

Attachment F

Conowingo Hydroelectric Project
(FERC Project No. 405)

Final Study Report Maryland Darter Survey Revised Study Plan
(“RSP 3.10”)

**FINAL STUDY REPORT
MARYLAND DARTER SURVEY
RSP 3.10**

CONOWINGO HYDROELECTRIC PROJECT

FERC PROJECT NUMBER 405



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EXECUTIVE SUMMARY

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt Conowingo Hydroelectric Project (Conowingo Project). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014. FERC issued the final study plan determination for the Project on February 4, 2010, approving the revised study plan with certain modifications.

The final study plan determination required Exelon to conduct surveys for Maryland darter (*Etheostoma sellare*), which is the subject of this report. The objective of this study was to determine if Maryland darter are present in the Susquehanna River below Conowingo Dam and/or the lower riffles of Deer and Octoraro creeks.

An initial study report (ISR) was filed on February 22, 2011, containing Exelon's 2010 and January 2011 study findings. An initial study report meeting was held on March 9, 10, and 11, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on April 27, 2011 by Commission Staff, several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on May 27, 2011. On June 24, 2011, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISRs should be made. For this study, FERC's June 24, 2011 order required no modifications to the original study plan. An updated study report (USR) was filed on January 23, 2012 describing the combined results of the 2010 and 2011 Maryland darter surveys. This final study report is being filed with the Final License Application for the Project.

Maryland darter surveys were initiated in October 2010 and concluded in early December 2011. Sampling in Deer and Octoraro creeks utilized electrofishing with a seine, and snorkeling. Twenty-four locations were sampled in Deer Creek and twelve locations were sampled in Octoraro Creek. The locations in Deer Creek included the riffle under the Stafford Bridge, the only location where Maryland darter has ever been recorded in Deer Creek, as well as many locations upstream and downstream of the Stafford Bridge. Sampling in the lower Susquehanna River using an electrified benthic trawl, supplemented with snorkeling and electrofishing (backpack electrofisher), was conducted between January and early December 2011. One hundred eighty-two locations in the lower Susquehanna River were sampled during the study. No Maryland darters were recorded; however, five of the six darter species that have been recorded in the lower Susquehanna River basin were collected, including the congeners *E. blennioides*, *E. zonale*, and *E. olmstedii*.

The program was successful in collecting fish of a wide range of sizes and species. Fifty-four species representing 13 families were collected, with 49 species from Deer Creek, 46 species from Octoraro Creek, and 40 species from the Susquehanna River. A total of 9,036 darters were collected and observed during this study program. The multiple sampling techniques employed over many locations, have demonstrated that fishes of similar size, morphology, and phylogeny to Maryland darter have been readily sampled.

The objective of conducting a thorough survey for Maryland darter in the lower Susquehanna River and lower reaches of Deer Creek and Octoraro Creek was accomplished. The Maryland darter has not been recorded since 1988 even though substantial effort has been expended in those specific areas where it had been recorded historically as well as extensive adjacent areas in Deer Creek (and Swan Creek and Gashey's Run), in Octoraro Creek, and in the Susquehanna River. With 182 sites sampled over four seasons and using multiple gear types, this survey represents the major sampling effort specifically for Maryland darter in the Susquehanna River. This information supplements other recent Maryland darter surveys in the river with the same gear that were supported by USFWS and MDNR.

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LIST OF ABBREVIATIONS

cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
ft	foot/feet
ILP	Integrated Licensing Process
ISR	Initial Study Report
MDNR	Maryland Department of Natural Resources
MW	Megawatt
NOI	Notice of Intent
PAD	Pre-Application Document
PSP	Preliminary Study Proposal
RM	River mile
RSP	Revised Study Proposal
SRBC	Susquehanna River Basin Commission
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USR	Updated Study Report
W	watt

1.0 INTRODUCTION

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt (MW) Conowingo Hydroelectric Project (Project). Exelon is applying for a new license using the FERC's Integrated Licensing Process (ILP). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014.

Exelon filed its Pre-Application Document (PAD) and Notice of Intent (NOI) with FERC on March 12, 2009. On June 11 and 12, 2009, a location visit and two scoping meetings were held at the Project for resource agencies and interested members of the public. Following these meetings, formal study requests were filed with FERC by several resource agencies. Many of these study requests were included in Exelon's Proposed Study Plan (PSP), which was filed on August 24, 2009. On September 22 and 23, 2009, Exelon held a meeting with resource agencies and interested members of the public to discuss the PSP.

Formal comments on the PSP were filed with FERC on November 22, 2009 by Commission staff and several resource agencies. Exelon filed a Revised Study Plan (RSP) for the Project on December 22, 2009. FERC issued the final study plan determination for the Project on February 4, 2010, approving the RSP with certain modifications.

The final study plan determination required Exelon to conduct surveys in 2010 and 2011 for Maryland darter (*Etheostoma sellare*), which is the subject of this report. The objective of this study was to determine if Maryland darter is present in the Susquehanna River below Conowingo Dam and/or the lower riffles of Deer and Octoraro creeks.

An initial study report (ISR) was filed on February 22, 2011, containing Exelon's 2010 study findings. An initial study report meeting was held on March 9, 10, and 11, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on April 27, 2011 by Commission Staff, several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on May 27, 2011. On June 24, 2011, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISRs should be made. For this study, FERC's June 24, 2011 order required no modifications to the original study plan. An updated study report (USR) was filed on January 23, 2012 describing the combined results of the 2010 and 2011 Maryland darter surveys. This final study report is being filed with the Final License Application for the Project.

2.0 BACKGROUND

The Susquehanna River below Conowingo Dam flows approximately 10 miles before entering the Chesapeake Bay. The river is tidal up to the mouth of Deer Creek (a west side tributary with confluence at river mile (RM) 7). Octoraro Creek enters the river from the east at approximately RM 10.

2.1 Conowingo Project Operations

The Conowingo Project uses limited active storage within Conowingo Pond for generation purposes. Maximum hydraulic capacity of the Conowingo powerhouse is 86,000 cubic feet per second (cfs). The current minimum flow requirements below Conowingo Dam were formally established with the signing of a settlement agreement in 1989 between the Project owners and several federal and state resource agencies (46 FERC ¶61,063) ([FERC 1989](#)). The established minimum flow regime below Conowingo Dam is the following:

March 1 – March 31	3,500 cfs or natural river flow
April 1 – April 30	10,000 cfs or natural river flow, whichever is less
May 1 – May 31	7,500 cfs or natural river flow, whichever is less
June 1 – September 14	5,000 cfs or natural river flow, whichever is less
September 15 – November 30	3,500 cfs or natural river flow, whichever is less
December 1 – February 28	3,500 cfs intermittent (maximum six hours off followed by equal amount on)

The downstream discharge must equal these values or the discharge (natural river flow) measured at the Susquehanna River at the Marietta United States Geological Survey (USGS) gage (No. 01576000), whichever is less. The Marietta USGS gage is located approximately 35 miles upstream of Conowingo Dam above the Safe Harbor Dam.

2.2 Historic Occurrence of Maryland Darter in the Lower Susquehanna River Basin

The Maryland darter was first collected and identified as such in 1912 from Swan Creek near Havre de Grace, Maryland. It was not found again until 1962, in Gashey's Run ([Knapp 1963](#)), a tributary to Swan Creek. The last record in Gashey's Run is from 1965 ([Knapp 1976](#)). The first record in Deer Creek is also from 1965, and the last record from any location was in Deer Creek in 1988 ([Raesly 1991](#)).

Although significant efforts since 1986 to collect Maryland darter from Deer Creek have been conducted, no Maryland darters have been recorded ([Kazyak et al. 2005](#); [Kilian et al. 2010](#); [Raesly 1991, 1992, 2010, 2011](#); [Stauffer and Arnold 1986](#)).

All records of the Maryland darter are from the riffles in the lower reaches of the three small streams, Swan Creek, Gashey's Run, and Deer Creek. If the Maryland darter existed in any other streams, it was likely extirpated as the upper Chesapeake Bay area was settled and developed, resulting in degraded water quality and habitat due to land clearing and concomitant sedimentation in streams, shoreline development for towns and cities, and pollution ([Stranko et al. 2010](#)). [Neely and George \(2006\)](#) have documented the colonization of the Susquehanna River by the non-native greenside darter (*E. blennioides*) and state that the greenside darter may pose a serious threat to the Maryland darter.

There is evidence that the habitat in Deer Creek has deteriorated due to development ([SRBC 2008](#)). [SRBC \(2008\)](#) projected 25-year population increases of 23% in the lowermost Deer Creek subwatershed where the Maryland darter had been most abundant (immediately above the confluence with the Susquehanna River), and of 5 – 35% across all Deer Creek subwatersheds. [Raesly \(1991\)](#) reported that collections in Deer Creek reflected a significant drop in total fish collected and species richness over time during the late 1980's. In addition, he also reported increases in nitrate and chloride concentrations suggesting a deterioration of water quality ([Raesly 1991](#)). [Stranko et al. \(2010\)](#) concluded that effects of urbanization and non-native species were important factors in the extirpation or extinction of 13 aquatic species in Maryland, including the Maryland darter. These various studies suggest that development in the watershed may have been a significant factor in reducing numbers or eliminating Maryland darter from the basin.

METHODS

As recommended by agencies, Dr. Richard L. Raesly was integrated into this study as co-principal investigator. This report includes the schedule, locations, and results for the sampling program.

3.0 SAMPLING LOCATIONS AND SEASON

The sampling occurred over 15 months from October 2010 through early December 2011 in all four seasons. Thorough coverage of the river below Conowingo Dam and the lower reaches of Deer and Octoraro creeks was accomplished ([Figure 3.1-1](#))¹. Stream flow during the period of study varied widely, including flood conditions, in all three bodies of water ([Figure 3.1-2](#)). During the study period the Susquehanna River varied from under 3,000 cfs to approximately 770,000 cfs. Deer Creek varied from approximately 75 cfs to approximately 5,500 cfs, and Octoraro Creek varied from approximately 55 cfs to approximately 5,500 cfs.

One hundred eighty-two locations in the Susquehanna River were sampled. Locations were selected throughout the lower river from near Conowingo Dam down to Havre de Grace and Perryville at the mouth of the river. Shallow water (e.g., just below Conowingo Dam, near the islands off of Susquehanna State Park) and deep areas downstream toward the mouth of the river were sampled. Sampling in the river occurred in all four seasons from January through early December, 2011 ([Figures 3.1-3 - 3.1-6](#)). Harsh winter conditions in January required ice-breaking at the boat launches to gain access to the main stem river. Due to access and safety considerations, winter sampling was restricted to the lowermost portion of the river (i.e., from the vicinity of Lapidum and Port Deposit downstream to Havre de Grace and Perryville, see [Figure 3.1-1](#)).

Twenty-four locations in Deer Creek and 12 locations in Octoraro Creek were sampled. Riffles, runs, backwaters, and pools (where they could be waded) were sampled. Fall (2010 and 2011), spring, and summer sampling was completed in both creeks ([Figures 3.1-7 and 3.1-8](#)). Multiple attempts to sample the creeks in December 2010 and January 2011 were unsuccessful due to ice and slush ([Figure 3.1-9](#)). The Stafford Bridge riffle (see Deer Creek figures for location of the bridge, the riffle begins just upstream of the bridge and continues for approximately 100 m downstream of the bridge) in the lower portion of Deer Creek is the only location in the Susquehanna River drainage where Maryland darter has been found (Raesly 2010). This riffle, and numerous locations upstream and downstream of the Stafford Bridge, were sampled thoroughly by electrofishing and snorkeling.

3.1 Sampling Gear

An electrified benthic trawl ([Freedman et al. 2009](#)) was the primary means used to sample the lower Susquehanna River. The power was provided by a 3,500 W generator and rectified by a Smith-Root Type

¹ Note that the river is segmented into 4 reaches. Subsequent figures of the river are presented by reach.

VI-A electrofisher. The net was set from the front of a jon boat and pulled downstream slightly faster than the current. Snorkeling and electrofishing (with backpack electrofisher) were also used in the river to sample for Maryland darter. All three of these sampling gears and techniques have been used by MDNR and USFWS to sample for Maryland darter in the lower Susquehanna River ([Raesly 2011](#); [Killian et al. 2010](#)). All fish collected were identified to species. Darters were enumerated and the abundance of other species was recorded qualitatively.

Sampling in Deer and Octoraro creeks was conducted primarily by electrofishing along with a seine. A Smith-Root Model 12B backpack electrofisher was used along with a 5-ft by 10-ft seine with 1/8-inch mesh. At a given sampling location, the seine was cast downstream approximately 10 - 15 ft and held tight to the substrate. As soon as the seine was in place, the person carrying the electrofisher activated the unit, and with one or two other biologists, moved systematically toward the seine while kicking the substrate to chase fish into the electric field and subsequently into the seine. Fish collected in the seine were identified to species. Darter species were enumerated, and for other species a qualitative record of abundance was made. A series (approximate range of 100 - 160) of electrofishing/seine collections comprised the effort for each sampling location depicted in the figures. The backpack electrofisher (without the seine) was also used in some of the pools of the Susquehanna River where boat access was not possible.

Snorkeling was used in some portions of the Susquehanna River and in both creeks. This sampling method was conducted by a crew of 2 - 5 biologists spread across a selected reach. They moved upstream together through a reach, noting the species observed, and recording abundance. The locations sampled by gear type in the river and creeks are presented in [Figures 3.2-1 - 3.2-6](#).

4.0 RESULTS

4.1 Sampling Schedule and Effort

The sampling objective included seasonal sampling over extensive portions of the lower Susquehanna River and lower reaches of Deer and Octoraro creeks. Sampling in the lower river was accomplished in all four seasons; sampling in the creeks was accomplished in three seasons because ice cover and flowing ice prohibited sampling in the creeks during winter months. Sampling in the river, Deer Creek, and Octoraro Creek occurred on 20, 13, and 12 days, respectively during the study period ([Table 4.1-1](#)).

4.2 Maryland Darter

All of the sampling techniques were successful in collecting or observing numerous fish. Maryland darter ([Figure 4.2-1](#)) was not collected from any of the 218 locations sampled. However, five of the possible six darter species recorded historically in this portion of the Susquehanna River basin, including three congeners of the Maryland darter, were collected from the creeks and river. The multiple sampling techniques employed over many locations demonstrated that fishes of similar size, morphology, and phylogeny to Maryland darter were readily sampled, thus this was a sound approach for finding Maryland darter in these reaches if it still exists.

4.3 Species Richness

Fifty-four species representing 13 families were collected ([Table 4.3-1](#)). The greatest species richness (49) was recorded from Deer Creek. The numbers of species collected in Octoraro Creek and the lower river were 46 and 40, respectively.

