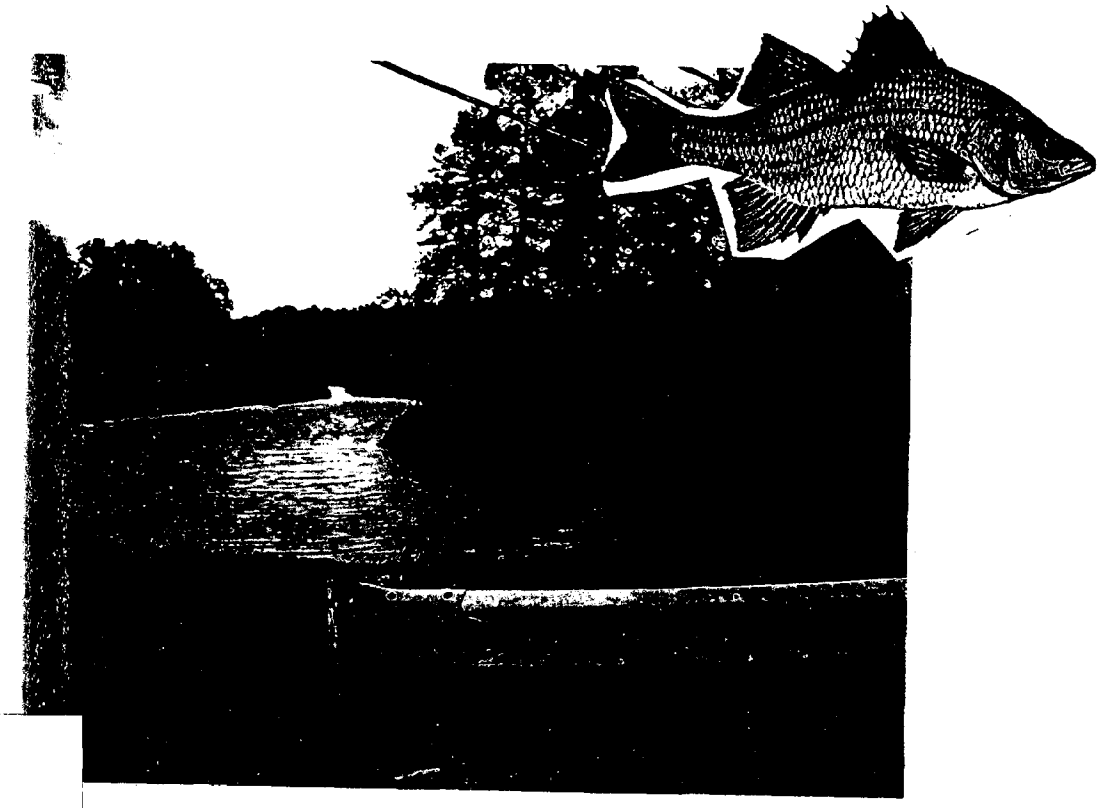
Anadromous Fish Survey of Somerset County Streams



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Anadromous Fish Survey of Somerset County Streams

Final Report

Submitted to

Commissioners for Somerset County
Princess Anne, Maryland 21853

by

Roman V. Jesien[1]
Thomas S. Hopkins[2]
Clement L. Counts, III[3]
Richard L. Takacs[4]

[1] Fisheries Scientist
Department of Natural Sciences
University of Maryland Eastern Shore
Princess Anne, Maryland 21853

[2] Professor of Biology
Department of Natural Sciences
University of Maryland Eastern Shore
Princess Anne, Maryland 21853

[3] Director
Coastal Ecology Research Laboratory
Box 1106
University of Maryland Eastern Shore
Princess Anne, Maryland 21853

[4] Horn Point Environmental Laboratory
University of Maryland
Cambridge, Maryland 21613

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This study was prepared under the supervision of the Somerset County Department of Technical and Community Services Ronald D. Adkins, Administrator, Joan S. Kean, Planner

