

**Vermilion Darter**  
**(*Etheostoma chermocki*)**

**5-Year Review:**  
**Summary and Evaluation**

**August 2011**

**U.S. Fish and Wildlife Service**  
**Southeast Region**  
**Jackson Ecological Services Field Office**  
**Jackson, Mississippi**

## **5-YEAR REVIEW**

### **Vermilion Darter (*Etheostoma chermocki*)**

#### **I. GENERAL INFORMATION**

**A. Methodology used to complete the review:** In completing this 5-year review, we relied on the best available information pertaining to historic and current distributions, life history, and habitats of this species. Our sources included the final rule listing this species under the Endangered Species Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. A *Federal Register* notice announcing the review and requesting information was published on July 29, 2008 (73 FR 43947), and a 60-day comment period was opened. Comments were evaluated and incorporated where appropriate into this final document (see Appendix A). No part of this review was contracted to an outside party. This review was completed by the Service's lead Recovery biologist in the Jackson Ecological Services Field Office, Mississippi.

#### **B. Reviewers**

**Lead Region** – Southeast Region: Kelly Bibb, 404-679-7132

**Lead Field Office** – Jackson, Mississippi, Ecological Services Field Office: Daniel J. Drennen, 601-321-1127

**Cooperating Field Office** – Daphne, Alabama, Ecological Services Field Office: Jeff Powell, 251-441-5858

#### **C. Background**

- 1. FR Notice citation announcing initiation of this review:** July 29, 2008 (73 FR 43947)
- 2. Species status:** Stable (2010 Recovery Data Call)  
Cursory surveys throughout the species' range indicate minor increases and decreases in relative abundance with a stable overall trend.
- 3. Recovery achieved:** (1 = 0-25% recovery objectives achieved)  
Recovery achieved is based on lack of permanent protection of populations from present and foreseeable threats and lack of long-term monitoring data.

**4. Listing history**

Original Listing

FR notice: 66 FR 59367

Date listed: December 28, 2001

Entity listed: Species

Classification: Endangered

Critical Habitat

FR notice: 75 FR 75913

Date Designated: December 7, 2010

**5. Review History:**

Recovery Data Call: 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, and 2001.

Recovery Plan: 2007

**6. Species' Recovery Priority Number at start of review (48 FR 43098): 2**

Degree of Threat: High

Recovery Potential: High

Taxonomy: Species

**7. Recovery Plan:**

Name of plan: Vermilion Darter (*Etheostoma nuchale*) Recovery Plan

Date issued: June 20, 2007

**II. REVIEW ANALYSIS**

**A. Application of the 1996 Distinct Population Segment (DPS) policy**

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

**2. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? No**

**B. Recovery Criteria**

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

**2. Adequacy of recovery criteria.**

**a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes**

**b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes**

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

Delisting of the vermilion darter will be considered when:

1) Populations of vermilion darters and its habitat within its known range in Turkey Creek are shown to be protected from present and foreseeable threats to the point where listing is no longer required through the implementation of activities including stewardship, outreach, best management practices, securing conservation easements or acquisitions, and ensuring adequate regulatory enforcement.

The vermilion darter is listed in the Turkey Creek watershed due to urbanization and industrialization. The current range of the vermilion darter is reduced to localized sites due to fragmentation, separation, and destruction of vermilion darter populations. There are both natural (waterfall) and manmade (impoundments) dispersal barriers that contribute to the separation and isolation of vermilion darter populations and affect water quality and quantity. The primary threats to the species are: degradation of water quality due to sedimentation and pollutants; altered stream flow regimes and water quantity due to construction and maintenance activities; insufficient stormwater management; and impoundments (five within the Turkey Creek and Dry Creek system). Other threats include: in-stream rock extractions; off-road vehicle usage; road, culvert, bridge, gas and water easement construction and maintenance (Drennen pers. obs. 1999-2009, Blanco and Mayden 1999). These activities lead to water quality degradation, stream channel instability, fragmentation of habitat and hydrology, and overall changes in the geomorphology of the Turkey Creek watershed. In addition, natural waterfalls are dispersal barriers to the connectivity of the vermilion darter populations. All together, the vermilion darter's habitat is fragmented and the various subpopulations may be genetically isolated. The reduction of habitat for spawning, rearing of young, population maintenance, and reduction of adaptive capabilities increases the possibility of local extinctions (Hallerman 2003; Burkhead *et al.* 1997).

