

ESTIMATION OF THE FISHERIES STANDING STOCK IN THE PATUXENT RIVER IN APRIL 2000

Prepared for:

Swanson Creek Oil Spill NRDA Trustee Council

Prepared by:

Aquatic Resources Subgroup

March 2002

ESTIMATION OF THE FISHERIES STANDING STOCK IN THE PATUXENT RIVER IN APRIL 2000

Prepared for:

Swanson Creek Oil Spill NRDA Trustee Council

Prepared by:

Aquatic Resources Subgroup

March 2002

TABLE OF CONTENTS

I. INTRODUCTION.....	1
II. PRIMARY SURVEYS AND SOURCES OF INFORMATION.....	1
III. GENERAL APPROACH TO ESTIMATING STANDING STOCK	2
IV. REFERENCES.....	5

LISTS OF FIGURES

Figure 1. Patuxent River in the Vicinity of Chalk Point.....	7
--	---

LIST OF TABLES

Table 1. Summary of standing stock estimates for open water habitat and shoreline/shoal habitat for April.	9
Table 2. Patuxent River fisheries studies reviewed to assess species occurrence and estimate fish standing stock.....	10
Table 3. Summary of finfish species in the open water and shoreline/shoal habitat of the Patuxent River in the vicinity of the Swanson Creek oil spill in April. Documented species (X) are based on the MDE finfish trawl surveys, MDNR ichthyoplankton surveys, and the CBL finfish surveys in April. Potential occurrence (P) was based on the general literature and professional judgment of MDNR and MDE fisheries biologists.	11
Table 4. Gear efficiency rates from CBL Fish Community Studies in the Patuxent River (Homer et al. 1979). Trawl efficiency rates include the month of the survey.....	12
Table 5. Summary of fish abundance per acre used for estimating standing stock. Field results were adjusted to incorporate gear efficiency (both open water and shoreline/shoal habitat) and relative seasonal occurrence (shoreline/shoal habitat only). Details of species-specific estimates are presented in Appendix C.....	12
Table 6. Summary of mean weight per fish used to estimate standing stock. Weight was calculated from the mean lengths measured during the MDE trawl study using applicable length:weight equations from the literature (as described under species-specific accounts presented in Appendix C). Actual weights were measured during the CBL study.	13
Table 7. Summary of mean catch during the MDNR juvenile seine surveys in the vicinity of Chalk Point [Eagle Harbor (EH) and Sheridan Point (SP)] during June-August, 1995-99 (Durell and Wagner 2000).	14
Table 8. MDE and PEPCO Finfish Biomass Stations 1, 3, & 4 for May 4 & 10, 2000	15
Table. 9 Summary of total finfish catch per station (1997-2000) in the DNR summer trawl survey (MDNR 2000a)	16

ESTIMATION OF THE FISHERIES STANDING STOCK IN THE PATUXENT RIVER IN APRIL 2000

I. INTRODUCTION

On April 7, 2000, an underground pipeline ruptured that was transporting a mixture of #2 and #6 fuel oil to the Chalk Point generating plant located near the town of Aquasco, Maryland (Figure 1). The fractured pipeline released approximately 126,000 gallons of product into Swanson Creek, a tidal tributary of the Patuxent River. On April 8 and 9, high winds with gusts in excess of 50 mph passed through the area, resulting in oil escaping from Swanson Creek and entering the mainstem of the Patuxent River and several of its tributaries. Oiling was documented along approximately 17 miles of shoreline of the Patuxent and several tributaries (e.g., Indian Creek and Trent Hall Creek). In addition, oil slicks were documented on the open water of the Patuxent River.

The Oil Pollution Act of 1990 provides the statutory authority for natural resource Trustees to restore resources and services injured by the release of oil and obtain compensation from the responsible parties (RPs) for their losses. Trustees for this spill include the National Oceanic and Atmospheric Administration (NOAA), the primary Federal trustee for coastal and marine resources; the U.S. Fish and Wildlife Service, the primary Federal trustee for migratory birds, some fish, many endangered species, and lands managed by the agency; and the Maryland Departments of the Environment and Natural Resources, which share responsibilities for natural resources and their supporting ecosystems within Maryland's boundaries or belonging to, managed by, controlled by, or appertaining to the state of Maryland. Pepco (the owner of the pipeline) and ST Services (the pipeline operating company) have been identified as the RPs.

The Trustees, in cooperation with the RPs, prepared this report to document the procedures used to estimate the species composition and abundance of fish and shellfish within the spill area during April-early May. The resulting species abundance and biomass per acre are summarized in Table 1. This information will be used to develop estimates of total injury to aquatic organisms based on oil fate and transport modeling to scale compensatory restoration actions.

II. PRIMARY SURVEYS AND SOURCES OF INFORMATION

Immediately following the spill, the Trustees and RPs initiated two site-specific surveys to assess the fisheries community in the vicinity of the spill. These include:

(1) MDE finfish community surveys: The methods and field results of the MDE finfish community survey are provided in Appendix A. This trawl survey was conducted using a 4.9-m semi-balloon otter trawl with 3.2-cm mesh body and no liner. Trawls were conducted for 6 minutes in the opposite direction as the tide. Trawls were typically conducted at 4 stations between Potts Point and Broomes Island including both impact stations and background stations during each survey (Figure 1 in Appendix A). Two surveys per week were conducted between April 10 and May 4, 2000 (total of 10 surveys). The results were analyzed to assess the fisheries community likely to be present at the time of the spill, and immediately following the spill.

(2) MDNR ichthyoplankton surveys: The survey methods and results are provided in Appendix B. Ichthyoplankton tows were conducted using a 1.53 x 1.53-m midwater trawl with a 0.5-m plankton net (505 μ m mesh) mounted in the cod-end. Tows were conducted for 5 minutes. Surveys were conducted in 6 regions of the Patuxent River between Sheridan Point and Lyons Creek. Two of these regions were in the vicinity of the spill including Region 1 (Sheridan Point) and Region 2 (Chalk Point). Surveys were generally conducted twice per week between April 10 and May 15, 2000. Data from this survey were used to assess the occurrence of various species and lifestages in the vicinity of the spill.

In addition to the two field surveys initiated by the Trustees following the spill, data and findings from the annual MDNR juvenile finfish survey were used to supplement findings from the MDE surveys for shallow water species. The MDNR juvenile finfish survey is the standard monitoring program for MDNR to develop indices of relative abundance primarily of striped bass (Durell and Wagner 2000). The survey is conducted with a 30.5 x 1.24-m beach seine with 6.4-mm mesh. Monthly sampling is conducted at 6 stations in the Patuxent River between June and August. Two of the standard stations are in the vicinity of the spill area (Eagle Harbor and Sheridan Point; Figure 1). The results from these stations were incorporated into the characterization of the shallow water fish community.

These survey results were supplemented with information in published field studies conducted along the Patuxent River. Overall, the results of a dozen Patuxent River fish surveys provided information on the fisheries community in the spill area (Table 2). Of these published studies, the fish community surveys conducted by the University of Maryland - Chesapeake Biological Laboratory (CBL) provided the most complete information. The CBL surveys were conducted in 1978-79 in open water and shoreline/shoal habitats of the Patuxent River. Monthly sampling was conducted throughout the year using a beach seine, purse seine (shallow and deep), and trawl (shallow and deep). The report provides historic standing stock estimates for fish species in the deep and shallow water habitats of the Patuxent River in the vicinity of the Swanson Creek oil spill (specifically Teague Point and Buena Vista; Figure 1). While the absolute standing stock estimates may be dated, the report provides important information on species occurrence, relative seasonal abundance, and biomass (e.g., mean weight per fish in April). In addition, the CBL surveys included site-specific gear efficiency studies in the Patuxent River.

III. GENERAL APPROACH TO ESTIMATING STANDING STOCK

Based on the site specific surveys and review of historical literature cited in Table 2, over 20 fish species were documented in the vicinity of the spill area between approximately Eagle Harbor and Broomes Island in April (Figure 1; Table 3). Species-specific standing stock estimates were developed for each of the more common species in April. For less common species, one total biomass estimate was developed.

The aquatic habitat was delineated into open water habitat (greater than approximately 1.6 meters) and shoreline/shoal habitat (less than about 1.6 meters). This delineation was based on the life history of various fishes (e.g., some fish such as mummichog are generally found only in shallow water) and the sampling design of the various studies (e.g., beach seine surveys are conducted in shallow habitat). Thus, separate standing stock estimates were developed for the deeper, open water habitat and the shallower shoreline/shoal habitat. Species-specific standing

stock estimates are provided in Appendix C.

Estimate of Open Water Standing Stock

The biomass estimate for the fish community in the open water habitat was generally based on the results of the MDE trawl survey, although some estimates were based on other studies due to potential under-representation in the trawl survey. These exceptions are specified in Appendix C, and were intended to develop a more accurate estimate than would have been possible based solely on the MDE trawl results (e.g., small fish may readily escape the trawl mesh and the MDE trawl results would not provide representative abundance estimates). For the common species, the MDE trawl results were standardized to abundance per acre based on the length of each trawl and appropriate species-specific gear efficiencies (Tables 4 and 5; Homer et al. 1979). The length of each trawl was determined based on the latitude and longitude recorded at the beginning and end of each tow. A summary of the trawl lengths and area swept is included in Appendix A. Gear efficiency was based on the results of species-specific efficiency studies that were conducted by CBL in the study area (Table 4; Homer et al. 1979). Biomass per fish was estimated using the mean length of fish collected during the MDE survey and incorporating length:weight equations from the literature (Table 6 and Appendix C). For species where length information was not adequate or possibly appropriate (e.g., less common species or crabs), species weight was based on mean weight reported during the beach seine, trawl, and purse seine surveys at all 4 stations sampled by CBL in April (Table 6; Homer et al. 1978, Homer et al. 1979).

The biomass for most open water species was estimated using the general approach outlined above. However, the biomass estimates for four species were estimated using different approaches. The biomass for striped bass sub-adults was based on the MDE trawl survey, and used as the basis to estimate the biomass of adult striped bass based on the age structure of striped bass in the MDNR striped bass surveys in the Potomac River (Fegley 2001). The biomass for Atlantic menhaden was estimated based on purse seine surveys conducted by CBL (Homer et al. 1979). The biomass of American eel and oysters were estimated based on species-specific studies conducted in the Patuxent River by MDNR. The American eel study is summarized in Appendix D, and the oyster biomass is estimated in Appendix E.

Estimate of Shoreline/Shoal Standing Stock

The biomass estimates for species associated with the shoreline/shoal habitat were typically based on either the MDE trawl results or MDNR summer seine results depending on which survey type provided the most valid estimate of biomass based on fish life history and gear collection efficiency (e.g., beach seine for small shoreline fish). The trawl results were used for species that would be expected to be present at comparable densities as in deeper water, and for species that would not be adequately represented in seine surveys. For smaller species that may be under-represented in the trawl surveys, biomass estimates were typically derived from the MDNR seine surveys conducted in the vicinity of the spill area (Table 7). The MDNR seine surveys are only conducted between June and August, and these results were adjusted to estimate April abundance based on relative seasonal occurrence found during historic surveys in the Patuxent River. Specifically, CBL found that overall fish abundance in the April beach seine surveys was less than 1 percent of the mean monthly abundance between June and August

(0.8%; April abundance = 168 fish, and mean June-August abundance = 20,711 fish). This value also approximated the relative seasonal occurrence of many of the individual species collected in beach seine surveys including Atlantic silverside, inland silverside, spottail shiner, and blueback herring (range of approximately 0.5-1.3%; Homer et al. 1978). Therefore, the MDNR seine results were adjusted for relative seasonal occurrence by multiplying the mean monthly abundance between June and August by 0.8% to estimate April abundance.

The standing stock estimates from the field results were corrected for species-specific gear efficiency for beach seines and trawls from the CBL fish community surveys (Table 4; Homer et al. 1979). The CBL seine efficiency studies used a 15.2 x 1.8-m seine with 0.6-cm mesh, and the MDNR seine surveys used a 30.4 x 1.8-m seine with 0.6-cm mesh. For species that did not have site-specific gear efficiencies reported, the gear efficiency for a surrogate species was used if available. If there was not an appropriate surrogate efficiency available, the mean site-specific gear efficiency rate for all fish species for that gear type was used. Standing stock estimates were calculated as number of fish per acre and biomass per acre (in kilograms).

Neither weight nor length was reported during the MDNR seine surveys, and biomass for these species was estimated based on the mean weight per species reported during the CBL surveys in April (Table 6; Homer et al. 1978, Homer et al. 1979). Biomass estimates for species based on the MDE trawl survey were estimated as outlined above for the open water habitat.

Total Standing Stock

Total standing stock estimates were calculated by summing the species-specific standing stock estimates (Table 1 and Appendix C). The biomass for the open water habitat was estimated to be 27.6 kg per acre of finfish, 2.1 kg per acre of crabs, and 1.8 kg per acre of oysters (measured as dry tissue weight). The total biomass in shoreline/shoal habitat was estimated to be 6.8 kg per acre including a total of 4.7 kg per acre of finfish and 2.1 kg per acre of macroinvertebrates.

Validation of Biomass Estimates with Pepco Trawl Data

The results of the standard Pepco trawl survey (Pepco 2000) were reviewed to validate estimates of species occurrence and abundance developed from the MDE, MDNR and CBL (Homer et al. 1979) surveys. Pepco has been conducting monthly trawl surveys between May and October for over 20 years. The surveys are conducted along 5 transects in the Patuxent River adjacent to, and upstream of, Swanson Creek. The surveys are conducted using a 4.9-m semi-balloon otter trawl with 2.5-cm mesh body and 1.0-cm mesh liner in the cod end. Since the gear used during the Pepco survey is comparable to the gear used during the historic CBL trawl surveys (4.9-m semi-balloon otter trawl with 3.2-cm mesh body and a 0.6-cm mesh liner in the cod-end), it was assumed that use of the gear efficiencies developed for the CBL trawl would be appropriate for the Pepco trawl. Since MDE used slightly different gear, a comparison of trawl results was made between the Pepco trawl and the MDE trawl at the same sampling stations in early May 2000. Trawl sampling was conducted at three standard MDE trawl stations using the MDE gear on May 4, 2000, and the Pepco gear on May 10, 2000. The abundance and biomass was calculated for the four most dominant species that comprised over 90% of the catch during both surveys. These species included white perch, hogchoker, Atlantic croaker, and bay anchovy. The abundance and biomass in the MDE trawl was comparable to the results of the Pepco trawls

(mean of 378 fish/acre weighing 37.3 kg/acre using the MDE gear, and 388 fish/acre weighing 37.0 kg using the Pepco gear; Table 8). Thus, the field results indicate the gear efficiency of the MDE trawl was comparable to the Pepco trawl and use of the historic CBL gear efficiency was appropriate for estimating fish abundance and biomass from the MDE trawl results.

In addition, the results of the MDE trawl survey were compared to baseline conditions documented during the MDNR summer trawl surveys (May-June, 1997-2000) to assess whether trends in fish abundance in the MDE trawl survey in April 2000 were comparable to baseline conditions (recognizing the difference in sampling months). Both trawl surveys assessed the fisheries community in the same section of the Patuxent River, and the stations for the two studies were proximal. The results of both surveys showed a substantial decrease in abundance between the upstream stations and the downstream stations. In the MDNR baseline surveys, abundance decreased 40% between Trueman Point and Chalk Point, and 75% between Trueman Point and the most downstream station (Battle Creek; Table 9). This decrease in abundance was also evident in the MDE trawl surveys. In the MDE trawl survey, there was almost a 50% decrease in abundance between the most upstream station (Potts Point) and Chalk Point (146.0 and 76.6 fish per acre, respectively; Appendix A). In addition, there was over a 90% decrease in abundance between the upstream and downstream background stations in the MDE survey (Potts Point and Broomes Island; Appendix A) that correspond most closely to the most upstream and downstream stations in the MDNR survey. These results provide further evidence that the results of the MDE trawl survey were appropriate for characterizing the fisheries community of the Patuxent River.

IV. REFERENCES

Durell, E.Q., and L.D. Wagner. 2000. A summary of Patuxent River juvenile finfish surveys results, 1995 to 1999. Maryland Department of Natural Resources, Fisheries Service, Resource Management Division. 88 pages

Environmental Consulting Services, Inc. (ECSI). 2000. Patuxent River ichthyoplankton survey. Prepared for the Swanson Creek Oil Spill NRDA Council - Aquatic Resources Subgroup. February 9, 2001. 15 pages.

Fegley, L.W. 2001. Characterization of striped bass spawning stocks in Maryland. Maryland Department of Natural Resources, Job No. 2A.

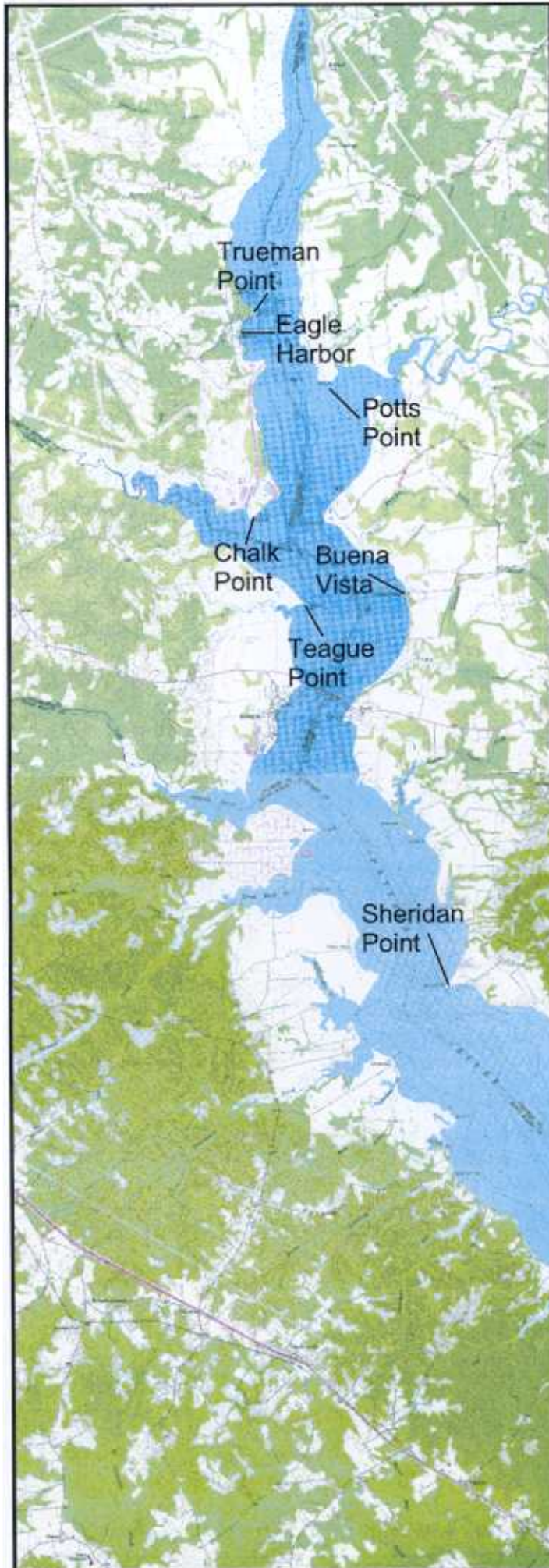
Homer, M., P.W. Jones, R. Bradford and J.A. Mihursky. 1978. Patuxent River finfish study: interim report to Maryland Power Plant Siting Program. University of Maryland, Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory. Ref No. UMCEES 78-155-CBL. 51 pp.

Homer, M., P.W. Jones, R. Bradford Jr., and J.A. Mihursky. 1979. Fish community studies in the Patuxent Estuary, 1978-79. Final report to the MDNR Power Plant Siting Program. University of Maryland, Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory. Ref No. UMCEES 79-203-CBL. 305 pages + appendix.

Maryland Department of the Environment (MDE). 2000. The Chalk Point-Patuxent River oil spill: Report of the MDE Fish Kill Investigation Section. 5 pages + appendix of data sheets April 10 - May 4, 2000.

- Maryland Department of Natural Resources (MDNR). 2000a. MDNR summer trawl survey on the Patuxent River. Fisheries Service, Annapolis, MD. 23 pages
- MDNR. 2000b. Fisheries database including commercial landings (1990-2000), and fall oyster survey results (1996-2000).
- Mihursky, J.A., and K.V. Wood. 1980. Chalk Point steam electric station studies: Patuxent Estuary studies, Ichthyoplankton population studies 1979 final report. University of Maryland, Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory. Ref No. UMCEES 80-39-CBL.
- O'Dell, J. and J. Mowrer. 1981. Survey and inventory of anadromous fish spawning and nursery areas for Patuxent River drainage and upper Chesapeake Bay drainage. Federal Aid Segment Report 1980-81. Nat. Mar. Fish. Serv. Proj. No. AFC-10-1. 78 pages + appendix
- O'Dell, J. and J. Mowrer. 1983. Survey and inventory of anadromous fish spawning and nursery areas for Patuxent River drainage. Federal Aid Segment Report 1981-82. Nat. Mar. Fish. Serv. Proj. No. AFC-10-2. 115 pages.
- O'Dell, J. and J. Mowrer. 1984. Survey and inventory of anadromous fish spawning streams and barriers in the Patuxent River drainage. Final Report, Project AFC-10. Maryland Department of Natural Resources, Annapolis, MD. 207 pages.
- Pepco. 2000. Data summary of long-term monitoring of trawl stations, 1997-2000.
- Roosenburg, W.M. 1998. Catch rate survey and experimental by-catch reduction of peeler bank traps in St. Mary's County, Maryland. Maryland Department of Natural Resources, Tidal Fisheries Technical Report Number 24. 25 pages.
- Secor, D.M., E.D. Houde, and D.M. Monteleone. 1994. Development of otolith-marking methods to estimate survival and growth of early life stages of natural and hatchery-produced striped bass in the Patuxent River spawning area in 1991. Maryland Department of Natural Resources, CBRM-GRF-94-1, Annapolis, MD.
- Secor, D.M. and E.D. Houde. 1995. Temperature effects on the timing of striped bass egg production, larval viability, and recruitment potential in the Patuxent River (Chesapeake Bay). *Estuaries*, Vol. 18(3):527-544.
- Secor, D.M., E.D. Houde, and D.M. Monteleone. 1995. A mark-release experiment on larval striped bass, *Morone saxatilis*, in a Chesapeake Bay tributary. *ICES J. mar. Sci.* 52:87-101.
- Setzler-Hamilton, E.M., and K.V. Wood. 1979. Chalk Point steam electric station studies: Patuxent Estuary studies, Ichthyoplankton population studies 1978 data report. University of Maryland, Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory. Ref No. UMCEES 79-20-CBL.
- Weeder, J.A. 2001. Sampling of American eel in the Patuxent River, Maryland - 1999. Maryland Department of Natural Resources - Fisheries Service, Stevensville, MD. 5 pages.

Figure 1. Patuxent River in the Vicinity of Chalk Point



SWANSON CREEK PROJECT

Figure 1. Patuxent River in the Vicinity of Chalk Point



TABLES

Table 1. Summary of standing stock estimates for open water habitat and shoreline/shoal habitat for April.