SUMMARY

A total of 29 fish species representing 13 families were collected in a survey of 21 stations at 10 Somerset County streams to determine utilization by anadromous fish species. Sampling for adult fish and early life history stages commenced on March 4 and continued through May 17. Collecting gear included plankton net, trap net and electrofisher. Anadromous fish species collected included alewife, blueback herring, yellow perch and white perch. Yellow perch and white perch were the first anadromous species collected (March 13 collections) and generally were seen throughout the study. River herring were initially collected about March 13 and occurred sporadically throughout the study. Based on occurrence of adult fish and early life stages tidal freshwater portions of Somerset Creek, Kings Creek, Taylor Branch, and Wicomico Creek appeared to be most important to anadromous spawners. Streams mot supporting anadromous species such as Rehobeth Branch, Marumsco Creek, or such as Manokin Branch which had poor utilization by andromous species, tended to be channelized or had minimal to no buffers in agriculatural areas.

1. INTRODUCTION

Directives for Local Program Development (14.15.10) contained in Subtitle 15 of the Chesapeake Bay Critical Area Commission, Criteria for Local Critical Area Program Development (COMAR 14.15.10) indicate that in developing their Critical Area Programs, local jurisdictions shall inventory or map the watersheds of anadromous fish spawning streams. The objective of this study was to inventory streams within Somerset County to determine use by spawning migratory species. Streams were sampled with fish traps, electrofisher, and plankton nets to determine the presence of either spawning adults or early life history stages.

1.A. Background Life History Information

Of the 260 fish species that occur in the Chesapeake Bay, the most sought after by both sport and commercial fishermen are the migratory species. These include anadromous fishes such as the herrings including American shad (Alosa sapidissima), blueback herring (Alosa aestivalis), alewife (Alosa pseudoharengus), and hickory shad (Alosa mediocris) that spend most of their adult lives in saltier coastal waters but return to freshwater to spawn, as well as the semi-anadromous species such as white perch (Morone americana) and yellow perch (Perca flavescens) which undergo large scale movements into head water streams to spawn. Spawning occurs in spring during increasing water temperatures.

1.A.1. River Herring

Blueback, alewife, and American shad are the most abundant herrings in the Chesapeake Bay and are found throughout all parts of the Bay and its tributaries. Hickory shad were historically abundant in the bay area but numbers are exceptionally low in recent times. Peak spawning activity of American shad generally occurs from 14° to 21° C. A variety of substrate types may be used for spawning but preferred areas are over sand and gravel bottom where there is sufficient water velocity to eliminate silt deposits. Active spawning occurs over a wide range of velocities but generally from 1 - 3 ft/sec. After spawning, adult shad return to the sea, leaving the Bay by June. Young shad remain in the Bay and its tributaries throughout the summer, some returning to the sea in the fall (Lippson 1973; Facey and Van Den Avyle 1986; Stier and Crance 1985).

Alewife runs usually occur from March through April, blueback runs from the last half of April through the first half of May. Males arrive at mouths of spawning rivers earlier than females. Spawning environments vary from streams only a few yards wide and a few inches deep to large rivers such as the Delaware and Potomac. Blueback herring prefer spawning sites

with fast currents and associated hard substrates. In contrast, alewives select a wide variety of spawning site, using standing water as well as mid-river sites. Spawning activities of both species occur diurnally and nocturnally, though the greatest activity apparently is nocturnal. Both males and females migrate rapidly downstream after spawning, and total spawning time for a single migratory group may be 5 days or less (Lippson 1973; Fay et al. 1983). However, numerous migratory groups typically utilize a stream reach.

1.A.2. White Perch

White perch are resident, semi-anadromous fish in the Chesapeake Bay. An ubiquitous, abundant species they can be found in all brackish water and tidal freshwater areas at one time or another. As early as March, ripe individuals move upstream to tidal freshwater or nearly freshwater to spawn, remaining there often until early June. Favored within these regions are areas where the slightly heavier-than-water adhesive white perch eggs will find suitable substrate for attachment such as shallow streams with overhanging tree branches and fallen limbs, or deeper-water areas with firm, sandy bottoms (Lippson 1973).