Noteworthy increases of land acquisition within the Turkey Creek watershed have occurred. Currently, approximately 21.16 km (13.15 mi) of habitat is available to the vermilion darter, of which 20.40 km (12.68 mi) are privately owned and 0.76 km (0.47 mi) are publicly owned by the City of Pinson, Jefferson County or the State of Alabama. The Turkey Creek Nature Center and Preserve (State of Alabama) protects roughly 10% of the Turkey Creek mainstem. Lands owned by the Freshwater Land Trust protect another 20% of the mainstem. Jefferson County and the City of Pinson have removed dwellings in flood plain areas along Dry Branch, Tapawingo Spring Run and the Turkey Creek main stem. Even though increases in land acquisitions to protect Turkey Creek have occurred, destruction of hill tops for subdivision construction in the headwaters decreases downstream water quality and proliferates stormwater runoff. Consequently, this criterion is not met because the vermilion darter and its habitat continue to be unprotected from present and foreseeable threats.

2) Stable or increasing population trends for at least 10 years throughout its known range are verified through monitoring and surveys.

Initially vermilion darter populations were documented to be sporadic and declining (Blanco and Mayden 1999). A 71 percent decline of vermilion darters were noted between 1995 and 1998 within the species' 11.6 km (7.2 mi) known range in the Turkey Creek mainstem. An estimate of effective population size of the species in 1999 was 1,174 individuals based on the estimate of population abundance of 1,847-3,238 individuals (Blanco and Mayden 1999). The effective population size is the average number of individuals in a population that actually contribute genes to succeeding generations and is generally lower than the observed, censused population size (Allaby 1991). From this statistic an estimate of the ancestral population size was made, producing 10,645-11,485 individuals. This was considered high for a population that occurs in only one stream (Khudamrongsawat *et al.* 2005). However, Powers (2003), observed a high density of populations of darters in a small stream, which supported the idea that the ancestral population size estimate was valid (Khudamrongsawat *et al.* 2005). Since vermilion darters have been noted in spring fed tributaries and a silty bottom habitat of the Unnamed Tributary to Beaver Creek, it may have been possible for Turkey Creek to support as many as 10,000 individuals of vermilion darters (Khudamrongsawat 2007). Consequently, the reduction of the total population size to 1,174 individuals from 10,000 individuals would be substantial (Khudamrongsawat 2007).

Cursory surveys of the major tributaries to Turkey Creek (Unnamed, Beaver, Dry creeks and Dry Branch) between 2000-2009 for presence or absence of the vermilion darter indicated that the species persists in three areas which are enhanced by groundwater flow from spring sites (Drennen pers. obs. 2000-2009, Stiles pers. comm. 2000-2009, Kuhajda pers. comm. 2000-2009). Surveys since 2006 (Stiles pers. comm. 2009) have not revealed the presence of vermilion darters within the headwaters of Turkey Creek at one historic site.

Given the overall sporadic nature of the species' population size within specific sites of its range, there is no evidence to suggest that the species has been increasing or dramatically decreasing over the last 5-10 years within its known range. However, additional surveys and monitoring are needed to document a stable trend over a 10-year period.

3) Suitable flows (water quantity) and water quality in Turkey Creek supporting the vermilion darter are determined through recovery tasks and assured, through State or local groundwater management plans, or water conservation plans.

The vermilion darter prefers streams with pools of moderate current alternating with riffles of moderately swift current, and low water turbidity (Boschung and Mayden 2004). Much of the cool, sediment free water provided to the Turkey Creek main stem comes from consistent and steady groundwater sources (springs). This water contributes to the flow and water quantity in the tributaries (Beaver Creek, Dry Creek, Dry Branch,

and the Unnamed Tributary to Beaver Creek). Flowing water transports nutrients and food items, moderates water temperatures, maintains adequate dissolved oxygen levels, and dilutes contaminants while enhancing normal life stages and behavior of the vermilion darter.