4.4 Other Darter Species

The five species of darters recorded included the three congeners of Maryland darter, *Etheostoma blennioides* (greenside darter), *E. olmstedii* (tessellated darter), and *E. zonale* (banded darter), as well as *Percina bimaculata* (Chesapeake logperch), and *P. peltata* (shield darter). Darters were collected at 74% (161) of the 218 locations sampled in all three water bodies. Darters were collected in all four seasons ([Table 4.4-1](#)) and with all three gear types ([Table 4.4-2](#)). A total of 9,036 darters were collected. Of these, the tessellated darter (6,431 total or 71%) was by far the most common.

Chesapeake logperch, threatened in Maryland ([Ashton and Near 2010](#)), was second in total numbers with 1,886 recorded. This represents 21% of the total number of darters recorded. Chesapeake logperch was also the most abundant of the darter species in Octoraro Creek with 1,260 of the 2,471 (51%) darters recorded; this total number of Chesapeake logperch is weighted by a single observation during snorkeling

(August 26, 2011 at location #8), of a school of logperch estimated at 1,220 individuals. Sampling results for all darter species recorded by season and location are presented in [Table 4.4-1](#) and by season and gear in [Table 4.4-2](#). The locations where all species were recorded can be found in [Appendices A- C](#).

5.0 DISCUSSION

The objective of conducting a thorough Maryland darter survey in the lower Susquehanna River and lower reaches of Deer and Octoraro creeks was accomplished. Maryland darter was not collected during the surveys at any location.

This work complements the previous and concurrent work conducted through MDNR and USFWS in recent years (e.g., [Kilian et al. 2010](#); [Raesly 2010, 2011](#)). [Raesly \(2010\)](#) stated there was a small chance that Maryland darter is present in the Susquehanna River but that the limited effort spent and gear used up to that time in sampling specifically for Maryland darter in the river may not have been adequate to find the rare species. Exelon's study used multiple gear types (electrified benthic trawl, snorkeling, backpack electrofisher) and was designed to thoroughly sample the river. With 182 river locations sampled over the four seasons, and multiple gear types used, this survey represents the major sampling effort of Maryland darter in the Susquehanna River

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TABLE 4.1-1: SAMPLING LOCATIONS IN THE LOWER SUSQUEHANNA RIVER, DEER CREEK AND OCTORARO CREEK BY DATE OF SAMPLING FROM OCTOBER 2010 – DECEMBER 2011.

Susquehanna River		Deer Creek		Octoraro Creek	
Location	Date	Location	Date	Location	Date
1 - 10	11-Jan-11	1	9-Oct-10	1	9-Oct-10
1 - 17	12-Jan-11	2	10-Oct-10	2	14-Nov-10
18 - 23	13-Jan-11	6	10-Oct-10	3	14-Nov-10
24 - 33	14-Jan-11	3	13-Nov-10	4	23-May-11
34 - 45	20-Feb-11	4	13-Nov-10	6	24-May-11
46 - 54	20-Jun-11	5	13-Nov-10	6	26-May-11
55 - 65	21-Jun-11	7	23-May-11	6	8-Jun-11
66 - 71	22-Jun-11	8	24-May-11	5	8-Jun-11
72 - 96	23-Jun-11	9	24-May-11	5	9-Jun-11
97 - 101	24-Jun-11	10	24-May-11	9	21-Aug-11
145 - 146	20-Aug-11	11	25-May-11	7	24-Aug-11
102 - 109	22-Aug-11	12	25-May-11	10	25-Aug-11
150 - 151	22-Aug-11	13	25-May-11	8	26-Aug-11
110 - 115	23-Aug-11	14	27-May-11	11	13-Nov-11
147 - 148	23-Aug-11	15	7-Jun-11	12	13-Nov-11
152 - 155	23-Aug-11	16	9-Jun-11		
116 - 120	24-Aug-11	17	19-Aug-11		
149	24-Aug-11	19	20-Aug-11		
156	24-Aug-11	20	20-Aug-11		
121 - 125	25-Aug-11	18	21-Aug-11		
157	26-Aug-11	21	21-Aug-11		
126 - 138	24-Oct-11	22	12-Nov-11		
139 - 144	25-Oct-11	23	12-Nov-11		
158-165	29-Nov-11	24	12-Nov-11		
166-175	30-Nov-11				
176-182	1-Dec-11				

TABLE 4.3-1: SPECIES OBSERVED IN THE LOWER SUSQUEHANNA RIVER, DEER CREEK, AND OCTORARO CREEK FROM OCTOBER 2010 – DECEMBER 2011.

Family	Genus species	Common Name	Susquehanna River	Deer Creek	Octoraro Creek	Total
Petromyzontidae	<i>Petromyzon marinus</i>	sea lamprey		x	x	
Anguillidae	<i>Anguilla rostrata</i>	American eel	x	x		
Clupeidae	<i>Alosa</i> sp.	River herrings/shad			x	
Clupeidae	<i>Dorosoma cepedianum</i>	gizzard shad	x	x	x	
Cyprinidae	<i>Campostoma anomalum</i>	central stoneroller		x	x	
Cyprinidae	<i>Carassius auratus</i>	goldfish	x	x	x	
Cyprinidae	<i>Clinostomus funduloides</i>	rosyside dace		x	x	
Cyprinidae	<i>Cyprinella analostana</i>	satfin shiner	x	x	x	
Cyprinidae	<i>Cyprinella spiloptera</i>	spotfin shiner	x	x	x	
Cyprinidae	<i>Cyprinella</i> sp.	shiner	x	x	x	
Cyprinidae	<i>Cyprinus carpio</i>	common carp	x		x	
Cyprinidae	<i>Exoglossum maxillingua</i>	cutlips minnow		x	x	
Cyprinidae	<i>Hybognathus regius</i>	Eastern silvery minnow		x		
Cyprinidae	<i>Luxilus cornutus</i>	common shiner		x	x	
Cyprinidae	<i>Nocomis micropogon</i>	river chub		x	x	
Cyprinidae	<i>Notropis amoenus</i>	comely shiner	x	x	x	
Cyprinidae	<i>Notropis hudsonius</i>	spottail shiner	x	x	x	
Cyprinidae	<i>Notropis procne</i>	swallowtail shiner	x	x	x	
Cyprinidae	<i>Notropis rubellus</i>	rosyface shiner	x	x	x	
Cyprinidae	<i>Pimephales notatus</i>	bluntnose minnow		x	x	
Cyprinidae	<i>Rhinichthys atratulus</i>	blacknose dace	x	x	x	
Cyprinidae	<i>Rhinichthys cataractae</i>	longnose dace	x	x	x	
Cyprinidae	<i>Semotilus atromaculatus</i>	creek chub		x	x	
Cyprinidae	<i>Semotilus corporalis</i>	fallfish		x	x	
Catostomidae	<i>Carpiodes cyprinus</i>	quillback	x	x	x	
Catostomidae	<i>Catostomus commersoni</i>	white sucker	x	x	x	
Catostomidae	<i>Erimyzon oblongus</i>	creek chubsucker	x			
Catostomidae	<i>Hypentelium nigricans</i>	northern hog sucker	x	x	x	
Catostomidae	<i>Moxostoma macrolepidotum</i>	shorthead redhorse	x	x	x	
Ictaluridae	<i>Ameiurus natalis</i>	yellow bullhead			x	
Ictaluridae	<i>Ameiurus nebulosus</i>	brown bullhead	x	x	x	
Ictaluridae	<i>Ictalurus punctatus</i>	channel catfish	x	x	x	
Ictaluridae	<i>Pylodictis olivaris</i>	flathead catfish	x	x		
Ictaluridae	<i>Noturus insignis</i>	marginated madtom	x	x	x	
Salmonidae	<i>Salmo trutta</i>	brown trout		x		
Belonidae	<i>Strongylura marina</i>	Atlantic needlefish	x	x		
Fundulidae	<i>Fundulus diaphanus</i>	banded killifish	x	x	x	
Moronidae	<i>Morone americana</i>	white perch	x	x	x	
Moronidae	<i>Morone saxatilis</i>	striped bass	x	x	x	
Centrarchidae	<i>Amploplites rupestris</i>	rock bass	x	x	x	
Centrarchidae	<i>Lepomis auritis</i>	redbreast sunfish	x	x	x	
Centrarchidae	<i>Lepomis cyanellus</i>	green sunfish	x	x	x	
Centrarchidae	<i>Lepomis gibbosus</i>	pumpkinseed	x	x	x	
Centrarchidae	<i>Lepomis macrochirus</i>	bluegill	x	x	x	
Centrarchidae	<i>Micropterus dolomieu</i>	smallmouth bass	x	x	x	
Centrarchidae	<i>Micropterus salmoides</i>	largemouth bass	x	x	x	
Percidae	<i>Etheostoma blennioides</i>	greenside darter	23	4	12	39
Percidae	<i>Etheostoma olmstedii</i>	tessellated darter	2819	2647	965	6431
Percidae	<i>Etheostoma zonale</i>	banded darter	125	45	81	251
Percidae	<i>Percina bimaculata</i>	Chesapeake logperch	262	364	1260	1886
Percidae	<i>Percina peltata</i>	shield darter	46	230	153	429
Percidae	<i>Perca flavescens</i>	yellow perch	x	x	x	
Percidae	<i>Sander vitreum</i>	walleye	x			
Cottidae	<i>Cottus caeruleomentum</i>	blue ridge sculpin		x		
						9036

TABLE 4.4-1: DARTER SPECIES AND NUMBERS COLLECTED IN THE SUSQUEHANNA RIVER, DEER CREEK, AND OCTORARO CREEK BY LOCATION AND SEASON FROM OCTOBER 2010 – DECEMBER 2011.

Season	Site Nos.	<i>Etheostoma blennioides</i>	<i>E. olmstedii</i>	<i>E. zonale</i>	<i>E. sellare</i>	<i>Percina bimaculata</i>	<i>P. peltata</i>	Total
Susquehanna River								
Winter	6, 12, 13, 15, 16, 18, 22, 25, 27, 33-43	0	297	0	0	0	0	297
Spring	46-55, 60-65, 70, 71, 78, 80, 83, 86, 91, 92, 97-101	0	465	4	0	36	21	526
Summer	103-106, 108-111, 113-115, 118-125, 145-157	23	1426	110	0	212	22	1793
Fall	126-144, 158-175, 178-181	0	631	11	0	14	3	659
Total	126 sites	23	2819	125	0	262	46	3275
Deer Creek								
Fall	1-6, 22-24	3	2082	32	0	61	83	2261
Winter	**	**	**	**	**	**	**	**
Spring	7-16	0	315	2	0	226	76	619
Summer	18-21	1	250	11	0	77	71	410
Total	23 sites	4	2647	45	0	364	230	3290
Octoraro Creek								
Fall	1-3, 11, 12	7	394	48	0	14	97	560
Winter	**	**	**	**	**	**	**	**
Spring	4-6	0	59*	0	0	11	0	70*
Summer	7-10	5	512	33	0	1235	56	1841
Total	12 sites	12	965*	81	0	1260	153	2471*
All Streams Combined								
Total	161 Sites	39	6431	251	0	1886	429	9036

*Note: During one snorkel survey *E. olmstedii* was recorded qualitatively as 'common' (defined as between 10 and 100) rather than enumerated, so the actual number for the cumulative surveys was greater by 11-99.

** No sampling done

TABLE 4.4-2: DARTER SPECIES AND NUMBERS COLLECTED IN THE SUSQUEHANNA RIVER, DEER CREEK, AND OCTORARO CREEK BY SEASON AND GEAR TYPE WITH EFFORT FROM OCTOBER 2010 – DECEMBER 2011.

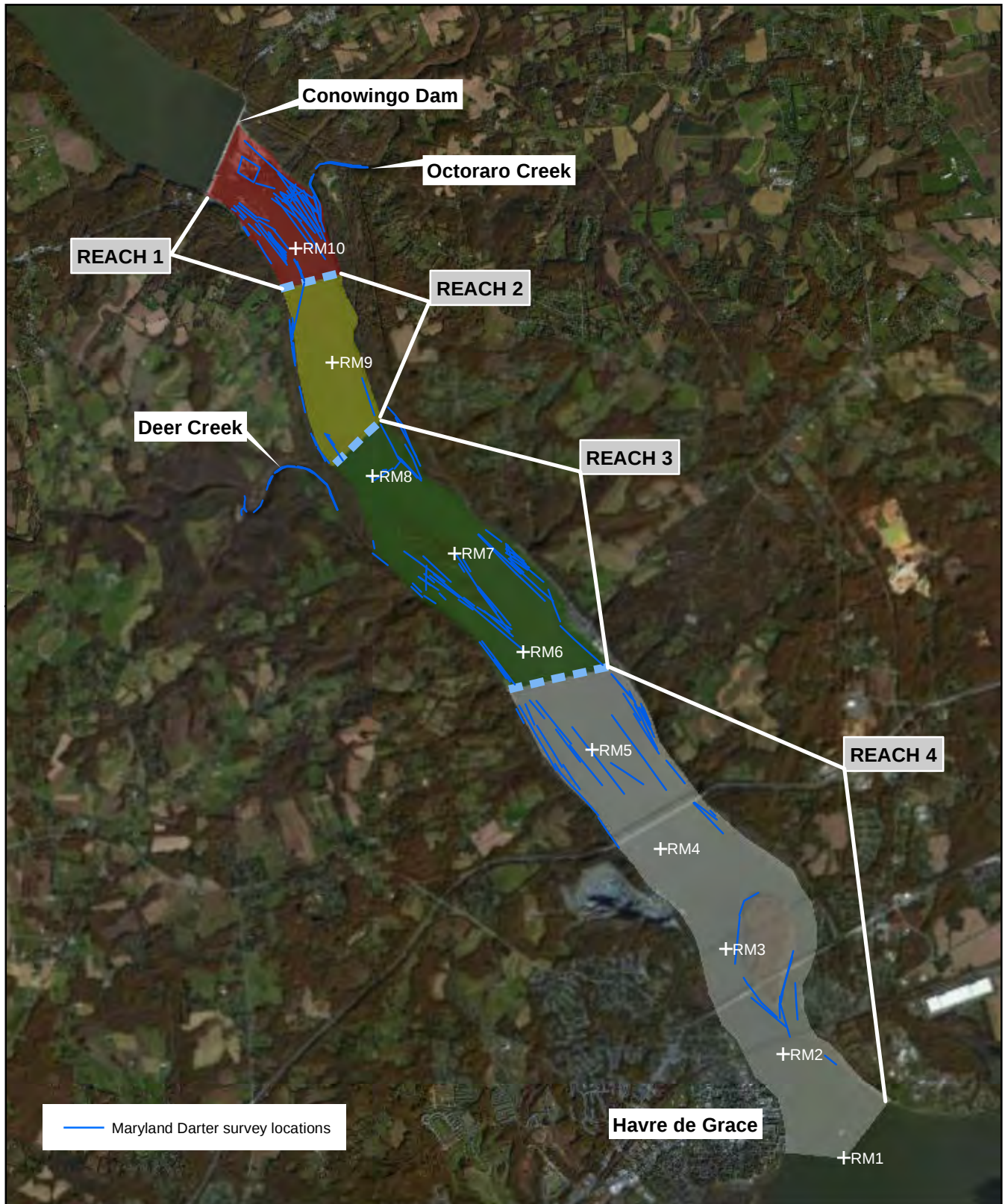
Susquehanna River	<i>Etheostoma blennioides</i>	<i>E. olmstedii</i>	<i>E. zonale</i>	<i>E. sellare</i>	<i>Percina bimaculata</i>	<i>P. peltata</i>	Row Sum	Cumulative Effort (seconds of shocking or observing)
Winter (total)	0	297	0	0	0	0	297	34200
Benthic Electric Trawl	0	297	0	0	0	0	297	34200
Backpack E-fisher								
Snorkeling								
Spring (total)	0	465	4	0	36	21	526	13956
Benthic Electric Trawl	0	465	4	0	36	21	526	13956
Backpack E-fisher								
Snorkeling								
Summer (total)	23	1426	110	0	212	22	1793	140739
Benthic Electric Trawl	2	260	10	0	17	8	297	8332
Backpack E-fisher	4	899	93	0	23	7	1026	43007
Snorkeling	17	267	7	0	172	7	470	89400
Fall (total)	0	631	11	0	14	3	659	20698
Benthic Electric Trawl	0	631	11	0	14	3	659	20698
Backpack E-fisher								
Snorkeling								
Total by Species	23	2819	125	0	262	46	3275	