1.A.2. Yellow Perch

For most of the year, yellow perch range in the low-salinity portions of the Chesapeake Bay tributaries. From late February to early March, mature yellow perch migrate upstream to the spawning grounds at the heads of streams in freshwater. In most cases, the spawning grounds mark the upstream limit of yellow perch distribution in Chesapeake Bay tributaries (Lippson 1973). Yellow perch spawning migrations occur from deep water into tributaries when water temperatures reach 7-13° C. Photoperiod, rising water temperatures and completion of maturation may trigger spawning. The female releases a gelatinous semi-buoyant string of eggs near aquatic or inundated vegetation. Rocks, sand, and gravel may be used if submerged vegetation is not available. Habitat suitability curves for spawning yellow perch indicate preferred water velocity is 0.5-2.5 ft/sec; depth is from 1.5-3 ft; and substrate consists of mud/soft clay or silt (Krieger et al. 1983). Spawning period may be of short duration extending for as little as two weeks for the entire spawning run (Lippson and Moran 1974).

2. METHODS AND MATERIALS

2.A. Sampling locations

Sampling for spawning adults was conducted at 21 sites located at 10 streams (Table 1, Figure 1). Criteria used to

select tributary streams were similar to Maryland Department of Natural Resources (DNR) investigations in which minimum conditions are typically set at: depth = one foot, width = 5 feet, and two miles of perennial flow. Since spawning of the target species takes place in freshwater, sites were selected which were upstream of obvious brackish water as indicated by dominance of salt intolerant riparian vegetation (i.e., cat tail Typha sp, tear thumb Polygonum sp). Also, sampling locations were selected at road crossings to facilitate access (Figure 1). Typically, sites were at or near the head of tide and were from approximately 15 to 22 ft in width and approximately 15 to 24 in in depth.

In order to obtain as broad coverage as possible, stations were dropped if it was obvious that anadromous fish did not utilize the area (i.e., Rehobeth Branch). Other stations were sampled to investigate use and were included for monitoring if anadromous species were located (Kings Creek). The numbers of larval fish and adult samples collected at each station are presented in Table 1.

2.B. Adult Fish

Adult fish were captured using fish traps and electrofisher. Fish traps were patterned after those currently used by DNR in stream surveys. Traps were constructed of one inch mesh plastic wire and were 4 feet long and 18 inches in diameter with an 18 inch internal funnel at each end. Traps were placed on the stream bottom and parallel to the stream current to capture upstream migrating fish. The traps were deployed for one 24-hr set per week to obtain quantitative samples. The electrofisher was a Smith-Root, Inc. back-pack mounted unit powered by a 24 v battery. One qualitative electrofishing sample was conducted per week to document utilization by anadromous fishes. Anadromous and migrating species were identified, counted, sexed, and spawning condition checked. Resident species were also identified. Water temperature was monitored at University of Maryland Eastern Shore (UMES) during spring. When temperatures approached 10° C (late February/early March), sampling for adults commenced and continued until it was felt that the major spawning pulse of the target species was over in mid-May.

2.C. Eggs and Larvae

Ichthyoplankton collections were obtained in conjunction with adult sampling. Once adults were observed, plankton nets were placed in the streams at the locations of adult fish sampling. A stationary plankton net was mounted on a 15 inch square frame for fixed sampling. The nets were fished for ten minute periods. The net was held on the bottom with the mouth facing upstream. Data collected during plankton sampling included date, time, water temperature, water velocity, and

conductivity.

Ichthyoplankton sampling continued concurrently with adult sampling. Eggs and larvae were sorted, identified and counted. Because of the similarities in the eggs and larvae of alewife and blueback herring, discrimination of these species was not conducted. It was assumed that the presence of herring eggs and/or larvae in the plankton samples indicates spawning of either or both species.