Species	Primary Data Source	Open Water Standing Stock		Shoreline/Shoal Standing Stock	
		Adjusted Number Per Acre	Kg Per Acre	Adjusted Number Per Acre	Kg Per Acre
American eel	MDNR eel survey	32.48	1.75		0.03
Atlantic croaker	MDE trawl survey	19.80	5.54		
Atlantic menhaden	CBL purse seine		1.90		1.90
Atlantic silverside	MDNR seine survey	4.65	0.022	4.65	0.022
Bay anchovy	MDE trawl survey	0.06	0.00017	0.06	0.00017
Blueback herring	MDNR seine survey	0.02	0.000045	0.02	0.000045
Brown bullhead	MDE trawl survey	0.37	0.043	0.37	0.043
Hogchoker	MDE trawl survey	488.75	7.82	NA	0.13
Inland silverside	MDNR seine survey			0.08	0.000095
Mummichog	MDNR seine survey			1.39	0.018
Spottail shiner	MDNR seine survey			0.04	0.00029
Striped bass (subadult)	MDE trawl survey	0.21	0.0074	0.21	0.0074
Striped bass (adult)	Literature	0.24	1.09	0.24	1.09
Striped killifish	MDNR seine survey			1.22	0.0048
White perch	MDE trawl survey	108.15	9.19	NA	1.38
Less common finfish species	MDE trawl survey; MDNR seine survey	4.48	0.22	1.08	0.027
TOTAL FINFISH			27.58		4.65
Blue crab	MDE trawl survey	67.53	1.42	67.53	1.42
Horseshoe crab	MDE trawl survey	0.37	0.66	0.37	0.66
Oysters ¹	MDNR oyster survey	1268.73	1.77		

¹ Dry tissue biomass

Table 2. Patuxent River fisheries studies reviewed to assess species occurrence and estimate fish standing stock

Study	Date	References
MDE Finfish Community Surveys (trawl)	April and May 2000	MDE 2000
MDNR Ichthyoplankton Surveys	April and May 2000	ECSI 2000
MDNR Juvenile Finfish Surveys (beach seine)	June through August, 1995-2000	Durell and Wagner 2000
MDNR Summer Trawl Survey	May and June, 1997-2000	MDNR 2000a
MDNR Commercial Landings	1990-2000 (year-round)	MDNR 2000b
MDNR Fall Oyster Surveys	1996-2000	MDNR 2000b
Pepco Trawl Surveys	May through October, 1997-2000	Pepco 2000
MDNR Eel Survey	June and July 1999	Weeder 2001
Bank Trap Survey	1998	Roosenburg 1998
CBL Striped Bass Surveys (ichthyoplankton tows)	1991	Secor et al. 1994, Secor et al. 1995, Secor and Houde 1995
MDNR Anadromous Fish Survey (beach seine and fyke nets)	1980-1983	O'Dell and Mowrer 1981, O'Dell and Mowrer 1983, O'Dell and Mowrer 1984
CBL Fish Community Studies in the Patuxent River Estuary (beach seine, purse seine, trawl, and ichthyoplankton tows)	1978-1979 (year-round)	Homer et al. 1978, Homer et al. 1979, Setzler-Hamilton et al. 1979, Mihursky and Wood. 1980

Table 3. Summary of finfish species in the open water and shoreline/shoal habitat of the Patuxent River in the vicinity of the Swanson Creek oil spill in April. Documented species (X) are based on the MDE finfish trawl surveys, MDNR ichthyoplankton surveys, and the CBL finfish surveys in April. Potential occurrence (P) was based on the general literature and professional judgment of MDNR and MDE fisheries biologists.

SPECIES NAME		OPEN WATER	SHORELINE/ SHOAL
Common Name	Scientific Name		
COMMON SPECIES			
American eel	<i>Anguilla rostrata</i>	X	X
Atlantic croaker	<i>Micropogonias undulatus</i>	X	
Atlantic menhaden	<i>Brevoortia tyrannus</i>	X	X
Atlantic silverside	<i>Menidia menidia</i>	X	X
Bay anchovy	<i>Anchoa mitchilli</i>	X	P
Blueback herring	<i>Alosa aestivalis</i>	X	X
Brown bullhead	<i>Ameiurus nebulosus</i>	X	X
Hogchoker	<i>Trinectes maculatus</i>	X	X
Inland silverside	<i>Menidia beryllina</i>		X
Mummichog	<i>Fundulus heteroclitus</i>		X
Spottail shiner	<i>Notropis hubsonius</i>		X
Striped bass	<i>Morone saxatilis</i>	X	X
Striped killifish	<i>Fundulus majalis</i>		X
White perch	<i>Morone americana</i>	X	X
LESS COMMON SPECIES			
Alewife	<i>Alosa pseudoharengus</i>	X	P
American shad	<i>Alosa sapidissima</i>	P	P
Banded killifish	<i>Fundulus diaphanus</i>		P
Bluegill	<i>Lepomis macrochirus</i>		P
Carp	<i>Cyprinus carpio</i>	P	P
Chain pickerel	<i>Esox niger</i>		P
Channel catfish	<i>Ictalurus punctatus</i>	X	P
Gizzard shad	<i>Dorosoma cepedianum</i>	P	P
Largemouth bass	<i>Micropterus salmoides</i>		X
Naked goby	<i>Gobiosoma boscii</i>	P	
Northern pipefish	<i>Syngnathus fuscus</i>	P	P
Oyster toadfish	<i>Opsanus tau</i>	P	X
Pumpkinseed	<i>Lepomis gibbosus</i>		P
Silvery minnow	<i>Hybognathus regius</i>		P
Spot	<i>Leiostomus xanthurus</i>	X	P
Spotted hake	<i>Urophycis regia</i>	X	
Summer flounder	<i>Paralichthys dentatus</i>	X	
Tessellated darter	<i>Etheostoma olmstedi</i>	P	P
Tidewater silverside	<i>Menidia peninsulæ</i>		X
White catfish	<i>Ameiurus catus</i>	X	X
Yellow bullhead	<i>Ameiurus natalis</i>	X	P
Yellow perch	<i>Perca flavescens</i>	P	P

Table 4. Gear efficiency rates from CBL Fish Community Studies in the Patuxent River (Homer et al. 1979). Trawl efficiency rates include the month of the survey.

Common Name	Species	Average Beach Seine Efficiency (%)	Average Trawl Efficiency (%)
Atlantic menhaden	<i>Brevoortia tyrannus</i>	26.6 +/- 20.9	
Atlantic silverside	<i>Menidia menidia</i>	81.8 +/- 15.4	
Bay anchovy	<i>Anchoa mitchilli</i>		86.4 +/- 11.8 (July)
Catfish spp.			37.3 +/- 16.7 (March)
Hogchoker	<i>Trinectes maculatus</i>		20.8 +/- 2.1 (March)
Inland silverside	<i>Menidia beryllina</i>	63.9 +/- 13.3	
Mummichog	<i>Fundulus heteroclitus</i>	39.9 +/- 14.7	
Spot	<i>Leiostomus xanthurus</i>		18.0 +/- 4.6 (July)
Striped killifish	<i>Fundulus majalis</i>	80.0 +/- 17.0	
White perch	<i>Morone americana</i>		65.9 +/- 15.0 (March)
All Finfish Species		45.4 +/- 23.5	46.9 +/- 13.3 (March)
Blue crab	<i>Callinectes sapidus</i>		29.9 +/- 3.0 (March)

Table 5. Summary of fish abundance per acre used for estimating standing stock. Field results were adjusted to incorporate gear efficiency (both open water and shoreline/shoal habitat) and relative seasonal occurrence (shoreline/shoal habitat only). Details of species-specific estimates are presented in Appendix C.

Species	OPEN WATER Mean Number of Fish Per Acre		SHORELINE/SHOAL Mean Number of Fish Per Acre	
	Field	Adjusted	Field	Adjusted
Atlantic croaker	3.56	19.80		
Atlantic silverside			475.35	6.39
Bay anchovy	0.05	0.06		
Blueback herring			0.74	0.02
Brown bullhead	0.14	0.37		
Hogchoker	101.66	488.75		
Inland silverside			6.3	0.08
Mummichog			69.57	1.39
Spottail shiner			3.7	0.04
Striped bass-subadults	0.14	0.21		
Striped killifish			122.31	1.22
White perch	71.27	108.15		
Less common fish - Total	2.10	4.48	61.04	1.08
Blue crab	20.19	67.53		
Horseshoe crab	0.11	0.37		

Table 6. Summary of mean weight per fish used to estimate standing stock. Weight was calculated from the mean lengths measured during the MDE trawl study using applicable length:weight equations from the literature (as described under species-specific accounts presented in Appendix C). Actual weights were measured during the CBL study.

Species	Mean Length TL (cm)	Mean Weight/Fish (kg)	
		Calculated (MDE)	Measured (CBL)
Atlantic croaker	30.55	0.279	
Atlantic silverside			0.005
Bay anchovy	7.00	0.003	
Blueback herring			0.020
Brown bullhead	21.00	0.114	
Hogchoker	9.13	0.016	
Inland silverside			0.001
Mummichog			0.013
Spottail shiner			0.008
Striped bass (sub-adults)	15.00	0.035	
Striped killifish			0.004
White perch	17.94	0.085	
ALL FISH			
Shoreline/shoal			0.025
Open Water			0.050
Blue crab			0.021

Table 7. Summary of mean catch during the MDNR juvenile seine surveys in the vicinity of Chalk Point [Eagle Harbor (EH) and Sheridan Point (SP)] during June-August, 1995-99 (Durell and Wagner 2000).

SPECIES	YEAR								MEAN ABUNDANCE			
	1995		1996		1997		1998		1999		1995-99	
	EH	SP	EH	SP	EH	SP	EH	SP	EH	SP	Seine	Acre ¹
COMMON SPECIES												
Atlantic croaker	0	0	0	0	1.0	1.3	9.3	17.0	0.3	0	2.9	16.1
Atlantic menhaden	13.7	1.7	67.0	0	3.3	0	0	0	0	0	8.6	47.6
Atlantic silversides	115.0	67.0	18.3	34.7	35.0	113.7	86.3	171.3	121.7	93.3	85.6	475.3
Bay anchovy	4.0	0	73.7	52.3	0.3	0	0	7.0	0.7	0	13.8	76.6
Blueback herring	0	0.7	0.7	0	0	0	0	0	0	0	0.1	0.7
Hogchoker	0.3	0	1.3	0	0	0	0	0	3.3	0	0.5	2.8
Inland silversides	1.7	0	6.7	1.7	0	0	0.7	0	0.7	0	1.1	6.3
Mummichog	19.3	5.3	23.3	5.7	2.0	3.3	33.0	7.7	13.0	12.7	12.5	69.6
Spottail shiner	0	0	4.3	0	0	0	2.3	0	0	0	0.7	3.7
Striped bass	0.3	2.3	29.0	1041.7	5.3	5.0	6.0	5.3	12.0	4.7	111.2	617.1
Striped killifish	43.0	30.7	26.3	18.7	5.3	49.7	21.3	6.0	18.7	0.7	22.0	122.3
White perch	208.7	4.0	267.7	945.3	65.3	38.7	89.0	23.0	4.3	0	164.6	913.7
TOTAL - Common												2351.8
LESS COMMON SPECIES												
Alewife	0	0	2.7	0.7	0	0	0.3	0	0	0	0.4	2.0
American shad	0	0	0.7	0	0	0	0	0	0	0	0.1	0.4
Atlantic needlefish	0.7	0	0	0.7	0.3	0.3	0	0.3	0.3	0	0.3	1.5
Banded killifish	0	0	0	0	0	0	0	15.0	0	0	1.5	8.3
Bluefish	0	0	0	0.3	0	3.7	0	0	0	0.3	0.4	2.4
Cownose ray	0	0	0	0.3	0	0	0	0	0	0	0.03	0.2
Gizzard shad	12.0	1.0	0.3	0	0	0	0	7.7	2.3	0.3	2.4	13.1
Northern pipefish	0	0.7	0	0	0	0	0	0	0	0	0.1	0.4
Rough silverside	0	2.7	0	23.0	0	0	0	0	0	9.3	3.5	19.4
Silvery minnow	0.3	0	1.0	0	0	0	0	0	0	0	0.1	0.7
Spot	0	0	0	0.3	9.0	5.3	0	2.3	0	0.7	1.8	9.8
Spotted seatrout	0.3	0	0	0	0	0	0	0	0	0	0.03	0.2
Striped anchovy	0.7	0.3	0	0	2.3	0	0	0	0	0.3	0.4	2.0
Summer flounder	0	0.3	0	0	0	0	0	0	0	0	0.03	0.2
Tesselated darter	0.3	0	0	0	0	0	0.3	0	0	0	0.1	0.4
TOTAL - Less Common												61.0

¹ Based on seined area of 749 m² according to Durell and Wagner (2000)

Table 8. MDE and PEPCO Finfish Biomass Stations 1, 3, & 4 for May 4 & 10, 2000
Atlantic croaker, bay anchovy, hogchoker, and white perch Only

Date	Tow Duration	Gear Type	Station	Estimated Area Sampled	Species	Number of Fish per Acre	Gear Efficiency	Mean Length (cm)	Mean Weight (kg)	Biomass-kg per acre	Total Biomass (kg)
5/4/00	6 minutes	MDE Trawl	1	1,977 m ²	Hogchoker	309.04	20.8%	9.25	0.02	25.27	38.27
					White perch	100.29	65.9%	18.00	0.09	13.00	
5/4/00	6 minutes	MDE Trawl	3	1,881 m ²	Hogchoker	354.92	20.8%	9.60	0.02	32.19	43.99
					White perch	96.80	65.9%	17.64	0.08	11.80	
5/4/00	6 minutes	MDE Trawl	4	2,073 m ²	Atlantic croaker	3.90	18.0%	32.5	0.35	7.48	29.69
					Hogchoker	259.65	20.8%	9.15	0.02	20.60	
					White perch	11.71	65.9%	18.33	0.09	1.60	
5/10/01	2 minutes	Pepco Trawl	1	1,209 m ² ¹	Hogchoker	237.58	20.8%	9.25	0.02	19.43	24.81
					White perch	63.58	65.9%	15.63	0.06	5.38	
5/10/01	2 minutes	Pepco Trawl	3	1,275 m ²	Atlantic Croaker	3.17	18.0%	7	0.006 ²	0.02	7.75
					Bay Anchovy	12.70	86.4%	5	0.001	0.02	
					Hogchoker	9.52	20.8%	5.67	0.004	0.19	
					White perch	66.66	65.9%	17.19	0.07	7.52	
5/10/01	2 minutes	Pepco Trawl	4	1,144 m ²	Atlantic croaker	3.54	18.0%	28.00	0.21	4.17	79.28
					Bay anchovy	3.54	86.4%	3.00	0.0002	0.0010	
					Hogchoker	435.12	20.8%	9.11	0.02	34.10	
					White perch	328.99	65.9%	17.77	0.08	41.02	

¹actual length not recorded, estimated area based on mean area of Stations 3 & 4 on May 10

²based on Hilderbrand and Schroeder (1928)

Table. 9 Summary of total finfish catch per station (1997-2000) in the DNR summer trawl survey (MDNR 2000a)

SPECIES	STATION BY YEAR																							
	Trueman Point				Chalk Point				Benedict				Golden Beach				Persimmon Creek				Battle Creek			
	1997	1998	1999	2000	1997	1998	1999	2000	1997	1998	1999	2000	1997	1998	1999	2000	1997	1998	1999	2000	1997	1998	1999	2000
Alewife	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
American eel	2	6	1	1	1	5	1	0	3	0	1	3	0	0	0	1	0	2	0	0	0	0	2	1
Atlantic croaker	2289	468	206	1	420	660	113	0	102	568	11	3	92	210	18	1	142	173	12	1	103	295	35	0
Atlantic menhaden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
Atlantic silverside	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0
Bay anchovy	12	11	63	5	0	4	38	4	24	5	17	0	16	6	54	0	14	4	47	5	15	2	23	0
Blueback herring	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown bullhead	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carp	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Channel catfish	1	7	10	6	6	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	1	0	0
Green goby	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Hogchoker	39	29	18	147	0	51	3	88	25	30	1	36	1	6	3	10	14	10	2	31	10	0	0	0
Lizardfish	0	8	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naked goby	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Oyster toadfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Spot	161	1	27	7	56	3	19	7	6	2	1	2	15	1	2	2	10	14	12	3	61	7	45	40
Spotted hake	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striped bass	46	0	19	1	13	2	12	11	10	10	2	4	21	1	7	1	10	4	1	1	66	11	3	1
Summer flounder	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Weakfish	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
White catfish	1	4	11	1	8	8	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
White perch	571	92	135	101	545	343	141	185	518	186	147	141	635	239	37	76	96	127	96	61	46	185	118	45
Winter flounder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0
Yellow perch	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
TOTAL	3125	627	497	294	1049	1084	327	296	690	803	182	193	780	463	125	94	288	335	173	108	303	504	226	87
MEAN				1136				689				467				366				226				280

**Appendix A - The Chalk Point-Patuxent River Oil Spill Report of the MDE Fish Kill
Investigation Section: April 7, 2000 through May 04, 2000 (including supporting
documentation)**

June 5, 2000

**The Chalk Point-Patuxent River Oil Spill
Report of the MDE Fish Kill Investigation Section
April 7, 2000 through May 04, 2000**



**Final Report
June 5, 2000**

Chris Luckett, Biologist

Charles Poukish, Section Head

Background

An oil spill occurred on Friday, April 7, 2000 at about 17:30 at the Potomac Electric Power Company's (PEPCO) Chalk Point Power Generating facility in Prince George's County. The spill occurred during testing of an underground pipeline feeding the plant that passes under Swanson Creek and its associated wetlands. Swanson Creek is a tributary to the Patuxent River on the Prince George's County-Charles County dividing line. The total volume of the spill was about 120,000 gallons. It consisted of both heavy #6 and lighter #2 fuel oils.

Initial efforts by PEPCO to contain the spill within Swanson Creek failed. Storms and high Northwesterly winds during the weekend overwhelmed containment efforts. By Monday morning, most of the discharged oil had bypassed the first response retainment barriers and infiltrated the Patuxent River. Accordingly, extensive shoreline contamination expanded from the marshes of Swanson Creek out and onto the eastern shoreline of the Patuxent River between God's Grace point and the vicinity of the Rt. 231 bridge on the Calvert County side.

On Sunday April 9th, at 09:00 hours, the MDE Fish Kill Investigation Section was placed on stand-by alert by Dr. Robert Summers, Director of Technical and Regulatory Services Administration (TARSA). Dr. Summers requested that the Fish Kill Response Unit prepare to contribute expertise and manpower in the forthcoming Natural Resource Damage Assessment (NRDA) activities. At 19:00 hours, the unit was given final orders to report to the Chalk Point Administration Building at 08:30 hours the next morning and begin participating in the development, coordination, and implementation of the multi-agency (NRDA) plan.

During the morning of April 10, oil sludge removal efforts appeared to be concentrated on the Eastern Shore of the Patuxent River at Hallowing Point, in Calvert County. Personnel from the Fish Kill Investigation Section (FKIS) arrived with ecological sampling gear and a 22' Boston Whaler at the Chalk Point facility at 09:00. At that time a large general briefing for the agency heads was underway in the spill control center. Upon completion of the general briefing, smaller meetings were held to address specific areas of concern and follow-up. Mr. Poukish and Mr. Luckett of the (FKIS) attended the aquatic faunal community assessment meeting. This meeting

June 5, 2000

was led by Wayne Kicklighter from ENTRIX (PEPCO's contracted environmental consultants). A list of attendees is included in Appendix 1. There was debate ~~also~~ concerning appropriate methodologies for fish, zooplankton, and shellfish monitoring; as well as the best approach to begin bioaccumulation studies for Polynuclear Aromatic Hydrocarbon (PAH) contamination and associated fish health monitoring. The meeting concluded at about 11:15. Some results of that meeting were:

1. It was agreed that fish community assessment surveys should be done in and around the spill area.
2. Trawling sites historically used by PEPCO environmental scientists should be included in the survey to help put the new data into historical context.
3. One site should be at the mouth of Swanson Creek, the area exposed to the most oil.
4. Two sites should be upstream of Swanson Creek, in the Patuxent River.
5. One site should be downstream of Swanson Creek and out of the area presently affected by the spill.
6. In addition to counting, measuring, and identifying fish, samples of certain fish should be collected for histological inspection by Dr. Cindy Driscoll (Md. DNR). If available a predatory species and a bottom dwelling species of economic importance should be evaluated histologically. The targeted species were either striped bass or white perch as predators, and channel catfish as a bottom dweller.
7. Collection of fish samples for PAH (polynuclear aromatic hydrocarbons) analysis was not approved at that time.
8. Monitoring in some form would continue for six to twelve months.
9. PEPCO or ENTRIX employees should accompany investigators in the field to observe their activities.

Trawling for community assessment and histological samples consumed the remainder of the day. Dr. Cindy Driscoll of Md. DNR and Mr. Paul Willenborg of PEPCO joined FKIS.

By the morning of April 11th, heavy oil deposits were reported downstream as far as Marsh Point on the Saint Mary's County side. There were reports of heavy shoreline oil deposits in various tributaries between Long Point and Marsh Point. The Oil Spill Command Center was relocated into a series of trailers behind the power plant. Fish Kill Response personnel met there briefly with Dr. Summers at about 09:00. They were instructed to proceed to the fish and wildlife command trailer and assist as needed. Personnel also met with Mr. Alan Williams, Administrator of the Emergency Operations and Technical Support Program. The unit was assigned to take Mr. Jeff Marshall and Mr. John Smiechowski of MDE's Oil Control Program onto the river to characterize the distribution of the oil on the shoreline in St. Mary's County. They also assisted the U.S. Fish and Wildlife command center by looking for fouled birds and reporting their locations via cellular phone. The boat was made available to shuttle several U.S. F & W shoreline assessors from one beach sector to another.

By the morning of April 12, the lighter oil component of the spill was continuing to encroach further down the Patuxent River. A 200-yard wide by several mile long slick was visible down to the vicinity of Jack Bay (about eight miles downstream of Swanson Creek). The clean up was once again hindered by 20-25 mph winds out of the NW. A meeting took place the previous evening between ENTRIX-PEPCO and various governmental agencies regarding sampling protocols and analysis. Mr. George Harman of MDE was in attendance. Protocols were drafted outlining proposed aquatic community surveys, bioaccumulation studies of fin-fish and oysters (PAH analysis), and histological studies to monitor potential pathological effect. Standard ambient water quality parameters were to be recorded at the surface and bottom at each sample site. The parameters include temperature, salinity, dissolved oxygen, and pH. The policy group originally called for the analysis of fish taken from pound nets in the impacted zone. However, logistical problems inhibited fishing the nets during this period. Furthermore, there were serious questions raised pertaining to the validity of such samples representing true PAH loadings of non-

June 5, 2000

captive fish. The FKIS attended more meetings inside the PEPCO offices to better define the sampling protocols and coordinate the sample analysis with ENTRIX/PEPCO. The final meeting was between Harley Speir, MD DNR-Fisheries, Dr. Ralph Markarian and John A. Dmitry of ENTRIX and Charles Poukish and Chris Luckett of FKIS. Dr. Markarian agreed to sampling trawled fish for PAH analysis and that John Dmitry of ENTRIX would coordinate with the lab. By 12:30 it was established that community surveys, field parameter water quality testing, water analysis sampling, and fish sampling for histology and PAH analysis would take place using a combination of three previously trawled sites in addition to a new site to be established further downstream and outside of the impacted area. Mr. John Dmitry of ENTRIX and Mr. Paul Willenborg of PEPCO accompanied the FKIS personnel during this sample run.

On April 14, the four previous trawl sites were again visited with the assistance of Dr. Cindy Driscoll of the DNR Cooperative Lab. Both community assessment and white perch histopathology sampling were performed from stations 1,3,4&5, (attachment). Additionally, white perch, striped bass, channel catfish and blue crabs were sampled from a fyke net near Trent Hall Point. Three specimens each of channel catfish, and white perch were wrapped whole in aluminum foil, placed on ice and labeled for potential PAH analysis. Two separate white perch and two striped bass were necropsied in the field and prepared for histological analysis. One fillet from each striped bass was also wrapped in aluminum foil and placed on ice for future PAH analysis. Eight crabs were delivered to the University of Maryland research vessel Orion (currently working on site) for their ongoing crab impact study. All the fish tissue samples for PAH analysis were delivered to the PEPCO/ENTRIX field station at Hallowing Point and archived in the freezer. Copies of the field sheets were given to Mr. Paul Willenborg of PEPCO. Two ENTRIX chain of custody forms were released to Matthew Barczyk at the Hallowing Point Lab on Wednesday April 19th.

Fish community monitoring continued twice a week during the weeks of April 17th, 24th and May 1st. All four established trawl sites were attempted on April 19th, 21st, 25th, 27th, May 2 and 4th. Most attempts were successful with the exception of one. Site number #1 (red day marker #32) was not sampled on the 21st of April due to severe lightning near the station. Resource damage assessment operations ceased for the day as severe thunderstorms approached. Histological samples were limited to four white perch and two hogchokers during this period. Three specimens displayed external tumor-like lesions from sites #4 and #5 on the 19th and site #3 on May 4th. The third white perch displayed a large hemorrhaged eye from site #1 on the 25th. The two hogchokers displayed large skin lesions at site #1 on May 2. No fish bioaccumulation tissue samples were retained during this sample period.

On May 10, a second round of PAH tissue sampling was conducted by PEPCO personnel with the assistance of FKIS personnel. Community monitoring and fish histology sampling was also accomplished for sites #1,3, and 4 before time constraints ended sampling for the day. PEPCO personnel completed the PAH sampling and community monitoring round on May 12. They retained custody of the PAH samples and assumed all future community monitoring efforts as part of their routine seasonal monitoring program.

Methods

A standard 18' otter trawl with the 1/2" cod end bag removed to facilitate capture of larger fish was deployed for six minutes at each station. Four stations were sampled each day. Those stations were as follows:

- #1. Approximately four miles upstream of Swanson Creek in the Patuxent River channel near Potts point and red daymarker #32.
- #2. Approximately one mile upstream of Swanson Creek in the Patuxent River channel immediately upstream of overhead power lines.