Favorable water quantity is an average daily discharge of over 50 cfs (cubic feet per second) of surface runoff and groundwater sources (springs and seepages) within the Turkey Creek main stem (U.S. Geological Survey 2009, compiled from average annual statistics). The upper limit for the average daily discharge is not known, but an average daily discharge over 100 cfs may increase instream channel erosion and rearrange instream habitats such as gravel, vegetation, etc. (Drennen pers. obs. February 2009). In addition, this average daily discharge, both minimum and flushing flows, are necessary within the tributaries to protect basic aquatic functions and to remove fine sediments and other pollutants (Drennen pers. obs., February 2009; Instream Flow Council, 2004; Gilbert *et al.* eds. 1994; Moffett and Moser 1978). These flows are supplemented by groundwater and contribute to the overall stream flushing effect by adding to the total flow high-quality water. This in turn contributes to the maintenance of stream banks and bottoms, essential for normal life stages and behavior of the vermilion darter.

Water quantity and flow regime with an average daily discharge between 50 and 100 cfs from both surface runoff and groundwater sources (springs and seepages) provide a constant water supply to maintain all life stages of the species in the stream environment, including migration, spawning, resting, feeding and larval development. It also removes fine particles and sediments.

Currently, suitable in-stream flows and water quality parameters in Turkey Creek that support the vermilion darter (U.S. Geological Survey 2009, compiled from average annual statistics, Drennen pers. obs., February 2009; Instream Flow Council, 2004; Gilbert *et al.* eds. 1994; Moffett and Moser 1978; Ingersol 1984; Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)) are not addressed in state, county or local management or conservation plans and not consistently implemented. Thus, this criterion is not met.

4) An average monthly reading of 10 NTU (Nephelometric Turbidity Units), a unit used to measure sediment discharge, or 15 mg/L TSS (Total Suspended Solid) or less discharge into the Turkey Creek watershed within and upstream of the vermilion darter's range is being attained and documented as occurring for a minimum of 10 consecutive years. Information will be compiled from sampling water quality monthly throughout the year during base, low and high flows.

Specifically, sediment is a severe problem related to non-point and point source pollution. Turbidity may change dramatically within a few hours depending on rainfall and change from a water column relatively free of visible sediment (10 NTU's) to brown (100 NTU's) (Drennen pers. obs. September 2009). Thus, the continued swing of water quality, especially turbidity, indicates that this criterion has not been met.

5) A captive vermilion darter population of 20 pairs (40 individuals) has been established and successfully propagated for augmentation.

Rakes and Shute (2005) produced 700 offspring from 20 adult warrior darters (*Etheostoma bellator*), a surrogate to the vermilion darter. Since there are only minor differences in the husbandry between the two species, the information obtained is applicable to the vermilion darter and the production of offspring for a potential ark population of augmentation of existing population where needed. Even though the information obtained from Rakes and Shute (2005) is applicable to begin a husbandry effort, there is no ark population or any vermilion darters in captivity for propagation and reintroduction in the event of extirpation of one of the existing vermilion darter populations. Therefore, this criterion is not met.

## **C. Updated Information and Current Species Status**

### **1. Biology and Habitat**

#### **a. Abundance, population trends (e.g. increasing, decreasing, and stable), demographic features, or demographic trends:**

The vermilion darter is found only in the Turkey Creek drainage, a tributary of the Locust Fork of the Black Warrior River, Jefferson County, Alabama. The current range of the vermilion darter is restricted to localized sites within the upper mainstem reach of Turkey Creek and four tributaries in Pinson, Jefferson County, Alabama (Boschung and Mayden 2004). Extensive surveys in similar habitats have failed to locate this species outside of its current drainage (Boschung *et al.* 1992, Blanco *et al.* 1995, Mettee *et al.* 1996, Shepard *et al.*, 1998, Blanco and Mayden 1999, Boschung and Mayden 2004).