Table 4.2-2 Continued:

Deer Creek	<i>Etheostoma blennioides</i>	<i>E. olmstedii</i>	<i>E. zonale</i>	<i>E. sellare</i>	<i>Percina bimaculata</i>	<i>P. peltata</i>	Row Sum	Cumulative Effort (seconds of shocking or observing)
Winter (total)	0	0	0	0	0	0	0	0
Benthic Electric Trawl								
Backpack E-fisher								
Snorkeling								
Spring (total)	0	315	2	0	226	76	619	74720
Benthic Electric Trawl								
Backpack E-fisher	0	280	2	0	204	58	544	19520
Snorkeling	0	35	0	0	22	18	75	55200
Summer (total)	1	250	11	0	77	71	410	41033
Benthic Electric Trawl								
Backpack E-fisher	1	167	10	0	60	58	296	8333
Snorkeling	0	83	1	0	17	13	114	32700
Fall (total)	3	2082	32	0	61	83	2261	50715
Benthic Electric Trawl								
Backpack E-fisher	2	2047	31	0	46	77	2203	32715
Snorkeling	1	35	1	0	15	6	58	18000
Total by Species	4	2647	45	0	364	230	3290	

Table 4.2-2 Continued:

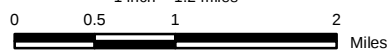
Octoraro Creek	<i>Etheostoma blennioides</i>	<i>E. olmstedii</i>	<i>E. zonale</i>	<i>E. sellare</i>	<i>Percina bimaculata</i>	<i>P. peltata</i>	Row Sum	Cumulative Effort (seconds of shocking or observing)
Winter (total)	0	0	0	0	0	0	0	0
Benthic Electric Trawl								
Backpack E-fisher								
Snorkeling								
Spring (total)	0	59	0	0	11	0	70	0
Benthic Electric Trawl								
Backpack E-fisher	0	59	0	0	7	0	66	8112
Snorkeling	0	0	0	0	4	0	4	N/A
Summer (total)	5	512	33	0	1235	56	1841	61987
Benthic Electric Trawl								
Backpack E-fisher	2	292	23	0	8	29	354	10687
Snorkeling	3	220	10	0	1227	27	1487	51300
Fall (total)	7	394	48	0	14	97	560	19781
Benthic Electric Trawl								
Backpack E-fisher	7	394	48	0	14	97	560	19781
Snorkeling								
Total by Species	12	965	81	0	1260	153	2471	



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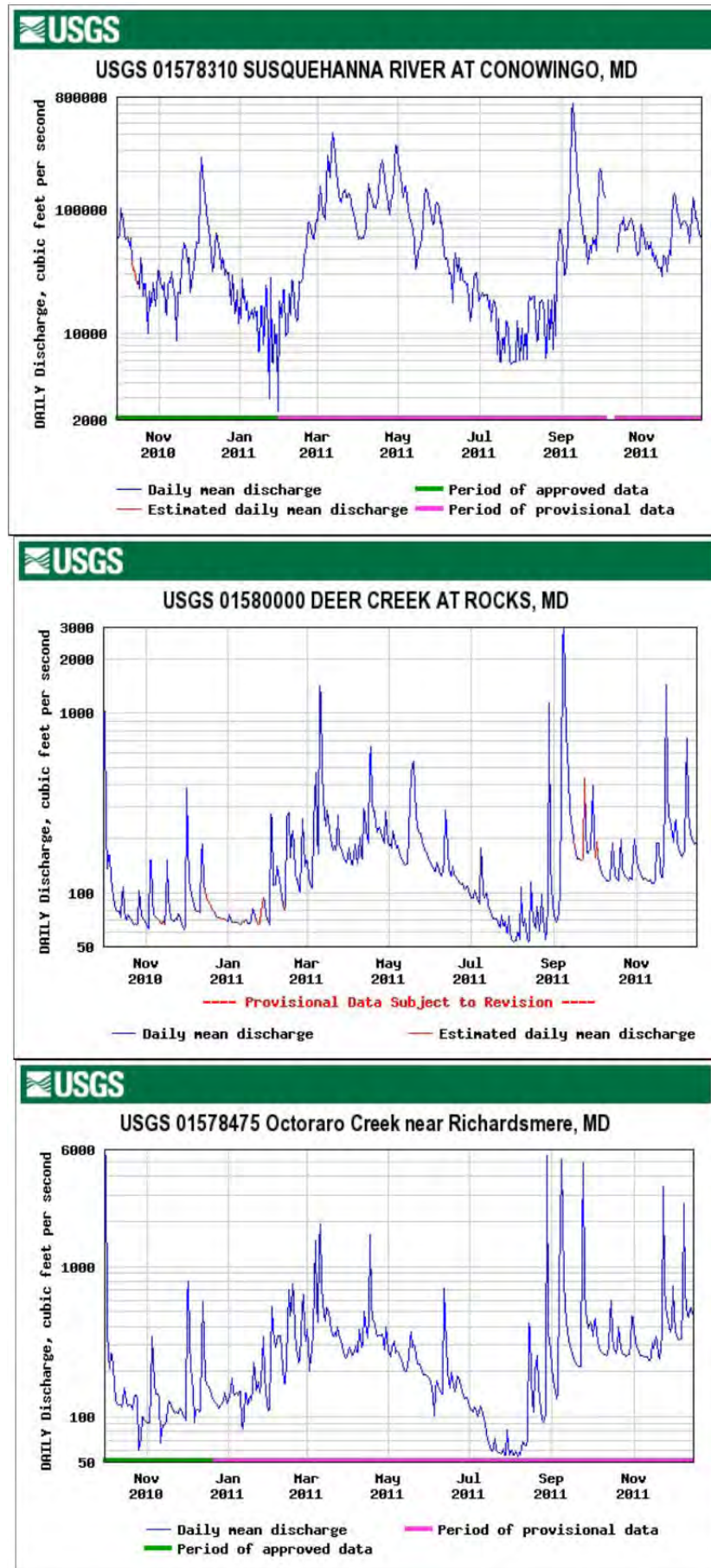
1 inch = 1.2 miles

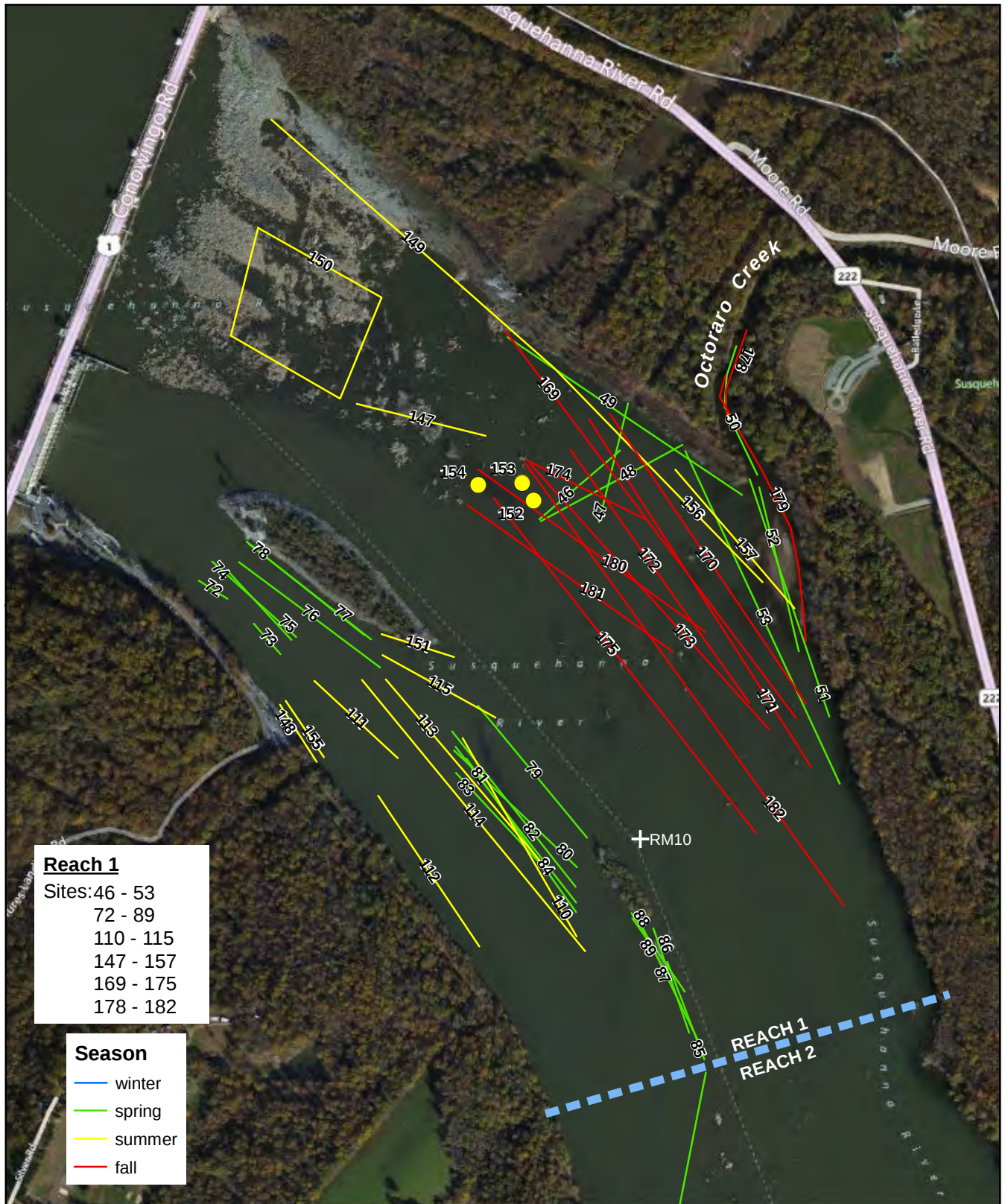


**Figure 3.1-1.
Figure Title: Maryland Darter Sampling
Locations**

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FIGURE 3.1-2: SREAMFLOW-OCTOBER 2010 TO DECEMBER 2011.





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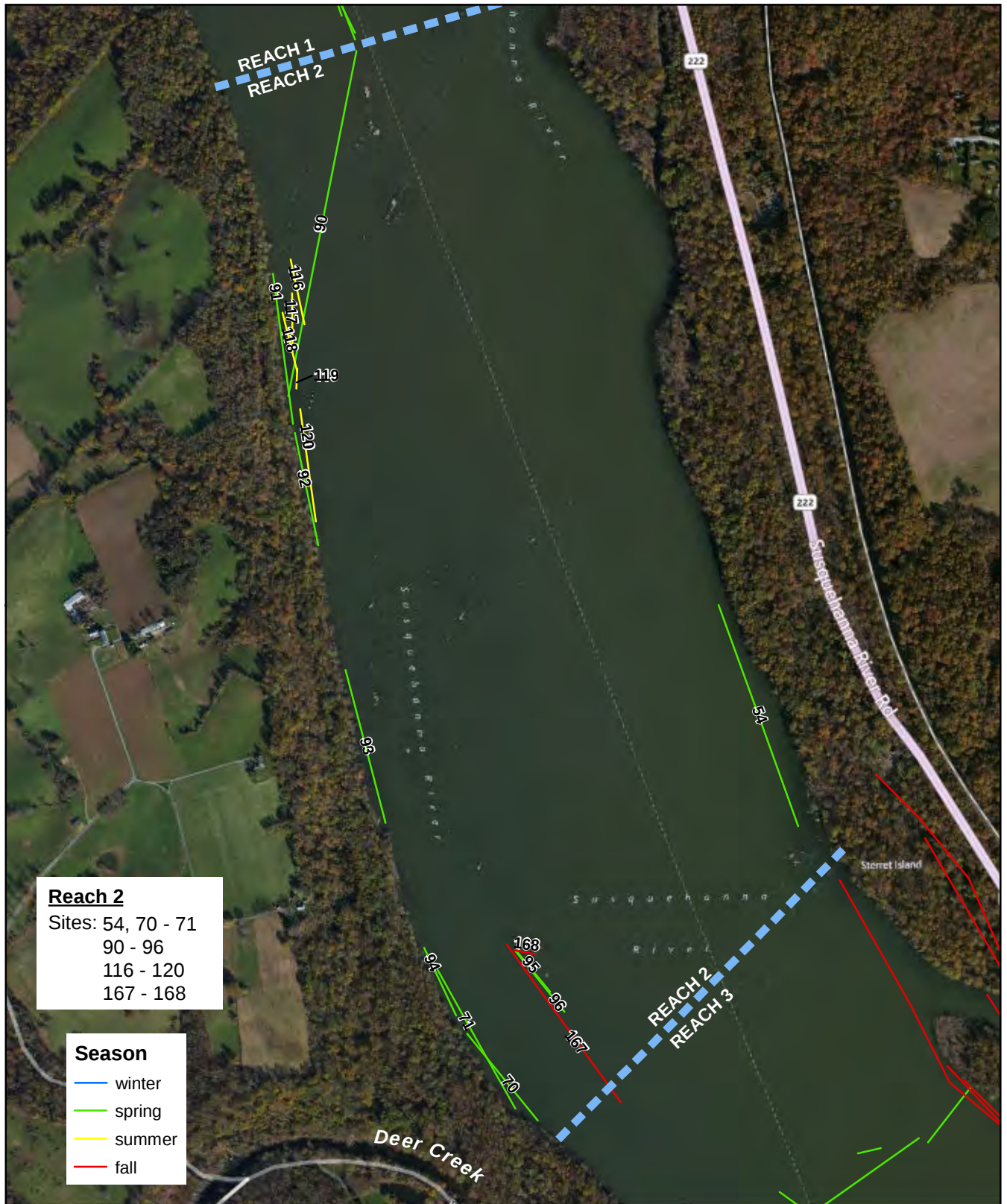