June 5, 2000

- #3. At the mouth of Swanson Creek in the Patuxent River.
- #4. Approximately one mile south of the route 231 Bridge in the Patuxent River channel near the red daymarker #24.
- #5. Approximately 11 miles south of Swanson Creek in the Patuxent River channel at Broomes Island and near the red daymarker #16.

All fish were identified to species, counted and measured to the closest cm. The histological fish samples included the heart, brain, nares, eye, liver, spleen, intestine, gonads, lateral line, skin and portions of the head and caudal kidneys. The tissue was then preserved in 10% formalin.

Fish sampled whole for PAH analyses were double wrapped in Aluminum foil, and frozen in the field with dry ice.

The Hydrolab Scout 2 multi-parameter water analysis instrument was deployed for basic water chemistry characterization. John Dimitry of ENTRIX collected the water samples and retained custody of them and the whole fish samples.

Discussion-Results

Data sheets for all community monitoring trawls and fish histology, water, and tissue sampling done by this section are contained in Appendix two. Figures 1-4 display species distribution and frequency data for FKIS community monitoring trawls. Most trawled fish appeared normal. A small percentage of the white perch displayed some form of skin anomaly, including scale loss, petechia under scales and fins, lesions, or tumor-like growths. Many of these were included in the histological samples. Several white perch displayed moderate to severe scale loss attributed to previous handling by scientific or commercial fishery personnel.

The targeted predator white perch was captured at all trawling stations in sufficient numbers for sample analysis. Only two targeted channel catfish were captured in bottom trawls. They were not kept as samples. Hogchokers were abundant in all trawling sites. Croakers were found at all sites during the sample period.

A few dead fish were found scattered throughout the area during the post spill investigation period. Most of these were gizzard shad found in numbers not unlike those found in areas more removed from the Patuxent River. Additionally, a few white perch and croaker were found scattered over time. They also were found throughout the state in about the same numbers and can likely be attributed as the discards of fishing activities.

Stations number one through four were sampled on April 10. Station number four was considered out of the impacted zone at that time. By April 12, station number four was in the middle of the impacted zone and station number five was established in keeping with the initial objective of maintaining a site downstream and out of the impacted area. Due to time constraints station number two was not sampled on April 12, but was replaced by station five.

Hydrolab data does not reveal anything unusual about the sampling sites. Dissolved oxygen is near or above saturation at most sites. It is interesting to note how well mixed the river is throughout the sample area.

June 5, 2000

on April 11

The Saint Mary's County survey conducted with MDE oil control program personnel identified about six swans with oil deposits. One was very heavily oiled on its head and body. A very badly oiled coot, a lightly oiled osprey, and dozens of ducks were observed oiled to various degrees. Deposits of heavy, black, tarry oil were visible on the Saint Mary's County side of the river and its tributaries. The size of the deposits varied from small clumps to areas in excess of two yards wide by one hundred yards long. Some deposits were on sandy beaches and others were observed in small tidal wetland creeks.

The field crew was unable to enter Swanson Creek more than 200 yards by boat due to shallow water and the presence of containment booms.

Conclusions

The three primary goals of the response assessment plan were achieved. They include; 1) the documentation of fish communities in the impact zone, 2) the collection of histological baseline data, and 3) the collection of fish tissue from the wild population for PAH analysis.

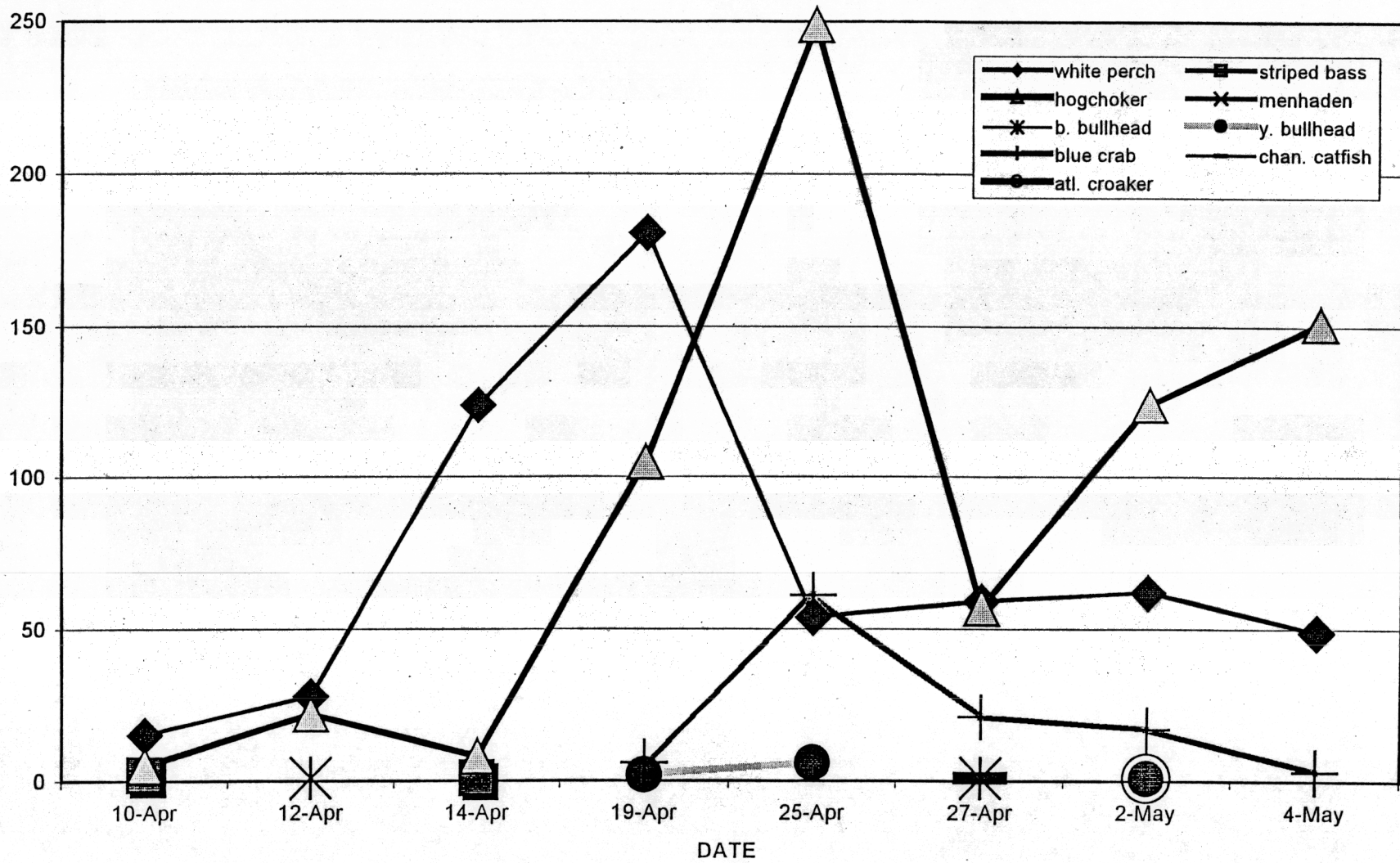
Based on field observations, no major acute impacts to the fish community were evident in the main branch of the Patuxent River immediately after the spill or during the study period. DNR shoreline assessment teams reported observing a small, localized mortality of mummichogs (200-300 individuals) near the Swanson Creek discharge site on Monday April 10th.

Appendix One

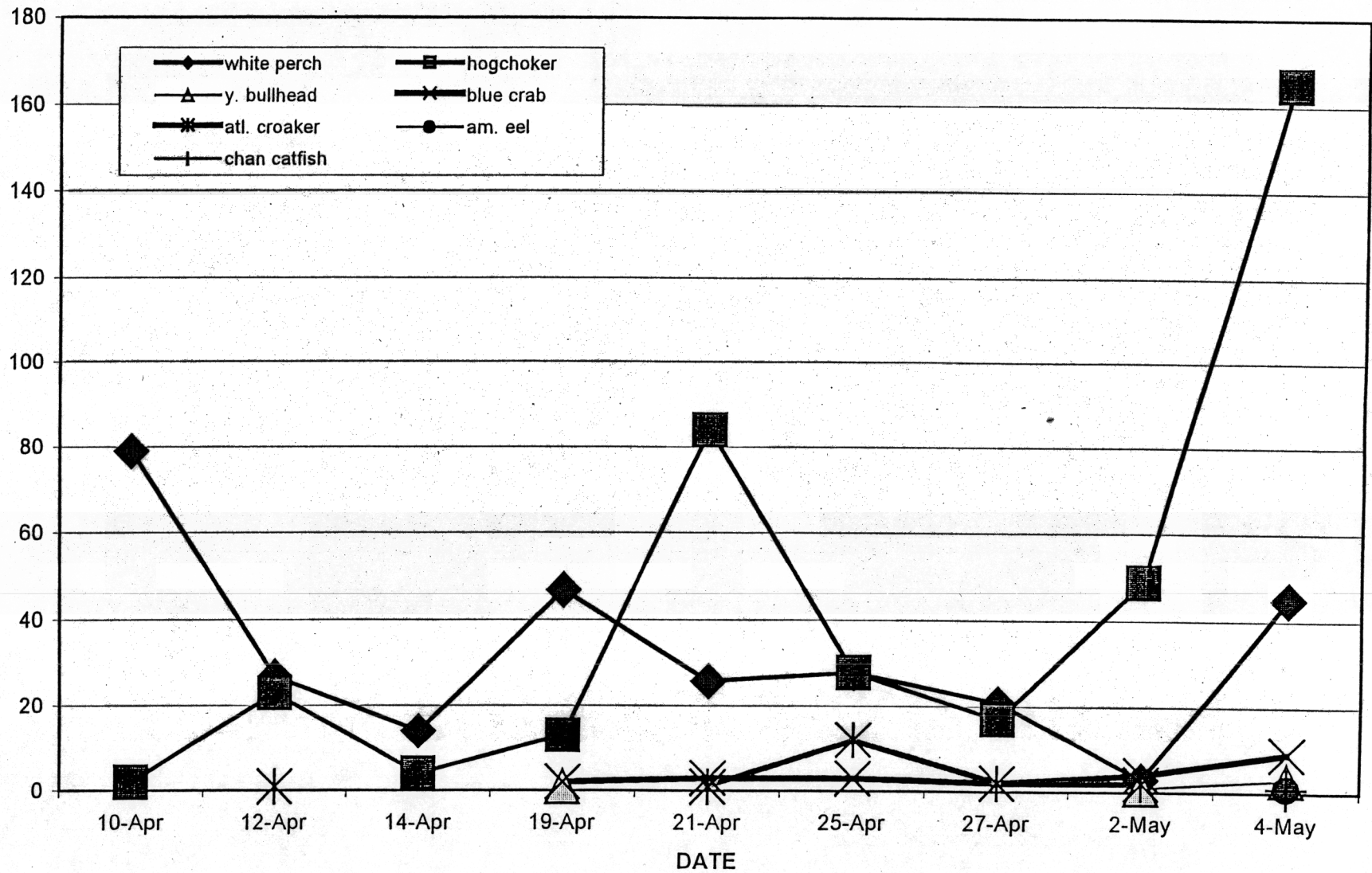
List of attendees to morning meeting on April 10, 2000. Meeting was to plan initial response for fish and shellfish assessment.

<u>Name</u>	<u>Representing</u>	<u>Phone</u>
Billy Moore	PEPCO	(202) 872-3430
Ed Krueger	PEPCO	(202) 331-8539
Tim Klaras	PEPCO	(301) 855-1295
Paul Willenborg	PEPCO	(301) 855-1295
Ann Wearmouth	PEPCO	(301) 855-1309
Shelle Perrie	PEPCO	(301) 855-1402
Jonathan McKnight	Md. DNR	(410) 729-8776
Cindy P. Driscoll	Md. DNR	(410) 228-5193
Harley Speir	Md. DNR	(410) 260-8303
Phil Jones	Md. DNR	(410) 260-8295
Eric Schweab	Md. DNR	(410) 260-8281
Richard Doleah	Md. DNR	(410) 260-8582
Carolyn Watson	Md. DNR	(410) 260-8113
Wayne Kicklighter	ENTRIX	(304) 535-1620
Bill Beatty	MDE	(410) 974-3238
Charles Poukish	MDE	(410) 974-3238
Chris Lockett	MDE	(410) 974-3238
John McKay	MDE	(410) 974-3238
William Evans	MDE	(410) 974-3238
Tom Broenan	NOAA	(301) 713-3038 x186
Carol Ann Manen	NOAA	(301) 713-3038 x196
Robert Burr	USDOJ	(215) 597-5378
Dan Murphy	USFWS	(410) 573-4521
Ken Rubin	Morgan, Lewis & Bockius	(202) 467-7140

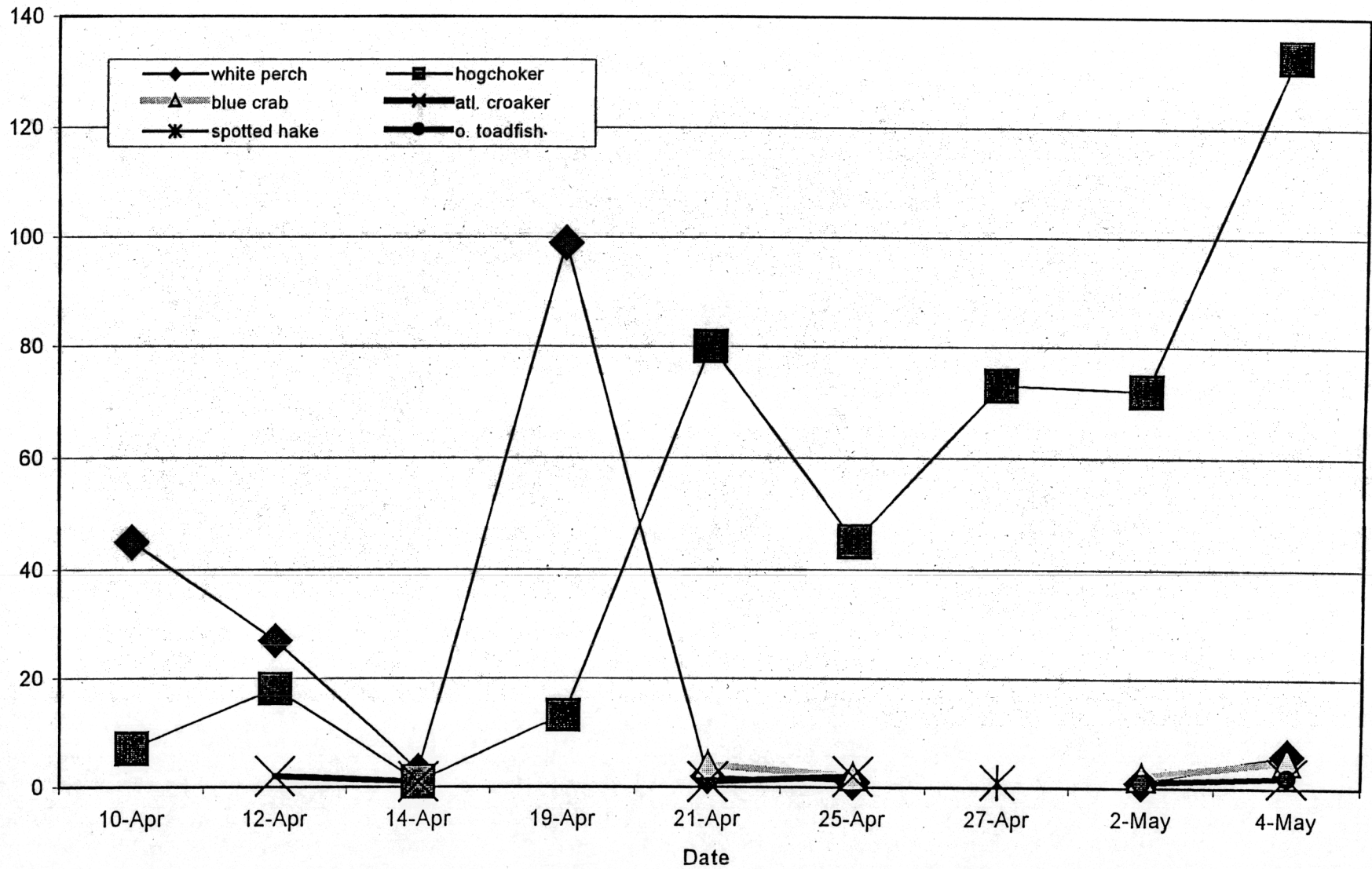
Station 1 Patuxent River R-32



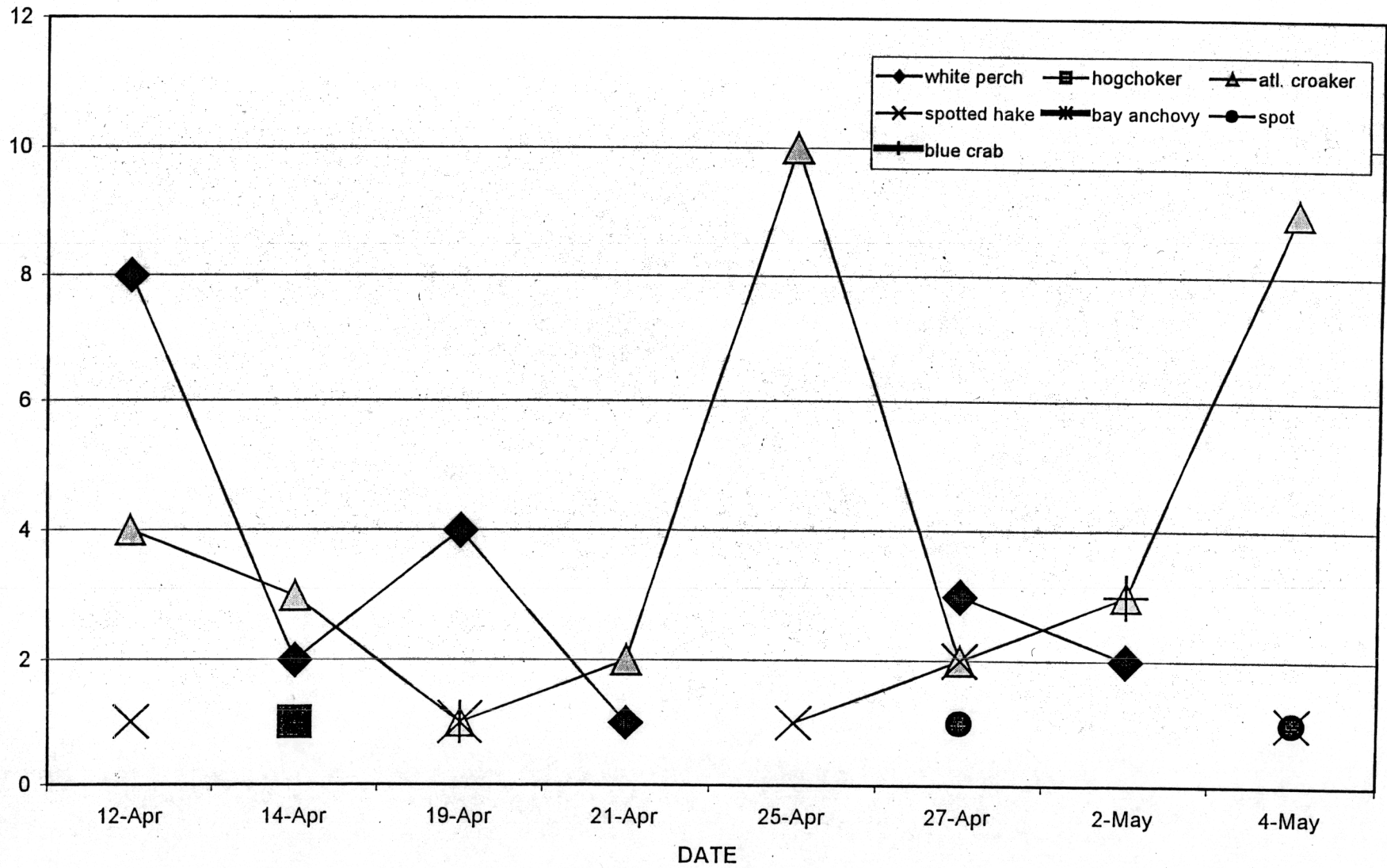
Station 3 Patuxent River Swanson Crk.



Station 4 Patuxent River Rt 231



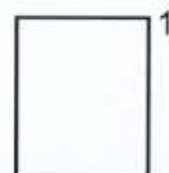
Station 5 Broomes Isl- Patuxent River



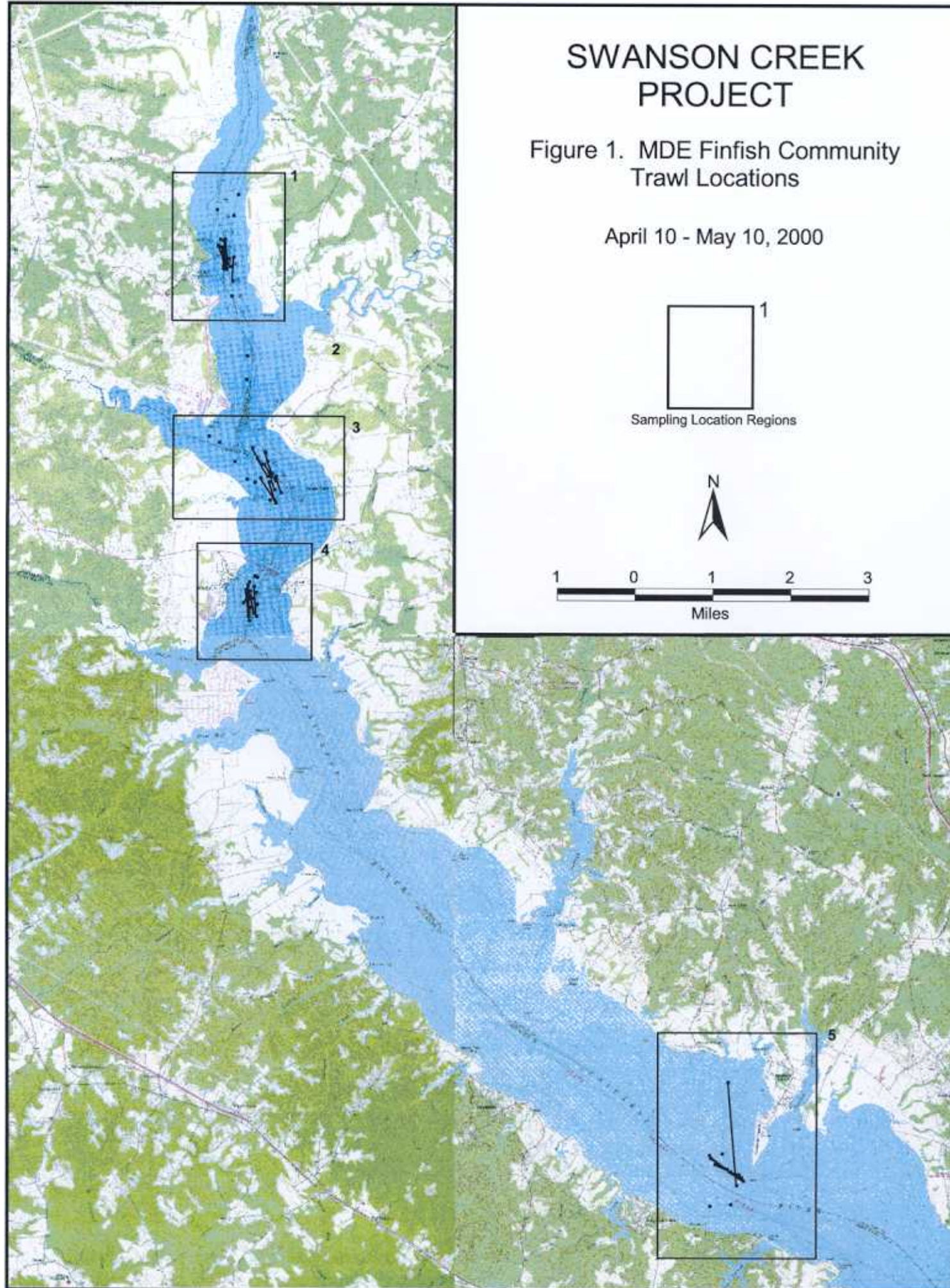
SWANSON CREEK PROJECT

Figure 1. MDE Finfish Community
Trawl Locations

April 10 - May 10, 2000



Sampling Location Regions



Summary of finfish collected during the MDE trawl survey, April 10 - May 4, 2000

Date	Station	Latitude		Longitude		Trawl Length (m)	Estimated Area Swept (m ²)	Species	Catch per Trawl	Catch per Acre
		Start	Stop	Start	Stop					
04/10/2000	1	38 34.231	38 33.974	76 40.608	76 40.611	521.80	2545	Hogchoker	5	7.95
								Striped bass	2	3.18
								White perch	15	23.86
04/10/2000	2	38 33.140	38 32.871	76 40.394	76 40.416	489.67	2388	White perch	25	42.37
04/10/2000	3	38 31.986	38 31.778	76 40.266	76 40.116	445.5	2173	Hogchoker	2	3.73
								White perch	79	147.15
04/10/2000	4	38 30.315	38 30.171	76 40.391	76 40.382	266.98	1302	Hogchoker	7	21.76
								White perch	45	139.87
04/12/2000	1	38 34.165	38 34.436	76 40.691	76 40.709	500.21	2439	Atlantic menhaden	1	1.66
								Brown bullhead	1	1.66
								Hogchoker	22	36.5
								White perch	28	46.45
04/12/2000	3	38 31.712	38	76 40.104	76			Atlantic croaker	1	2.14
								Hogchoker	23	49.31
								White perch	27	57.89
04/12/2000	4	38 30.255	38 30.458	76 40.315	76 40.397	374.64	1827	Atlantic croaker	2	4.43
								Hogchoker	18	39.87
								White perch	27	59.81
04/12/2000	5	38 23.951	38 24.075	76 33.441	76 33.732	479.73	2340	Atlantic croaker	4	6.92
								White perch	8	13.84
								Less Common Fish	1	1.73
04/14/2000	1	38 34.115	38 34.409	76 40.702	76 40.727	545.05	2658	Hogchoker	8	12.18
								Striped bass	1	1.52
								White perch	124	188.79
04/14/2000	3	38 31.523	38 31.759	76 40.020	76 40.216	519.83	2535	Hogchoker	4	6.39
								White perch	14	22.35
04/14/2000	4	38 30.209	38 30.543	76 40.276	76 40.314	623.83	3042	Atlantic croaker	1	1.33
								Hogchoker	1	1.33
								White perch	3	3.99
04/14/2000	5	38 24.003	38 24.181	76 33.546	76 33.846	542.57	2646	Atlantic croaker	3	4.59
								Hogchoker	1	1.53
								White perch	2	3.06
04/19/2000	1	38 34.105	38 34.281	76 40.722	76 40.759	337.1	1644	Hogchoker	105	258.48
								White perch	181	445.57
								Less Common Fish	2	4.92
04/19/2000	3	38 31.631	38 31.833	76 40.024	76 40.105	394.08	1922	Hogchoker	13	27.37
								White perch	47	98.97
								Less Common Fish	1	2.11
04/19/2000	4	38 30.215	38 30.414	76 40.94	76 40.386	366.42	1787	Hogchoker	13	29.44
								White perch	99	224.21
04/19/2000	5	38 23.964	38 24.085	76 33.454	76 33.761	497.75	2427	Atlantic croaker	1	1.67
								Bay anchovy	1	1.67
								White perch	4	6.67
04/21/2000	3	38 31.601	38 31.783	76 39.927	76 39.995	346.56	1690	Atlantic croaker	1	2.39
								Hogchoker	84	201.14
								White perch	26	62.26
04/21/2000	4	38 30.489	38 30.268	76 40.405	76 40.405	410.72	2003	Atlantic croaker	1	2.02
								Hogchoker	80	161.64
								White perch	2	4.04
04/21/2000	5	38 24.143	38 24.025	76 33.834	76 33.596	413.97	2019	Atlantic croaker	2	4.01
								White perch	1	2
04/25/2000	1	38 34.109	38 34.240	76 40.747	76 40.737	244.37	1192	Hogchoker	107	363.35
								White perch	54	183.37
								Less Common Fish	6	20.37
04/25/2000	3	38 31.725	38 31.916	76 40.001	76 40.170	421.93	2058	Atlantic croaker	1	1.97
								Hogchoker	28	55.07
								White perch	28	55.07

