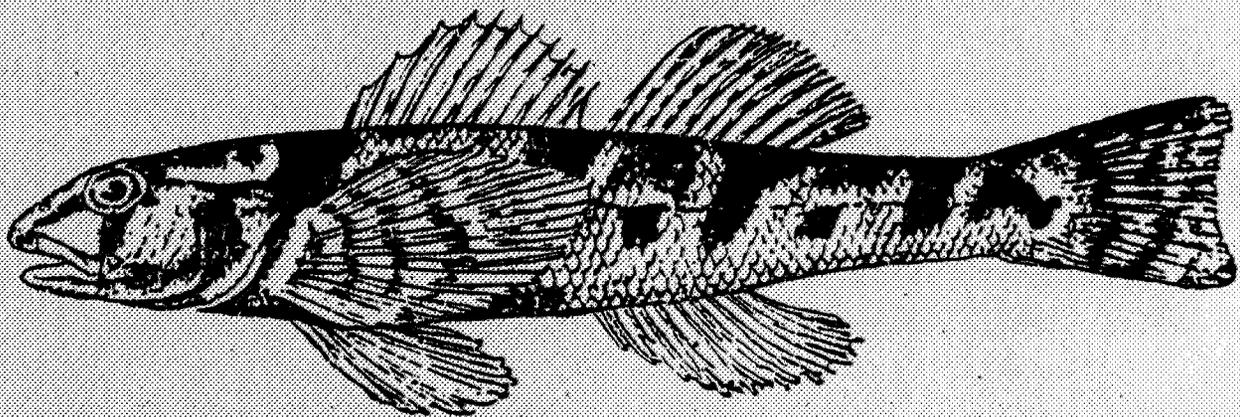


The Maryland Darter Recovery Plan



September 1985

Region 5

U.S. FISH AND WILDLIFE SERVICE



THE
MARYLAND DARTER

RECOVERY PLAN

Prepared by:

REGION 5
U.S. FISH AND WILDLIFE SERVICE

FIRST REVISION
SEPTEMBER 1985

Approved: _____

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October 17, 1985

THIS IS THE REVISED MARYLAND DARTER RECOVERY PLAN. IT HAS BEEN APPROVED BY THE U.S. FISH AND WILDLIFE SERVICE. IT DOES NOT NECESSARILY REPRESENT OFFICIAL POSITIONS OR APPROVALS OF COOPERATING AGENCIES AND IT DOES NOT NECESSARILY REPRESENT THE VIEWS OF ALL PERSONS WHO PARTICIPATED IN THE PREPARATION OF THIS PLAN. THIS PLAN IS SUBJECT TO MODIFICATIONS AS DICTATED BY NEW FINDINGS AND CHANGES IN SPECIES STATUS AND COMPLETION OF TASKS DESCRIBED IN THE PLAN. GOALS AND OBJECTIVES WILL BE ATTAINED AND FUNDS EXPENDED CONTINGENT UPON APPROPRIATIONS, PRIORITIES, AND OTHER BUDGETARY CONSTRAINTS.

LITERATURE CITATIONS SHOULD READ AS FOLLOWS:

U.S. Fish and Wildlife Service, 1985. Revised Maryland Darter Recovery Plan. U.S. Fish and Wildlife Service, Newton Corner, MA 38 pp.

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I. Introduction

The original description of the Maryland darter, Etheostoma sellare (Radcliffe and Welsh) published in 1913, was based on two subadult male specimens taken in 1912. Radcliffe and Welsh recorded the type-locality as "Swan Creek near Havre de Grace, Maryland." This was presumed to be the Swan Creek actually located at Aberdeen and for 50 years many efforts were made to collect the darter in this and nearby streams to obtain additional specimens. All attempts failed until 1962, when a group of Cornell University students discovered a juvenile specimen among numerous juveniles of the tessellated darter (Etheostoma olmstedi) that they had taken from Gasheys Run near Aberdeen. The rediscovery of the Maryland darter stimulated collecting activities along the Lower Susquehanna River drainage and an adult female was also taken in Gasheys Run by L. Knapp and party in April 1965. As both Gasheys Run and the adjacent Swan Creek are quite small, the question remained as to why substantial collecting efforts failed to take more specimens. This may have been answered when Edward C. Raney and Frank J. Schwartz located a population of the Maryland darter in Deer Creek, southeast of Darlington, Harford County, Maryland, in May 1965. Although collections of fishes had been taken from Deer Creek prior to 1965, the apparently restricted habitat of the darter near the creek mouth had been overlooked.