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1 inch = 0.2 miles
 0 0.125 0.25
 Miles

Figure 3.1-3
 Figure Title: Susquehanna River - Reach 1
 Sampling Locations by Season

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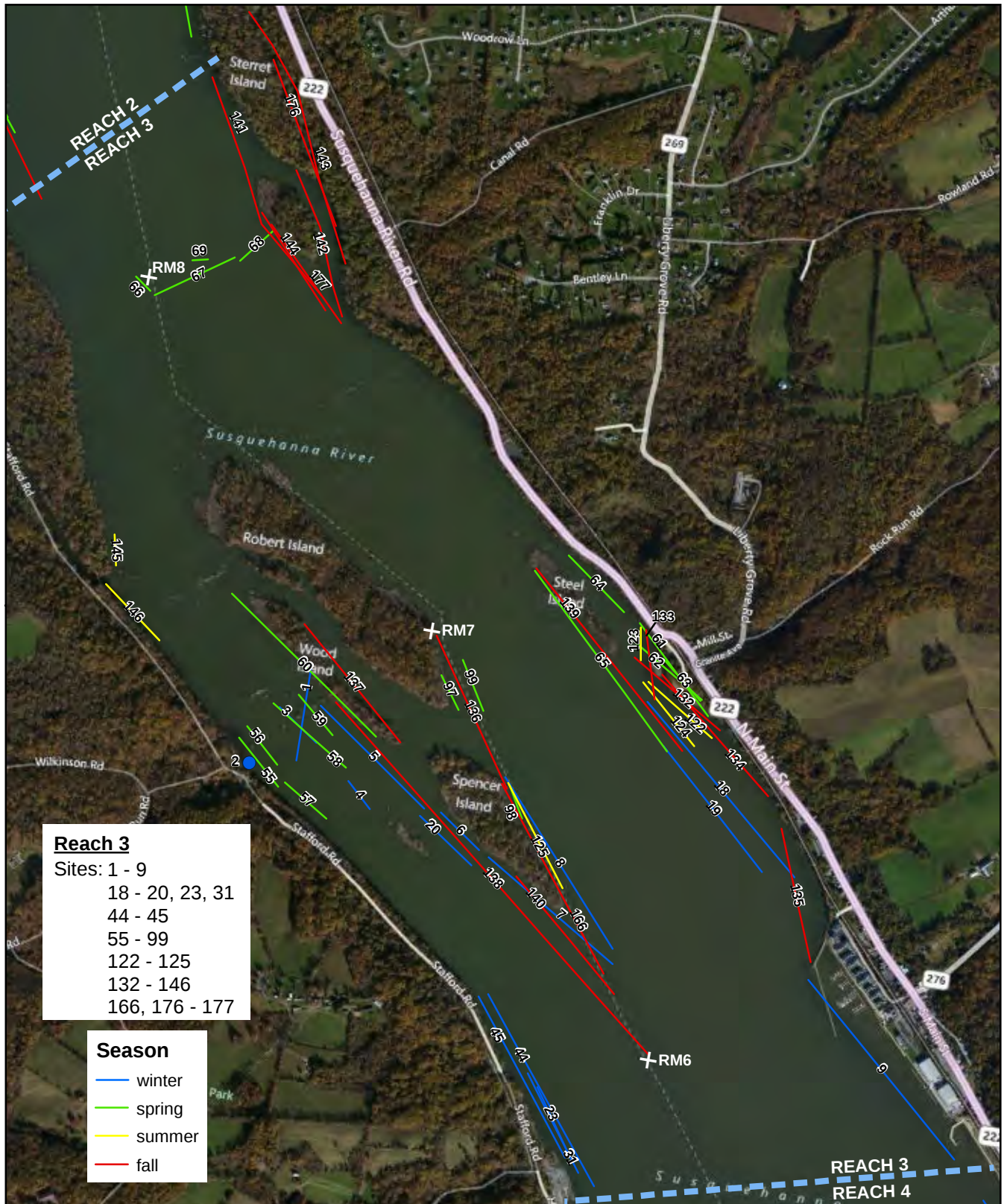
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1 inch = 0.2 miles

0 0.2 0.4 Miles

Figure 3.1-4.
 Figure Title: Susquehanna River - Reach 2
 Sampling Locations by Season

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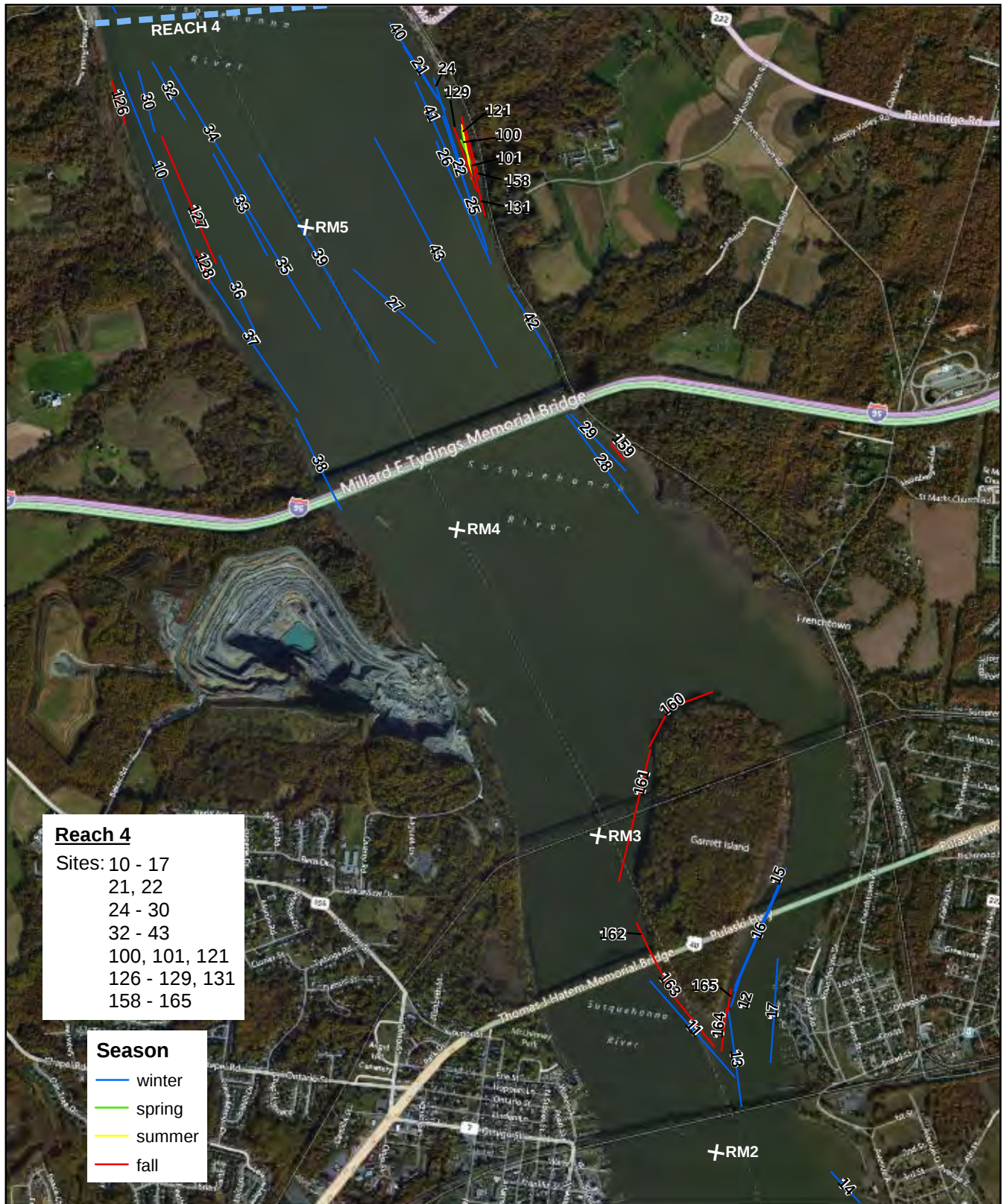


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1 inch = 0.3 miles
 0 0.275 0.55
 Miles

**Figure 3.1- 5.
 Figure Title: Susquehanna River - Reach 3
 Sampling Locations by Season**

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1 inch = 0.4 miles

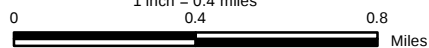


Figure 3.1- 6.
 Figure Title: Susquehanna River - Reach 4
 Sampling Locations by Season

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1 inch = 0.1 miles
0 0.1 0.2 Miles

Figure 3.1-7.
Figure Title: Deer Creek Sampling Locations
by Season

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1 inch = 0.1 miles

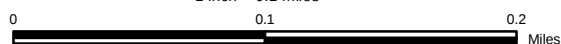


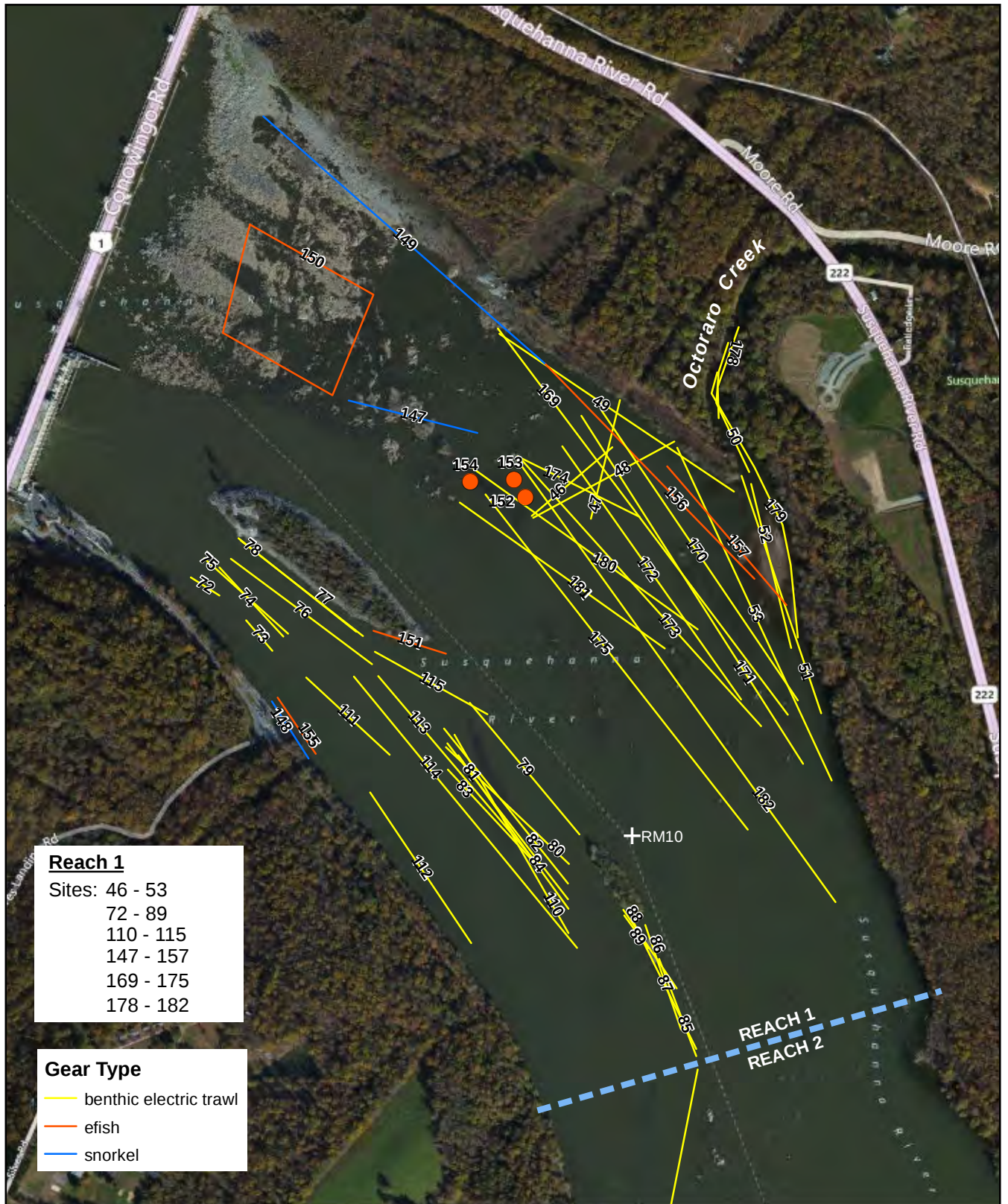
Figure 3.1-8.
Figure Title:

Octoraro Creek Sampling
Locations by Season

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Figure 3.1-9. December 2010 Conditions on Deer Creek and Octoraro Creek



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1 inch = 0.2 miles

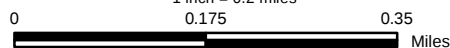
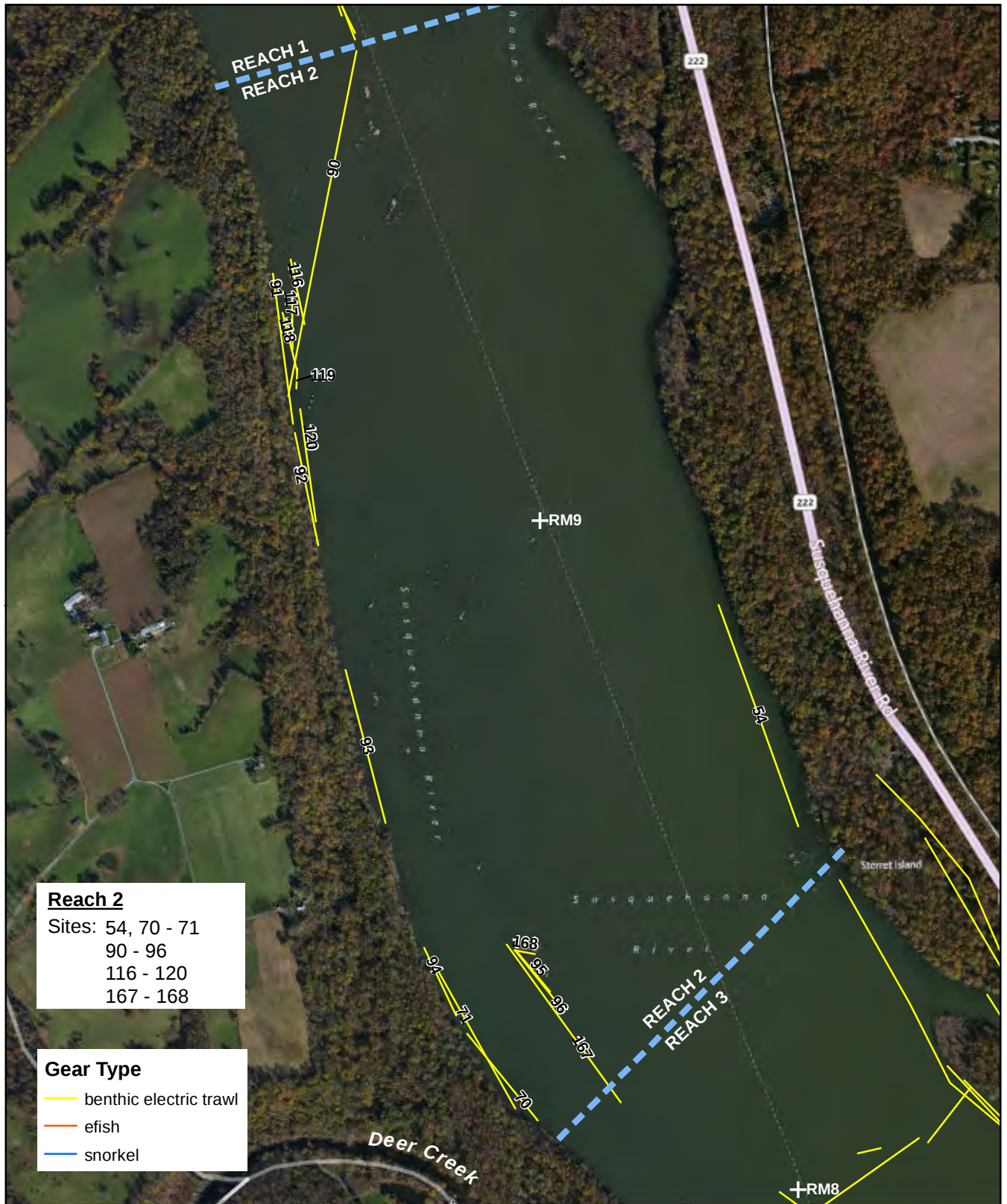