Summary of finfish collected during the MDE trawl survey, April 10 - May 4, 2000

Date	Station	Latitude		Longitude		Trawl Length (m)	Estimated Area Swept (m ²)	Species	Catch per Trawl	Catch per Acre
		Start	Stop	Start	Stop					
04/25/2000	4	38 30.424	38 30.563	76 40.424	76 40.408	255.91	1248	Atlantic croaker	2	6.49
								Hogchoker	45	145.92
								White perch	1	3.24
04/25/2000	5	38 23.993	38 23.850	76 33.583	76 33.468	313.88	1531	Atlantic croaker	10	26.44
								Less Common Fish	1	2.64
								Brown bullhead	1	2.95
04/27/2000	1	38 34.350	38 34.216	76 40.767	76 40.674	281.22	1371	Hogchoker	57	168.2
								White perch	59	174.1
								Less Common Fish	1	2.95
								Atlantic croaker	2	8.96
04/27/2000	3	38 32.046	38 31.950	76 40.143	76 40.111	185.15	903	Hogchoker	17	76.19
								White perch	22	98.6
								Hogchoker	73	237.13
04/27/2000	4	38 30.593	38 30.456	76 40.391	76 40.400	255.46	1246	Less Common Fish	1	3.25
								Atlantic croaker	2	5.1
04/27/2000	5	38 23.992	38 23.901	76 33.565	76 33.371	325.37	1587	White perch	3	7.65
								Less Common Fish	3	7.65
								Atlantic croaker	1	1.98
05/02/2000	1	38 34.094	38 34.313	76 40.693	76 40.754	419.87	2048	Hogchoker	124	245.37
								White perch	62	122.68
								Less Common Fish	1	1.98
								Atlantic croaker	2	6.5
05/02/2000	3	38 31.824	38 31.947	76 40.047	76 40.123	255.52	1246	Hogchoker	49	159.13
								White perch	3	9.74
								Less Common Fish	1	3.25
								Hogchoker	72	223.51
05/02/2000	4	38 30.365	38 30.493	76 40.465	76 40.371	267.32	1304	White perch	1	3.1
								Less Common Fish	1	3.1
								Atlantic croaker	3	8.24
05/02/2000	5	38 24.030	38 23.936	76 33.604	76 33.438	302.27	1474	White perch	2	5.49
								Hogchoker	151	309.04
05/04/2000	1	38 34.371	38 34.171	76 40.812	76 40.710	405.46	1977	White perch	49	100.29
								Hogchoker	165	354.92
05/04/2000	3	38 32.100	38 31.913	76 40.327	76 40.208	385.78	1881	White perch	45	96.8
								Less Common Fish	4	8.6
								Atlantic croaker	2	3.90
05/04/2000	4	38 30.520	38 30.291	76 40.434	76 40.399	425.06	2073	Hogchoker	133	259.65
								White perch	6	11.71
								Less Common Fish	2	3.90
								Atlantic croaker	9	22.06
05/04/2000	5	38 24.031	38 23.933	76 33.607	76 33.405	338.59	1651	Less Common Fish	2	4.9

	Average Abundance per Trawl	Average Abundance per Acre
Atlantic croaker	1.47	3.56
Atlantic menhaden	0.03	0.05
Bay anchovy	0.03	0.05
Brown bullhead	0.06	0.14
Hogchoker	41.38	101.66
Striped bass	0.09	0.14
White perch	31.38	71.27
Less Common Fish	0.79	2.10
Average	9.40	22.37

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/10/00		Investigator: C. Poukish C. Luckett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)		
Location: R-32	Depth: 4-9.5 Ft.	Tide: Ebb	County: Charles/P.G.			Lat: Start 38 34.231 Stop 38 33.974	Long: Start 76 40.608 Stop 76 40.611			
Time: 1330- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 1		Weather: Sunny, 68F				
Notes: Three histological samples taken of white perch as numbered below. Cindy Driscoll (DNR) kept the fish samples>										

OOCPPAWP07	17.5cm	Female	2mm prolif. lesion on dorsal surf, 2cm post. to head.
OOCPPAWP08	17.0cm	Female	No significant lesions (NSL)
OOCPPAWP09	17.0cm	Male	NSL

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch													2	4	3	1	4	1			
Striped bass														1	1						
Hogchoker								2	2	1											
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/10/00	Investigator: C. Poukish, C. Lockett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)	
Location: upstream of power line	Depth: 9.7 Ft.	Tide: Ebb	County: PG	Lat: Start 38 33.140 Stop 38 32.871	Long: Start 76 40.394 Stop 76 40.416		
Time: 1353- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 2	Weather: Sunny 68F		
Notes: three white perch taken for histology: As below. Cindy Driscoll (DNR) kept the fish samples.							

OOCPPAWP10	18.0cm	Female	NSL
OOCPPAWP11	18.0cm	Female	NSL
OOCPPAWP12	18.0cm	Female	NSL

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch												1		6	6	5	3	4			
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/10/00	Investigator: C. Poukish, C. Luckett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)
Location: upstream of power line	Depth: 9.7 Ft.	Tide: Ebb	County: PG	Lat: Start 38 33.140 Stop 38 32.871	Long: Start 76 40.394 Stop 76 40.416	
Time: 1353- Six minutes	Sample Gear: 16ft Otter Trawl		Station #: 2	Weather: Sunny 68F		
Notes: three white perch taken for histology: As below. Cindy Driscoll (DNR) kept the fish samples.						

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/10/00			Investigator: C. Poukish, C. Luckett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)					
Location: mouth Swanson Creek		Depth: 11.3 Ft.		Tide: Ebb		County: PG			Lat: Start 38 31.986 Stop 38 31.778			Long: Start 76 40.266 Stop 76 40.116		
Time: 1450- Six minutes			Sample Gear: 16ft Otter Trawl			Station #: 3			Weather: Sunny 68F					
Notes: three white perch and one hogchoker taken for histology: As below. Cindy Driscoll (DNR) kept the fish samples.														

OOCPPAWP13	23.0cm	Female	NSL
OOCPPAWP14	18.0cm	Male	NSL
OOCPPAWP15	22.0cm	Male	NSL
OOCPPAHO16	8.0cm		

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch													2	7	7	6	21	17	7	6	6
Hogchoker								2													
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/10/00		Investigator: C. Poukish, C. Lockett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)		
Location: R-24, Rt. 231	Depth: 16 Ft.	Tide: Ebb	County: PG			Lat: Start 38 30.315 Stop 38 30.171	Long: Start 76 40.391 Stop 76 40.382			
Time: 1532- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 4		Weather: Sunny 68F				

Notes: three white perch taken for histology: As below. Cindy Discoll (DNR) kept the fish samples.

OOCPPAWP17	21.0cm	Female	NSL
OOCPPAWP18	20.0cm	Female	NSL
OOCPPAWP19	19.0cm	Female	NSL

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															1	5	13	5	12	6	3
Hogchoker								3	2	1			1								
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
Surface 300' from dock	14.27	13.15	133.5	8.64	5.5	9700

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/10/00	Investigator: C. Poukish, C. Lockett, Cindy Driscoll DNR, Paul Willenborg (PEPCO)
Location: R-24, Rt. 231	Depth: 16 Ft.	Tide: Ebb	County: PG	Lat: Start 38 30.315 Stop 38 30.171	Long: Start 76 40.391 Stop 76 40.382	
Time: 1532- Six minutes	Sample Gear: 16ft Otter Trawl		Station #: 4	Weather: Sunny 68F		
Notes: three white perch taken for histology: As below. Cindy Discoll (DNR) kept the fish samples.						

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/12/00			Investigator: C. Poukish Chris Luckett, John Dimitry, Paul Willenborg (PEPCO)		
Location: R-32, God's Grace Pt.		Depth: 7-9 Ft.		Tide: Ebb		County: PG		Lat: Start 38 34.165 Stop 38 34.436		Long: Start 76 40.691 Stop 76 40.709	
Time: 1712- Six minutes			Sample Gear: 16ft Otter Trawl			Station #: 1			Weather: NNW wind 25mph		
Notes: Three white perch taken for histology-Given to B. Coakley DNR. Six white perch sampled for PAH, water samples taken for PAH, nutrients by J. Dimitry ENTRIX as numbered below.											

ENTRIX water samples: PRMC11W, PRMC13W. For nearby samples see supplemental samples sheet attachment.

ENTRIX fish samples for PAH: 22cm, 16cm, 22cm, 16cm, 17cm, 19cm

Fish for Histology given to DNR: 20cm, 19cm, 18 cm

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch														1		16	3	3	2	1	
Hogchoker								6	8	3	1	4									
Atlantic menhaden															1						
Brown bullhead															1						
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	2																				

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
surface	14.7	8.65	86	7.17	2.2	4,160
1.2M	14.7	9.3	89	7.1	2.2	4,110

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/12/00			Investigator: C. Poukish C. Lockett, John Dimitry, Paul Willenborg (PEPCO)		
Location: mouth Swansons Creek		Depth: 13 Ft.	Tide: Ebb	County: CA/SM		Lat: Start 38 31.712 Stop 38		Long: Start 76 40.104 Stop 76			
Time: 1632- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 3		Weather: NNW wind 25mph				
Notes: Three white perch taken for histology-Given to B. Coakley DNR. Five white perch sampled for PAH, water samples taken for PAH, nutrients by J. Dimitry ENTRIX as numbered below.											

ENTRIX water samples: PRMC03. For nearby water samples see supplemental samples sheet attachment.

ENTRIX fish samples for PAH: 18cm, 17cm, 21cm, 18cm, 23cm.

Fish for histology given to DNR: 20cm, 20cm, 19cm.

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch														1	2	4	6	3	6	2	1
Hogchoker							1	11	8	2	1										
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	43
White perch	1	1																			
Atlantic croaker																					1

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
surface	14.5	9.8	100	8.06	5.6	10,050
2.6	14.3	10.4	102	8.95	5.8	10,330

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/12/00		Investigator: C. Poukish C. Luckett, John Dimitry, Paul Willenborg (PEPCO)			
Location: R-24, Rt. 231	Depth: 13-15 Ft.	Tide: Ebb	County: CA/SM			Lat: Start 38 30.255 Stop 38 30.458		Long: Start 76 40.315 Stop 76 40.367			
Time: 1539- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4		Weather: NNW wind 25mph				

Notes: Three white perch taken for histology-Given to B. Coakley DNR. Five white perch sampled for PAH, water samples taken for PAH, nutrients by J. Dimitry ENTRIX as numbered below.

ENTRIX water samples: PRMC07. For nearby samples see supplemental samples sheet attachment.

ENTRIX fish samples for PAH: 18cm, 18cm, 22cm, 17cm, 18cm.

Fish for histology given to DNR: 18cm, 18cm, 19cm.

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															1	5	4	9	6	2	
Hogchoker								6	5	3	2		1	1							
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker						1					1										

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
surface	14.6	10.7	112	8.47	6.6	11,750
3.0	14.15	12.3	114	8.2	7.1	12,460

Fish-Counting Record-MDE

River: Patuxent River				Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill				Date: 4/12/00				Investigator: C. Poukish C. Luckett, John Dimitry, Paul Willenborg (PEPCO)			
Location: R-16 Broomes Island		Depth: 31 Ft.		Tide: Ebb		County: CA/SM				Lat: Start 38 23.951 Stop 38 24.075		Long: Start 76 33.441 Stop 76 33.732			
Time: 1402- Six minutes				Sample Gear: 16ft Otter Trawl				Station #: 5				Weather: NNW wind 25mph			

Notes: Three white perch taken for histology-Given to B. Coakley DNR. Five white perch sampled for PAH, water samples taken for PAH, nutrients by J. Dimitry ENTRIX as numbered below.

ENTRIX water samples: PRMC05. For nearby samples see supplemental samples sheet attachment.

ENTRIX fish samples for PAH: 18cm, 19cm, 19cm, 23cm, 19cm.

Fish for histology given to DNR: 17cm, 19cm, 21cm.

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																	1	1	5		1
Spotted hake											1										
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker										1		1		1			1				

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
surface	12.98	10.46	108.6	8.42	11.3	19,200
9.4 M	12.9	10.6	107.7	8.35	11.4	19,300

Supplemental Water Sample Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 04/12/00	Investigator: C. Poukish C. Luckett, John Dimitry, Paul Willenborg (PEPCO)
Taken By: John Dimitry ENTRIX	Analysis: PAH, nutrients	Custody of: ENTRIX	Weather: Cloudy, 60°	Wind: NNW 20-25		

Sample Number	Location	Time	Latitude	Longitude
PR-MC-03w	End of trawl St. #3 Chalk Pt.	16:40	n/a	n/a
PR-MC-05w	Red Daymarker #16 Broomes Is.	14:10	N 38° 24.075	W 076° 33.732
PR-MC-06w	Red daymarker #18, Jacks Bay	14:20	N 38° 25.618	W 076° 36.342
PR-MC-07w	Red daymarker #24	15:50	N 38° 30.458	W 076° 40.367
PR-MC-08w	Just South of Swanson Ck	16:00	N 38° 31.476	W 076° 39.996
PR-MC-10w	Under Power lines	17:02	N 38° 32.749	W 076° 40.445
PR-MC-11w	Red daymarker #32	17:20	N 38° 34.436	W 076° 40.709
PR-MC-12w	+/- four miles N. of Chalk Pt.	17:35	N 38° 35.129	W 076° 40.664
PR-MC-13w	Red daymarker #32 (duplicate)	17:20	N 38° 34.436	W 076° 40.709

All samples taken in two +/- one liter bottles to be split into smaller bottles by ENTRIX.
 Samples to be analyzed by ENTRIX Contractors.

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/14/00	Investigator: C. Poukish Chris Lockett, Dr. Cindy Driscoll
Location: Trent Hall	Depth: 1 M	Tide: ebb	County: SM	Lat: Start 38 28.225 Stop	Long: Start 76 39.654 Stop	
Time: 1100		Sample Gear: Fyke net		Station #:	Weather: cloudy, 60F	
Notes: collected fish from fisherman (Mr. Daily)—fyke net was fished for two nights						

Samples collected for histology and kept in custody of Dr. Driscoll

Striped bass #00CPPASB22, 48Cm male-nematode evident in flesh, empty stomach, pale liver
 Striped bass#00CPPASB23, 44.5Cm male-healthy
 White perch #00CPPAWP24, 18Cm female-healthy
 White perch #00CPPAWP25, 19Cm male-healthy

Samples wrapped whole in aluminum foil, labeled, and archived in ENTRIX /PEPCO freezer in custody of Paul Willenborg at Hollowing Point for possible PAH

Annalysis

Channel Catfish #1 47cm, #2 43cm, #3 46cm
 White perch #1 21cm, #2 21cm, #3 23cm

One fillet was taken from each of the necropsied striped bass and also wrapped in aluminum foil, labeled and archieved in the ENTRIX/PEPCO Freezer at Hollowing Point

Eight blue crabs delivered to the University of Maryland Research Vessel Orion on site

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	12.5	12.8	126	8.7	9.0	15,500

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 04/14/2000		Investigator: C. Poukis Chris Luckett	
Location: FYKE NET at TRENT HALL		Depth: 1M	Tide: High-Slack	County: SM	Lat: Start Stop 38°28.225	Long: Start Stop 76°39.654			
Time: - Six minutes 1100		Sample Gear: 10ft Otter Trawl FYKE NET		Station #: TRENT HALL Pt.		Weather: Cloudy 60° F			
Notes: COMMERCIAL FISHERMAN PROVIDED SAMPLES TO MDE, ONR. Net has been in water 2 DAYS (MR. DALY)									

SELECTIVE SAMPLE ONLY: NOT COMMUNITY SURVEY
WHOLE FISH

All Crabs transferred to The Orion p.

Also collected 8 BLUE CRABS from FYKE NET

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																					11
Striped bass																					
hogchoker																					
Channel Cat																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
WHITE PERCH		1																			
Channel CAT	1 at 47cm,	1 at 43cm,	1 at 46cm	← WHOLE FROZEN FOR PAH Analysis																	
STRIPED BASS	1 at 44.5cm,	1 at 48cm,	← HISTOLOGY and FROZEN MUSCLE TISSUE ← OOCPPASB22 OOCPPASB23																		
2 WHITE PERCH FROZEN WHOLE FOR PAH ANALYSIS																					

3 WHITE PERCH FROZEN WHOLE FOR PAH Analysis

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
Surf	12.5	12.8	126.0	8.7	9.0	15,500
0.8 m						

Bottom?

WHITE PERCH FOR HISTOLOGY FROM FYKE NET
18cm ♀ OOCPPAWP24
19cm ♂ OOCPPAWP25

HISTOLOGICAL SAMPLES FROM FYKE NET

STRIPED BASS

Ⓐ 48cm OOCPPASB22 ♂

Ⓑ 44.5cm OOCPPASB23 ♂

BOTH HAD PALE LIVERS

Ⓑ HASNT FED AT ALL: FULL GALL BLADDER

Ⓐ MONITORING CLYTES TO NEMATODE FOUND (1)

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/14/00	Investigator: C. Poukish Chris Luckett, Dr. Cindy Driscoll	
Location: R-32, Potts Pt.	Depth: 15ft.	Tide: ebb	County: CA/PG		Lat: Start 38 34.115 Stop 38 34.409	Long: Start 76 40.702 Stop 76 40.727	
Time: 1408- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 1		Weather: cloudy, 65F, wind N 0-5mph	
Notes: Histology—00CPPAWP30, 19Cm male, 00CPPAWP31, 21Cm female (lesion near vent)—samples kept in Dr. Driscolls custody							

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch													1	6	9	18	29	16	12	12	11
Striped bass																1					
hogchoker								5	3												
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	5	1	3		1																

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.7	10.9	110	8.58	5.6	9,940
4.5	13.1	9.84	97	8.11	7.8	13,600

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/14/00		Investigator: C. Poukish Chris Luckett, Dr. Cindy Driscoll		
Location: mouth of Swanson Creek		Depth: 12.6ft.	Tide: ebb	County: CA\CH		Lat:	Start 38 31.523 Stop 38 31.759		Long: Start 76 40.020 Stop 76 40.216	
Time: 1335- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 3		Weather: cloudy, 60-65F, wind 0-5mph				
Notes: Orion trawling in vicinity/ visible oil slick ---- Histology- 00CPPAWP28, 21Cm female, 00CPPAWP29, 20Cm female- samples in Dr. Driscolls custody.										