Including the two type-specimens, a total of 80 Maryland darters are known to be preserved in scientific collections. Apparently, no specimens have been preserved since 1971.

Additional sightings of the darter were made in 1974, 1976 thru 1981 and in 1983 by several investigators using seines or by snorkeling. Numbers reported during field surveys ranged from one to ten, although sightings could include repeat observations of the same individual(s). A single adult specimen was captured and released by L.W. Knapp, C.M. Frisbie and J. Sheridan on May 15, 1981, and on September 2, 1983 two adult Maryland darters were observed by W.R. Carter and K. Gustafson-Greenwood.

Taxonomic Relationships

Since the original description, the limited published data on the Maryland darter has primarily concerned its taxonomic relationships. Radcliffe and Welsh (1913) placed the new species in the genus Hadropterus without comment. Noting the lack of caducous scales, Hubbs and Black (1940) re-assigned Etheostoma sellare to Poeclichthys and discussed its relationships with the P. variatus group. Bailey and Gosline (1955) envisioned the subgenus Etheostoma as including E. sellare and 14 other species. The rediscovery of the Maryland darter was very briefly reported by Knapp, et al. (1963). In his survey of the breeding tubercles within the Etheostoma, Collette (1965), placed E. sellare

with the non-tuberculate E. inscriptum species group. Richards (1966) used differences in dentition, tuberculation, body shape, color pattern and habits to distinguish three species groups within the subgenus Etheostoma and two specialized relatives, E. blennius and E. sellare. Because of its specialized head shape and naked body, Tsai (1966) concluded that "E. sellare diverged very early from other members in the evolution of the subgenus Etheostoma." A treatment of the Maryland darter by Knapp (1976) includes a redescription, discussions of relationship and status, and a summary of life history information.

Habitat Description

Although Radcliffe and Welsh stated that their two Maryland darter specimens came from a long, stony riffle in Swan Creek, the precise locality cannot be established. It is probable that in 1912 the lower reaches of Swan Creek had less silt accumulation than at present, and this may account for failure of subsequent investigators to collect additional specimens.

Maryland darter collections have been made at two other localities in Harford County, Maryland (Figure 1). Two specimens were found (1965) in riffles of Gasheys Run near Aberdeen. These riffles are only one to three meters in width and are composed of gravel and silt. Normal flow