Numbers of eggs and larvae were calculated according to the following formula:

$$\frac{\text{Number of eggs and larvae in 5 min set}}{\text{Water Velocity X Area of net opening}} = \text{Number/ft}^3 \qquad (1),$$

where the water velocity was the arithmetic average of stream velocity at the surface bottom and 60% up from the bottom of the stream, and the area of the net opening in the water.

2.D. Water Quality

Water samples were collected and analyzed for dissolved oxygen, conductivity, temperature, turbidity, pH, alkalinity, and hardness. Water samples were collected in conjunction with fish sampling. Dissolved oxygen was determined using a Nestler Dissolved Oxygen meter. Conductivity was determined using a Yellow Springs Instrument (YSI) Model 33 S-C-T meter; temperature was determined using the temperature mode on the S-C-T meter; pH using an Orion pH meter. Oxygen saturation values were determined using formulae given in Green and Carritt (1967). Water velocity was determined using a Marsh McBirney Model 210 flowmeter. Water velocity was the arithmetic mean of measurements determined at the surface, bottom, and at 60% depth (= theoretical maximum velocity [Buchanan 1968]).

3. RESULTS

3.A. Adult Fish

A total of 29 fish species representing 13 families were collected in the Somerset County streams (Table 2). Species collected in the trap nets at each site are presented in Table 3 and those collected by electrofisher are presented in Tables 4 through 11. Weekly electrofishing sampling commenced in March 4 and continued through May 17. Anadromous fish species collected included alewife, blueback herring, yellow perch and white perch. Yellow perch and white perch were the first anadromous species collected (March 13 collections) and generally were seen throughout the study. River herring were initially collected about March 13 and occurred sporadically.

From 11 to 23 fish species were collected at each station. Streams were divided into two groups relative to the number of species collected. A total of 20 to 23 species were collected from Somerset Creek, Kings Creek, and Taylor Branch. Also four anadromous species (i.e., alewife, blueback herring, white perch and yellow perch) were collected at these locations. From 11 to 13 species were collected from Manokin Branch, Dividing Creek, Rehobeth Branch and Marumsco Creek. Except for white perch at Manokin Branch, anadromous species were not collected from the latter four locations. A total of 12 species were collected from Wicomico Creek at the dam at Eden Allen Dam and the four anadromous species of concern. The station was used to obtain information of species in the immediate vicinity of the dam and no effort was made to obtain a complete species list of the area because of its large size.

3.B. Ichthyoplankton

White perch and river herring eggs and larvae were collected at stations in which adults were captured. Species, density and life stage of fish collected from the 16 ichthyoplankton sampling stations are presented in the Appendix. Histograms of abundance from Somerset, Taylor Branch and Kings Creek stations that were most productive, are presented in Figures 2 through 4. Taylor Branch and Kings Creek were the most productive of all stations in terms of white perch and river herring spawning according to the following summary of Figures 2 through 4 in which maximum numbers per sample are presented:

	White Perch (No/ft3)		River Herring (No./ft3)	
Site	Eggs	Larvae	Eggs	Larvae
Somerset Creek	0.32	0.006	0.0042	0.002
Taylor Branch	1.15	0.025	0.012	0.025
Kings Creek	2.5	0.018	0.22	0.035

Ichthyoplanton sampling along a longitudinal gradient at Kings Creek (Stations 12, 21, 13, 14, and 15) indicated that most spawning activity occurred at or just below head of tide and that the lower tidal portions were used as a nursery for the larval and juvenile fish (Appendix).

3.C. Water Quality

3.C.1. Temperature

Water temperature rose throughout the study from less then 8 C at March 3 to > 25 C April 27 (Figure 5). Temperatures in all the investigated streams were comparable and no temperature

anomalies were detected. Stream temperatures remained greater than 10 C (generally considered the temperature of active feeding by fishes) after the April 6 sampling period.

3.C.2. Dissolved Oxygen

Dissolved oxygen ranged from 6.2 to 12.4 mg/l throughout all the streams (Figure 6). Oxygen saturation curves indicate that waters were typically saturated in oxygen (Figure 7). Super-saturated conditions occurred at Manokin Branch, Dividing Creek and Marumsco Branch.