	Cm																				
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															2	2	2	1	4	1	1
hogchoker							1		3												
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch		1																			

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	14.2	13.5	142	9.04	7.1	12,350
4M	12.8	10.5	104	8.23	9.5	16,300

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/14/00		Investigator: C. Poukish Chris Luckett, Dr. Cindy Driscoll		
Location: R-24 below Rt. 231 bridge		Depth: 18-20 ft.	Tide: ebb	County: CA/CH		Lat: Start 38 30.209 Stop 38 30.543		Long: Start 76 40.276 Stop 76 40.314		
Time: 1251- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 4		Weather: cloudy, 60F, wind N 0-5mph				
Notes: Histology samples- 00CPPAWP26 female, 00CPPAWP27 male—samples kept in custody of Dr. Driscoll										

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																			2		
hogchoker									1												
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch		1																			
Atlantic croaker													1								

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.37	11.91	124.4	8.71	9.2	15,800
6.3M	12.56	8.84	88.2	8.04	10.8	18,300

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/14/00		Investigator: C. Poukish Chris Lockett, Dr. Cindy Driscoll		
Location: R-16 Broomes Island		Depth: 34Ft.	Tide: Flood Slk	County: CA/ SM		Lat: Start 38 24.003 Stop 38 24.181		Long: Start 76 33.546 Stop 76 33.846		
Time: 1006 - Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 5		Weather: cloudy, 50F, wind N 0-5				
Notes: Histology samples- 00CPPAWP20 male 20Cm, 00CPPAWP21 female 22Cm—kept in custody of Dr. Cindy Driscoll										

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																				1	
Hogchoker								1													
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	1																				
Croaker									1		1		1								

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	12.55	10.5	110	8.57	11.3	19,100
7.8	12.27	7.37	73	7.71	12.4	20,800

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/19/00		Investigator: C. Poukish Chris Lockett, Matt Barczyk- ENTRIX			
Location: R-32 Potts Point	Depth: 14 ft.	Tide: ebb	County: CA\PG			Lat:	Start 38 34.105 Stop 38 34.281		Long: Start 76 40.722 Stop 76 40.759		
Time: 1248- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 1			Weather: mostly cloudy, 55F, wind 10-15 NNW			
Notes: three white perch displayed abrasive-like lesions, one white perch displayed moderate fungal infection on side											

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch												1		6	11	23	39	39	21	25	8
Yellow bullhead																					
hogchoker							3	53	25	13	4	4	2	1							
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	7	1																			
Yellow bullhead		1			1																
Blue crabs 6																					

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.9	8.2	80	7.0	1.9	3,430
3.3M	13.2	8.8	83	6.98	4.0	7,270

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/19/00		Investigator: C. Poukish Chris Luckett, Matt Barczyk-ENTRIX				
Location: mouth of Swanson Creek		Depth: 13.8 ft.	Tide: ebb	County: CAICH			Lat: Start 38 31.631 Stop 38 31.833		Long: Start 76 40.024 Stop 76 40.105			
Time: 12:13- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 3			Weather: cloudy, 55F, wind 10-15 mph NNW				
Notes:												

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																3	10	10	11	8	2
Yellow bullhead																					
hogchoker								8	5												
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	1	2																			
Yellow bullhead								1													
Blue crab 2																					

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.2	8.6	86	7.38	5.4	9,700
3.2	12.99	8.2	83	7.3	6.4	11,800

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/19/00		Investigator: C. Poukish Chris Luckett, Matt Barczyk-ENTRIX		
Location: R-24 below Rt. 231 bridge		Depth: 16 ft.	Tide: ebb	County: CA\CH		Lat:	Start 38 30.215 Stop 38 30.414	Long: Start 76 40.394 Stop 76 40.386		
Time: 11:09- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4		Weather: overcast, 50F, wind 10-15 mph NNW			
Notes: Histology on white perch with tumor on dorsal-lateral aspect 3mm, risen-white-spongy, 00CPPAWP33 female, 23cm										

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															2	5	10	23	16	13	9
hogchoker								5	5	1	1			1							
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	8	3		1																	

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	12.8	8.75	87	7.62	6.8	12,000
5.5	10.9	8.6	85	7.6	7.7	13,710

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/19/00			Investigator: C. Poukish Chris Lockett, Matt Barczyk-ENTRIX				
Location: R-16 Broomes Island		Depth: 31 ft.		Tide: ebb		County: CA\SM			Lat: Start 38 23.964 Stop 38 24.085			Long: Start 76 33.454 Stop 76 33.761	
Time: 10:08- Six minutes			Sample Gear: 16ft Otter Trawl			Station #: 5			Weather: overcast, 50F, wind 10-15 NNW				
Notes: one white perch with lesion on ventral right side behind pelvic fins, 3.5 mm size, histology 00CPPAWP32 female													

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																			1		2
Bay anchovy							1														
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	1																				
Atlantic croaker					1																

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.1	9.1	94	8.37	11.2	19,000
10M	13.1	10.5	100	8.29	11.3	19,100

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/21/00		Investigator: C. Poukish Chris Luckett, Matt Rowe, Karen Eason		
Location: R-16, Broomes Island	Depth: 30ft.	Tide: high-flood	County: CA\SM			Lat: Start 38 24.143 Stop 38 24.025		Long: Start 76 33.834 Stop 76 33.596		
Time: 09:31-Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 5		Weather: overcast, 60F, wind SSE 5-10mph			
Notes:										

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																		1			
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic Croaker											1									1	

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.7	10.3	108	8.49	10.8	18,400
9.9	13.7	9.8	103	8.4	10.9	18,500

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/21/00		Investigator: C. Poukish Chris Lockett, Matt Rowe, Karen Eason	
Location: R-24, below Rt. 231	Depth: 24ft.	Tide: ebb	County: CA\CH			Lat: Start 38 30.489 Stop 38 30.268		Long: Start 76 40.405 Stop 76 40.405	
Time: 10:14- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4		Weather: overcast, periods of rain, 60F, wind SSE 5-10		
Notes:									

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																			1	1	
Blue crabs #4																					
hogchoker							2	32	35	7		4									
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker										1											

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	14.3	10.2	105	8.4	7.8	13,570
5M	14.0	10.4	105	8.35	9.1	15,600

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/21/00		Investigator: C. Poukish Chris Lockett, Matt Rowe, Karen Eason		
Location: mouth of Swanson Creek		Depth: 13ft.	Tide: ebb		County: CA\CH		Lat: Start 38 31.601 Stop 38 31.783		Long: Start 76 39.927 Stop 76 39.995	
Time: 10:45- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 3			Weather: cloudy, rain, severe lightning		
Notes: one white perch with 2 lesions above lateral line, 3mm wide, irregular, risen, red- one white perch with red lesion above lateral line- 1mm wide.										

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															1	2	5	5	7	5	1
Blue crab #3																					
hogchoker							1	33	34	5	3	4	1	1	1	1					
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker				1																	

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
No data						
lightning						

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/25/00		Investigator: C. Poukish Chris Lockett, Bob Nailon ENTRIX			
Location: R-32 Potts Pt.	Depth: 14 ft.	Tide: High Ebb	County: CA\PG			Lat: Start 38 34.109 Stop 38 34.240		Long: Start 76 40.747 Stop 76 40.737			
Time: 11:56- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 1		Weather: overcast, scattered showers, 55F, wind NE 15				
Notes: Histological sample-White Perch with hemorrhaged eye 17cm-00CPPAWP35male----1 dead white perch, 1 dead crab											

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch														1	4	6	15	14	7	7	
Yellow bullhead																					
hogchoker							5	48	38	6	7	1	2								
Blue crab #61																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch																					
Yellow bullhead			1	1	1	2		1													

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	14.2	9.2	91	7.28	3.1	5,770
4 M	14.3	9.2	94	7.35	4.0	7,280

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/25/00	Investigator: C. Poukish Chris Lockett, Bob Nailon ENTRIX	
Location: off Swanson Creek	Depth: 12.5 ft.	Tide: High slack	County: CAICH	Lat: Start 38 31.725 Stop 38 31.916	Long: Start 76 40.001 Stop 76 40.170		
Time: 11:16- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 3	Weather: overcast, scattered showers, 55F, wind NE 15		
Notes: white perch with hemorrhaged eye, Five white perch with scale loss, reddening , and petechia on fins							

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															2	2	5	5	7	4	2
Atlantic croaker																					
hogchoker							1	8	13	4	1		1								
Blue crab #3																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch					1																
Atlantic croaker			1																		

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	14.2	9.4	96	8.02	5.7	10,070
3.9M	13.96	9.0	87	7.9	8.5	14,740

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/25/00		Investigator: C. Poukish Chris Lockett, Bob Nailon ENTRIX		
Location: R-24, below Rt. 231	Depth: 23 ft.	Tide: High Flood	County: CA\CH			Lat: Start 38 30.424 Stop 38 30.563	Long: Start 76 40.424 Stop 76 40.408			
Time: 10:41- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 4		Weather: cloudy, rain, wind NE 15 mph, 55F				
Notes:										

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																	1				
Atlantic croaker																					
hogchoker							2	15	19	2	3	3		1							
Blue crab #2																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker										1		1									

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	14.1	9.7	101	8.34	6.8	12,010
5.7M	13.6	8.0	83	8.02	9.9	17,000

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/25/00		Investigator: C. Poukish Chris Lockett, Bob Nailon ENTRIX		
Location: R-16, Broomes Island		Depth: 37-38 ft.	Tide: flood	County: CA/SM		Lat: Start 38 23.993 Stop 38 23.850	Long: Start 76 33.583 Stop 76 33.468			
Time: 09:51- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 5		Weather: overcast, rain, wind NE 5mph, 55F				
Notes:										

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Spotted hake													1								
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker						3	1		2	1		2				1					

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	14.0	10.4	110	8.63	9.6	16,500
15.7	13.2	9.0	91	8.18	10.7	18,100

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill		Date: 4/27/00	Investigator: C. Poukish Chris Luckett, Tracy MacMillan ENTRIX	
Location: R-32, Potts Point	Depth: 15 ft.	Tide: high slack	County: CA-PG	Lat: Start 38 34.350 Stop 38 34.216	Long: Start 76 40.767 Stop 76 40.674		
Time: 11:42- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 1	Weather: overcast, scattered showers, 55F, wind SE 10-15		
Notes: White perch- 1 18cm with lesion 3mm wide, 1 16cm with tumor on pelvic fin, 12 with petechia on fins (caudal, pelvic, pectoral, anal), 1 9cm hogchoker with lesions on operculum.							

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch														3	5	14	16	13	5	1	2
Channel catfish																					
hogchoker							1	19	27	5	2	1	2								
Blue crab #21																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Channel catfish																			1		
Brown bullhead						1															

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	13.2	9.89	98	8.08	5.0	9,030
2.9	13.5	9.3	92	7.99	6.6	11,680

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/27/00		Investigator: C. Poukish Chris Lockett, Tracy MacMillan ENTRIX		
Location: off Swanson Creek		Depth: 13ft.	Tide: high flood	County: CA\CH		Lat: Start 38 32.046 Stop 38 31.950		Long: Start 76 40.143 Stop 76 40.111		
Time: 11:02- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 3		Weather: cloudy, scattered showers, 55F, SE wind 10-15				
Notes: white perch- 7 with slight petechia on pectoral and pelvic fins, 1 with tumor on dorsal fin										

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															1	2	2	4	5	6	1
Blue crab #2																					
hogchoker							1	4	6	3	1	1		1							
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch			1																		
Atlantic croaker								1	1												

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	13.4	9.16	93	8.26	7.7	13,420
2.6M	13.4	9.6	96	8.22	7.7	13,410

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/27/00		Investigator: C. Poukish Chris Lockett, Tracy Macmillan ENTRIX			
Location: R-24, below Rt. 231 bridge	Depth: 30-24ft.	Tide: high flood	County: CA\CH			Lat: Start 38 30.593 Stop 38 30.456		Long: Start 76 40.391 Stop 76 40.400			
Time: 10:28- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4			Weather: overcast, scattered showers, 55F, wind SE 10-15			
Notes:											

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
hogchoker					1			24	31	5	5	6	1								
Spotted hake													1								
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.4	9.6	98	8.45	8.0	13,970
9.1M	13.6	8.1	82	8.13	8.7	15,100

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 4/27/00		Investigator: C. Poukish Chris Lockett, Tracy MacMillan ENTRIX		
Location: R-16, Broomes Island		Depth: 34ft.	Tide: high flood	County: CA\SM		Lat: Start 38 23.992 Stop 38 23.901		Long: Start 76 33.565 Stop 76 33.371		
Time: 09:43- Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 5		Weather: cloudy, scattered showers, 55F, wind SSE 5-8 mph			
Notes: white perch- 2 with petechia on fins and ventral side										

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																	1	1	1		
spot																					
Atlantic croaker																					
Spotted hake												1	1								
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
spot	1																				
Atlantic croaker						1			1												

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	13.84	11.4	121	8.96	10.1	17,200
10.4M	13.23	8.5	87	8.17	10.6	18,100

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 5/2/00			Investigator: C. Poukish Chris Luckett, Bob Nailon ENTRIX			
Location: R-32, Potts Point		Depth: 13-14ft		Tide: high flood		County: CA\PG			Lat: Start 38 34.094 Stop 38 34.313		Long: Start 76 40.693 Stop 76 40.754	
Time: 11:35-Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 1			Weather: partly cloudy, 65F, wind 20mph				
Notes: one white perch with lesion on right side near pectoral fin, Histology 00CPPAHO36, 37—eroded tail, large lesion 8mm, small lesions on #36												

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch													1	2	2	8	12	20	11	3	3
Hogchoker +20							2	33	25	12	12	10	8		2						
Blue crab 17																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Yellow bullhead			1																		
Atlantic croaker							1														

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
0.5	16.8	8.1	84	7.09	2.4	4,460
3.7M	16.5	8.65	89	7.22	3.6	6,630

Fish-Counting Record-MDE

River: Patuxent River				Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill				Date: 5/2/00		Investigator: C. Poukish Chris Luckett, Bob Nailon ENTRIX	
Location: R-16, Broomes Island		Depth: 30ft.		Tide: flood		County: CA\SM		Lat: Start 38 24.030 Stop 38 23.936		Long: Start 76 33.604 Stop 76 33.438	
Time: 09:42-Six minutes		Sample Gear: 16ft Otter Trawl				Station #: 5		Weather: cloudy, 60F, wind NW 5mph			
Notes: one white perch with 2cm lesion near vent											

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																		1	1		
Blue crab 3																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker						1				2											

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	15.6	11.0	119	8.96	9.2	15,900
12.5M	13.7	9.2	91	8.3	10.3	17,500

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 5/2/00			Investigator: C. Poukish Chris Lockett, Bob Nailon ENTRIX			
Location: R-24, Rt. 231		Depth: 24ft.	Tide: flood	County: CA\CH			Lat: Start 38 30.365 Stop 38 30.493			Long: Start 76 40.465 Stop 76 40.371		
Time: 10:32-Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4			Weather: partly cloudy, 60F, wind N 5-10mph				
Notes:												

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																		1			
hogchoker							2	27	25	6	3	4	3	2							
Blue crab 2																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Oyster toad	1																				

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	16.3	9.32	99	8.31	5.9	10,490
3.2M	15.7	8.9	94	8.28	6.8	11,940

Fish-Counting Record-MDE

River: Patuxent River				Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill				Date: 5/2/00		Investigator: C. Poukish Chris Luckett, Bob Nailon ENTRIX			
Location: mouth of Swanson Creek		Depth: 12ft.		Tide: flood		County: CA\CH			Lat: Start 38 31.824 Stop 38 31.947		Long: Start 76 40.047 Stop 76 40.123		
Time: 11:04- Six minutes			Sample Gear: 16ft Otter Trawl				Station #: 3			Weather: partly cloudy, 65F, wind N 15-20			
Notes:													

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																	1		1		
hogchoker							3	22	13	6	3		2								
Blue crab 4																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	1																				
Yellow bullhead								1													
Atlantic croaker							1			1											

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	16.5	8.75	93	7.9	4.9	8,800
3.0 M	15.97	8.73	91	8.13	6.2	10,410

Fish-Counting Record-MDE

River: Patuxent River				Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill				Date: 5/4/00		Investigator: C. Poukish Chris Luckett	
Location: R-32, Potts Point		Depth: 14-17ft.		Tide: flood		County: CA\PG		Lat: Start 38 34.371 Stop 38 34.171		Long: Start 76 40.812 Stop 76 40.710	
Time: 12:27- Six minutes		Sample Gear: 16ft Otter Trawl				Station #: 1		Weather: sunny, 70F, wind S 10-15mph			
Notes: one white perch with lesion on left ventral side, 1.5cm wide-22Cm male											

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch												1			3	8	7	15	4	4	2
Hogchoker +24							9	31	49	14	11	9	3		1						
Blue crab 3																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch	5																				

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	18.4	7.66	82	7.01	2.0	3,740
4.1M	17.85	7.5	80	7.01	2.9	5,350

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 5/4/00		Investigator: C. Poukish Chris Luckett	
Location: mouth of Swanson Creek		Depth: 12-13.5ft	Tide: flood	County: CA\CH		Lat: Start 38 32.100 Stop 38 31.913		Long: Start 76 40.327 Stop 76 40.208	
Time: 11:14- Six minutes		Sample Gear: 16ft Otter Trawl		Station #: 3		Weather: sunny, 70F, wind 10-15mph			
Notes: Histology 00CPPAWP38 - 2Cm wide lesion on right ventral side, one white perch observed with 3mm risen red tumor									

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch															2	9	13	11	3	5	1
Yellow bullhead																					
Hogchoker +40							4	40	34	15	9	12	7	1	1	1	1				
(blue crab 9)																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
White perch		1																			
Yellow bullhead					1		1				1										
American eel												1									
Channel catfish														1							

Hydrolab Readings

<u>Depth</u>	<u>Temp.</u>	<u>D.O.</u>	<u>% Sat.</u>	<u>pH</u>	<u>Salinity</u>	<u>Cond</u>
<u>0.5</u>	<u>18.4</u>	<u>9.16</u>	<u>101</u>	<u>8.01</u>	<u>4.0</u>	<u>7,290</u>
<u>3.4M</u>	<u>17.0</u>	<u>8.3</u>	<u>89</u>	<u>8.16</u>	<u>6.1</u>	<u>10,770</u>

Fish-Counting Record-MDE

River: Patuxent River			Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill			Date: 5/4/00		Investigator: C. Poukish Chris Luckett		
Location: R-24, Rt. 231	Depth: 26-29ft	Tide: flood	County: CA\CH			Lat: Start 38 30.520 Stop 38 30.291		Long: Start 76 40.434 Stop 76 40.399		
Time: 10:39-Six minutes		Sample Gear: 16ft Otter Trawl			Station #: 4		Weather: sunny, 70F, wind 10-15mph			
Notes:										

Cm

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
White perch																	3	1		1	1
Oyster toad															1						
Hogchoker +40 (blue crab 5)							3	40	29	7		6	5	3							
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Oyster toad				1																	
Atlantic croaker								1							1						

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	17.6	9.69	107	8.48	5.5	9,870
8M	16.86	9.1	97	8.37	6.7	11,730

Fish-Counting Record-MDE

River: Patuxent River				Study: Oil Spill Damage Assessment from Chalk Point Power Plant spill				Date: 5/4/00		Investigator: C. Poukish Chris Luckett	
Location: R-16, Broomes Island		Depth: 30ft.		Tide: flood		County: CA SM		Lat: Start 38 24.031 Stop 38 23.933		Long: Start 76 33.607 Stop 76 33.405	
Time: 09:52-Six minutes		Sample Gear: 16ft Otter Trawl				Station #: 5		Weather: sunny, 65F, wind 5-10mph			
Notes:											

Cm																					
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Spotted hake															1						
Atlantic croaker																					
Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Atlantic croaker					4	2			1		1	1									
spot						1															

Hydrolab Readings

Depth	Temp.	D.O.	% Sat.	pH	Salinity	Cond
0.5	16.4	11.7	129	9.1	9.3	16,000
9.4M	15.5	9.9	104	8.7	9.6	16,500

FISH COMMUNITY ASSESSMENT, PATUXENT RIVER-2000

Station #5

DATE

SPECIES

	white perch	hogchoker	atl. croaker	spotted hake	bay anchovy	spot	blue crab
12-Apr	8		4	1			
14-Apr	2	1	3				
19-Apr	4		1			1	
21-Apr	1		2				
25-Apr			10	1			
27-Apr	3		2	2			1
2-May	2		3				3
4-May			9	1			1

Supporting Documents for the MDE Trawl Survey April 10 – May 4, 2000

Summary of crabs collected during the MDE trawl survey, April 21 - May 4, 2000

Date	Station	Species	Abundance per Trawl	Abundance per Acre
4/21/00	3	Blue crab	3	7.18
		Horseshoe crab	0	0
4/21/00	4	Blue crab	4	8.08
		Horseshoe crab	0	0
4/21/00	5	Blue crab	0	0
		Horseshoe crab	0	0
4/25/00	1	Blue crab	61	207.14
		Horseshoe crab	0	0
4/25/00	3	Blue crab	3	5.9
		Horseshoe crab	0	0
4/25/00	4	Blue crab	2	6.49
		Horseshoe crab	0	0
4/25/00	5	Blue crab	0	0
		Horseshoe crab	0	0
4/27/00	1	Blue crab	21	61.97
		Horseshoe crab	0	0
4/27/00	3	Blue crab	2	8.96
		Horseshoe crab	0	0
4/27/00	4	Blue crab	0	0
		Horseshoe crab	0	0
4/27/00	5	Blue crab	0	0
		Horseshoe crab	0	0
4/30/00	1	Blue crab	11	28.60
		Horseshoe crab	0	0
4/30/00	3	Blue crab	10	26.00
		Horseshoe crab	0	0
4/30/00	4	Blue crab	3	7.80
		Horseshoe crab	0	0
4/30/00	5	Blue crab	0	0.00
		Horseshoe crab	1	2.60
5/2/00	1	Blue crab	17	33.64
		Horseshoe crab	0	0
5/2/00	3	Blue crab	4	12.99
		Horseshoe crab	0	0
5/2/00	4	Blue crab	2	6.21
		Horseshoe crab	0	0
5/2/00	5	Blue crab	3	8.24
		Horseshoe crab	0	0
5/4/00	1	Blue crab	3	6.14
		Horseshoe crab	0	0
5/4/00	3	Blue crab	9	19.36
		Horseshoe crab	0	0
5/4/00	4	Blue crab	5	9.76
		Horseshoe crab	0	0
5/4/00	5	Blue crab	0	0
		Horseshoe crab	0	0

AVERAGE

Blue crab
Horseshoe crab

7.09	20.19
0.04	0.11

Appendix B - Patuxent River Ichthyoplankton Survey. (Survey conducted at the request of the Trustees and responsible parties.)

PATUXENT RIVER ICHTHYOPLANKTON SURVEY

Introduction

Following the oil spill from a broken pipeline at the Chalk Point Power Station on April 7, 2000, the Maryland Department of Natural Resources conducted a survey of the Patuxent River to describe ichthyoplankton community, which could be impacted by the spill. The following presents descriptions of the sampling and laboratory protocols, summarizes the catch and provides insight as to species composition, abundance and distribution.

Materials and Methods

Field:

Sampling was conducted in the Patuxent River from Sheridan Point (rkm 29) to Lyons Creek (rkm 66) (Figure 1). Efforts were taken to insure that the striped bass spawning area was included in the sampling. This spawning area has been described from historic collections (Hollis, 1967; Setzler et al., 1979; Mihursky et al., 1980; Secor et al., 1994) to potentially include from Lyons Creek to Chalk Point (rkm 38). The total survey area was sampled using a stratified-random design including six regions, each with four 1.61 km (1 mile) strata. For each sampling trip, a single segment was randomly selected from each stratum, and sampled with a single ichthyoplankton tow. Regions were numbered from Sheridan Point (Region 1) upstream to Lyon's Creek (Region 6). Sampling trips were made on at least two days per week from the week starting April 10 through May 15, 2000. There were 13 sampling trips during that period in which 75 samples were collected. Samples were collected using a 1.53 x 1.53-m mid-water trawl fitted with a plankton net in the cod-end to more effectively sample fish eggs and larvae. The mouth of the mid-water trawl, approximately 1 m deep, was made of 3.18-cm stretch-mesh nylon, and the remainder was made of 1.27-cm stretch-mesh nylon. The plankton net, mounted in the cod-end as a liner, was 0.5 m diameter, with a 8:1 length to mouth ratio made of 505- μ m Nitex®. This was the same gear used to collect egg-juvenile striped bass in the Choptank River (Uphoff, 1989 and 1993) and upper Chesapeake Bay (Kernehan et.al., 1981). The gear was towed near surface for five minutes in the direction of the water current at standard tow speed based on engine RPM's. Catch data was tabulated and presented as number per unit of collection effort, i.e., a plankton tow for a standard duration and at a standard speed. Samples were preserved with 5-10 percent buffered formalin. Data recorded at each station included, location number, date, time, latitude/longitude, and water temperature, dissolved oxygen and salinity of surface and bottom waters.

Laboratory:

Samples were rinsed with freshwater to remove the preservative; specimens were removed from the sample detritus, and identified to the lowest practical taxonomic level. The laboratory process was conducted in two phases; samples were rinsed and specimens removed as part of Phase 1, and specimens were identified, measured and counted as part of Phase 2. Both phases

were subject to a Continuous Sampling Plan, Type 1 quality control program, which by its design and execution insures a maximum aggregate error of 10 percent or less. Briefly, this program requires the independent inspection of sample units by a qualified person to insure that at least 95 percent of contents were removed or identified and counted by the technician/biologist during each of two processing Phases. The technician/biologist must process 18 consecutive units without failing a QC inspection before proceeding to the less intensive random inspection procedure when one in seven units are inspected. If at any time a technician/biologist fails an inspection, then they revert to 100 percent inspections and must pass 18 consecutive inspections before returning to the random protocol.

During Phase 1 after rinsing and before specimen removal, rose bengal stain was added to the sample to facilitate sorting. Also during Phase 1, a volumetric split sub-sampling technique was used when settled material in the sample was greater than 400 ml and/or if number of ichthyoplankton specimens was greater than 500. Sub-sampling was used in 10 of 75 collections processed.

During Phase 2, all ichthyoplankters were identified, classified by developmental stage and counted. Members of the genus *Morone* received additional processing. All specimens of *Morone* 10-15 mm total length (TL) were cleared and stained using the techniques described by Fritzsche and Johnson (1981) and Waldman and Andreyko (1993) to facilitate identification to species. Specimens of that size cannot be identified to species reliably based solely on external morphological characteristics. Up to 30 specimens of each developmental stage of striped bass (*Morone saxatilis*), from each collection were measured to the nearest tenth of a millimeter. However, for purposes of basic data summarization, striped bass length data is presented in tabular form grouped in one millimeter increments where, for example, "3 mm" includes individuals from 2.1 to 3.0 mm total length (TL).