The historic population size of the vermilion darter within the Turkey Creek drainage is unknown. However, an estimate of the ancestral population size was calculated based on an effective population size estimate by Blanco and Mayden (1999). The estimated ancestral population size is 10,645-11,485 individuals (see earlier discussion under section II.B.3.). In the 1960s and 1970s, the vermilion darter was common at certain sites in Turkey Creek but began decreasing and became rare by the early 1990's (Boschung *et al.* 1992; K. Marion, University of Alabama in Birmingham, pers. comm. 2007). Currently, populations of vermilion darters are variably common at scattered locations within its range (Kuhajda *et al.* 2009) and sparse and isolated within other areas of Turkey Creek, due to natural or manmade causes. Relative abundance data by Blanco and Mayden (1999), during 1998 and 1999, indicated the population size of vermilion darters was between 1,847 and 3,238 individuals based on the number of vermilion darters caught within the Turkey Creek main stem and the tributaries of Dry and Beaver creeks. In 2003, Stiles and Blanchard (2003), found 107 between March and August 2003 within these same areas, suggesting a continued decline.

Cursory surveys conducted sporadically within the Turkey Creek mainstem and tributaries from 2004-2009 (Stiles pers. comm. 2000-2009, Kuhajda pers. comm. 2000-2009, Khudamrongsawat 2007) indicate an overall sparseness, sporadic and isolated nature of the vermilion darter. Since 2007 vermilion darters have been consistently found in regularly surveyed sites in the Turkey Creek mainstem and tributaries (Stiles pers. comm. 2009); however no vermilion darters have been collected at a site on upper Turkey Creek, likely due to a tremendous amount of large sediment (gravel and silt) originating from two recently constructed hill top subdivisions (Drennen pers. obs. September 2009).

**b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

Khudamrongsawat (2007) developed nine microsatellite loci of the vermilion darter and observed that heterozygosity was lower than expected for this species. However, one gene locus showed significant deviation from the Hardy-Weinberg equilibrium. All markers were tested and Khudamrongsawat (2007) found that sufficient allelic variation existed for future monitoring of the genetic structure of the population. Variation was high within the vermilion darter population despite evidence of a declining census size suggesting that the species may be considered as one population. Genetic bottlenecking was not observed in the species but due to the recent decline of the vermilion darter, it may take some time until a severe bottleneck is observed.

**c. Taxonomic classification or changes in nomenclature:**

No new information.

**d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range:**

The current range of the vermilion darter is slightly reduced from the historic range due to fragmentation of sites and separation of vermilion darter populations. There are both natural (waterfall) and manmade (impoundments) dispersal barriers that contribute to the separation and isolation of vermilion darter populations. Fragmentation of the species' habitat has subjected these isolated populations within the Turkey Creek system to genetic isolation and reduction of space for rearing and reproduction, population maintenance and reduction of adaptive capabilities and increased likelihood of local extinctions (Hallerman 2003, Burkhead *et al.* 1997).

**e. Habitat or ecosystem conditions:**

Several stakeholders within the Turkey Creek watershed have incorporated best management practices along the mainstem of Turkey Creek and tributaries in construction, planning and development plans (Pinson Planning Commission



2009; Black Warrior Clean Water Partnership Committee 2005). Recently the City of Pinson removed structures within the Dry Branch flood plan, in order to reduce flooding and for the formation of green areas (Sanders pers. comm. 2009). In addition, the Turkey Creek Nature Center has been established, along with preservation of additional areas along the Turkey Creek main stem (Steel pers. comm. 2009). The Freshwater Land Trust recently obtained land within the Turkey Creek headwaters. In September 2009, a meeting and habitat tour united stakeholders, government officials, private conservation organizations and academia to network and discuss problems and solutions regarding management and conservation of the vermilion darter and the Turkey Creek watershed (Drennen pers. obs. September 2009)

Even though conservation gains have been made within parts of the vermilion darter habitat, hill top removal for construction continues in the headwaters of the creek. This is the non-point source of major sedimentation within Turkey Creek (Rogers pers. comm. September 2009).

## **2. Five-Factor Analysis**

### **a. Present or threatened destruction, modification or curtailment of its habitat or range:**

Protection of specific habitat attributes associated with the Turkey Creek mainstem and its tributaries is essential for the recovery of the species. Specifically, maintaining adequate surface and subsurface water quality, especially the reduction of turbidity, improving water quantity and flow, and protection of the habitat substrate and vegetation, along with protection of significant riparian buffer zones along the tributaries are important for the species to recover. Currently, several subdivision developments have faltered under declining economic conditions. In doing so, large areas of hill tops have been denuded and left to erode (Drennen pers. obs. September 2009). Erosion from these areas is significant with turbidity levels changing from 10-15 NTU to 100-150 NTU within a couple of hours of heavy rains (Drennen pers. obs. September 2009, Rogers pers. comm. September 2009).