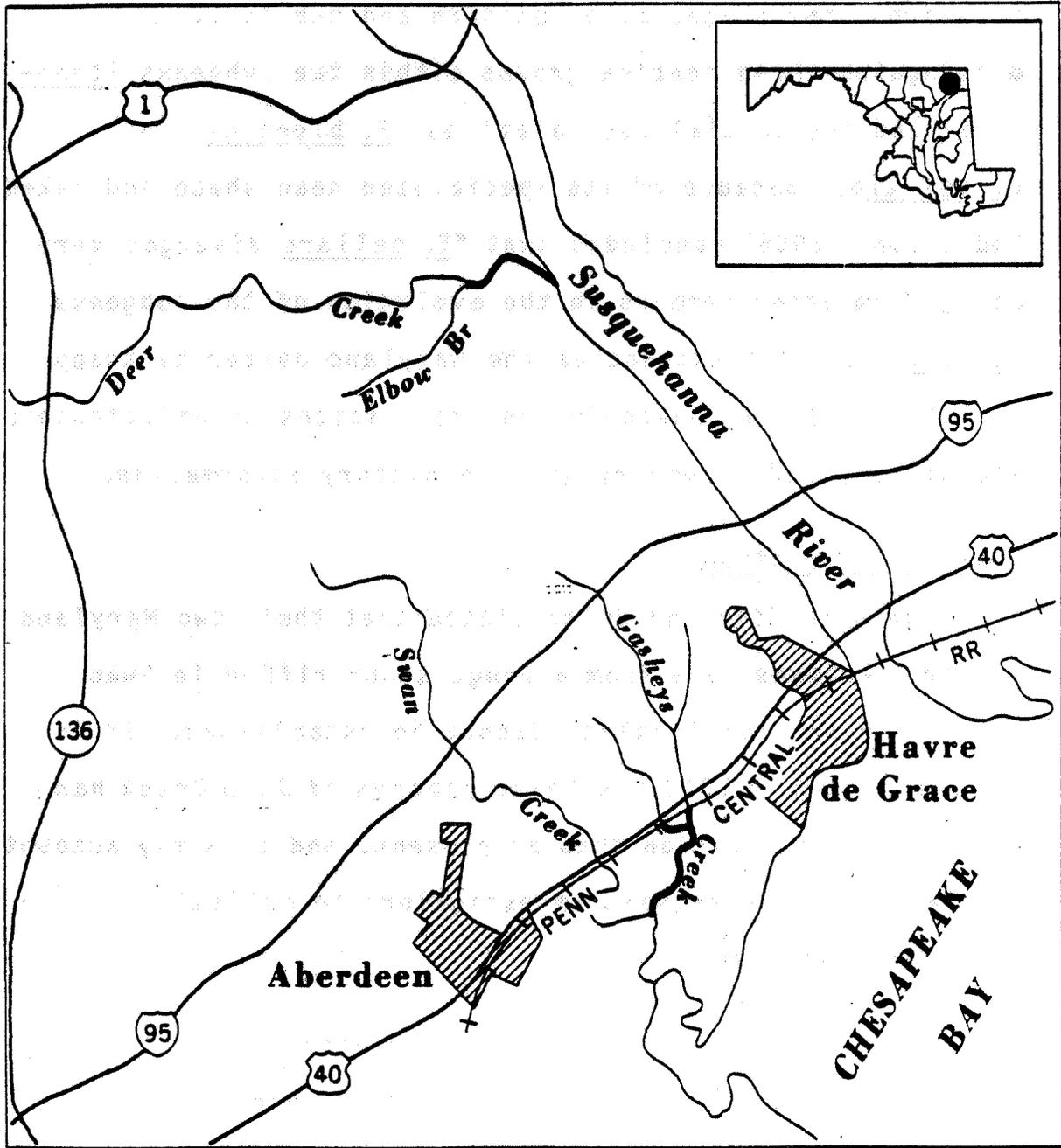


Figure 1. Known current and historic locations of the Maryland Darter in Harford County, Maryland.

velocities are slight and the stream scarcely maintains a flow over the riffles during drought conditions. Tesselated darters are quite abundant in this habitat.

The riffle site in Deer Creek undergoes considerable seasonal fluctuation in size. However, at normal low flows it is about 25 meters in width. The substrate is composed of rubble, rocks and gravel. Rooted aquatic plants, primarily riverweed (Podostemum ceratophyllum) are moderately abundant on rocks in the riffle area. Water moss (Fontinalis sp.) is also prominent on submerged rocks. Two genera of blue-green algae, probably indicators of pollution, were found along the stream margins during August of 1974. Gurley flowmeter readings taken on October 23, 1974, at the foot of the riffle's maximum depth (61 cm) at heights of 51.0, 20.3 and 45.7 cm above the bottom were 29.0, 84.8 and 79.0 cm/sec respectively. Seventy-six of the preserved Maryland darter specimens and all subsequent sightings were made at this site. Tesselated darters were also taken here but primarily in areas of lesser flow along stream margins.

These two sites, Gasheys Run and Deer Creek seem to have little in common other than they are both located slightly upstream from the stream mouths. Marked differences exist in both size and substrate of the two riffles and in the numbers of Maryland darters noted. Extensive surveys

indicate that despite the presence of seemingly good habitat further upstream and the lack of appreciable physical barriers, the Maryland darter does not move up these streams much above the presently known collection sites. All location records of the species have been from below the 20-foot contour.

Distribution

Any attempt to interpret the distributional history of the Maryland darter requires considerable speculation. Perhaps, like a few other darters, it is restricted to swift riffles of the Coastal Plain. If so, its range in the lower Susquehanna River could have been markedly reduced when submergence of coastal areas resulted in the formation of Chesapeake Bay. A further constriction of the range may have occurred with the completion of Conowingo Dam in 1928 and of other impoundments further upstream toward Harrisburg. The mouths of streams directly above Conowingo Dam are inundated and comparable sites on many streams such as Swan Creek below the dam are rather heavily silted and of reduced water quality. If the above reasoning is correct, the Deer Creek riffle site may support the only remaining permanent population of the Maryland darter. It is probable that the lack of suitable habitat prevents E. sellare from becoming established in Gasheys Run and that only stragglers from the Deer Creek population have been found there in the past. It is only about 21 kilometers from the mouth of Deer

Creek to the mouth of Gasheys Run. Upstream movement in the Susquehanna River from the mouth of Deer Creek is effectively blocked by Conowingo Dam. At least one other darter does survive in the upper bay as appreciable numbers of E. olmstedii are found along the western shore below Havre de Grace. One alternative to a Deer Creek origin of stragglers reaching Gasheys Run would be for the Maryland darter to live in the Susquehanna River below Conowingo Dam. This is unlikely, as severe fluctuations in the amount of water released from Conowingo Dam occur almost daily. When electrical power is being generated, the river below resembles a giant raceway. Much of the substrate is bedrock, and unconsolidated materials such as rubble and gravel have largely been flushed out. Protected areas tend to fill with silt. Since only limited darter collecting has been attempted in this difficult and seemingly unfavorable habitat, it cannot be entirely ruled out.