Pertaining to the identification of the larval stages of herrings, there is an equivocal stage at which the postlarval forms of blueback herring (*Alosa aestivalis*), alewife (*A. pseudoharengus*), and gizzard shad (*Dorosoma cepedianum*) can not be easily separated using morphological features. This stage begins when the gizzard shad has absorbed its yolk at approximately 6.5 mm TL, and continues until the anal fin rays can be counted at 18 - 20+ mm TL. Therefore laboratory identifications were made by developmental stage as follows:

Yolksac-	<i>Alosa</i> spp. (blueback herring/alewife) gizzard shad
Postlarvae-	herrings (blueback herring, alewife and gizzard shad)
> ~20 mm TL-	<i>Alosa</i> spp. (blueback herring/alewife) gizzard shad

However, for discussion purposes in the section to follow, all life stages of *Alosa* spp. and gizzard shad were grouped into the aggregate taxon of "herrings". Since the character of this component of the ichthyoplankton community was defined by the much larger aggregate group which could not be separated as discussed previously, the relatively few individuals that were identified to genus or species did not justify individual treatment. To prevent a loss of information, the summary table with the total catch includes taxa at the lowest level of

identification achieved in the laboratory. This table presents the catch as total number collected. However, summary tables by taxon, weeks and regions present the data in terms of number per plankton tow to insure the comparability of weeks and regions when and where collection effort was not always equal.

Results

General Catch Composition:

Totals of 2,327 fish eggs, 979 yolksac larvae, 51,402 postlarvae, and 330 juveniles were collected in 75 samples taken during the spring of 2000 (Table 1). Specimens of at least 13 taxa were collected. However, herrings, white perch and striped bass comprised more than 99 percent of the total catch. All other taxa, except Atlantic menhaden (*Brevoortia tyrannus*), carp (*Cyprinus carpio*), Atlantic silverside (*Menidia menidia*), and yellow perch (*Perca flavescens*), were represented by 10 or fewer individuals in the total catch. During the collection period April 10 – May 15, 2000, surface water temperature ranged from 12 to 26.8°C, exhibiting a typical spring warming pattern (Table 2). Surface salinity data indicated two relatively distinct partitions within the study area; fresh/low salinity in Regions 4, 5 and 6, with values ranging from 0.1 to 1.26 ppt., and oligo-/mesohaline salinities in Regions 1, 2, and 3, with values ranging to 9.5 ppt. Summaries of the catch data for the three dominant taxa are presented below in order of decreasing abundance.

Species Accounts:

Herrings - The herring group includes blueback herring, alewife and gizzard shad. A total of 34,781 herrings was collected comprising 63.2 percent of the total catch. This included 118 eggs (1 *Alosa* sp. and 117 gizzard shad), 366 yolksac larvae (43 *Alosa* sp. and 323 gizzard shad), 33,912 postlarvae (including 240 *Alosa* sp. and 48 gizzard shad), and 145 juveniles (all *Alosa* sp.) (Table 1). A map of the distribution of herring is provided in Figure 2.

Herring eggs were collected during the weeks of April 10 and 17, and May 8 and 15 at water temperatures ranging from 12 to 26.3°C and salinity ranging from 0.1 to 7.6 ppt (Tables 2 and 3). One *Alosa* sp. egg was collected the week of April 10 in Region 5. The remaining eggs collected were gizzard shad. Herring eggs were most abundant during the week of May 15 with an average number per tow of 8.0. Eggs were collected in all regions but Regions 1 and 3, and were most abundant in Region 5 with an average number per tow of 8.7.

Herring yolksac larvae were collected during the weeks of April 10 through May 8 at water temperatures ranging from 13.82 to 26.3°C and salinity ranging from 0.1 to 3.1 ppt (Tables 2 and 3). Herring yolksac larvae were most abundant the week of May 8 with an average number per tow of 24.9. Yolksac larvae were collected in Regions 3 through 6 and were most abundant in Region 5 with an average number per tow of 25.8.

Herring postlarvae were collected in all weeks of sampling at temperatures ranging from 12 to 26.3°C and salinity ranging from 0.1 to 7.4 ppt (Tables 2 and 3). Postlarvae were most abundant during the last two weeks of sampling with respective mean numbers per tow of 1,544.2 and 2,215.8. Post larvae were most abundant in the upstream portion of the study area in Region 5

followed by Region 6, with average numbers per tow of 2,009.0 and 993.5, and downstream in Regions 1 and 2, average numbers per tow were 1.3 to 1.9, respectively.

Herring juveniles were collected in Region 5 on May 15 with an average number per tow of 13.2 (Table 3). These were *Alosa* spp. juveniles. The temperature and salinity were 24.3 and 0.2 ppt (Table 2).

White perch - A total of 16,310 white perch was collected comprising 29.6 percent of the total catch. This included 286 eggs, 79 yolk sac larvae, and 15,945 postlarvae (Table 1). A map of the distribution of white perch is provided in Figure 3.

White perch eggs were collected during the weeks of April 10 through May 8 at water temperatures of 13 to 23.8°C and salinity ranging from 0.1 to 9.5 ppt (Tables 2 and 4). White perch eggs were most abundant during the week of April 17 with an average number per tow of 16.3. Eggs were collected from all regions but were most abundant in Region 5 with an average of 21.3 per tow.

White perch yolk sac larvae were collected during the weeks of April 10 through May 8 with water temperatures ranging from 13.7 to 23.8°C and salinity from 0.1 to 2.3 ppt (Tables 2 and 4). Yolk sac larvae were relatively low in abundance with weekly average numbers per tow ranging from 0.4 to 2.5. Larvae were only collected from Regions 3 through 6, and were most abundant in Region 6 with an average of 3.9 larvae per tow.

White perch postlarvae were collected during all weeks of sampling at water temperatures ranged from 13 to 26.3°C and salinity's of 0.1 to 6.7 ppt (Tables 2 and 4). Postlarvae were most abundant during the week of May 8 with an average number per tow of 899.3. Postlarvae were taken in all regions, but were most abundant in Region 5 with an average of 1,233.1 per tow.

Striped bass - A total of 3,640 striped bass was collected comprising 6.6 percent of the total catch. This included 1,916 eggs, 519 yolk sac larvae, 1,205 postlarvae, and 1 juvenile (Table 1). A map of the distribution of striped bass is provided in Figure 4.

Striped bass eggs were collected during the weeks of April 10 through May 8 at water temperatures ranged from 13 to 25.88°C and salinity ranged from 0.1 to 7.6 ppt (Tables 2 and 5). Striped bass eggs were most abundant during the week of April 17 with an average number per tow of 124.4. Eggs were taken in all regions, but the average number per tow was similarly high in Regions 4 and 5 with values of 85.0 and 74.5, respectively.

Striped bass yolk sac larvae were collected during the weeks of April 10 through May 8 at water temperatures and salinities ranged from 13.8 to 26.3°C and 0.1 to 0.8 ppt, respectively (Tables 2 and 5). Yolk sac larvae were most abundant during the week of May 8 with an average number per tow of 36.7. Yolk sac larvae were taken in Regions 3 through 6, but the average number per tow was similarly high upstream in Regions 4 and 5 with values of 18.6 and 24.7. No yolk sac larvae were collected downstream in Regions 1 and 2.

Striped bass postlarvae were collected during the weeks of April 24 through May 15 at water temperatures ranged from 13.99 to 26.3°C and salinity ranged from 0.1 to 0.8 ppt (Tables 2 and 5). Postlarvae were most abundant during the week of May 8 when the average number per tow was 95.9. Postlarvae were taken in Regions 3 through 6, but were most abundant in Region 5 where the average number per tow was 104.5. No postlarvae were collected in downstream

Regions 1 and 2. A total of 234 striped bass larvae were measured representing a subsample of the total catch (Table 6). Based on the aggregate distribution for weeks combined, individuals measured ranged from 3 to 19 mm TL with a modal length of 6 mm. Given the relatively small sample size of lengths (<40) during five of six collection periods, a detailed temporal discussion was not attempted.

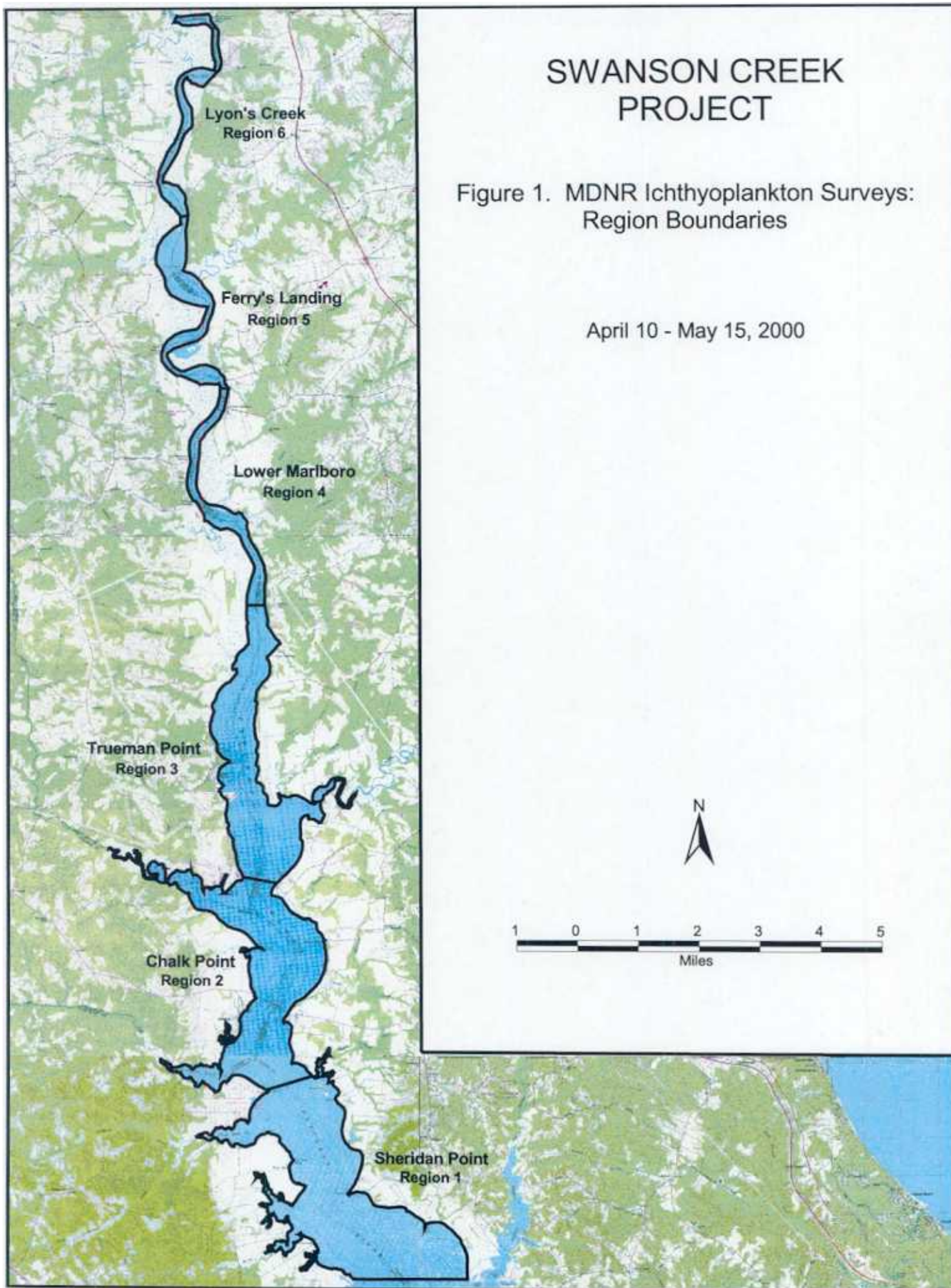
Literature Cited

- Fritzche, R.A., and G.D. Johnson. 1981. Early osteological development of white perch and striped bass with emphasis of identification of their larvae. *Transactions of the American Fisheries Society* 109:387-406.
- Hollis, E.H. 1967. An investigation of striped bass in Maryland. Maryland Department of Natural Resources, Federal Aid in Fish Restoration, F-3-R, Final Report, Annapolis.
- Kernehan, R.J., M.R. Headrick, and R.E. Smith. 1981. Early life history of striped bass in the Chesapeake and Delaware Canal and vicinity. *Transactions of the American Fisheries Society*. 110:121-136.
- Mihursky, J.A., K.V. Wood, S. Kerig, and E.M. Setzler-Hamilton. 1980. Chalk Point steam electric station studies, Patuxent estuary studies. Ichthyoplankton population studies 1979 final report. University of Maryland, Chesapeake Biological Laboratory, UMCEES 80-39-CBL, Solomons.
- Secor, D.M., E.D. Houde, and D.M. Monteleone. 1994. Development of otolith-marking methods to estimate survival and growth of early life stages of natural and hatchery-produced striped bass in the Patuxent River spawning area in 1991. Maryland Department of Natural Resources. CBRM-GRF-94-1, Annapolis.
- Setzler, E.M., K.V. Wood, D. Shelton, G. Drewry, and J.A.. Mihursky. 1979. Chalk Point steam electric station studies. Ichthyoplankton population studies 1978 data report. University of Maryland, Chesapeake Biological Laboratory, UMCEES 79-20-CBL, Solomons.
- Uphoff, J.H. 1989. Environmental effects on survival of eggs, larvae, and juveniles of striped bass in the Choptank River, Maryland. *Transactions of the American Fisheries Society* 118:251-263.
- Uphoff, J.H. 1993. Determining striped bass spawning stock status from the presence or absence of eggs in ichthyoplankton survey data. *North American Journal of Fisheries Management* 13:645-656.
- Waldman, J.R., and H. Andreyko. 1993. Variation in patterns of interdigitation among supraneurals, pterygiophores, and vertebral elements diagnostic for striped bass and white perch. *Copeia* 4:1097-1113.

SWANSON CREEK PROJECT

Figure 1. MDNR Ichthyoplankton Surveys:
Region Boundaries

April 10 - May 15, 2000



SWANSON CREEK PROJECT

Figure 2. MDNR Ichthyoplankton Surveys:
Percent Composition of
Herring

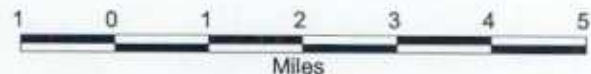
April 10 - May 15, 2000

Percent Catch

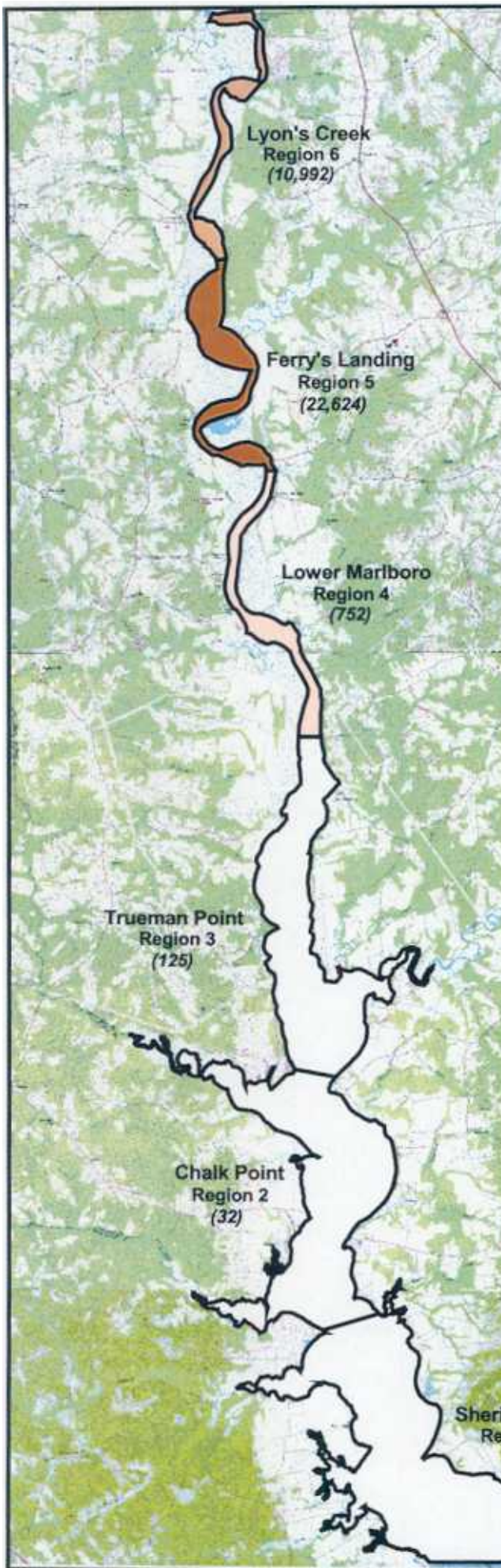


Total Catch

(#) Cumulative Total
in Catches



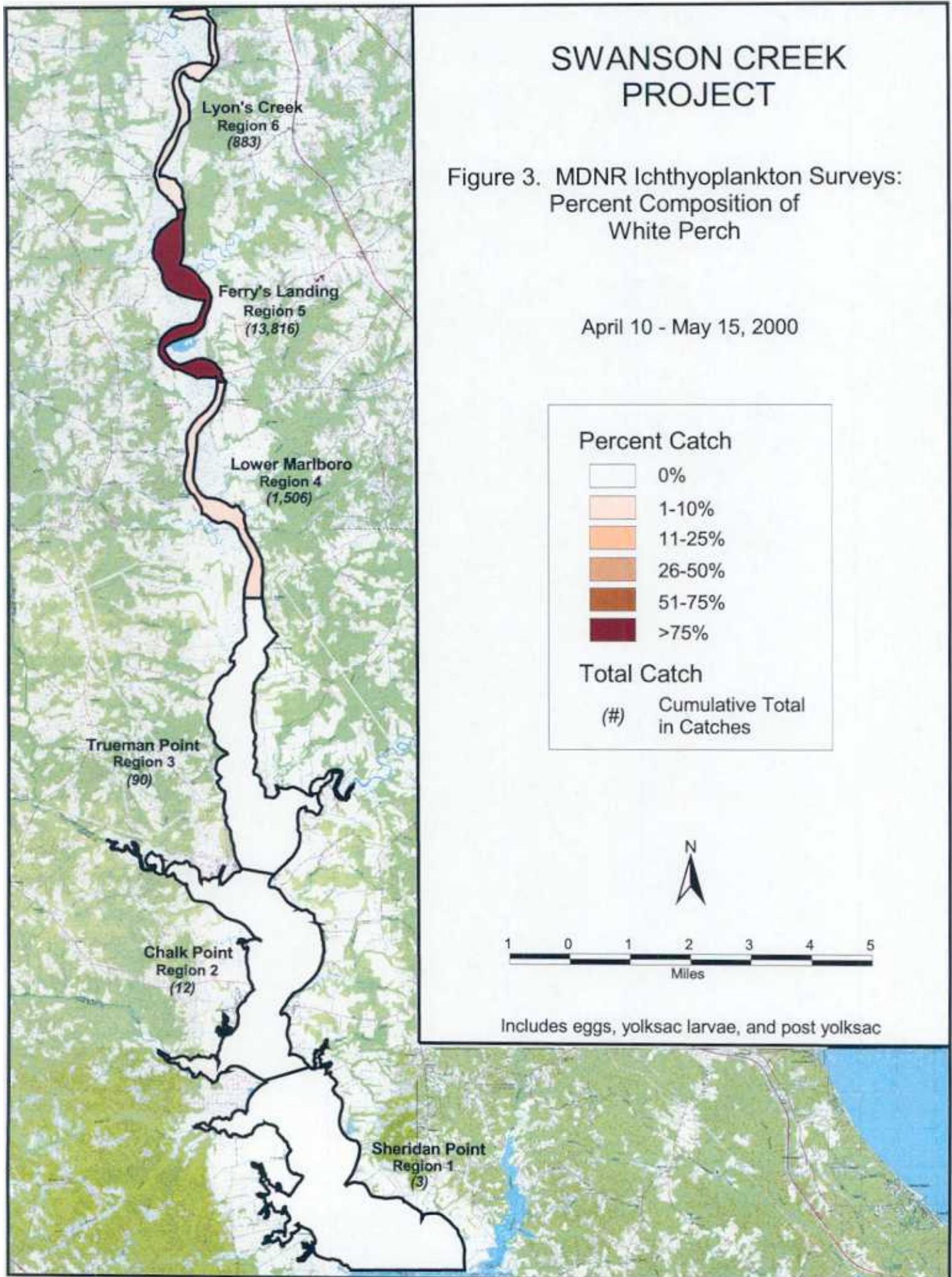
Includes eggs, yolk sac larvae, post yolk sac, and juveniles



SWANSON CREEK PROJECT

Figure 3. MDNR Ichthyoplankton Surveys:
Percent Composition of
White Perch

April 10 - May 15, 2000

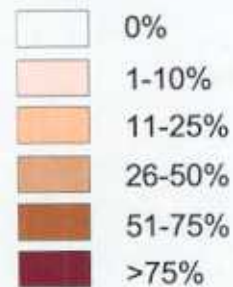


SWANSON CREEK PROJECT

Figure 4. MDNR Ichthyoplankton Surveys:
Percent Composition of
Striped Bass

April 10 - May 15, 2000

Percent Catch



Total Catch

(#) Cumulative Total
in Catches



Includes eggs, yolksac larvae, post yolksac, and juveniles

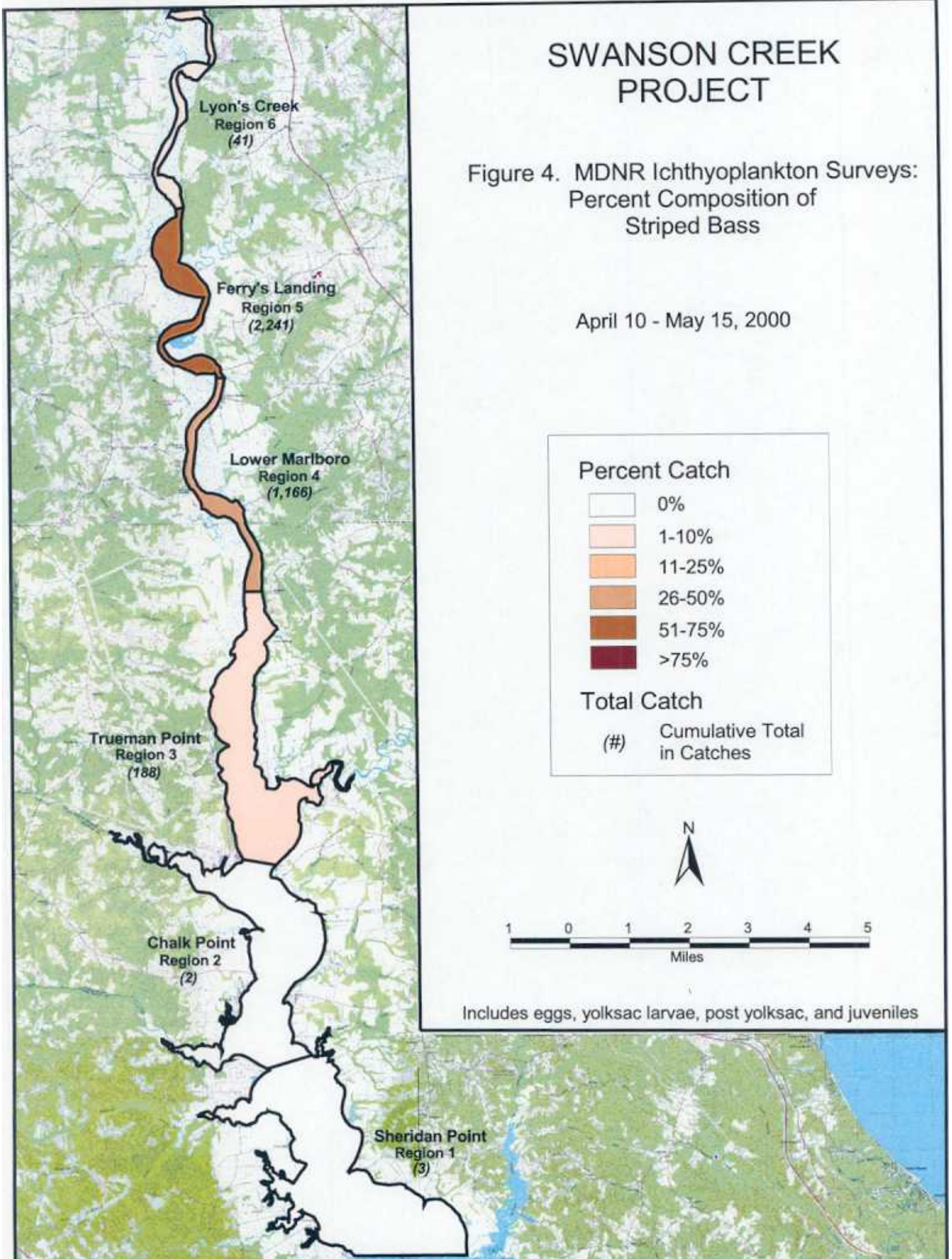


Table 1. Numbers of fish eggs, yolksac larvae, postlarvae and juveniles collected in 75 ichthyoplankton collections in the Patuxent River between Sheridan Point and Lyons Creek during April 10 through May 15, 2000.