The long-term recovery of the species is based on conservation and connectivity of all populations. The protection of the recharge area and spring systems that supply a constant and steady water supply into Turkey Creek system are essential especially at the Tapawingo Springs site and on private land at the headwaters of the Unnamed Tributary to Beaver Creek.

Non-point source pollution from land surface runoff can originate from virtually any land use activity and may be correlated with impervious surfaces and storm water runoff. Pollutants may include sediments, fertilizers, herbicides, pesticides, animal wastes, septic tank and gray water leakage, and petroleum products. These pollutants tend to increase concentrations of

nutrients and toxins in the water and alter the chemistry of subsurface and surface waters such that the habitat and food sources for species like the vermilion darter are negatively impacted. Construction and road maintenance activities associated with urban development typically involve earth-moving activities that increase sediment loads into nearby aquatic systems through storm water runoff during and after precipitation events. Excessive sediment and increased turbidity can make the habitat of vermilion darters and associated benthic fish species unsuitable for feeding and reproduction by covering and eliminating available food sources and nest sites. Sediment has been shown to wear away and/or suffocate periphyton (organisms that live attached to objects underwater and provide likely food items for species such as the vermilion darter), disrupt aquatic insect communities, and negatively impact fish growth, physiology, behavior, reproduction and survivability (Waters 1995, Knight and Welch 2001). Sediment is the most abundant pollutant in the Mobile River Basin (Alabama Department of Environmental Management 1996).

The diminutive range of the vermilion darter is in the industrial and urbanized areas of the City of Pinson. Because of the vermilion darter's limited range, the threat of declining water quality from stormwater runoff is the greatest impact facing the species.

**b. Overutilization for commercial, recreational, scientific, or educational purposes:**

In general, small species of fish such as the vermilion darter are not utilized for either sport or bait purposes and are unknown to the public. Therefore, take of these species by the public has not been a problem. Scientific collecting and take by private and institutional collectors are not threats, and scientific collecting is controlled by the State of Alabama through the issuance of collection permits. However, the potential for the species to be collected is possible.

**c. Disease or predation:**

Predation undoubtedly occurs within all sites for the vermilion darter. There is no evidence to suggest that disease or natural predators threaten the species in the Turkey Creek main stem or tributaries.

The invasive Northern crayfish (*Orconectes virilis*) has been observed to feed on living watercress darters (*Etheostoma nuchali*) at Roebuck Spring, Birmingham, Alabama (Duncan *et al.* 2008). The presence of this crayfish has been found simultaneously with the vermilion darter. Brooke (2008) found this species to be the dominate crayfish within the 7.2 mile range of the vermilion darter and more than 60 percent of the crayfish sampled were *Orconectes virilis*. No predation has been observed but there is a high potential for this to occur (Brooke pers. comm. 2009)

**d. Inadequacy of existing regulatory mechanisms:**

The vermilion 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.) and the Alabama Water Pollution Control Act, as amended, 1975 (Code of Alabama, §§ 22-22-1 to 22-22-14). Because of inconsistency in implementation of Clean Water Act regulations and other best management practices, which are voluntary for some activities and mandatory for others, existing regulatory mechanisms in Alabama are still inadequate. Consistently enforced and monitored regulations would help reduce sediment loading in springs, streams and other aquatic habitats.

The vermilion darter is also protected by the State of Alabama (Code of Alabama §§ 220-2-.92). They are protected against take, capture, and possession unless a party has an appropriate scientific collection permit or written permit from the State.

There are currently no requirements within the scope of other environmental laws within Alabama to specifically consider the vermilion darter or ensure that a project will not jeopardize its continued existence. The effectiveness of existing environmental laws and regulations protecting fish species in headwater streams, springs and seepages is not known because of inconsistencies in enforcement.

