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 formal consultation with the Service.

Federal agency actions within the species' habitat that may require consultation as described in the preceding paragraph include the issuance of section 404 Clean Water Act permits by the ACOE; construction and management of gas pipeline and power line rights-of-way or hydropower facilities by the Federal Energy Regulatory Commission; construction and maintenance of roads, highways, and bridges by the Federal Highway Administration; pesticide regulation by the USEPA; and issuance of coal mining permits by the Office of Surface Mining.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C. 42–43; 16 U.S.C. 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities.

Our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), is 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. The intent of this policy is to increase public awareness of the effect of a listing on proposed and ongoing activities within the range of listed species. The following activities could potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting of the species, including import or export across State lines and international boundaries, except for properly documented antique specimens at least 100 years old, as defined by section 10(h)(1) of the Act.

(2) Violation of any permit that results in harm or death to any individuals of this species or that results in degradation of its habitat to an extent that essential behaviors such as breeding, feeding and sheltering are impaired.

(3) Unlawful destruction or alteration of diamond darter habitats (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 diamond darter.

(4) Unauthorized discharges or dumping of toxic chemicals or other pollutants into waters supporting the diamond darter that kills or injures individuals, or otherwise impairs essential life-sustaining behaviors such as breeding, feeding, or finding shelter.

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

Required Determinations

National Environmental Policy Act

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), 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.

References Cited

A complete list of all references cited in this rule is available on the Internet at *http://www.regulations.gov* or upon request from the West Virginia Field Office (see **FOR FURTHER INFROMATION CONTACT**).

Author(s)

The primary author of this document is staff from the West Virginia Field Office (see **ADDRESSES**).

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 follows:

PART 17—[AMENDED]

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

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

■ 2. Amend § 17.11(h) by adding an entry for ''Darter, diamond'' to the List of Endangered and Threatened Wildlife in alphabetical order under Fishes to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*		*
FISHES							
*	*	*	*	*	*		*
Darter, diamond	*Crystallaria cincotta*	U.S.A. (IN, KY, OH, TN, WV).	Entire	E	815	NA	NA
*	*	*	*	*	*		*

Dated: July 18, 2013.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

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