Figure 3.2- 1.
 Figure Title: Susquehanna River - Reach 1
 Sampling Locations by Gear Type

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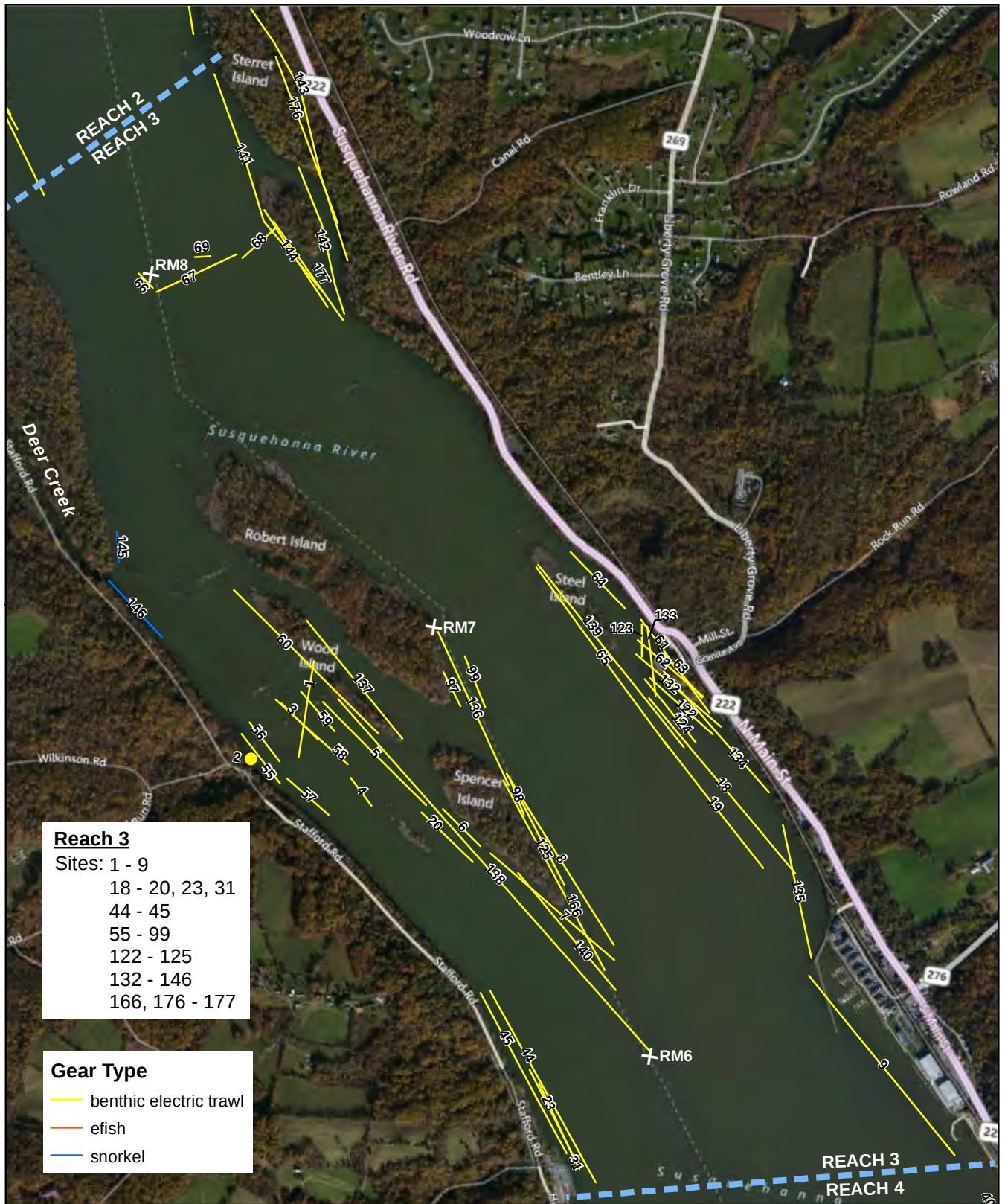


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Figure 3.2 - 2.
 Figure Title: Susquehanna River - Reach 2
 Sampling Locations by Gear Type

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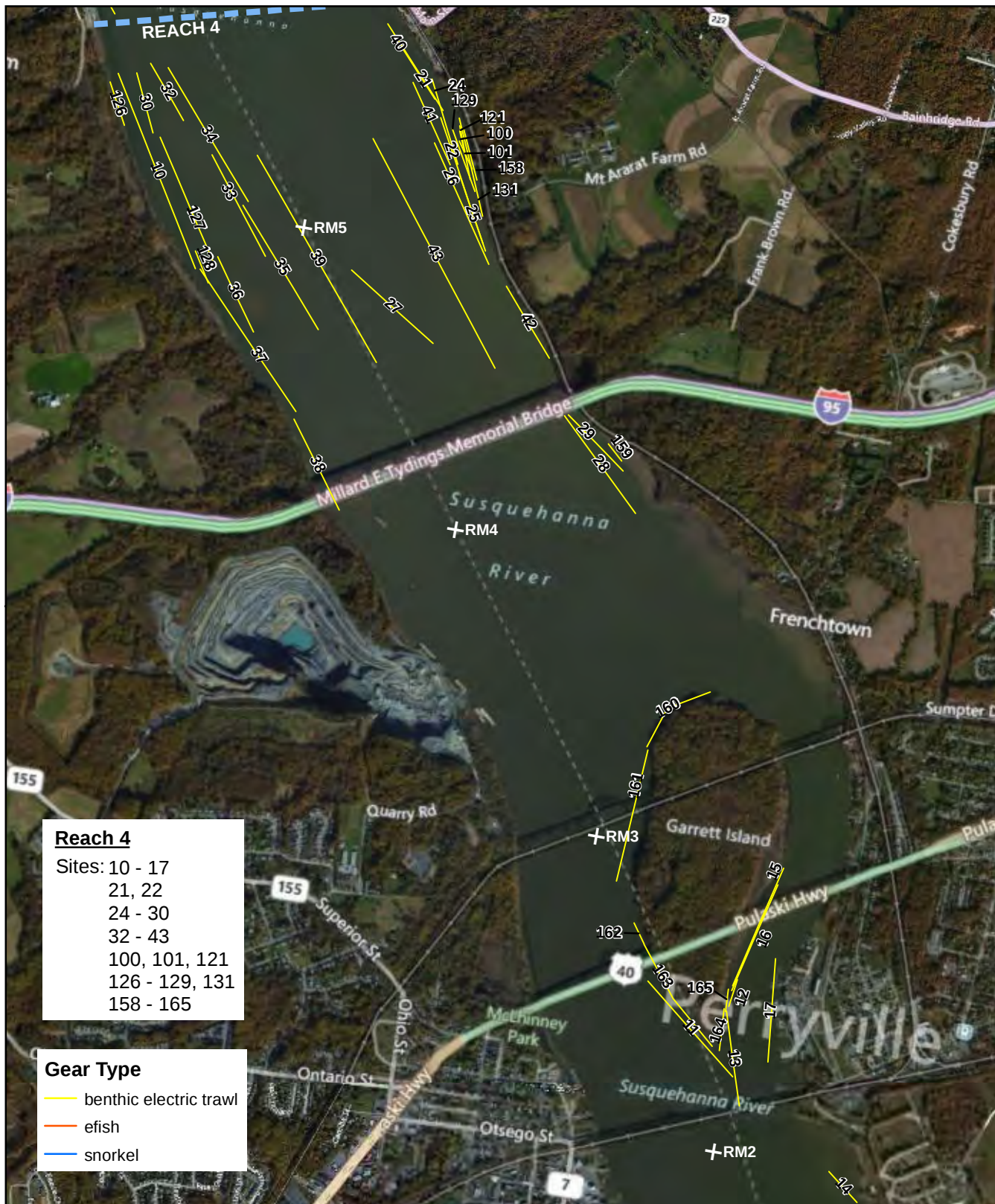
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1 inch = 0.3 miles
 0.3 0.6
 Miles

Figure 3.2- 3.
 Figure Title: Susquehanna River - Reach 3
 Sampling Locations by Gear Type

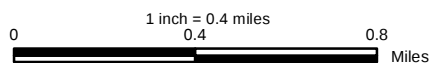
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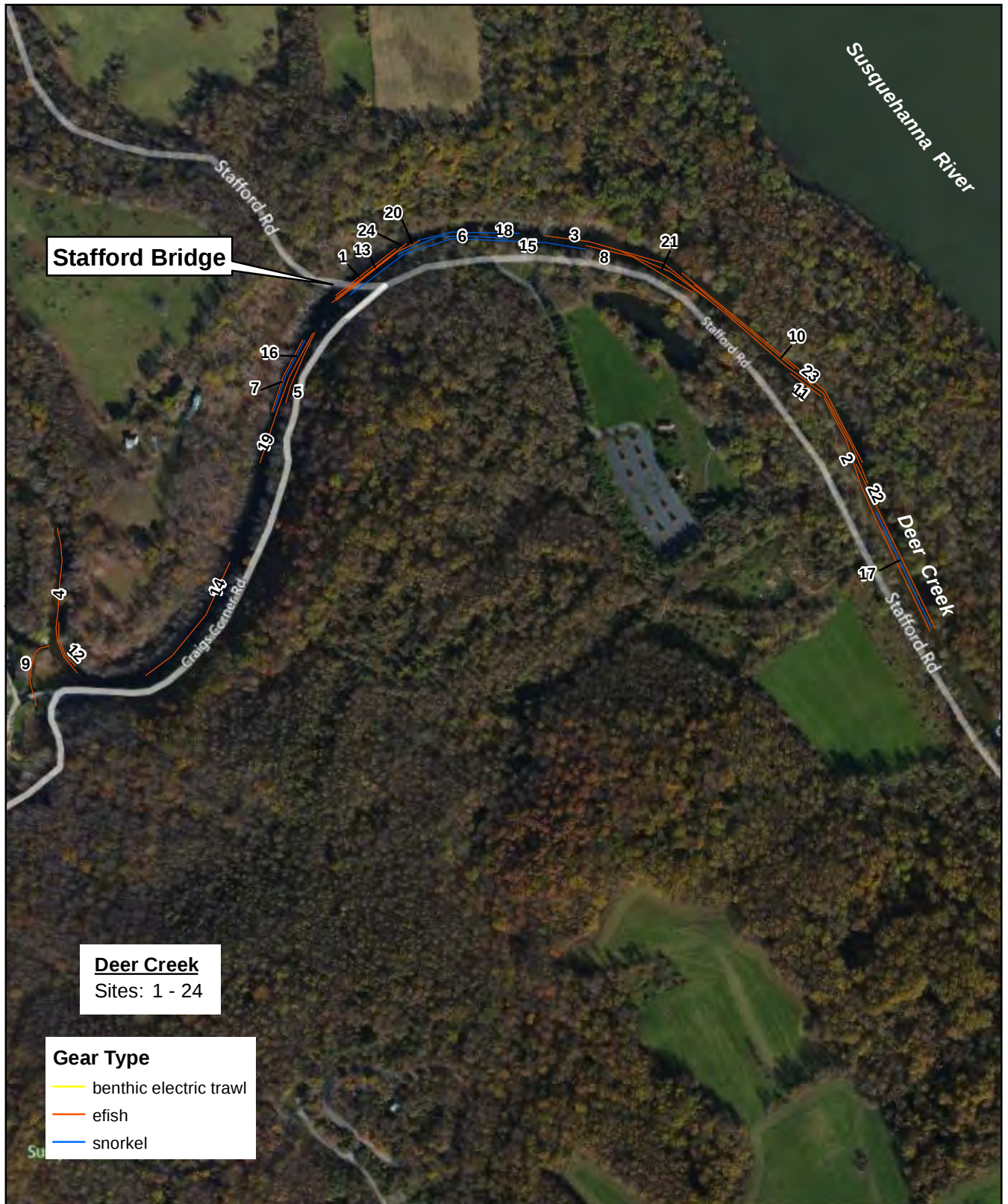
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Figure 3.2- 4.
 Figure Title: Susquehanna River - Reach 4
 Sampling Locations by Gear Type



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1 inch = 0.1 miles

0 0.1 0.2 Miles

**Figure 3.2-5.
Figure Title: Deer Creek Sampling Locations
by Gear Type**

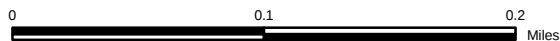
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PROJECT NO. 405**

1 inch = 0.1 miles



**Figure 3.2-6.
Figure Title: Octoraro Creek Sampling
Locations by Gear Type**

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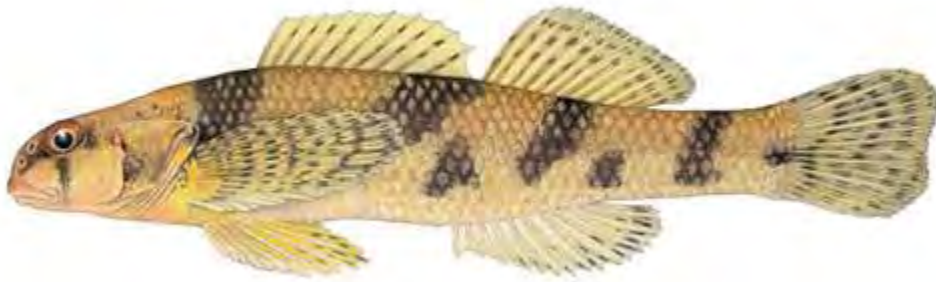


Figure 4.2-1: Maryland darter. Illustration by David Neely.