**e. Other natural or manmade factors affecting its continued existence:**

Fragmentation of the species' habitat has isolated the populations within the Turkey Creek system and reduced space for rearing and reproduction and population maintenance. Fragmentation and resulting isolated populations has likely reduced adaptive capabilities, and increased the likelihood of local extinctions (Hallerman 2003; Burkhead *et al.* 1997)

Khudamrongsawat *et al.* (2007) found that genetic variation was high within the vermilion darter population despite evidence of a declining census size. It is assumed that the species may be considered as one population. Genetic bottlenecks were not observed in the species. However, it is believed that

since the decline of the vermilion darter is recent that it may take some time until a severe bottleneck could be observed.

Genetic variation and diversity within a species are essential for recovery, adaptation to environmental changes, and long-term viability (capability to live, reproduce, and develop (Noss and Cooperrider 1994; Harris 1984). Long-term viability is founded on numerous interbreeding local populations throughout the range (Harris 1984). Continuity of water flow between suitable habitats is essential in preventing further fragmentation of the species' habitat and populations, conserving the essential riffles, runs, and pools needed by vermilion darters, and promoting genetic flow throughout the populations. Continuity of habitat will maintain spawning, foraging and resting sites as well as providing heterozygosity or gene flow throughout the population. Connectivity of habitats also permits improvement in water quality and water quantity by allowing an unobstructed water flow throughout the connected habitats.

#### **D. Synthesis**

The vermilion darter population in Turkey Creek and tributaries shows evidence of sustainability even though recent survey numbers are low at some sites within the species' range. Since 2001, in most stream reaches of the species habitat, population numbers have been low but stable. Significant conservation gains have been made within site specific habitats of the vermilion darter, such as the Turkey Creek mainstem, the Turkey Creek Nature Preserve and Center, Turkey Creek at Tapawingo Spring confluence, and the headwaters of the Unnamed Tributary to Beaver Creek. Restoration of the Upper Turkey Creek portion of the species' range at Old Shadow Lake Dam has recently been initiated. The removal of the dam will increase the upstream range of the species about 100 meters (Rushing 2011). Upstream areas are of prime development interests for hill top removal for exclusive subdivision development. Routinely after each major storm event, significant amounts of sediment and gravel from these development sites enter the system, increasing the water turbidity from a normal 10 NTU's to 100 NTU's or more (Drennen pers. obs. 2009).

The survivability of the species is perilous due to threats that render the species vulnerable to random natural and human induced events such as: continued deterioration of water quality and quantity; increased stormwater runoff, urbanization and industrialization; geomorphic modifications of the tributaries; degradation of spring water flow and spring water quality; and persistent low and sporadic population numbers of the vermilion darter. Therefore, the vermilion darter continues to meet the definition of an endangered species under the Act.

### **III. RESULTS**

#### **A. Recommended Classification:**

No change is needed.

### **IV. RECOMMENDATIONS FOR FUTURE ACTIONS**

- Continue implementing recovery actions from the Vermilion Darter Recovery Plan (U.S. Fish and Wildlife Service 2007).
- Continue protection of the vermilion darter's habitat, maintenance of connections throughout Turkey Creek and tributaries
- Continue to protect springs, seeps and groundwater within the Turkey Creek Watershed.
- Continue monitoring of the populations structure and genetic variation of the species.
- Work with neighborhood associations and developers to reduce and eliminate unsustainable urbanization on hilltops.
- Continue working with all stakeholders including the City of Pinson, Jefferson County, the State of Alabama, landowners, non-governmental organizations such as the Freshwater Land Trust, Turkey Creek Nature Preserve, and the Black Warrior River Keeper, to protect Turkey Creek, Beaver Creek, the Unnamed Tributary to Beaver Creek, Dry Creek, Dry Branch, Tapawingo Springs and all of spring sites within the area, in particular with regard to storm water runoff and non-point source pollution.

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- Waters, T. F. 1995. Sediment in streams: sources, biological effects and control. Am. Fish. Soc. Mono. 7. Bethesda, MD. 251 pp.