Identifying Features

Adult Maryland darters may be separated from other darters by using the following combination of characters: gill membranes slightly conjoined, presence of approximately four dark saddles across the back, complete lateral line and presence of a small dark spot behind the lower rear margin of the eye. It should be noted, however, that the saddles were poorly developed in the juvenile specimen taken from Gasheys Run in 1962 and a lateral series of blotches in the

form of x's and w's was prominent along the side. With such a pattern, young Maryland darters could easily be confused with tessellated darters. Other darters that may be found in the same general area with the Maryland darter are the shield darter, Percina peltata; logperch, P. caprodes; tessellated darter, Etheostoma olmstedii; glassy darter, E. vitreum; and the banded darter, E. zonale.

Biological Considerations

Although no Maryland darters have been taken during spawning, examination of gonads in preserved specimens indicates that spawning occurs in late April or early May. Length-frequency data and age determinations employing scale reading techniques, indicate the presence of three age groups, 0, I, and II. The largest known specimen (70 mm standard length) may possibly have belonged to Age Group III. Stomach content analysis of five specimens taken in November, 1965 revealed a large number of snails (Clappia virginica), parts of 11 caddisfly larvae (Hydropsyche sp.), two stonefly nymphs (Perlidae) and one mayfly (Heptageniidae). Despite the abundance of snails in the November collection, it cannot be assumed that snails are the principal item of diet throughout the year.

The Maryland darter acquired a controversial aspect when the municipality of Stewartstown, Pennsylvania, built a sewage treatment plant and applied to the Environmental Protection

Agency for permission to release chlorinated wastes into Ebaugh's Creek, a headwater tributary of Deer Creek. A public hearing was held by EPA on September 25, 1974, and despite considerable opposition, the permit was granted by EPA effective October 30, 1974. A warning concerning possible detrimental effects of the chlorinated wastes on the darter was given by Knapp (1974). A spill of liquified cattle wastes upstream of the Deer Creek site in 1985 while apparently not impacting the darter, does emphasize the vulnerability of the species.

Status

In recognition of its scarcity, the Maryland darter was designated as an endangered species in 32 FR 4001: March 11, 1967. It has also been accorded similar status by the State of Maryland, by Miller (1972) and by the Smithsonian Institution Center for Natural Areas (1974). At the present time, the darter is protected by both Federal and Maryland laws and regulations.

Critical habitat was designated for the species in the August 29, 1984 (49 FR 34228). It includes the following area:

Maryland (Harford County): (1) Deer Creek main channel from the junction with Elbow Branch thence downstream to the junction with the Susquehanna River. (2) Gasheys Run (also known as Gasheys

Creek) main channels of east and west forks from their overcrossing by old Penn Central Railroad (presently titled to National Railroad Passenger Corporation, AMTRAK) south to the confluence with Swan Creek.

Constituent elements of this habitat are considered to be quality and permanence of stream flow in shallow areas of the streams (riffles), and presence of unsilted rocky crevices for shelter and production of aquatic insects and snails for food.

The greatest problem in preserving the Maryland darter, if its parent population proves to be limited to its presently known habitat in Deer Creek, is the protection of Deer Creek from the detrimental effects of unrestricted water and land uses within the watershed. Such detrimental uses and/or resultant impacts include:

1. prolonged periods of high turbidity;
2. impoundments;
3. runoff containing excessive nutrients, organic wastes, ammonia, pesticides, herbicides, and other toxic substances;
4. sewage plant malfunction or flooding resulting in excessive chlorine and untreated sewage being introduced into the stream;
5. accidental discharge of liquid manure;
6. long-term effects of chloramines;

7. reduction of stream flow by withdrawals for consumptive uses;
8. construction projects which have potential for spills and lethal runoff; and
9. leachate from sanitary landfills.

The detrimental effects which may be produced by liquid manure discharges (No. 5 above) were dramatically demonstrated in August of 1985 when approximately 200,000 cubic feet of liquid manure leaked into Deer Creek from an adjacent dairy farm storage lagoon. This leak eliminated nearly all fish life in a five-mile reach of the creek. Fortunately, the darter's known population occurs more than ten miles downstream of this kill zone. A single similar event at a location further downstream location could cause extirpation of the darter.