3.C.3. Conductivity

Conductivity values typically were less than 200 uS/cm at all the streams, which indicates the waters at the time of the survey were very fresh (Figure 8). The highest conductivities encountered were at Somerset Creek 320 uS/cm, when it was noted that the tide was exceptionally high and water was running upstream because of it. Also, the consistently low conductivity values indicate no anomalies in the source of the stream waters such as ground water input from high conductivity aquifers.

3.C.4 Water Velocity

Water velocity typically was less than 1 ft/s (Figure 9). Velocity less than 0.2 ft/s was associated with supersaturated oxygen levels at Manokin Branch, Rehobeth Branch, and Dividing Creek (Figure 7).

3.C.5 pH

pH was typically low, with only one (Taylor Branch) greater than 7.0 (Figure 10). One sample from Dividing Creek was determined to be 4.5. This sample (April 11) was associated with a rain event as indicated by the high water velocity at that date. The pH may have been depressed through runoff from the rain event.

4.0 Discussion

Data collected during the fish survey indicates that most stream within Somerset County support a fish fauna indicative of healthy stream conditions. The presence of anadromous fishes should be viewed that stream quality is good and should be maintained. Streams that did not support anadromous species such as Rehobeth, Marumsco and Manokin were observed to be located in intensely cultivated watersheds. Problems viewed at the streams were associated with channelization, and siltation due to runoff from agricultural fields near areas with no stream buffers. The

continued presence of anadromous species such as yellow perch and river herring should continue to be used as an indicator of steam quality. There is relatively "large" population of river herring that are prevented from upstream access at the dam at Edan Allen Road. Some thought should be given to the possibility of installing a fish ladder at the dam to afford access to fish to the upper portion of Wicomico Creek.

Fishes such as banded sunfish, mud sunfish and bluespotted sunfish were found in a variety of locations (i.e., Rehobeth Branch, Manokin Branch, Dividing Creek, Kings Creek). The distribution of these fishes is resticted to generally small, low gradient streams that drain swampy areas and therefore have low pH. Low pH values were observed in streams draining Dividing Creek. These streams drain swamps where the buildup of organic acids can be quite high naturally.

It has been our observation that streams in the upper watershed require good riparian buffers to protect lower sections of the stream from impacts due to agriculture. The impacts remain even if the lower sections do have significant buffers. It appears that streams with buffers of 25 to 50 ft were of significantly higher quality than streams without any buffer. It is our recommendation that further study be conducted on stream riparian zone relationship in the streams of Somerset County. At the very least good stream buffers (25 to 50 ft wide) should be maintained along all streams.

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Table 1. Tributaries and stations surveyed in Somerset County for anadromous fish species.

Station	Location Fig. 1	Within Critical Area	Tax Map No.	Watershed No.	Description	No. Collections IP	Elect	Trap
Somerset Creek	1	YES	5	02-13-03-03-01	Bridge at Rt 529	11	10	6
	2	YES	4	02-13-03-03-01	Downstream of Rt 529 bridge on private landowners property		3	1
Manokin Branch	3	NO	6	02-13-02-08	UMES campus	10	11	5
Taylor Branch	4	YES	23	02-13-02-08	Bridge at Westover Rd		5	1
	5	YES	23	02-13-02-08	Bridge at Rt 13	12	6	6
	6	YES	23	02-13-02-08	Bridge at Stewart Neck Rd	1	1	
Dividing Creek	7	NO*	17	02-13-02-04	Bridge at Rt 388	10	7	7
	8	YES	43	02-13-02-04	Bridge at Worth Rd	1		
	19	YES	26	02-13-02-04	Bridge at Fleming Mill Rd	1		
Rehobeth Branch	9	NO	50	02-13-02-02	Bridge at Charles Barnes Rd	2	3	5
Marumsco Creek	10	NO	58	02-13-02-01	Bridge at Rt 667		1	
	11	NO*	49	02-13-02-01	Bridge at Charles Barnes Rd	9	8	7
Kings Creek	12	YES	24	02-13-02-08-01	Bridge at Westover Rd	10	8	4
	21	NO*	24	02-13-02-08-01	Bridge at Arden Rd	1		
	13	NO*	24	02-13-02-08-01	Bridge at Dublin Rd	1	1	
	14	NO	25	02-13-02-08-01	Bridge at Perry Hawkins Rd	1	1	
	15	YES	23	02-13-02-08-01	Bridge at Stewart Neck Rd	2		