Eggs:		
Unidentifiable fish		5
Blueback herring/alewife	<i>Alosa sp.</i>	1
Gizzard shad	<i>Dorosoma cepedianum</i>	117
Atlantic silverside	<i>Menidia menidia</i>	2
White perch	<i>Morone americana</i>	286
Striped bass	<i>Morone saxatilis</i>	1916
Yolksac Larvae:		
Blueback herring/alewife	<i>Alosa spp.</i>	43
American shad	<i>Alosa sapidissima</i>	1
Gizzard shad	<i>Dorosoma cepedianum</i>	323
Common carp	<i>Cyprinus carpio</i>	5
Atlantic silverside	<i>Menidia menidia</i>	9
White perch	<i>Morone americana</i>	79
Striped bass	<i>Morone saxatilis</i>	519
Postlarvae:		
Herrings		33,864
Blueback herring/alewife	<i>Alosa spp.</i>	240
Atlantic menhaden	<i>Brevoortia tyrannus</i>	10
Gizzard shad	<i>Dorosoma cepedianum</i>	48
Common carp	<i>Cyprinus carpio</i>	4
Atlantic silverside	<i>Menidia menidia</i>	12
White perch/striped bass	<i>Morone spp.</i>	2
White perch	<i>Morone americana</i>	15,945
Striped bass	<i>Morone saxatilis</i>	1205
Tessellated darter	<i>Etheostoma olmstedi</i>	2
Yellow perch	<i>Perca flavescens</i>	70
Larvae:		
Unidentifiable fish		6
Juvenile:		
Bay anchovy	<i>Anchoa mitchilli</i>	8
Blueback herring/alewife	<i>Alosa spp.</i>	145
Atlantic menhaden	<i>Brevoortia tyrannus</i>	87
Common carp	<i>Cyprinus carpio</i>	2
Striped bass	<i>Morone saxatilis</i>	1
Yellow perch	<i>Perca flavescens</i>	84
Hogchoker	<i>Trinectes maculatus</i>	3

Table 2. Surface water temperature (C) and salinity (ppt) by week and region measured in the Patuxent River between Sheridan Point and Lyons Creek from April 10 through May 15, 2000.

Surface Temperature

Date	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
Apr-14	12	13	13.5	13.82	13.73	13.7
Apr-17	14.7	15.1	15.7	16	16.3	16.6
Apr-20	14.8	14.2	14.6	14.4	14.1	12.7
Apr-24	14.5	14.4	14.5	14.3	14.4	13.9
Apr-27	13.3	13.4	13.5	13.6	13.99	13.5
May-1	14.9	15.2	15.5	15.3	15.6	15.5
May-3	16.6	17.8	17.4	18.4	18	18.2
May-8	21.4	22.5	24.3	23.3	23.7	23.8
May-10	23.72	24.25	25.07	25.13	25.88	26.3
May-15	21.1	22.1	24.3	25	24.3	24.1

Surface Salinity

Date	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
Apr-14				1.26	0.18	0.17
Apr-17	9.5	8.2	2.5	0.2	0.1	0.1
Apr-20	7.6	6.9	3.1	0.3	0.1	0.1
Apr-24	8.6	5.6	1.4	0.2	0.1	0.1
Apr-27	8.2	7.8	3.1	1.7	0.1	0.1
May-1	5.4	4.4	0.5	0.1	0.1	0.1
May-3	6	3.8	0.8	0.1	0.1	0.1
May-8	7.4	6.5	2.3	0.5	0.2	0.1
May-10	7	6.03	4.04	0.55	0.21	0.14
May-15	8	6.7	3.7	0.8	0.2	0.1

Table 3. Average catch per tow and percent of composition by week and by region of herrings collected in the Patuxent River between Sheridan Point and Lyons Creek from April 10 through May 15, 2000.

Herring Eggs

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyons Cr	Weekly Mean	Percent Composition
10-Apr					1		0.0	0%
17-Apr		2		2	39		3.6	26%
24-Apr							0.0	0%
1-May							0.0	0%
8-May		2			24		2.2	16%
15-May					32	16	8.0	58%
Regional Mean	0.0	0.3	0.0	0.2	8.7	1.5		
Percent Composition	0%	3%	0%	2%	82%	14%		

Herring Yolksac

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyons Cr	Weekly Mean	Percent Composition
10-Apr				2	2	4	0.4	1%
17-Apr					3	5	0.7	2%
24-Apr			1		12	5	1.5	5%
1-May			2		1	30	2.8	9%
8-May				29	266	4	24.9	83%
15-May							0.0	0%
Regional Mean	0.0	0.0	0.2	2.8	25.8	4.4		
Percent Composition	0%	0%	1%	8%	78%	13%		

Herring Post Larvae

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyons Cr	Weekly Mean	Percent Composition
10-Apr		3	2	108	76		9.0	0.2%
17-Apr			4	72	574	31	56.8	1.4%
24-Apr			3	24	160	66	21.1	0.5%
1-May	5		20	225	461	259	80.8	2.1%
8-May	10	8	66	246	12284	5916	1544.2	39.3%
15-May	1	17	27	44	8544	4656	2214.8	56.4%
Regional Mean	1.3	1.9	8.1	65.4	2009.0	993.5		
Percent Composition	0.0%	0.0%	0.2%	1.7%	51.2%	25.3%		

Herring Juveniles

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyons Cr	Weekly Mean	Percent Composition
10-Apr							0.0	0%
17-Apr							0.0	0%
24-Apr							0.0	0%
1-May							0.0	0%
8-May							0.0	0%
15-May					145		24.2	100%
Regional Mean	0.0	0.0	0.0	0.0	13.2	0.0		
Percent Composition	0%	0%	0%	0%	100%	0%		

Table 4. Average catch per tow and percentages by week and region of white perch collected in the Patuxent River between Sheridan Point and Lyons Creek from April 10 through May 15, 2000.

White Perch Eggs

Week of	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Weekly Mean	Percent Composition
	Sheridan Pt	Chalk Pt	Trueman Pt	Lwr Marlboro	Ferry Landing	Lyon's Cr		
10-Apr		1	1	1	42	4	2.3	11%
17-Apr	1	2	1	7	184		16.3	74%
24-Apr				1			0.1	0%
1-May					2	28	2.5	11%
8-May				1	6	4	0.9	4%
15-May							0.0	0%
Regional Mean	0.1	0.2	0.1	0.9	21.3	3.3		
Percent Composition	0%	1%	1%	4%	82%	13%		

Formatted

White Perch Yolksac

Week of	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Weekly Mean	Percent Composition
	Sheridan Pt	Chalk Pt	Trueman Pt	Lwr Marlboro	Ferry Landing	Lyon's Cr		
10-Apr				6	3	20	1.4	25%
17-Apr				11	14	5	2.5	45%
24-Apr						3	0.3	5%
1-May					1	11	1.0	18%
8-May			1			4	0.4	8%
15-May							0.0	0%
Regional Mean	0.0	0.0	0.1	1.5	1.6	3.9		
Percent Composition	0%	0%	1%	21%	23%	54%		

Formatted

White Perch Post Larvae

Week of	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Weekly Mean	Percent Composition
	Sheridan Pt	Chalk Pt	Trueman Pt	Lwr Marlboro	Ferry Landing	Lyon's Cr		
10-Apr		8	4	212	727	51	47.7	4%
17-Apr			5	407	1382	31	152.1	12%
24-Apr			6	46	1188	167	117.3	9%
1-May	1		72	430	211	59	64.4	5%
8-May	1			382	9928	480	899.3	69%
15-May		1		2	128	16	24.5	2%
Regional Mean	0.2	0.6	5.8	134.5	1233.1	73.1		
Percent Composition	0%	0%	0%	9%	85%	5%		

Formatted

Table 5. Average catch per tow and percentages by week and region of striped bass collected in the Patuxent River between Sheridan Point and Lyons Creek from April 10 through May 15, 2000.

Striped Bass Eggs

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyon's Cr	Weekly Mean	Percent Composition
10-Apr		1	5	2	36		2.1	1%
17-Apr	3		12	758	720		124.4	79%
24-Apr			1	4	8	1	1.2	1%
1-May			131	171	45	8	29.6	19%
8-May					10		0.8	1%
15-May							0.0	0%
Regional Mean	0.3	0.1	9.9	85.0	74.5	0.8		
Percent Composition	0%	0%	6%	50%	44%	0%		

Striped Bass Yolksac

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyon's Cr	Weekly Mean	Percent Composition
10-Apr				4			0.2	0%
17-Apr			8	18			2.2	5%
24-Apr				3	5		0.7	2%
1-May			30	10	1		3.4	8%
8-May				170	266	4	36.7	85%
15-May							0.0	0%
Regional Mean	0.0	0.0	2.5	18.6	24.7	0.4		
Percent Composition	0%	0%	5%	40%	53%	1%		

Striped Bass Post Larvae

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyon's Cr	Weekly Mean	Percent Composition
10-Apr							0.0	0%
17-Apr							0.0	0%
24-Apr					4		0.3	0%
1-May			1	1			0.2	0%
8-May				25	1098	28	95.9	92%
15-May					48		8.0	8%
Regional Mean	0.0	0.0	0.1	2.4	104.5	2.5		
Percent	0%	0%	0%	2%	95%	2%		

Striped Bass Juveniles

Week of	Region 1 Sheridan Pt	Region 2 Chalk Pt	Region 3 Trueman Pt	Region 4 Lwr Marlboro	Region 5 Ferry Landing	Region 6 Lyon's Cr	Weekly Mean	Percent Composition
10-Apr							0.0	0%
17-Apr							0.0	0%
24-Apr							0.0	0%
1-May							0.0	0%
8-May							0.0	0%
15-May		1					0.2	100%
Regional Mean	0.0	0.1	0.0	0.0	0.0	0.0		
Percent Composition	0%	100%	0%	0%	0%	0%		

Table 6. Length frequency of subsampled striped bass taken in ichthyoplankton collections on the Patuxent River between Sheridan Point and Lyons Creek from April 10 through May 15, 2000.

Length Group	Week of Apr-10	Apr-17	Apr-24	May-1	May-8	May-15	Total by Length Group
2.1 - 3.0		9		11			20
3.1 - 4.0		9		9	4		22
4.1 - 5.0	1	3	1	1	23		29
5.1 - 6.0	2	2	2	8	75		89
6.1 - 7.0		2	2	6	25		35
7.1 - 8.0					5		5
8.1 - 9.0			1	1	7		9
9.1 - 10.0					6		6
10.1 - 11.0					4	1	5
11.1 - 12.0					3		3
12.1 - 13.0					5		5
13.1 - 14.0					4		4
14.1 - 15.0						1	1
15.1 - 16.0							0
16.1 - 17.0							0
17.1 - 18.0							0
18.1 - 19.0						1	1
Weekly Total	3	25	6	36	161	3	234

Appendix C - Standing stock estimates by species

Standing Stock Estimates by Species

The species-specific approach for developing standing stock estimates is provided below. The site-specific gear efficiency rates used for correcting the field measurements are provided in Table 4. The species abundance and biomass used to estimate standing stock are provided in Tables 5 and 6. The resulting standing stock estimates are provided by species in Table 1.

American Eel (*Anguilla rostrata*). Since adult and juvenile American eel may not be adequately represented in standard trawl or seine surveys, standing stock estimates were derived from the results of an MDNR eel survey in the Patuxent River conducted in June and July 1999 (Appendix D; Weeder 2001). The study reported summer standing stocks in abundance and biomass per acre near Benedict, MD. The summer estimates were adjusted for seasonal occurrence (56%) based on the CBL deep water trawl results (Homer et al. 1979). In the Patuxent River, CBL reported that eel were generally restricted to deeper water habitat and they found eel biomass in shallow water was 1.5% of the total eel biomass in the spring (Homer et al. 1979). Biomass per acre was estimated as follows:

Open Water: 3.13 kg per acre X 56% seasonal occurrence = 1.75 kg per acre

Shoreline/shoal: 1.75 kg per acre x 1.5% = 0.03 kg per acre

Atlantic Croaker (*Micropogonias undulatus*). Atlantic croaker are typically found in deeper, open water habitat (Lassuy 1983). This species was collected in the MDE trawl survey in April 2000. They were not reported in any surveys by CBL in 1978-79 (Homer et al. 1979). There were no eggs or larvae reported in the MDNR ichthyoplankton survey. The mean number of croaker collected during the MDE trawl surveys in April 2000 was corrected for gear efficiency using spot as a surrogate (Tables 4 and 5). Biomass was calculated by incorporating the mean length of croaker in the MDE trawl survey with the length:weight equation for Atlantic croaker reported by Hildebrand and Schroeder (1928) as ($W = 0.0425L^3 - 2.206L^2 + 46.151L - 283.75$). The biomass per acre was estimated for open water as follows:

3.56 fish per acre / 18% gear efficiency x 0.28 kg per fish = 5.54 kg per acre

Atlantic Menhaden (*Brevoortia tyrannus*). Atlantic menhaden have been reported during historic and recent open water and shoreline/shoal surveys. Menhaden were documented during the MDNR ichthyoplankton survey in April 2000. Atlantic menhaden are schooling fish and may not be adequately represented in trawls or beach seines. Therefore, biomass estimates were based on the results of the deep and shallow water purse seine surveys conducted in April by CBL (Homer et al. 1979). The CBL purse seine study found a mean biomass of 1.90 kg per acre in April.

Atlantic Silverside (*Menidia menidia*). Atlantic silverside were reported in open water and shoreline/shoal surveys in recent years. Eggs, larvae, juveniles, and adults were reported in the MDNR ichthyoplankton survey in April 2000. They were not reported in the MDE trawl survey in April 2000. Standing stock estimates were developed by adjusting the mean MDNR seine results in Table 7 by the relative seasonal occurrence in the CBL seine surveys (0.8%; Homer et al. 1979). The estimate was adjusted for gear efficiency (beach seine) and mean weight per fish reported in the CBL surveys (Tables 4 and 6). Since Atlantic silverside were documented in open water and shoreline/shoal surveys in recent years, biomass was estimated for both habitats as follows:

$$475.35 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 81.8\% \text{ gear efficiency} \times 0.00464 \text{ kg per fish} \\ = 0.022 \text{ kg per acre}$$

Bay Anchovy (*Anchoa mitchilli*). Bay anchovy have been reported in the vicinity of the spill area during open water and shoreline/shoal surveys including the MDE trawl survey, MDNR seine survey, MDNR summer trawl survey, and CBL surveys. Historic purse seine surveys indicate that bay anchovy are abundant in the Patuxent River in late spring and summer, but are virtually absent in early spring (March-April, Homer et al. 1979). Some adult and juvenile bay anchovy were reported in April 2000 in the MDNR ichthyoplankton survey (eggs and larvae were not collected). The MDE trawl results were adjusted for gear efficiency (Tables 4 and 5). Mean length of anchovy in the MDE survey during April was incorporated into the length:weight equation reported by Robinette (1983) as $\text{Log } W = -4.76779 + 2.81451 \text{ Log } \text{FL}$. April biomass for open water and shoreline/shoal habitat was estimated as follows:

$$0.05 \text{ fish per acre} / 86.4\% \text{ gear efficiency} \times 0.003 \text{ kg per fish} = 1.7 \times 10^{-4} \text{ kg per acre}$$

Blueback Herring (*Alosa aestivalis*). Blueback herring were reported during some shoreline/shoal surveys, including the MDNR seine surveys in June-August, and the monthly CBL purse seine surveys. Blueback herring were not reported in the MDE trawl survey in April-May 2000, or the historic CBL deep water trawl surveys. They were also not collected during gill net surveys in the spill area in April 2000 (Hornick and Zlokovitz 2000). Eggs and larvae were collected in the spill area during the MDNR ichthyoplankton surveys in April 2000. The shoreline/shoal standing stock estimate was developed by adjusting the mean number of blueback herring caught during the MDNR seine surveys (Table 7) based on relative seasonal occurrence for all fish in the CBL beach seine surveys (0.8%; Homer et al. 1979). The April estimate was adjusted for gear efficiency for a surrogate species (Atlantic menhaden; Table 4). Mean weight per fish was based on the CBL surveys (Table 6). April biomass per acre in shoreline/shoal and open water habitat was estimated as follows:

$$0.74 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 26.6\% \text{ gear efficiency} \times 0.0020 \text{ kg per fish} = 4.5 \\ \times 10^{-5} \text{ kg per acre}$$

Brown Bullhead (*Ameiurus nebulosus*). Brown bullhead were reported in the spill area during several surveys including the 2000 MDE trawl survey and the CBL trawl surveys. Bullhead eggs and larvae were not collected during the MDNR ichthyoplankton survey in the vicinity of the spill in April 2000 (Regions 1 and 2). The MDE trawl survey results were used to estimate standing stock in open water and shoreline/shoal water habitats by incorporating gear efficiency reported for catfish species in the CBL study (Tables 4 and 5). Mean weight per fish was calculated by incorporating the mean length of bullhead caught during the April 2000 MDE survey into the length:weight equation reported by Carlander (1969) as $\text{Log } W = -5.061 + 3.065 \text{ Log } \text{TL}$. April biomass per acre for open water and shoreline/shoal habitat was estimated as follows:

$$0.14 \text{ fish per acre} / 37.3\% \text{ gear efficiency} \times 0.114 \text{ kg per fish} = 0.043 \text{ kg per acre}$$

Hogchoker (*Trinectes maculatus*). Hogchoker have been reported in recent open water and shoreline/shoal surveys. Juveniles were the only lifestage collected during the MDNR ichthyoplankton survey in April 2000. Mean length from the MDE trawl survey was incorporated into the length:weight equation for hogchoker reported by Dawson (1962) as $\text{Log } W = -1.052666 + 2.658 \text{ Log } \text{SL}$. The standing stock estimate for open water was calculated

based on the mean catch in the MDE survey and adjusted for gear efficiency (Tables 4 and 5). The MDE trawl results were adjusted for shoreline/shoal habitat based on the CBL finding that hogchoker were absent from the shore zone and increased in abundance with increasing water depth (Homer et al. 1979). Specifically, they found that hogchoker biomass in shallow water was 1.7 percent of the deeper water biomass in the spring (biomass of 5.32 kg per acre in deep water and 0.09 kg per acre in shallow water). Biomass per acre was calculated as follows:

Open Water: $101.66 \text{ fish per acre} / 20.8\% \text{ gear efficiency} \times 0.016 \text{ kg per fish} = 7.82 \text{ kg per acre}$

Shoreline/Shoal: $8.02 \text{ kg per acre} \times 1.7\% = 0.13 \text{ kg per acre}$

Inland Silverside (*Menidia beryllina*). This species was reported in the April CBL beach seine surveys and the MDNR summer seine surveys. They were not reported during the MDNR ichthyoplankton survey or MDE trawl survey in April 2000, or the historic MDNR or CBL deep-water trawl surveys. The results of the MDNR seine survey (Table 7) were adjusted by the relative seasonal occurrence in the CBL beach seine surveys in April (Homer et al. 1979). The April estimate was adjusted based on the gear efficiency for beach seines and the mean weight per fish in the CBL surveys (Tables 4 and 6). This species was only reported in shoreline/shoal habitat in April. Biomass per acre for shoreline/shoal habitat was estimated as follows:

$6.3 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 63.9\% \text{ gear efficiency} \times 0.0012 \text{ kg per fish} = 9.5 \times 10^{-5} \text{ kg per acre}$

Mummichog (*Fundulus heteroclitus*). Mummichog were reported in the MDNR seine surveys during the summer and the CBL beach seine surveys in April. In addition, dead mummichog were documented in Swanson Creek during the spill. Mummichog were not reported in the MDE or CBL deep water trawls. Eggs and larvae were not collected during the MDNR ichthyoplankton survey in April 2000. The mean number of mummichog in the MDNR seine survey (Table 7) was adjusted by the relative seasonal abundance and gear efficiency during the CBL seine surveys (Table 4; Homer et al. 1979). Mean weight per fish was based on April-May catch reported during the CBL surveys (Table 6). Mummichog are primarily found in shoreline/shoal habitat, and biomass per acre for this habitat was estimated as follows:

$69.57 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 39.9\% \text{ gear efficiency} \times 0.013 \text{ kg per fish} = 0.018 \text{ kg per acre}$

Spottail Shiner (*Notropis hubsonius*). Spottail shiner were reported in shoreline/shoal habitat during the MDNR seine surveys in the summer, and the CBL shallow surveys in April. They were not reported in April during the MDE trawl survey, the CBL deep water trawls, or the MDNR ichthyoplankton surveys. The standing stock estimate was calculated by adjusting the mean number of spottail shiners in the MDNR surveys (Table 7) with the relative seasonal abundance documented for all fish during the CBL beach seine surveys. In addition, abundance was adjusted for gear efficiency of a surrogate species (Atlantic silverside), and mean weight per fish was based on the mean weight of spottail shiners during the April CBL surveys (Tables 4 and 6). Biomass per acre for shoreline/shoal habitat was estimated as follows:

$3.7 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 81.8\% \text{ gear efficiency} \times 0.0081 \text{ kg per fish} = 2.9 \times 10^{-4} \text{ kg per acre}$

Striped Bass (*Morone saxatilis*). Striped bass were reported in the MDE trawl survey, the MDNR seine survey, and the MDNR ichthyoplankton survey in the spill area in April (eggs and

larvae). The standing stock estimate for sub-adult striped bass (Age 3 and younger) was based on the mean catch in the MDE trawl survey and corrected for gear efficiency using white perch as a surrogate (Tables 4 and 5). Biomass for sub-adults was based on the mean length in the MDE trawl survey and the length:weight equation presented by Fay et al. (1983) as $\text{Log } W = -5.0001 + 3.0501 \text{ Log } \text{FL}$. Since larger striped bass (>Age 3) may not have been adequately represented in the MDE trawl survey, the standing stock of larger adults was estimated based on the age-class distribution in the MDNR striped bass spawning stock surveys in the Potomac River, 1985-2001 (Fegley 2001). MDNR found that adult striped bass (>Age 3) comprised 53.5% of the striped bass population in April-May (i.e., there were 1.15 striped bass fish >Age 3 for each striped bass Age 3 and younger). Mean weight for striped bass >Age 3 is 4.44 kg per fish (French et al. 1996). Although striped bass would be expected to primarily utilize the open water habitat in April, they may also be found in shallow water habitat. The total biomass per acre for striped bass in both habitats was estimated as 1.09 kg per acre based on the following equations:

Sub-adults: $0.14 \text{ fish per acre} / 65.9\% \text{ gear efficiency} \times 0.035 \text{ kg per fish} = 0.0074 \text{ kg per acre}$

Adults: $0.21 \text{ sub-adult abundance per acre adjusted for gear efficiency} \times 115\% \times 4.44 \text{ kg per fish} = 1.09 \text{ kg per acre}$

Striped Killifish (*Fundulus majalis*). Striped killifish were reported in shoreline/shoal habitat during the MDNR summer seine surveys and the April CBL seine surveys. They were not collected in historic deep-water surveys by CBL, the MDE trawl survey, or the MDNR ichthyoplankton survey. The standing stock estimate was calculated by adjusting the mean number of killifish in the MDNR surveys in Table 7 with the relative seasonal abundance for all fish and gear efficiency for a surrogate species in the CBL surveys (mummichog; Table 4). Mean weight per fish was based on the CBL surveys (Tables 6). Striped killifish were only documented in the shoreline/shoal habitat in these studies. Biomass per acre was estimated for shoreline/shoal habitat as follows:

$122.31 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 80\% \text{ gear efficiency} \times 0.0039 \text{ kg per fish} = 0.0048 \text{ kg per acre}$

White Perch (*Morone americana*). White perch have been reported in most fish surveys in the lower Patuxent River, and were one of the most abundant species collected during the MDE surveys. Standing stock was estimated based on the mean catch in the MDE trawl surveys during April and gear efficiency (Tables 4 and 5). To estimate biomass, mean length per fish in the MDE trawl survey was incorporated into the following length:weight equation: $\text{Log } W = -4.8884 + 3.024 \text{ Log } L$ (MDNR unpublished data). The open water estimate was used to estimate the biomass in the shallow water habitat based on the CBL finding that the biomass of white perch in shallow water was 15.0% of deep water biomass in the spring (biomass of 16.3 kg per acre in open water and 2.6 kg per acre in shallow water; Homer et al. 1979). Biomass per acre was estimated as follows:

Open Water: $71.27 \text{ fish per acre} / 65.9\% \text{ gear efficiency} \times 0.085 \text{ kg per fish} = 9.19 \text{ kg per acre}$

Shoreline/Shoal: $9.15 \text{ kg per acre} \times 15.0\% = 1.38 \text{ kg per acre}$

Less Common Finfish Species. The species-specific estimates described above comprise the large majority of April finfish abundance and biomass documented in the spill area in recent and historic surveys. These species-specific descriptions comprise 98% of the open water fish

abundance in April based on the MDE trawl surveys, and 100% of the April abundance reported during the CBL deep trawl surveys. In addition, these species-specific descriptions comprise all or almost all of the shoreline/shoal fish abundance based on the MDNR juvenile finfish surveys (97%), and the CBL shallow trawl and beach seine surveys in April (100%).