**APPENDIX A: QUALITATIVE RELATIVE ABUNDANCE OF SPECIES COLLECTED DURING
THE SURVEY IN THE SUSQUEHANNA RIVER. DARTERS ARE ENUMERATED.**

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		1	2	3	4	5	6	7	8
Sampling Site:		1	2	3	4	5	6	7	8
Date:		1/11/11	1/11/11	1/11/11	1/11/11	1/11/11	1/11/11	1/11/11	1/11/11
Gear Code ^a :		1	1	1	1	1	1	1	1
Effort (shock or observation seconds):		600	360	600	240	840	420	1140	1200
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel								
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp								
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish								
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter						1		
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		9	10	11	12	13	14	15	16
		1/11/11	1/11/11	1/12/11	1/12/11	1/12/11	1/12/11	1/12/11	1/12/11
		1	1	1	1	1	1	1	1
		1140	1800	900	300	660	420	1020	960
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel								1
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad				3				
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp				15				
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner				2	1		2	
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish								
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish				1			1	
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Ambloplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish							1	
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill						1	1	1
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter				1	1		3	2
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		17	18	19	20	21	22	23	24
		1/12/11	1/13/11	1/13/11	1/13/11	1/13/11	1/13/11	1/13/11	1/14/11
		1	1	1	1	1	1	1	1
		660	600	600	240	480	960	480	540
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel								
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad	1	1						
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella sp.</i>	shiner								
<i>Cyprinus carpio</i>	common carp								
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish								
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								1
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed		1						
<i>Lepomis macrochirus</i>	bluegill					2			
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter		1			5			
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		25	26	27	28	29	30	31	32
		1/14/11	1/14/11	1/14/11	1/14/11	1/14/11	1/14/11	1/14/11	1/14/11
		1	1	1	1	1	1	1	1
		600	720	660	780	1380	660	600	420
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel					1		1	
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp								28
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpododes cyprinus</i>	quillback								1
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish			29	1				
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish	1							
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed		1						
<i>Lepomis macrochirus</i>	bluegill	1				1			
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	1		1					
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		33	34	35	36	37	38	39	40
		1/14/11	2/20/11	2/20/11	2/20/11	2/20/11	2/20/11	2/20/11	2/20/11
		1	1	1	1	1	1	1	1
		900	900	900	780	1200	720	1200	600
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel			6	2	2	3	1	1
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								1
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	7				1	3		
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner							1	
<i>Notropis hudsonius</i>	spottail shiner					31		7	7
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner							1	
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback	2							
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker					1			
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead					1		1	
<i>Ictalurus punctatus</i>	channel catfish					1		8	1
<i>Pylodictis olivaris</i>	flathead catfish							2	
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish		1			8	6		2
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass						1		
<i>Lepomis auritis</i>	redbreast sunfish					3	1		
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed						1		
<i>Lepomis macrochirus</i>	bluegill						1		
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	3	3	19	3	61	8	76	29
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								2
<i>Sander vitreum</i>	walleye							1	
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		41	42	43	44	45	46	47	48
		2/20/11	2/20/11	2/20/11	2/20/11	2/20/11	6/20/11	6/20/11	6/20/11
		1	1	1	1	1	1	1	1
		1080	540	1200	600	600	220	647	415
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	1	1				*	*	
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella sp.</i>	shiner								
<i>Cyprinus carpio</i>	common carp								
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner	3							
<i>Notropis hudsonius</i>	spottail shiner	40	12						
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	2	1					*	*
<i>Pylodictis olivaris</i>	flathead catfish		1						
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch							*	
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish		2					*	
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed		1						
<i>Lepomis macrochirus</i>	bluegill	1							
<i>Micropterus dolomieu</i>	smallmouth bass							*	
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	63	16	1			1	4	1
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter						1	1	
<i>Perca flavescens</i>	yellow perch	1	1	1					
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		49	50	51	52	53	54	55	56
		6/20/11	6/20/11	6/20/11	6/20/11	6/20/11	6/20/11	6/20/11	6/21/11
		1	1	1	1	1	1	1	1
		647	415	608	392	538	352	519	133
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*		**	*	*		*	
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner						*		
<i>Cyprinella</i> sp.	shiner				**	*			
<i>Cyprinus carpio</i>	common carp	*		*	*	*			
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner					*			
<i>Notropis procne</i>	swallowtail shiner				*				
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace			**	*	*			
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpionodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker				*				
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker	*							
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*	*	*	*			*	
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish					*			
<i>Fundulus diaphanus</i>	banded killifish			*	*	*			
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish				*	*			
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass			*	*				
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	6	4	11	4	7	1	2	
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch			3					
<i>Percina peltata</i>	shield darter	1							
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		57	58	59	60	61	62	63	64
		6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11
		1	1	1	1	1	1	1	1
		289	266	114	540	430	340	423	174
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel				*	**	*	*	*
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner						*		
<i>Cyprinus carpio</i>	common carp					*			
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker							*	
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse				*				
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish					*			
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								*
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass				*		*		
<i>Amploplites rupestris</i>	rock bass								*
<i>Lepomis auritis</i>	redbreast sunfish						*		
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter				9	44	32	35	3
<i>Etheostoma zonale</i>	banded darter				1				
<i>Percina bimaculata</i>	Chesapeake logperch					10	5	7	1
<i>Percina peltata</i>	shield darter					12	1	1	
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		65	66	67	68	69	70	71	72
		6/21/11	6/22/11	6/22/11	6/22/11	6/22/11	6/22/11	6/22/11	6/23/11
		1	1	1	1	1	1	1	1
		447	61	374	393	36	159	208	5
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*			*	*	*	
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner						*	*	
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp								
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker							*	
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*					*	*	
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish	*							
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch							*	
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	4		1	1		1	1	
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		73	74	75	76	77	78	79	80
		6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11
		1	1	1	1	1	1	1	1
		115	138	147	301	261	280	123	177
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*		*		*	*	
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner				*	*	*		
<i>Cyprinus carpio</i>	common carp								
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish		*		*	*		*	
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch		*	*				*	
<i>Morone saxatilis</i>	striped bass								*
<i>Ambloplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass					*			
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter						1		1
<i>Etheostoma zonale</i>	banded darter						1		
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		81	82	83	84	85	86	87	88
		6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11
		1	1	1	1	1	1	1	1
		210	186	123	197	135	189	208	86
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel			*			*		
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner		*						
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella sp.</i>	shiner	*							
<i>Cyprinus carpio</i>	common carp		*		*	*			
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner	*					**	*	*
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*	*	*	*			*	
<i>Pylodictis olivaris</i>	flathead catfish					*			
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch	*			*	*	*		
<i>Morone saxatilis</i>	striped bass			*	*				
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								*
<i>Micropterus salmoides</i>	largemouth bass		*					*	
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter								
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch			1			1		
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		89	90	91	92	93	94	95	96
		6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11	6/23/11
		1	1	1	1	1	1	1	1
		7	225	274	274	192	102	84	178
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel		*	*					
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad				*				
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner		*		*				
<i>Cyprinella sp.</i>	shiner								
<i>Cyprinus carpio</i>	common carp			*			*	*	
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner		*	*	*				
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker			*					
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse								
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish						*		
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch				*	*	*		*
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill			*					
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter			1	1		3		
<i>Etheostoma zonale</i>	banded darter				2				
<i>Percina bimaculata</i>	Chesapeake logperch			1					
<i>Percina peltata</i>	shield darter			2					
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		97	98	99	100	101	102	103	104
		6/24/11	6/24/11	6/24/11	6/24/11	6/24/11	8/22/11	8/22/11	8/22/11
		1	1	1	1	1	1	1	1
		349	198	359	103	201	120	173	359
Sampling Site:									
Date:									
Gear Code ^a :									
Effort (shock or observation seconds):									
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*	*	*	*		*	*
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	*	*					*	
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner								
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse							*	*
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish						*		
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch	*							
<i>Morone saxatilis</i>	striped bass					*			
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish	*					*	**	*
<i>Lepomis cyanellus</i>	green sunfish						*		*
<i>Lepomis gibbosus</i>	pumpkinseed				*				
<i>Lepomis macrochirus</i>	bluegill							*	*
<i>Micropterus dolomieu</i>	smallmouth bass		*						
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter							1	1
<i>Etheostoma olmstedii</i>	tessellated darter	19	32	1	35	198	8	37	58
<i>Etheostoma zonale</i>	banded darter						1	1	6
<i>Percina bimaculata</i>	Chesapeake logperch		3			4		1	2
<i>Percina peltata</i>	shield darter	1				1			
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

	Sampling Site: Date: Gear Code ^a : Effort (shock or observation seconds):	105	106	107	108	109	110	111	112
		8/22/11	8/22/11	8/22/11	8/22/11	8/22/11	8/23/11	8/23/11	8/23/11
		1	1	1	1	1	1	1	1
		380	881	261	407	802	364	134	230
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*		*	*	*		
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad		**	*	**				
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp		*		*	*	*		
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner		*						
<i>Notropis hudsonius</i>	spottail shiner		**		**	*			
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace		*			*			
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback					*			
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		*	*	*	*	*		*
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish						*	*	
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginied madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish		*		*	*			
<i>Morone americana</i>	white perch	*						*	
<i>Morone saxatilis</i>	striped bass					*			
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish	*				*			
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill	*	*		*				
<i>Micropterus dolomieu</i>	smallmouth bass					*			
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	23	23		1	4	20	2	
<i>Etheostoma zonale</i>	banded darter					1			
<i>Percina bimaculata</i>	Chesapeake logperch		1	1		3			
<i>Percina peltata</i>	shield darter		1		1	3			
<i>Perca flavescens</i>	yellow perch	*							
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

	Sampling Site: Date: Gear Code ^a : Effort (shock or observation seconds):	113	114	115	116	117	118	119	120
		8/23/11	8/23/11	8/23/11	8/24/11	8/24/11	8/24/11	8/24/11	8/24/11
		1	1	1	1	1	1	1	1
		462	513	183	62	95	176	232	308
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*	*			*		*
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad								
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner							*	
<i>Cyprinella spiloptera</i>	spotfin shiner							*	
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	*					*		*
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner							*	*
<i>Notropis procne</i>	swallowtail shiner							*	
<i>Notropis rubellus</i>	rosyface shiner								*
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		*	*					*
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*		*					*
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill							*	
<i>Micropterus dolomieu</i>	smallmouth bass								*
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	6	10	1			4	1	18
<i>Etheostoma zonale</i>	banded darter								1
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter						1		
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		121	122	123	124	125	126	127	128
		8/25/11	8/25/11	8/25/11	8/25/11	8/25/11	10/24/11	10/24/11	10/24/11
		1	1	1	1	1	1	1	1
		424	518	148	474	626	260	979	197
	Petromyzon marinus								
	Anguilla rostrata	*	*		*	*	*	*	
	Alosa sp.								
	Dorosoma cepedianum								
	Campostoma anomalum								
	Carassius auratus								
	Clinostomus funduloides								
	Cyprinella analostana								
	Cyprinella spiloptera								
	Cyprinella sp.								
	Cyprinus carpio		*						
	Exoglossum maxillingua								
	Hybognathus regius								
	Luxilus cornutus								
	Nocomis micropogon								
	Notropis amoenus								
	Notropis hudsonius					*		*	
	Notropis procne								
	Notropis rubellus								
	Pimephales notatus								
	Rhinichthys atratulus								
	Rhinichthys cataractae								
	Semotilus atromaculatus								
	Semotilus corporalis								
	Carpoides cyprinus								
	Catostomus commersoni								
	Erimyzon oblongus								
	Hypentelium nigricans								
	Moxostoma macrolepidotum							*	
	Ameiurus natalis								
	Ameiurus nebulosus								
	Ictalurus punctatus	*						*	
	Pylodictis olivaris								
	Noturus insignis								
	Salmo trutta								
	Strongylura marina								
	Fundulus diaphanus								
	Morone americana								
	Morone saxatilis								
	Amploplites rupestris								
	Lepomis auritis		*						
	Lepomis cyanellus	*	*						
	Lepomis gibbosus								
	Lepomis macrochirus	*	*			**			
	Micropterus dolomieu								
	Micropterus salmoides								
	Etheostoma blennioides								
	Etheostoma olmstedii	1	27	1	4	11	4	174	3
	Etheostoma zonale								
	Percina bimaculata		5			4			
	Percina peltata		2						
	Perca flavescens							*	
	Sander vitreum								
	Cottus caeruleomentum								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		129	130	131	132	133	134	135	136
		10/24/11	10/24/11	10/24/11	10/24/11	10/24/11	10/24/11	10/24/11	10/24/11
		1	1	1	1	1	1	1	1
		371	284	853	280	105	557	383	560
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*		*				*
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad			*					*
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish	*							
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella sp.</i>	shiner								
<i>Cyprinus carpio</i>	common carp				*		*		*
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner			**					*
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		*			*		*	*
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	**	**		*		*		*
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish			*					
<i>Morone americana</i>	white perch						*		
<i>Morone saxatilis</i>	striped bass						*		*
<i>Amploplites rupestris</i>	rock bass			*					
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed			*					
<i>Lepomis macrochirus</i>	bluegill		*	*					
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	15	38	181	17		2	2	26
<i>Etheostoma zonale</i>	banded darter			1	3	1			
<i>Percina bimaculata</i>	Chesapeake logperch			2	3		3		
<i>Percina peltata</i>	shield darter					1			
<i>Perca flavescens</i>	yellow perch			*					
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

	Sampling Site: Date: Gear Code ^a : Effort (shock or observation seconds):	137	138	139	140	141	142	143	144
		10/24/11	10/24/11	10/25/11	10/25/11	10/25/11	10/25/11	10/25/11	10/25/11
		1	1	1	1	1	1	1	1
		226	1842	331	302	489	345	608	186
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*	*					
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad							*	
<i>Campostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	*	**	*	*		*		
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner		*						
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner							*	
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpiodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker						*		
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse	*	**				*		*
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish		*			*		*	*
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom					*	*		
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch		*	*					
<i>Morone saxatilis</i>	striped bass								
<i>Amploplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass				*	*			
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	3	18		1	5	1	1	1
<i>Etheostoma zonale</i>	banded darter		2		1	1	1		
<i>Percina bimaculata</i>	Chesapeake logperch		2			1			
<i>Percina peltata</i>	shield darter						1		
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