The recommendations in this plan should be used to bring about the protection and recovery of the Maryland darter and the watershed containing its known habitat. The presence of blue-green algae within the known habitat and heavy sediment deposition just downstream suggests that water quality standards may need to be improved and/or adhered to and that activities which may degrade the watershed should be identified. Studies by the Maryland Water Resources Administration are being conducted to document needs for improved water quality standards.

Another possible course of action to help preserve the species should additional population segments be found, would be to initiate propagation efforts under controlled environmental conditions using living streams and/or other hatchery/rearing systems. Cooperators to assist these efforts might include Pennsylvania State University, the University of Maryland or the U.S. Fish and Wildlife Service.

Whether any recommended recovery plan action can prevent the decline or extirpation of the Maryland darter remains to be seen. However, unless the actions specified in this plan are implemented in the near future, the darter population will be further jeopardized.

II. RECOVERY

Recovery Outline

OBJECTIVE: To protect, maintain, and enhance the present population and habitat of the Maryland darter in order to restore a stable and self-sustaining population. If six additional such populations are found in disparate locations, consider for reclassification to threatened.

- 1.0 Establish and utilize a Maryland Darter/Deer Creek Management Group.
- 2.0 Determine species' requirements and range.
 - 2.1 Determine species' requirements.
 - 2.11 Collect life history information.
 - 2.12 Define habitat requirements.
 - 2.2 Sample the Susquehanna River drainage in Maryland, Pennsylvania, and the Upper Chesapeake Bay tributaries to locate additional Maryland darter populations.
 - 2.21 Establish area priorities for surveys.
 - 2.22 Survey potential habitats in order of priority.
- 3.0 Protect and maintain the existing Maryland darter population.

- 3.1 Control and coordinate issuance of both Federal and state collecting permits.
- 3.2 Enforce protective laws and regulations.
- 4.0 Protect, maintain, and enhance existing Maryland darter habitat.
 - 4.1 Establish Sensitive Management Areas, protecting the known habitat site on Deer Creek.
 - 4.11 Designate and manage the state-owned Maryland darter site on Deer Creek as a state Sensitive Management Area.
 - 4.12 Obtain easements, cooperative agreements, or acquire by fee acquisition streamside buffer zones along Deer Creek between Nobles Mill and the occupied riffle.
 - 4.2 Insure sufficient water for maintenance of the species.
 - 4.21 Utilize the Fish and Wildlife Service In-stream Flow Methodology to determine flow requirements of the darter.
 - 4.22 With the cooperation of the Maryland Water Resources Administration, include protective measures in water use permits.

4.3 Map land use, land use trends, pollution sources and related features in the Deer Creek watershed.

4.4 Maintain or improve water quality through coordination with the Maryland Water Resources Administration.

4.41 Monitor and determine baseline water quality using data from Maryland Water Resources Administration monitoring stations.

4.411 Reestablish and operate water quality monitoring stations at Stafford Road Bridge and other locations on Deer Creek.

4.412 Compile and analyze water quality data from monitoring stations on Deer Creek.

4.42 Regulate Water Quality.

4.421 Enforce water quality regulations for point and non-point discharges to streams providing Maryland darter habitat.

4.422 Evaluate future discharge permits as to their impact on baseline water quality and recommend water

quality standards to regulatory agencies.

4.5 Provide input to watershed development activities

4.51 Work with Deer Creek Scenic River Advisory Board.

4.52 Recommend protective measures for watershed development projects to appropriate authorities.

4.53 Establish and implement protective zoning standards through coordination with local authorities.

4.531 Monitor rural and urban development patterns and update plans for Deer Creek watershed.

4.532 Review current zoning guidelines and recommend protective measures to local authorities.

4.533 Monitor implementation of protective zoning measures.

4.6 Enhance the Deer Creek watershed

4.61 Work with appropriate agencies to facilitate improved land use practices to reduce sedimentation and agricultural pollution.

- 4.611 Promote SCS farm plans to include expanded sediment control measures in Deer Creek watershed.
- 4.612 Work with SCS to improve safety of manure holding facilities in Deer Creek watershed.
- 4.613 Promote the implementation of Non-Point source discharge plans (208).
- 4.614 Develop and present educational series on sediment and agricultural run-off control to landowners in Deer Creek watershed.