For the open water habitat, the biomass was estimated based on the abundance of less common species collected in the MDE trawl survey (2.1 fish per acre; Appendix A). These species include catfish species, oyster toadfish, spot, and spotted hake. It is recognized that these species were largely collected either upstream or downstream of the spill area, and/or only reported weeks after the spill. However, the estimated biomass is intended to represent other transient species, or species with low abundance that may have been present in the spill area, but were not documented in the MDE trawl survey. In addition to the less common species in the MDE surveys, these other species may include river herring, carp, catfish species, gizzard shad, and yellow perch among others (Table 3). The estimate was adjusted for gear efficiency based on the average trawl efficiency for all species in the CBL surveys (Table 4). Biomass was estimated based on the mean weight per fish in the CBL deep-water surveys in April (Table 6). The total standing stock for these less common species in open water was estimated as follows:

$$2.10 \text{ fish per acre} / 46.9\% \text{ gear efficiency} \times 0.050 \text{ kg per fish} = 0.22 \text{ kg per acre}$$

For the shoreline/shoal habitat, the MDNR seine surveys were used to estimate the overall biomass of less common species. The summer MDNR seine surveys reported over a dozen less common species including silverside species, river herring, spot, and killifish species (Table 7). The overall standing stock of these species was calculated from the MDNR survey results by totaling the mean abundance of the less common species (Table 7). The total abundance of less common species was adjusted based on relative seasonal occurrence reported in the CBL seine surveys for all fish in April (0.8%; Homer et al. 1979). April abundance was corrected for gear efficiency based on the mean gear efficiency for all fish using a beach seine by CBL (Table 4). Biomass was based on mean weight per fish in the CBL shallow water surveys in April including beach seine, purse seine, and shallow trawl surveys (Table 6). The shoreline/shoal biomass was estimated as follows:

$$61.04 \text{ fish per acre} \times 0.8\% \text{ seasonal occurrence} / 45.4\% \text{ gear efficiency} \times 0.025 \text{ kg per fish} = 0.027 \text{ kg per acre}$$

Blue Crab (*Callinectes sapidus*). Blue crabs emerge from the mud in mid- to late April and were collected in the MDE trawl by the third week of April. The standing stock for blue crab was estimated based on the catch in the MDE trawl survey between April 21 and May 4 (Table 5, Appendix A). Mean catch was adjusted based on reported gear efficiency for blue crab (Table 4). Biomass was based on mean crab weight in April during the CBL surveys (Table 6). The standing stock for blue crab in open and shoreline/shoal habitat was estimated as follows:

$$20.19 \text{ crab per acre} / 29.9\% \text{ gear efficiency} \times 0.021 \text{ kg per crab} = 1.42 \text{ kg per acre}$$

Horseshoe Crab (*Limulus polyphemus*). Horseshoe crabs are known to occur in the spill area, and there is no known historic information on standing stock in the Patuxent River. The only horseshoe crab was collected on April 30 when only counts were obtained. Since no lengths or weights were measured and the survey was conducted in addition to the standard twice per week approach, the catch data for this date was only used for crab estimates; it was not used to estimate finfish biomass. The mean number of horseshoe crabs reported during the MDE survey

was used to estimate standing stock in both open water and shoreline/shoal habitat (Table 5). The gear efficiency for blue crabs reported during the CBL trawl surveys was used to estimate the standing stock of horseshoe crabs (Table 4). While blue crabs and horseshoe crabs have significantly different movements (e.g. blue crabs are relatively fast swimmers), the use of blue crab gear efficiencies for horseshoe crabs should represent a conservative approach to estimating biomass. Mean weight was 1.8 kg per crab based on ASMFC (2001). Biomass per acre for shoreline/shoal and open water habitats was estimated as follows:

$$0.11 \text{ crab per acre} / 29.9\% \text{ gear efficiency} \times 1.8 \text{ kg per crab} = 0.66 \text{ kg per acre}$$

Oysters. The oyster standing stock between Chalk Point and Broomes Island was estimated by integrating the commercial catch for this river section (fall 1999-spring 2000) with the results of the MDNR fall oyster survey. The specific approach to estimating biomass was developed by MDNR and the Academy of Natural Sciences, and is summarized in Appendix E. The absolute standing stock estimate for the river section was 14,395 kg dry tissue weight. This equals 1.77 kg per acre for the open water habitat of this river section (approx. 8,150 acres).

Additional References

Atlantic States Marine Fisheries Commission (ASMFC). 2001. Horseshoe crab state compliance reports for 2000 and management proposals for 2001. Washington D.C.

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology-Life History Data on Freshwater Fishes of the United States and Canada. Ames, Iowa.

Dawson, C.E. 1962. Length-weight and standard length-total length relationships for South Carolina hogchokers, *Trinectes maculatus*. Trans. Am. Fish. Soc. 91:89-90.

Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic)—alewife/blueback herring. I.S. Fish and Wildlife Service, Division of Biological Services, FWS/OBS-82/11.9. U.S. Army Corps of Engineers, TR EL-82-4. 25 pp.

French, D. and 19 others. 1996. The CERCLA type A natural resource damage assessment model for coastal and marine environments (NRDAM/CME). Technical Documentation, Vol. I-V. Final report submitted to the Office of Environmental Policy and Compliance, U.S. Department of Interior, Washington D.C., April 1996, Contract No. 14-0001-91-C-11.

Hildebrand, S.F., and S.C. Schroeder. 1928. Fishes of Chesapeake Bay. Bull. U.S. Bur. Fish. 43(1927).

Hornick, H.T. and E.R. Zlokovitz. 2000. Observations on finfish collected from the Chalk Point area of the Patuxent River, April 30, 2000. Maryland Department of Natural Resources, Fisheries Service, Annapolis, MD.

Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements (Gulf of Mexico) - Atlantic croaker. U.S. Fish and Wildlife Service, Division of Biological Services. FWS/OBS-82/11.3. U.S. Army Corps of Engineers, TR-EL-82-4. 12 pp.

Public Service Electric & Gas Company (PSE&G). 1999. Salem Generating Station Permit Renewal Application NJDES Report #NJ0005622. Submitted to NJDEP March 4, 1999.

Robinette, H.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) -- bay anchovy and striped anchovy. U.S. Fish and Wildlife Service, Division of Biological Services, FWS/OBS-82/11.14. U.S. Army Corps of Engineers, TR EL-82-4. 15 pp.

Rogers, S.G. and M.J. VanDenAyvle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic)—Atlantic menhaden. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.108). U.S. Army Corps of Engineers TR EL-82-4 23 pp.

Weeder, J.A. 2001. Sampling of American eel in the Patuxent River, Maryland - 1999. Maryland Department of Natural Resources - Fisheries Service, Stevensville, MD. 5 pages.

Appendix D - Sampling of American Eel in the Patuxent River, Maryland – 1999

Sampling of American Eel in the Patuxent River, Maryland - 1999

Prepared February 2001
Julie A. Weeder, Fisheries Biologist
Maryland Department of Natural Resources Fisheries Service
301 Marine Academy Drive
Stevensville, MD 21666
410-643-6785 (voice) 410-643-4136 (fax) jweeder@dnr.state.md.us

American eels (*Anguilla rostrata*) were collected from the Patuxent River above the Route 231 bridge near Benedict on three days during June and July 1999. Eels were also captured from the lower Patuxent River near Solomons during May 1999. Sampling was performed by USFWS personnel under the directions of MDNR personnel using eel pots baited with razor clams (*Tagelus* spp.). A constant proportion of two pot types was used each sample day (16% 1/3-inch bar mesh pots with a 1/2-inch bar mesh cull panel and 84% 1/3-inch bar mesh pots without the cull panel). Differences in catch rates between the two pot types were negligible. Pots were set on three constant transects at each site (Table 1). Transects near Benedict extended northeast while those near Solomons extended southwest. Up to ten pots were set on each transect, one every 50 feet. All pots were set in water deeper than 5 feet.

No eels less than 19 cm long were observed (Figure 1). The median length of eels caught near Benedict was 30 cm. Most of the catch had been in the Chesapeake Bay watershed 2 years or less. Nearly all of the eels observed were large enough (>22 cm) to be caught in commercial eel pots.

We caught more eels (number and weight) at the Benedict site than the Solomons site (Table 2). Sampling near Solomons occurred in May when water temperatures were 15-20°C (Table 2), while sampling near Benedict occurred in June and July when water temperatures were higher (24-28°C) (Table 2).

We assumed that the effective sampling radius of each pot was 25 feet (half of the 50 feet between each pot) and thus each pot sampled a 1964 ft² (0.045 acre) area. The total area sampled per day was determined by multiplying the number of pots used by the area sampled per pot (Table 2). When all sampling days were combined, near Benedict we caught 58 eels (3.13 kg) per acre, while near Solomons we caught 1.6 eels (0.51) per acre (Table 2).

Fishery-independent sampling also occurred in the Sassafras and Susquehanna Rivers

during spring and summer 1999 (Table 2). We caught less eels per pot and per acre (number and weight) in the Sassafras River than in the Patuxent River near Benedict, but more in the Susquehanna River compared to the Patuxent River near Benedict. No statistical comparisons of catch rates were performed.

The use of passive, baited gear complicates use of this catch data for estimating eel abundance in the sample areas. Eels can be drawn to the bait from nearby areas of the Patuxent, and the success of the gear is partly dependent upon eel behavior, as well as upon absolute abundance in the sampled area.

Table 1: Transect start point coordinates, Patuxent River eel sampling 1999.

Route 231 Bridge near Benedict

Transect start point	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)
1	38 30 46.80	76 40 2.16
2	38 30 50.52	76 40 4.80
3	38 30 52.26	76 40 8.34

Lower Patuxent River near Solomons

1	38 19 43.72	76 28 5.88
2	38 20 44.10	76 28 36.36
3	38 23 11.52	76 30 45.30

**Figure 1: Length frequency of eels captured in the Patuxent River near Benedict
summer 1999 (n=225)**

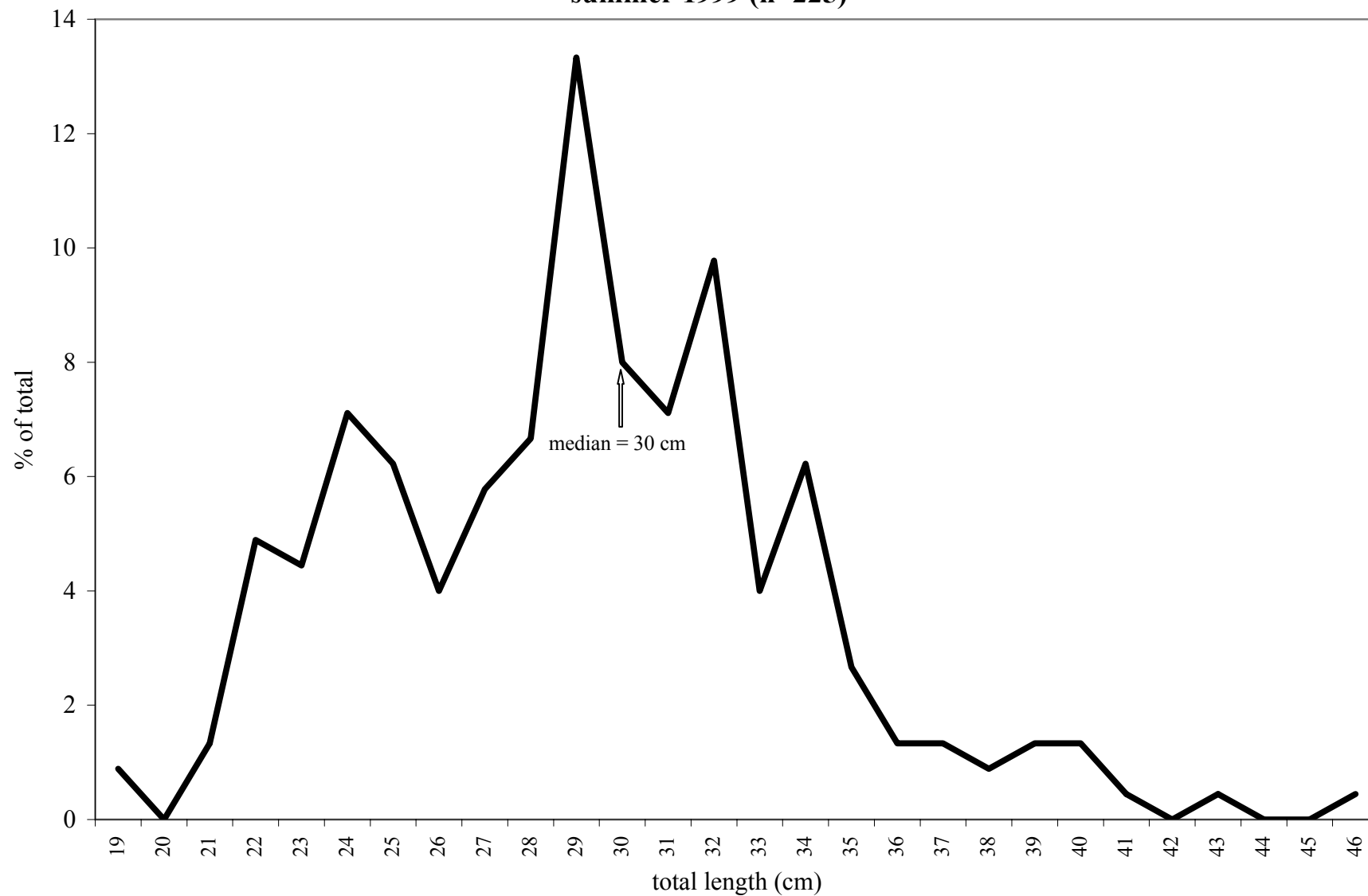


Table 2: Number and weight of eels caught in the Patuxent, Sassafras and Susquehanna Rivers 1999 with temperature, salinity, depth and soak time.

collection location and date and date	number pots	number eels	total weight (kg)	number eels per pot	weight eels per pot (kg)	area sampled (acres)	number eels per acre	weight eels per acre (kg)	soak time (hours)	median depth (ft)	bottom temperature (C)	bottom salinity (ppt)
Patuxent River - Above the Route 231 Bridge, near Benedict												
6/23/1999	30	96	4.9	3.1	0.16	1.35	71.0	3.65	48	17	24.5	9.3
7/9/1999	30	95	5.5	3.2	0.18	1.35	70.2	4.06	96	21	28.3	11.7
7/21/1999	26	34	1.7	1.3	0.07	1.17	29.0	1.48	96	20	28.0	10.2
all	86	225	12.2	2.6	0.14	3.88	58.0	3.13	240	19	27.0	10.2
Patuxent River - Lower Patuxent River near Solomons												
5/6/1999	28	4	1.3	0.1	0.05	1.26	3.2	1.03	48	28	15.1	13.0
5/28/1999	28	0	0.0	0.0	0.00	1.26	0.0	0.00	72	14	20.9	11.3
all	56	4	1.3	0.1	0.02	2.52	1.6	0.51	120	19	18.0	12.2
Sassafras River												
4/8/1999	41	36	1.36	0.9	0.03	1.85	19.5	0.74	48	10	16	1.0
4/14/1999	48	8	0.34	0.2	0.01	2.16	3.7	0.16	48	12	13.3	0.1
4/29/1999	34	49	2.51	1.4	0.07	1.53	32.0	1.64	48	10	16.1	0.8
5/12/1999	33	75	2.02	2.3	0.06	1.49	50.4	1.36	48	9	20.3	0.8
all	156	168	6.23	1.1	0.04	7.03	23.9	0.89	192	11	16.4	0.9
Susquehanna River												
5/21/1999	25	95	6.06	3.8	0.24	1.13	84.3	5.38	96	9	22	0.1
5/28/1999	27	122	6.15	4.5	0.23	1.22	100.2	5.05	72	8	23	0.1
6/4/1999	28	83	4.1	3.0	0.15	1.26	65.7	3.25	72	8	24	0.1
all	80	300	16.31	3.8	0.20	3.61	83.2	4.52	240	8	23	0.1

**Appendix E - Estimate of absolute abundance of oysters in the upper Patuxent River in the
spring of 2000**

Appendix E

Estimate of absolute abundance of oysters in the upper Patuxent River in the spring of 2000

The absolute abundance of oysters in the Patuxent River from Broomes Island north was estimated as follows:

First, the abundance of legal oysters (≥ 3 inches) in numbers (AL) was estimated from the equation:

$$AL = (H * NLB) * (1/U) \text{ where:}$$

H = the Patuxent River oyster harvest of 1046 bushels from Broomes Island north during the 1999-2000 oyster season (Maryland DNR Fisheries Statistics Project);

NLB = average number of 4-inch oysters per bushel (174) based on length-weight relationships of more than 1800 oysters collected from the Patuxent River during 1998-2000 (Figure 2) by Abbe and Albright. The average size of legal oysters of 4 inches was determined from data collected during the MDNR 2000 fall oyster survey on Thomas, Broad Neck, Buzzard Island and Holland Point.

U = exploitation rate (0.067) on a harvested oyster bar in Chesapeake Bay (Flag Pond; Abbe 1988). The exploitation rate used here is based on standing stock estimates calculated from data collected on Flag Pond bar just before the 1984 and 1985 oyster seasons opened and again shortly after they ended. Standing stock estimates were: fall 1984 - 5.33 legal oysters m^{-2} , spring 1985 - 4.93 legal oysters m^{-2} , fall 1985 - 6.14 legal oysters m^{-2} and spring 1986 - 5.77 legal oysters m^{-2} . Standing stocks were also estimated for fall 1983 and spring 1984 of 5.80 and 3.98 legal oysters m^{-2} , respectively, but these data were not included in the estimate of U because the intensive harvesting on Flag Pond during the 1983 season was not representative of current harvest patterns in the upper Patuxent River.

$$\text{Fall Totals (11.47 legal) - Spring (10.70 legal) / Fall (11.47)}$$

$$0.77 / 11.47 = 0.067$$

$$AL \text{ from harvested areas} = (1046 * 174) / 0.067 = 2,716,478$$

The exploitation rate from Flag Pond was based on an area that was harvested when legal densities were 4-6 m^{-2} . The estimation of oysters in this report therefore represents oysters on areas known to be harvested. Most harvesting is probably from Holland Point, Broad Neck and Thomas. However, there are presently many areas of the upper Patuxent that are not harvested such as Macks Hollow, Prison Point, Jacks Marsh and Gatton where substantial numbers of oysters can also be found as well as other areas where smaller populations exist (Teague, Elbow, Brooks Shallows, Buzzard Island). To compensate for these unharvested areas, the estimated number of legal oysters was multiplied by 2 which may be conservative.

Thus the absolute abundance of legal oysters from all areas of the upper Patuxent is estimated at

$$5,432,955.$$

The absolute abundance of sublegal oysters in numbers (AS) was then estimated as follows:

$$AS = AL * R \text{ where}$$

AL = the absolute abundance of legal oysters (calculated above) and

R = the ratio of sublegal oysters to legal oysters (0.30) was determined from data collected during the MDNR 2000 fall oyster survey on Thomas, Broad Neck, Buzzard Island and Holland Point where a total of 160 legal and 48 sublegal oysters were collected.

The absolute abundance of sublegals was therefore

$$5,432,955 * 0.30 = 1,629,887$$

The absolute abundance in live wet weight (AW) in the Patuxent from Broomes Island north was calculated as follows:

$$AW = (AL * WL) + (AS * WS) \text{ where}$$

AL = absolute abundance of legal size oysters,

WL = average weight per legal oyster assuming 174 oysters per 80-lb bushel (209 g or 0.46 lb from Figure 2),

AS = absolute abundance of sublegal size oysters and

WS = average weight per sublegal oyster of 2 ½ inches (64 g or 0.141 lb from Figure 3 which fits low range data better than Figure 2) based on an average size from the MDNR 2000 fall oyster survey on Thomas, Broad Neck, Buzzard Island and Holland Point.

$$\text{Absolute Total Live Weight} = (5,432,955 * 0.46 \text{ lb}) + (1,629,887 * 0.141 \text{ lb}) =$$

$$2,499,159 + 229,814 = \mathbf{2,728,973 \text{ lb or } 1,240,442 \text{ kg}}$$

Literature Cited

Abbe, G. R. 1988. Population structure of the American oyster, *Crassostrea virginica*, on an oyster bar in central Chesapeake Bay: Changes associated with shell planting and increased recruitment. *Journal of Shellfish Research* 7:33-40.

Fisheries Standing Stocks at Chalk Point

Reviewed by George Abbe

Page 3, line 10. awept should be swept

Following page 6 is a page entitled “List of Figures” followed by only 1 figure. There is no list.

A “List of Tables” page also presents no list. It is simply followed by tables.

Page 10 Table 1. This table should be labeled as standing stock estimates for April. This is stated in the text, but not clear if you’re just looking at the table.

Page 10 Table 1. Striped bass populations are presently more abundant than some of the literature may indicate. Although not an expert in finfish, I find it hard to believe that this species is only found at about a pound per acre and that adult striped bass are 900 times less abundant than white perch.

Page 12 Table 3. Oyster toadfish and striped bass can certainly be found in shallow water areas although they are not shown in this table. Pipefish can likewise be found in open water.

Page 13 Table 5. Crab abundances are shown and biomass is calculated, but nowhere do I see any size or weight data for them. Average crab is estimated at 21 grams which represents a crab about 3 inches in carapace width. This size is not unrealistic.

In the summary of finfish collected during the MDE trawl survey, there are no units for Trawl Length and Estimated Area Swept. I assume they are m and m², respectively. The Abundance per Acre doesn’t appear to make use of the gear efficiency data unless abundance per trawl has already been adjusted for it.

Ichthyoplankton Survey

Page 1 Methods Line 6 - replace starta with strata.

Line 19 - Catch data was tabulated and presented as number....

Last line, last word on page - replace “the” with “that”

This report refers to Figs. 2, 3 and 4, but only Fig 1 is included.

Standing Stock Estimates by Species

Silversides - 475 fish per acre were caught, but only 6.39 are shown in Table 1. My adjusted number is 4.65 so I don’t know how 6.39 was calculated. Biomass is OK.

Mummichog were 0.10 kg per acre based on a mean weight of 71 g. However, a weight of 71 g for a mummichog makes no sense. They might be 7 g, but not 71g. At 7g the biomass would be about 0.01 kg per acre.

Striped Bass biomass of sub-adults seems incredibly low at 7 g per acre. The biomass of adults also seems incredibly low at 0.53 kg or 1.2 lb per acre, but that may be due to the fact that it was

based on a percentage of subadults in upper Bay populations. Large striped bass should have been moving up the river to spawn at this time, so biomass should have been much higher. Phil Jones at MDNR and I felt it would be better to review spring commercial catch data from the Patuxent and try to improve estimates of abundance based on this. It will still involve some guesswork, but at least it should produce a more reliable number.

Striped Killifish biomass should be 0.0048 kg per acre, not 0.0064.

Oyster abundance is based on commercial catch between Broomes Island and Benedict and an exploitation rate of 0.093 (which should have been 0.067) calculated from harvest rates on Flag Pond bar. The exploitation rate from Flag Pond was based on an area that was harvested when legal densities were 4-6 m². Legal oysters in the Patuxent are probably not often found at this density so the true exploitation rate is likely lower. The estimation of oysters in this report represents oysters on areas known to be harvested. However, there are presently many more areas of the Patuxent that are not harvested than ones that are. Most oysters are probably harvested from Holland Point, Broad Neck and Thomas bars. However, there are substantial numbers of oysters on other areas such as Macks Hollow, Prison Point, Jacks Marsh and Gatton. I think that the estimate of oysters from Broomes Island to Benedict, based on unharvested areas and lower exploitation rates, could be twice what is shown. See revision of Appendix E.

I don't think you will get 260 4-inch oysters in an 80-lb bushel. Based on length-weight relationships of more than 1800 Patuxent River oysters collected during 1998 to 2001 from Solomons to Benedict and ranging in size from 60 to 120 mm, we have determined that:

Oyster Length	Weight in grams	Weight in pounds	Number per 80-lb bushel
3-inch	109	0.24	333
3 ½-inch	150	0.33	242
4-inch	209	0.46	174

These oysters were scrubbed and weighed in the lab so they were very clean. Harvested oysters are not cleaned to this degree so they would be somewhat heavier. See attached Figure 2 and 3.