	Sampling Site: Date: Gear Code ^a : Effort (shock or observation seconds):	145	146	147	148	149	150	151	152
		8/20/11	8/20/11	8/23/11	8/23/11	8/24/11	8/22/11	8/22/11	8/23/11
		3	3	3	3	3	2	2	2
		13500	13500	24000	14400	24000	6891	1449	5400a
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*	*	*			***	**	***
<i>Alosa sp.</i>	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad	***	*	***		***	**		
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish						*		
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner						***		
<i>Cyprinella sp.</i>	shiner	**	**		***				
<i>Cyprinus carpio</i>	common carp			**		*	**		*
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow	**							
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub	**	*						
<i>Notropis amoenus</i>	comely shiner			**				*	
<i>Notropis hudsonius</i>	spottail shiner				*			*	
<i>Notropis procne</i>	swallowtail shiner	***	**	*	*			*	
<i>Notropis rubellus</i>	rosyface shiner						***		
<i>Pimephales notatus</i>	bluntnose minnow	*							
<i>Rhinichthys atratulus</i>	blacknose dace				*				
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpododes cyprinus</i>	quillback			*	*	**	*		
<i>Catostomus commersoni</i>	white sucker								
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		*	*		*	*		
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*		*	*	**	**	*	*
<i>Pylodictis olivaris</i>	flathead catfish						*		
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish	*		**		**	**		*
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass	*	*	*					
<i>Amploplites rupestris</i>	rock bass						*	*	
<i>Lepomis auritis</i>	redbreast sunfish	**	**	**	**	**			
<i>Lepomis cyanellus</i>	green sunfish	*	*	***	**		**	*	***
<i>Lepomis gibbosus</i>	pumpkinseed					*			
<i>Lepomis macrochirus</i>	bluegill	**	**	***	**	***	**	*	***
<i>Micropterus dolomieu</i>	smallmouth bass	**	*	**		**	*		
<i>Micropterus salmoides</i>	largemouth bass			**	*	**	*		*
<i>Etheostoma blennioides</i>	greenside darter				10	7			
<i>Etheostoma olmstedii</i>	tessellated darter	3	26	7	224	7	40	9	23
<i>Etheostoma zonale</i>	banded darter				7		1	1	1
<i>Percina bimaculata</i>	Chesapeake logperch	21	11	42		98	7		5
<i>Percina peltata</i>	shield darter	5				2	1		
<i>Perca flavescens</i>	yellow perch					*			
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleomentum</i>	blue ridge sculpin								

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

*<10 *Lepomis* Hybrid collected at site 150

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		Sampling Site:	153	154	155	156	157	158	159	160
		Date:	8/23/11	8/23/11	8/23/11	8/24/11	8/26/11	11/29/11	11/29/11	11/29/11
		Gear Code ^a :	2	2	2	2	2	2	2	1
		Effort (shock or observation seconds):	2400a	4200a	7800a	6912	4355	435	281	601
<i>Petromyzon marinus</i>	sea lamprey									
<i>Anguilla rostrata</i>	American eel		***	**	***	***	***	*	*	
<i>Alosa sp.</i>	River herrings/shad									
<i>Dorosoma cepedianum</i>	gizzard shad		*	*	*		**			
<i>Camptostoma anomalum</i>	central stoneroller									
<i>Carassius auratus</i>	goldfish									
<i>Clinostomus funduloides</i>	rosyside dace									
<i>Cyprinella analostana</i>	satinfin shiner						*			
<i>Cyprinella spiloptera</i>	spotfin shiner				*		*			
<i>Cyprinella sp.</i>	shiner									
<i>Cyprinus carpio</i>	common carp			*	*	*			*	*
<i>Exoglossum maxillingua</i>	cutlips minnow									
<i>Hybognathus regius</i>	Eastern silvery minnow				*	**	**			
<i>Luxilus cornutus</i>	common shiner									
<i>Nocomis micropogon</i>	river chub									
<i>Notropis amoenus</i>	comely shiner					**	***			
<i>Notropis hudsonius</i>	spottail shiner				*	**	***	*	*	*
<i>Notropis procne</i>	swallowtail shiner				*	*				
<i>Notropis rubellus</i>	rosyface shiner				*	*	**			
<i>Pimephales notatus</i>	bluntnose minnow					*	**			
<i>Rhinichthys atratulus</i>	blacknose dace						*			
<i>Rhinichthys cataractae</i>	longnose dace						*			
<i>Semotilus atromaculatus</i>	creek chub									
<i>Semotilus corporalis</i>	fallfish									
<i>Carpionodes cyprinus</i>	quillback									
<i>Catostomus commersoni</i>	white sucker					*	*			
<i>Erimyzon oblongus</i>	creek chubsucker									
<i>Hypentelium nigricans</i>	northern hog sucker									
<i>Moxostoma macrolepidotum</i>	shorthead redhorse									
<i>Ameiurus natalis</i>	yellow bullhead									
<i>Ameiurus nebulosus</i>	brown bullhead									
<i>Ictalurus punctatus</i>	channel catfish				*	*	*			*
<i>Pylodictis olivaris</i>	flathead catfish		*							
<i>Noturus insignis</i>	marginated madtom					*	**			
<i>Salmo trutta</i>	brown trout									
<i>Strongylura marina</i>	Atlantic needlefish									
<i>Fundulus diaphanus</i>	banded killifish			**		***	**			
<i>Morone americana</i>	white perch									
<i>Morone saxatilis</i>	striped bass						*			
<i>Amploplites rupestris</i>	rock bass			*		*	*		*	
<i>Lepomis auritis</i>	redbreast sunfish				**	*	*			
<i>Lepomis cyanellus</i>	green sunfish		**	***	***	***	*			*
<i>Lepomis gibbosus</i>	pumpkinseed								*	*
<i>Lepomis macrochirus</i>	bluegill		**	**	***	***	*	*	**	
<i>Micropterus dolomieu</i>	smallmouth bass		*			*				
<i>Micropterus salmoides</i>	largemouth bass		*	*		*	*		*	
<i>Etheostoma blennioides</i>	greenside darter				3	1				
<i>Etheostoma olmstedii</i>	tessellated darter		18	34	100	118	557	15	7	4
<i>Etheostoma zonale</i>	banded darter			1	6	3	80			
<i>Percina bimaculata</i>	Chesapeake logperch		5	4			2			
<i>Percina peltata</i>	shield darter				1		5	1		
<i>Perca flavescens</i>	yellow perch									
<i>Sander vitreum</i>	walleye									
<i>Cottus caeruleomentum</i>	blue ridge sculpin									

^a Gear codes: 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

^u sample time, no shock time recorded in data

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		161	162	163	164	165	166	167	168
		11/29/11	11/29/11	11/29/11	11/29/11	11/29/11	11/30/11	11/30/11	11/30/11
		1	1	1	1	1	1	1	1
		811	141	998	368	167	568	248	73
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel	*		**	**	*	*		*
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad			*			*		
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner								
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	**	*	*	*	*	**	**	**
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner								
<i>Notropis hudsonius</i>	spottail shiner	**	*	**		*	**	*	
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpionodes cyprinus</i>	quillback						*		
<i>Catostomus commersoni</i>	white sucker					*		*	
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse							*	
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead			*					
<i>Ictalurus punctatus</i>	channel catfish			*			*	**	
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish			**					
<i>Morone americana</i>	white perch			*	*				
<i>Morone saxatilis</i>	striped bass								
<i>Ambloplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish			*					
<i>Lepomis cyanellus</i>	green sunfish			*		*			
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill				*				
<i>Micropterus dolomieu</i>	smallmouth bass	*						*	
<i>Micropterus salmoides</i>	largemouth bass	*							
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	43	5	17	5	7	7	1	1
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch	*		**	*	*			
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleoventum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

^u sample time, no shock time recorded in data

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		169	170	171	172	173	174	175	176
		11/30/11	11/30/11	11/30/11	11/30/11	11/30/11	11/30/11	11/30/11	12/1/11
		1	1	1	1	1	1	1	1
		689	544	472	642	509	284	N/A	506
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel								
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad		*						*
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner	*							
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp	*			*	*		*	
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner	*	*						*
<i>Notropis hudsonius</i>	spottail shiner	**	*	**	*				
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpionodes cyprinus</i>	quillback					*			
<i>Catostomus commersoni</i>	white sucker				*				*
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker				*				
<i>Moxostoma macrolepidotum</i>	shorthead redhorse	*	*	*	**	*			
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish					*			*
<i>Pylodictis olivaris</i>	flathead catfish								
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass			*		*			
<i>Ambloplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass								
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedii</i>	tessellated darter	1	1	5	1	4	1	6	
<i>Etheostoma zonale</i>	banded darter				1				
<i>Percina bimaculata</i>	Chesapeake logperch		1	1	1				
<i>Percina peltata</i>	shield darter							1	
<i>Perca flavescens</i>	yellow perch								*
<i>Sander vitreum</i>	walleye								
<i>Cottus caeruleoventum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

^u sample time, no shock time recorded in data

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

Appendix A: Summary statistics & qualitative relative abundance of fishes recorded in Susquehanna River during Maryland darter survey.

		177	178	179	180	181	182		
		12/1/11	12/1/11	12/1/11	12/1/11	12/1/11	12/1/11		
		1	1	1	1	1	1		
		204	595	592	842	337	633		
	Sampling Site:								
	Date:								
	Gear Code^a:								
	Effort (shock or observation seconds):								
<i>Petromyzon marinus</i>	sea lamprey								
<i>Anguilla rostrata</i>	American eel								
<i>Alosa</i> sp.	River herrings/shad								
<i>Dorosoma cepedianum</i>	gizzard shad	*	*	*	*	*	*		
<i>Camptostoma anomalum</i>	central stoneroller								
<i>Carassius auratus</i>	goldfish								
<i>Clinostomus funduloides</i>	rosyside dace								
<i>Cyprinella analostana</i>	satinfin shiner								
<i>Cyprinella spiloptera</i>	spotfin shiner					*			
<i>Cyprinella</i> sp.	shiner								
<i>Cyprinus carpio</i>	common carp		**	**					
<i>Exoglossum maxillingua</i>	cutlips minnow								
<i>Hybognathus regius</i>	Eastern silvery minnow								
<i>Luxilus cornutus</i>	common shiner								
<i>Nocomis micropogon</i>	river chub								
<i>Notropis amoenus</i>	comely shiner		*	*					
<i>Notropis hudsonius</i>	spottail shiner			**		*	*		
<i>Notropis procne</i>	swallowtail shiner								
<i>Notropis rubellus</i>	rosyface shiner								
<i>Pimephales notatus</i>	bluntnose minnow								
<i>Rhinichthys atratulus</i>	blacknose dace								
<i>Rhinichthys cataractae</i>	longnose dace								
<i>Semotilus atromaculatus</i>	creek chub								
<i>Semotilus corporalis</i>	fallfish								
<i>Carpionodes cyprinus</i>	quillback								
<i>Catostomus commersoni</i>	white sucker		*	*			*		
<i>Erimyzon oblongus</i>	creek chubsucker								
<i>Hypentelium nigricans</i>	northern hog sucker								
<i>Moxostoma macrolepidotum</i>	shorthead redhorse			*	*				
<i>Ameiurus natalis</i>	yellow bullhead								
<i>Ameiurus nebulosus</i>	brown bullhead								
<i>Ictalurus punctatus</i>	channel catfish	*	**	*	*	*			
<i>Pylodictis olivaris</i>	flathead catfish					*			
<i>Noturus insignis</i>	marginated madtom								
<i>Salmo trutta</i>	brown trout								
<i>Strongylura marina</i>	Atlantic needlefish								
<i>Fundulus diaphanus</i>	banded killifish								
<i>Morone americana</i>	white perch								
<i>Morone saxatilis</i>	striped bass				*				
<i>Ambloplites rupestris</i>	rock bass								
<i>Lepomis auritis</i>	redbreast sunfish								
<i>Lepomis cyanellus</i>	green sunfish								
<i>Lepomis gibbosus</i>	pumpkinseed								
<i>Lepomis macrochirus</i>	bluegill								
<i>Micropterus dolomieu</i>	smallmouth bass								
<i>Micropterus salmoides</i>	largemouth bass			*					
<i>Etheostoma blennioides</i>	greenside darter								
<i>Etheostoma olmstedi</i>	tessellated darter		2	1	4	1			
<i>Etheostoma zonale</i>	banded darter								
<i>Percina bimaculata</i>	Chesapeake logperch								
<i>Percina peltata</i>	shield darter								
<i>Perca flavescens</i>	yellow perch								
<i>Sander vitreum</i>	walleye		*	*		*			
<i>Cottus caeruleoventum</i>	blue ridge sculpin								

^a **Gear codes:** 1-benthic electric trawl; 2-backpack electrofisher; 3-snorkeling

^u sample time, no shock time recorded in data

Relative abundance codes: * 1 - 10; ** 11-99; *** >=100

**APPENDIX B: QUALITATIVE RELATIVE ABUNDANCE OF SPECIES COLLECTED DURING
THE SURVEY IN DEER CREEK. DARTERS ARE ENUMERATED.**

Appendix B: Summary statistics & qualitative relative abundance of fishes recorded in Deer Creek during Maryland darter survey.