5.0 Develop public and scientific awareness of the need to accomplish the primary objective of the plan.

5.1 Develop news releases.

5.2 Develop "present status" brochures.

5.3 Present public information sessions on species.

Recovery Plan Narrative

The narrative portion of this plan is a continuation of the recovery section and briefly shows areas of recovery plan emphasis. If these steps are accomplished, the goal of reclassifying the Maryland darter may eventually be achieved. The objective refers to additional "self-

sustaining populations" in "disparate locations." For the purposes of this plan, a self-sustaining population would be characterized by one or more stretches of stream containing several occupied riffles with evidence of reproduction and the potential for recruitment between occupied sites. In order to allow for reclassification to "threatened," these populations need to be separated by enough distance to disallow the potential for extirpation by a singular event.

1.0 Establish and utilize a Maryland Darter/Deer Creek Management Group.

This group will be headed by an individual from the Maryland Heritage Program of the Department of Natural Resources. Each of the other cooperating agencies identified in the implementation schedule will be given the opportunity to participate. The purpose of the group will be to implement the recovery plan through a coordinated effort of all participating agencies.

2.0 Determine species' requirements and range.

2.1 Determine species' requirements.

2.11 Collect life history information.

Because of the extremely limited number of darters, no direct information on their life history is known. These data are important to insure effective management of the species.

2.12 Define habitat requirements.

Before the darter can be adequately protected, the constituents of its habitat must be determined so they may be maintained at the one known site and also be used to identify potentially viable new sites.

2.2 Sample Susquehanna River drainage in Maryland, Pennsylvania and upper Chesapeake Bay tributaries to locate all Maryland darter populations.

2.21 Establish area priorities for surveys.

Potential areas to be sampled have been prioritized with those most likely to harbor additional populations to be sampled first. This will hopefully provide range extension data early in the recovery process and allow for protection of new populations.

2.22 Survey potential habitats in order of priority - (see 2.21.)

This task has been initiated.

3.0 Protect and maintain the existing Maryland darter population.

3.1 Control and coordinate issuance of both Federal and state collecting permits.

Coordination of issuance of Federal and state collecting permits would prevent taking of Maryland darters incidental to scientific collecting activities. By eliminating or minimizing the issuance of permits for areas of known populations, this incidental but damaging taking could be eliminated.

3.2 Enforce protective laws and regulations.

Enforcement of Federal and state laws protecting the darter and its habitat would be of obvious benefit to the recovery of the species.

Particular emphasis should be placed on laws and regulations designed to minimize silt and other pollutants from reaching state waters.

4.0 Protect, maintain and enhance existing Maryland darter habitat.

4.1 Establish Sensitive Management Areas (SMA), protecting the known Maryland darter site on Deer Creek.

4.11 Designate and manage the state-owned Maryland darter site and an adjacent 500 foot corridor along the stream bank of Deer Creek as a Sensitive Management Area.

Designation of the Deer Creek site as a state SMA would provide further state protection capabilities that would benefit the darter and its habitat.

4.12 Obtain easements, cooperative agreements or acquire by fee acquisition 100-500 foot-wide streamside buffer zones along Deer Creek between Noble Mill and the occupied site.

Should easements or cooperative agreements prove to be unobtainable, fee acquisition of available land should be considered as an alternative. In any case, additional protection would be realized.

4.2 Insure sufficient water for maintenance of the species.

4.21 Utilize the Fish and Wildlife Service's instream flow methodology.

Use of the instream flow methodology will allow determination of flows necessary for protection of the darter.

4.22 With the cooperation of the Maryland Water Resources Administration (MWRA), include protective measures in water use permits.

Coordination with the MWRA in their issuance of water use permits would allow consideration of maintenance of sufficient water volume for Maryland darter protection. Of particular importance would be discussions with Aberdeen Proving Grounds (the major water user) regarding water withdrawal during low flow periods. Results obtained in 4.21 should provide the basis for these discussions.

4.3 Map land use, land use trends, pollution sources and related features in the Deer Creek watershed.

This is an essential first step in the identification of threats and management needs in the known habitat.

4.4 With the cooperation of the MWRA maintain or improve water quality.

4.41 Monitor water quality and determine baseline water quality using data from MWRA monitoring stations.

4.411 Reestablish and operate water quality monitoring stations at Stafford Road Bridge and other locations on Deer Creek.