### **Personal Communications**

- Brooke, Nelson. September. 2009. Comments on the abundance of the Northern Crayfish in Turkey Creek.
- Kujahda, Bernard. 2000- 2009. Collection manager, University of Alabama. Comments about his unpublished data of cursory presence-absence of vermilion darters and their habit in the Turkey Creek watershed
- Marion, Ken. 2007. Biology professor. University of Alabama in Birmingham. Status of the vermilion darter at the bridge crossing of Highway 79.
- Rogers, Paul. September 2009. Alabama Department of Environmental Management. Comments about sedimentation in Turkey Creek and the hill top subdivision construction impacts.
- Sanders, Hoyt. September 2009. Mayor of Pinson. Comments on plans to establish greenways in the Dry Branch floodplain.
- Steel, Taylor. September. 2009. Manager of Turkey Creek Nature Center and Preserve. Comments about conservation and acquisition within the Turkey Creek mainstem.
- Stiles, Robert. 2000-2009. Biology professor (retired), Samford University, Birmingham, AL. Comments about his cursory presence-absence data of the vermilion darters and their habit in the Turkey Creek watershed.
- Stiles, Robert. September 2009. Biology professor (retired), Samford University, Birmingham, AL. Comments about his unpublished data on the decline of the vermilion darter and its habitat within the upper reaches of the species range.

### **Personal Observations**

- Drennen, D. 1999-2010. U.S. Fish and Wildlife Service. Jackson, MS. Personal observations of habitat conditions and water quality problems within the Turkey Creek watershed.



Drennen, D. February 2009. Personal observation of the water flow, velocity and quantity of Turkey Creek at the Narrows site and at Tapawingo Springs Road and Turkey Creek bridge in Jefferson County, Pinson, Alabama.

Drennen, D. September 2009. Personal observation of the change in water quality based on color and NTU units before and after a storm event within Turkey Creek and tributaries.

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of**  
**Vermilion darter**

Current Classification: Endangered  
Recommendation resulting from the 5-Year Review

☐ Downlist to Threatened  
☐ Uplist to Endangered  
☐ Delist  
☒ No change is needed

Review Conducted By: Daniel Drennen

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

Approve: Cathy Hargrett Date: 7/28/11

**REGIONAL OFFICE APPROVAL:**

Lead Regional Director, Fish and Wildlife Service

Approve: Just Myer Date: 8/30/11

## **Appendix A: Summary of peer review for the 5-year review of vermilion darter (*Etheostoma chermocki*)**

### **A. Peer Review Method:**

In conducting this 5-year review, we have relied on available information pertaining to historic and current distributions, life histories, and habitats of the vermilion darter. We specifically solicited information from knowledgeable individuals, agencies, academia, and conservation organizations. We sent the 5-year review notice via email to 21 different state and Federal agencies, individuals in academia and non-government conservation organizations.

### **B. Peer Review Charge:**

Copy of the cover letter:

“Colleagues,

On July 29, 2008, the U.S. Fish and Wildlife Service published a notice in the Federal Register announcing a 5-year review of 20 federally listed species, including the vermilion darter. The purpose of the 5-year review is to summarize new information for the species, ensure that the classification of species as threatened or endangered is accurate and reflects the best available information, and to identify actions required to conserve the species.

You have been identified as knowledgeable about the vermilion darter. In order to ensure that the best available information has been used to conduct this 5-year review, we now request your peer review of the attached document. The format is standardized, and we are seeking comments on the accuracy of the data used, identification of any additional new information that has not been considered in this review.

We appreciate your interest in furthering the conservation of rare plants and animals by becoming directly involved in the review process of our Nation’s threatened and endangered species. Your review, comments and recommendations will receive serious consideration.

We hope that you view this peer review process as a worthwhile undertaking. Please give me a call if you have any questions or if you need copies of the references cited (601-321-1127). Also, feel free to respond by email ([daniel\\_drennen@fws.gov](mailto:daniel_drennen@fws.gov)) or letter, whichever is most convenient. Thank you for your assistance.”

### **C. Summary of Peer Review Comments:**

Bernard Kuhajda  
Collections Manager  
Department of Biological Sciences  
Box 870345  
University of Alabama  
Tuscaloosa, AL 35487-0345

Dr. Robert Stiles  
Samford University (retired)  
2221 Great Rock Road  
Vestavia Hills, Alabama 35216

Comments received were generally editorial in nature.

**D. Response to Peer Review**

Editorial comments were evaluated and incorporated as appropriate.