Gear Codes: 1- benthic electric trawl; 2 - backpack electrofisher; 3 snorkeling

Relative abundance codes: * - 1 - 10; ** - 11-99;

*** - >=100

Gear Codes: 1- benthic electric trawl; 2 - backpack electrofisher; 3 snorkeling Relative abundance codes: * - 1 - 10; ** - 11-99; *** - >=100		Sampling Sites				Sampling Sites							Sampling Sites				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
		Date				Date							Date				
		9-Oct-10	10-Oct-10	13-Nov-10	13-Nov-10	13-Nov-10	10-Oct-10	23-May-11	24-May-11	24-May-11	24-May-11	25-May-11	25-May-11	25-May-11	27-May-11	7-Jun-11	
		Gear				Gear							Gear				
		2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3
		Effort (shock or observation seconds)				Effort (shock or observation seconds)							Effort (shock or observation seconds)				
4408	3510	4256	2843	1138	18000	2499	3516	1507	2203	2822	2376	2923	4173	30000			
Petromyzon marinus	sea lamprey	*	*		*				*		*	*	*		*	**	
Anguilla rostrata	American eel	***	***	***	***	***	*	***	***	***	***	***	***	***	***		
Alosa sp.	River herrings/shad																
Dorosoma cepedianum	gizzard shad			*		*	*										
Camptostoma anomalum	central stoneroller		*														
Carassius auratus	goldfish							*				*	*	*			
Clinostomus funduloides	rosyside dace	*				*				***	*			*			
Cyprinella analostana	satinfish shiner		*		*				*		*	**		*	**		
Cyprinella spiloptera	spottin shiner	**	***	*	**	*		**	**		**	**		*	**		
Cyprinella sp.	shiner						***										
Cyprinus carpio	common carp		*									*					
Exoglossum maxillingua	cutlips minnow	**	**	*	**	**	***	*	**		*	**	*	**	*		
Hybognathus regius	Eastern silvery minnow																
Luxilus cornutus	common shiner	*	*	*			**					*					
Nocomis micropogon	river chub	**	***	**	***	***	***	***	***		*	**	**	**		**	
Notropis amoenus	comely shiner		*				**			*							
Notropis hudsonius	spottail shiner	*		*			**	***	***		**	**	*	*	*	**	
Notropis procne	swallowtail shiner		**	*			**				***	*				**	
Notropis rubellus	rosyface shiner	*	**				***	**	*		*	*	*	*	*		
Pimephales notatus	bluntnose minnow	*	*				*				*						
Rhinichthys atratulus	blacknose dace	**	*	*	*					**	*			*	*		
Rhinichthys cataractae	longnose dace	***	**	**	***	***		**	**	*	**		***	***	**		
Semotilus atromaculatus	creek chub	*								***		*	*				
Semotilus corporalis	fallfish		*	*	*			*	*								
Carpiodes cyprinus	quillback																
Catostomus commersoni	white sucker	**	**	*	**	*		*	*	*		*		*	*		
Erimyzon oblongus	creek chubsucker																
Hypentelium nigricans	northern hog sucker	**	**	**	**	**	*		*		*	*	*			**	
Moxostoma macrolepidotum	shorthead redhorse							*									
Ameiurus natalis	yellow bullhead																
Ameiurus nebulosus	brown bullhead	**	***	*				**	**	*		**	**	**	**	**	
Ictalurus punctatus	channel catfish		*				*		**		**	**	*	**	**	**	
Pylodictis olivaris	flathead catfish																
Noturus insignis	margin darter	***	***	***	**	**	*	***	***	*	***	**	**	***	***	**	
Salmo trutta	brown trout	*								*							
Strongylura marina	Atlantic needlefish										*				*		
Fundulus diaphanus	banded killifish		**	***	***	***	*		*								
Morone americana	white perch								**		**	*	*	*			
Morone saxatilis	striped bass																
Amploplites rupestris	rock bass	*	*			*	*	*	*	*	*	*		**	**		
Lepomis auritis	redbreast sunfish	**	***	*	*	*	***	*	**	*		*	*	*	**	**	
Lepomis cyanellus	green sunfish	***	***	*	**	*	***	**	***	*	*	***	**	***	*	**	
Lepomis gibbosus	pumpkinseed	***	***	*	**	**	***					*	*	*	*	**	
Lepomis macrochirus	bluegill	**	***	*	**	**	***	*				*	*			**	
Micropterus dolomieu	smallmouth bass	*	*				**									**	
Micropterus salmoides	largemouth bass	*			*		*				*						
Etheostoma blennioides	greenside darter		2				1										
Etheostoma olmsted	tessellated darter	193	279	501	43	35	35	29	40	26	88	46	36	13	2	20	
Etheostoma zonale	banded darter	9	16	2			1		1					1			
Percina bimaculata	Chesapeake logperch	11	9	5	5	7	15	48	65		31	4	12	22	22	5	
Percina peltata	shield darter	29	13	13	2	18	6	7	31		3	1	5	6	5	1	
Perca flavescens	yellow perch													*			
Sander vitreum	walleye																
Cottus caeruleomentum	blue ridge sculpin	**	*	**	***	**		**	*	**	*		**	**	**		

Appendix B: Summary statistics & qualitative relative abundan

Gear Codes: 1- benthic electric trawl; 2 - backpack electrofisher; 3 snorkeling

Relative abundance codes: * - 1 - 10; ** - 11-99; *** - >=100

		Sampling Sites								
		16	17	18	19	20	21	22	23	24
		Date								
		9-Jun-11	19-Aug-11	21-Aug-11	20-Aug-11	20-Aug-11	21-Aug-11	12-Nov-11	12-Nov-11	12-Nov-11
		Gear								
		3	3	3	2	2	2	2	2	2
		Effort (shock or observation seconds)								
		25200	11700	21000	2317	2680	3336	5883	6883	3794
<i>Petromyzon marinus</i>	sea lamprey	**		*		*				
<i>Anguilla rostrata</i>	American eel				***	***	***	**	***	***
<i>Alosa sp.</i>	River herrings/shad									
<i>Dorosoma cepedianum</i>	gizzard shad				**					
<i>Camptostoma anomalum</i>	central stoneroller									
<i>Carassius auratus</i>	goldfish				*	**				*
<i>Clinostomus funduloides</i>	rosyside dace					**				*
<i>Cyprinella anallastana</i>	satinfish shiner				**	**	**	**		*
<i>Cyprinella spiloptera</i>	spottail shiner				**	**	**	**	***	**
<i>Cyprinella sp.</i>	shiner	**		**						
<i>Cyprinus carpio</i>	common carp			*		*				
<i>Exoglossum maxillingua</i>	cutlips minnow			*	**	**	**			
<i>Hybognathus regius</i>	Eastern silvery minnow				*					
<i>Luxilus cornutus</i>	common shiner									
<i>Nocomis micropogon</i>	river chub	**		**	**	**	**	*	*	**
<i>Notropis amoenus</i>	comely shiner							***	***	***
<i>Notropis hudsonius</i>	spottail shiner	**		**	*	*	**	*	*	*
<i>Notropis procne</i>	swallowtail shiner	**		***	*	*		***	***	**
<i>Notropis rubellus</i>	rosyface shiner				*	**	*			*
<i>Pimephales notatus</i>	bluntnose minnow			**		*			*	*
<i>Rhinichthys atratulus</i>	blacknose dace					**				*
<i>Rhinichthys cataractae</i>	longnose dace	**			**	***	**			*
<i>Semotilus atromaculatus</i>	creek chub				*	*				*
<i>Semotilus corporalis</i>	fallfish			**	*	*	**		*	**
<i>Carpiodes cyprinus</i>	quillback									
<i>Catostomus commersoni</i>	white sucker			**		*	*	*	*	*
<i>Erimyzon oblongus</i>	creek chubsucker									
<i>Hypentelium nigricans</i>	northern hog sucker	**		*	*	*	*	*	*	*
<i>Moxostoma macrolepidotum</i>	shorthead redhorse						*		*	*
<i>Ameiurus natalis</i>	yellow bullhead									
<i>Ameiurus nebulosus</i>	brown bullhead				*	*				
<i>Ictalurus punctatus</i>	channel catfish			*			**	*		*
<i>Pylodictis olivaris</i>	flathead catfish			*						
<i>Noturus insignis</i>	marginated madtom				**	***	***	*	*	**
<i>Salmo trutta</i>	brown trout									
<i>Strongylura marina</i>	Atlantic needlefish									
<i>Fundulus diaphanus</i>	banded killifish							*	*	*
<i>Morone americana</i>	white perch			*						
<i>Morone saxatilis</i>	striped bass							*		
<i>Amploplites rupestris</i>	rock bass			*	*	*	*			
<i>Lepomis auritis</i>	redbreast sunfish	**		**	*	**	*			
<i>Lepomis cyanellus</i>	green sunfish	**		*	*	**	**	*	*	*
<i>Lepomis gibbosus</i>	pumpkinseed					*	*	*	*	**
<i>Lepomis macrochirus</i>	bluegill	**		***	*	*	*	**	*	**
<i>Micropterus dolomieu</i>	smallmouth bass	**		*	*	*	*		*	*
<i>Micropterus salmoides</i>	largemouth bass			*					*	
<i>Etheostoma blennioides</i>	greenside darter						1			
<i>Etheostoma olmsted</i>	tessellated darter	15		83	27	48	92	415	397	184
<i>Etheostoma zonale</i>	banded darter			1	5	4	1	1	2	1
<i>Percina bimaculata</i>	Chesapeake logperch	17		17	19	16	25		1	8
<i>Percina peltata</i>	shield darter	17		13	27	13	18		1	1
<i>Perca flavescens</i>	yellow perch							**	***	*
<i>Sander vitreum</i>	walleye									
<i>Cottus caeruleomentum</i>	blue ridge sculpin				*	*				

**APPENDIX C: QUALITATIVE RELATIVE ABUNDANCE OF SPECIES COLLECTED DURING
THE SURVEY IN OCTORARO CREEK. DARTERS ARE ENUMERATED.**

Appendix C: Summary statistics & qualitative relative abundance of fishes recorded in Octoraro Creek during Maryland darter survey.

Gear Codes: 1- benthic electric trawl; 2 - backpack electrofisher; 3 snorkeling

Relative abundance codes: * - 1 - 10; ** - 11-99; *** - >=100

		Sampling Sites				Sampling Sites							
		1	2	3	4	5	6	7	8	9	10	11	12
		Date				Date							
		9-Oct-10	14-Nov-10	14-Nov-10	23-May-11	9-Jun-11 ^a	8-Jun-11 ^b	24-Aug-11	26-Aug-11	21-Aug-11	25-Aug-11	13-Nov-11	13-Nov-11
		Gear				Gear							
		2	2	2	2	2	3	3	3	2	2	2	2
		Effort (shock or observation seconds)				Effort (shock or observation seconds)							
		4234	3641	1989	4968	3144	N/A	29700	21600	4057	6630	6666	3251
<i>Petromyzon marinus</i>	sea lamprey					**	**	*	*	*	*		
<i>Anguilla rostrata</i>	American eel	***	***	***	***	***	**			***	***	***	***
<i>Alosa sp.</i>	River herrings/shad								***				
<i>Dorosoma cepedianum</i>	gizzard shad	**						***	**	**	*		
<i>Camptostoma anomalum</i>	central stoneroller	*											
<i>Carassius auratus</i>	goldfish				*					*			
<i>Clinostomus funduloides</i>	rosyside dace		*	*	*								
<i>Cyprinella analostana</i>	satinfish shiner	*				**				**	***	**	***
<i>Cyprinella spiloptera</i>	spotfin shiner	***	***	**		**				**	***	***	***
<i>Cyprinella sp.</i>	shiner						**	*	**				
<i>Cyprinus carpio</i>	common carp						**	*	*	*	*		*
<i>Exoglossum maxilllingua</i>	cutlips minnow	**	*	*	*	*		*		*	*		
<i>Hybognathus regius</i>	Eastern silvery minnow							**	***	**	*		
<i>Luxilus cornutus</i>	common shiner	*	*	*	*		**			*			
<i>Nocomis micropogon</i>	river chub	**	**	***	*	*	**	**		**	*	*	*
<i>Notropis amoenus</i>	comely shiner	*			*			***	***	**	***	***	***
<i>Notropis hudsonius</i>	spottail shiner	*	**	*	**	*	**	***	***	**	***	***	***
<i>Notropis procne</i>	swallowtail shiner	**	**	**	*	*	**	***	***	**	*	**	**
<i>Notropis rubellus</i>	rosyface shiner	***	**	***	*		**	***	**	***	***		
<i>Pimephales notatus</i>	bluntnose minnow	*	*		*			**	*	**			*
<i>Rhinichthys atratulus</i>	blacknose dace	**	*	*					*		*		
<i>Rhinichthys cataractae</i>	longnose dace	***	**	***			**			**	**		
<i>Semotilus atromaculatus</i>	creek chub				*			*			*		
<i>Semotilus corporalis</i>	fallfish	*					**	*		*	*		
<i>Carpiodes cyprinus</i>	quillback						**		*	*			
<i>Catostomus commersoni</i>	white sucker	*	*	*	*		**	**	*	*	*	*	*
<i>Erimyzon oblongus</i>	creek chubsucker												
<i>Hypentelium nigricans</i>	northern hog sucker	**	**	**			**	*	*	*	*	*	*
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		*		*				*		*	*	
<i>Ameiurus natalis</i>	yellow bullhead									*	*		
<i>Ameiurus nebulosus</i>	brown bullhead	**			*								
<i>Ictalurus punctatus</i>	channel catfish	*			*	*	**	*	*	**	*	**	**
<i>Pylodictis olivaris</i>	flathead catfish												
<i>Noturus insignis</i>	marginated madtom	***	***	***	**	**		*		**	**	**	**
<i>Salmo trutta</i>	brown trout												
<i>Strongylura marina</i>	Atlantic needlefish												
<i>Fundulus diaphanus</i>	banded killifish		***	***		*	**		***	*			
<i>Morone americana</i>	white perch				**								
<i>Morone saxatilis</i>	striped bass							*	*				
<i>Amplolites rupestris</i>	rock bass	*	*		*	*		*	*	*		*	
<i>Lepomis auritis</i>	redbreast sunfish	**	*	*	*	*	**	**	**	**	*	*	*

Gear Codes: 1- benthic electric trawl; 2 - backpack
electrofisher; 3 snorkeling

Relative abundance codes: * - 1 - 10; ** - 11-99;
*** - >=100

		Sampling Sites				Sampling Sites							
		1	2	3	4	5	6	7	8	9	10	11	12
		Date				Date							
		9-Oct-10	14-Nov-10	14-Nov-10	23-May-11	9-Jun-11 ^a	8-Jun-11 ^b	24-Aug-11	26-Aug-11	21-Aug-11	25-Aug-11	13-Nov-11	13-Nov-11
		Gear				Gear							
		2	2	2	2	2	3	3	3	2	2	2	2
		Effort (shock or observation seconds)				Effort (shock or observation seconds)							
		4234	3641	1989	4968	3144	N/A	29700	21600	4057	6630	6666	3251
<i>Lepomis cyanellus</i>	green sunfish	***	**	**	**	**	**	*	**	**	**	**	*
<i>Lepomis gibbosus</i>	pumpkinseed	*	*	*	*	*	**	*	*	*	*		
<i>Lepomis macrochirus</i>	bluegill	**	**	**	**	*	**	**	***	*	**	*	*
<i>Micropterus dolomieu</i>	smallmouth bass		*				**	**	**	*	*		*
<i>Micropterus salmoides</i>	largemouth bass	*						*	**	*			
<i>Etheostoma blennioides</i>	greenside darter	5		2				2	1		2		
<i>Etheostoma olmstedii</i>	tessellated darter	75	157	67	47	12	**	127	93	98	194	53	42
<i>Etheostoma zonale</i>	banded darter	15	11	19				9	1	4	19	3	
<i>Percina bimaculata</i>	Chesapeake logperch	5	1	4	5	2	4	7	1220	3	5	4	
<i>Percina peltata</i>	shield darter	19	22	52				27		6	23	3	1
<i>Perca flavescens</i>	yellow perch	*							*			*	*
<i>Sander vitreum</i>	walleye												
<i>Cottus caeruleomentum</i>	blue ridge sculpin												

^a sample taken on 8-Jun-11 and 9-Jun-11

^b sample taken on 24-May-11, 26-May-11, and 8-Jun-11