The operation of water quality monitoring stations would provide a means of establishing baseline conditions in Deer Creek near the known population of the darter. It would also provide a means of recording fluctuations in water quality as a result of activities within the watershed:

4.412 Compile and analyze water quality data from monitoring stations on Deer Creek.

Compilation and analysis of water quality data would allow establishment of baseline conditions and identification of changes in water quality. These data could serve as an indicator of potential habitat deterioration and allow protective measures to be taken.

4.42 Regulate water quality.

4.421 Enforce water quality regulations for point and non-point discharges to streams providing Maryland darter habitat.

This task can be accomplished only with the cooperation and support of State and Federal water quality agencies. Such a cooperative effort could result in reducing the potential impacts resulting from turbidity, runoff, chloramines and other environmental contaminants. Data developed in task 4.3 (watershed mapping) should provide the necessary background information.

4.422 Evaluate future discharge permits as to their impact on baseline water quality and recommend water quality standards to regulatory agencies.

With the cooperation of the MWRA, the water quality needs of the Maryland darter would be considered in the issuance of future discharge permits. Where possible, recommendations as to water quality standards for streams harboring the darter would be made, thereby affording further protection for the species.

4.5 Provide input to watershed development activities.

4.51 Work with the Deer Creek Scenic Rivers Review Board.

Protection for the Maryland darter can be facilitated by providing groups such as the Review Board with information on the species and the status of recovery efforts.

4.52 Recommend protective measures for watershed development projects to pertinent authorities.

Self-explanatory.

4.53 Establish and implement protective zoning standards.

With the cooperation of area planning agencies and zoning bodies, much can be accomplished in the protection of the Deer Creek watershed. These accomplishments could include minimizing the potential run-off or discharge of contaminants and limiting construction related turbidity.

4.531 Monitor rural and urban development patterns and update plans for Deer Creek watershed.

Mapping of land use trends (Task 4.3) should assist in this effort.

4.532 Review current zoning guidelines and recommend protective measures to local authorities.

Special emphasis should be placed on working with the Harford County Department of Planning and Zoning in this endeavor.

4.533 Implement protective zoning measures.

This task can be carried out only by Harford County and other local authorities with input from biological personnel.

4.6 Enhance Deer Creek watershed.

4.61 Work with appropriate agencies to facilitate improved land use practices.

Such coordination could reduce sedimentation and agricultural pollution.

4.611 Promote SCS farm plans to include expanded sediment control measures in the Deer Creek watershed.

Control of sediment and resultant turbidity is critical in ensuring the survival of the Maryland darter over its limited range.

4.612 Work with SCS to improve safety of manure holding facilities in Deer Creek drainage.

In light of the severe August, 1985, fish kill resulting from a manure leak into Deer Creek, this measure deserves special attention.

4.613 Promote the implementation of non-point source discharge plans (208).

Implementation of non-point source discharge plans would facilitate the elimination of contaminant runoff in the Deer Creek watershed.

4.614 Develop and present an educational series on sediment and agricultural runoff control to landowners in the Deer Creek watershed.

A public information program is essential to explain the need for

sediment and runoff control actions and thereby increase the potential for their support.

5.0 Develop public and scientific awareness of the need to accomplish the primary objective of the plan.

The limited range of the Maryland darter makes it particularly vulnerable to actions of local citizens who could be essential in determining whether this species survives. A public information program on the recovery activities is essential in increasing the potential for public support. The following tasks relate to the implementation of an effective public information program.

5.1 Develop news releases.

As important developments in the recovery of the species occur, press releases should be employed to maintain and increase public awareness.

5.2 Develop status brochures.

Brochures should be developed detailing the present status of the species, recovery efforts and contributions which could be made to recovery thru public participation.

5.3 Present public information sessions on the species.

Whenever possible, presentations should be made to interested groups, outlining recovery activities, progress and the potential role of the citizen in the recovery of the species.

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IMPLEMENTATION SCHEDULE CODE

GENERAL CATEGORIES FOR IMPLEMENTATION

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - 0

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Priorities for Implementation

1. **Priority 1.** An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
2. **Priority 2.** An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
3. **Priority 3.** All other actions necessary to provide for full recovery of the species. (Recognizing that the ultimate success of the Program is species recovery, priority 3 actions likely to lead to full recovery and delisting of a species in the foreseeable future will tend to rank higher than other priority 3 actions.)

Part III Implementation Schedule

Maryland Darter

General Category	Plan Task	Task No.	Priority	Task Duration	Responsible Agency	Other	Estimated Costs FY 1	Estimated Costs FY 2	Estimated Costs FY 3	Comments/Notes
04	Establish and utilize management group	1.0	1	Continuous	5	MHP	-	-	-	
I3	Collect life history information	2.11	2	2 yr	5	MHP	1,000	1,000	-	
I3	Define habitat requirements	2.12	2	3 yr	5	MHP	2,000	2,000	2,000	
I1	Establish survey priorities	2.21	1	1 yr	5	MTA, MHP	-	-	-	Completed
I1	Survey sites in order of priority	2.22	1	3 yr	5	MHP	6,000	7,000	-	Ongoing, to be completed in FY 87
04	Control and coordinate collection permits	3.1	1	Continuous	5	MTA	-	-	-	
02	Enforce protective laws and regs	3.2	1	Continuous	5	MTA, OEP, MMRA	-	-	-	

General Category	Plan Task	Task No.	Priority	Task Duration	Responsible Agency Region	Other	FY 1	FY 2	FY 3	Comments/Notes
M3	Designate sensitive management area	4.11	1	Continuous	5	MFPWS, MHP	-	-	-	
A1.2.6	Protect stream side buffer zones	4.12	1	3 yr	5	MHP, MET, MFPWS	1,500,000	250,000	250,000	Based on estimated cost of buffer zone
I3	Utilize Instream Flow Methodology	4.21	1	1 yr	5		5,000	-	-	
M3	Include protective measures in water use permits	4.22	1	Continuous	5	MMRA, MTA, MHP	-	-	-	
I14	Map land use and pollution sources	4.3	1	1 yr	5		15,000	-	-	
I12	Reestablish and operate Deer Creek monitoring stations	4.411	2	Continuous	5	OEP	3,000	3,000	3,000	
I12	Analyze water quality data	4.412	2	Continuous	5	OEP, MHP, MTA	-	-	-	

General Category	Plan Task	Task No.	Task	Priority	Task Duration	Responsible Agency	FWS Region	Other	Estimated Costs	Comments/Notes	
									FY 1	FY 2	FY 3
I3	Enforce water quality regs	4.421	1	Continuous	5	OEP, MMRA			-	-	-
M3	Evaluate discharge permits	4.422	2	Continuous	5	OEP, MTA, MHP			-	-	-
O1	Work with Deer Creek Scenic Rivers Advisory Board	4.51	2	3 yr	5	MHP			-	-	-
M3	Recommend protective measures for dev't projects	4.52	1	Continuous	5	MHP, MTA, HCDPZ			-	-	-
I14	Monitor and update rural and urban dev't plans	4.531	2	Continuous	5	HCDPZ, MHP			-	-	-
O3	Review zoning guidelines	4.532	1	1 yr	5	MHP, HCDPZ			-	-	-
M3	Implement protective zoning	4.533	1	Continuous	5	HCDPZ			-	-	-

General Category	Plan Task	Task No.	Priority	Task Duration	Responsible Agency	Other	Estimated Costs FY 1	Estimated Costs FY 2	Estimated Costs FY 3	Comments/Notes
M3	Promote SCS farm plans	4.611	1	Continuous	5	SCS, MHP, MDA	-	-	-	
M3	Improve safety of manure pits	4.612	1	Continuous	5	SCS, MHP, MDA	-	-	-	
M3	Promote 208 plans	4.613	2	Continuous	5	MHP, OEP	-	-	-	
01	Landowner education runoff series	4.614	1	1 yr	5	MHP, SCS	2,000	-	-	
01	Develop news releases	5.1	2	1 yr	5	MHP	-	-	-	
01	Develop status brochures	5.2	2	1 yr	5	MHP	2,000	-	-	
01	Present public information sessions	5.3	2	Continuous	5	MHP, MTA	-	-	-	

HCDPZ - Harford County Department of Planning and Zoning

MDA - Maryland Department of Agriculture

MET - Maryland Environmental Trust, DNR

MHP - Maryland Natural Heritage Program, DNR

MFPWS - Maryland Forest, Park and Wildlife Service, DNR

MTA - Maryland Tidewater Administration, DNR

MMRA - Maryland Water Resources Administration, DNR

OEP - Office of Environmental Programs, Maryland Department of
Health and Mental Hygiene

SCS - Soil Conservation Service

APPENDIX

List of Reviewers

**George Andrew Moser, U.S. Fish and Wildlife Service,
Annapolis, Maryland.**

**Arnold Norton, Maryland Natural Heritage Program, Maryland
Department of Natural Resources.**

**Derek Richardson, Maryland Natural Heritage Program,
Maryland Department of Natural Resources.**

**D. Daniel Boone, Maryland Natural Heritage Program, Maryland
Department of Natural Resources.**