Table 1. Tributaries and stations surveyed in Somerset County for anadromous fish species.

Station	Location Fig. 1	Within Critical Area	Tax Map No.	Watershed No.	Description	No. Collections IP	Elect	Trap
Back Creek	17	YES	32	02-13-02-08	Bridge at Rt 413		1	
	18	YES	32	02-13-02-08	Bridge at Sign Post Rd	1		
Wicomico Creek	16	YES	4	02-13-03-03	Bridge at Eden Allen Rd		6	
Pocomoke River	20	YES	51	02-13-02-02	Bridge at Pocomoke City	1		

* Nontidal Wetland of Significant Importance
IP = Ichthyoplankton Sampling
Elect = Electrofishing
Trap = Trap netting

Table 2. A list of fish species captured in the spring 1990 stream survey of Somerset County.

Common Name	Scientific Name
Gars	Lepisosteidae
Longnose gar	*Lepisosteus osseus*
Eel	Anguillidae
American eel	*Anguilla rostrata*
Herrings	Clupeidae
Blueback herring	*Alosa aestivalis*
Alewife	*Alosa pseudoharengus*
Gizzard shad	*Dorosoma cepedianum*
Mudminnows	Umbridae
Eastern mudminnow	*Umbra pygmaea*
Pikes	Esocidae
Redfin pickerel	*Esox american*
Chain pickerel	*Esox niger*
Minnows	Cyprinidae
Carp	*Cyprinus carpio*
Golden shiner	*Notemigonus crysoleucas*
Suckers	Catostomidae
Creek chubsucker	*Erimyzon oblongus*
Catfish	Ictaluridae
White catfish	*Amieurus catus* (=*Ictalurus*)
Yellow bullhead	*Amieurus natalis*
Brown bullhead	*Amieurus nebulosus*
Tadpole madtom	*Notus gyrinus*
Pirate Perch	Aphredoderidae
Pirate perch	*Aphredoderus sayanus*
Killifish	Cyprinodontidae
Banded killifish	*Fundulus diaphanus*
Mummichog	*Fundulus heteroclitus*
Stiped killifish	*Fundulus majalis*

Table 2 (cont.)

Common Name	Scientific Name
Siversides	Atherinidae
Inland silversides	*Menidia beryllina*
Sunfish	Centrarchidae
Mud sunfish	*Acantharcus pomotis*
Bluespotted sunfish	*Enneacanthus gloriosus*
Banded sunfish	*Enneacanthus obesus*
Pumpkinseed sunfish	*Lepomis gibbosus*
Bluegill	*Lepomis macrochirus*
Largemouth bass	*Micropterus salmoides*
Black crappie	*Pomoxis nigromaculatus*
Perches	Percidae
Swamp darter	*Etheostoma fusiforme*
Tessellated darter	*Etheostoma olmstedi*
Yellow perch	*Perca flavescens*

Table 3. Results of trap net catches. Station numbers correspond to Table 1 and Figure 1.

	Somerset Creek (Station 1)							
	Month-Day							
Species	3-23*	3-30	4-6	4-12	4-20	4-28	5-3	No. of Occurrences
Notemigonus crysoleucas		1						1
Aphredoderus sayanus		1						1
Morone americana	1		21	20		2	1	5
Lepomis gibbosus						1		1
Lepomis macrochirus						1		1
Total No. Species (5)	1	2	1	1	0	3	1	

* Station 2

	Manokin Branch (Station 3)					
	Month-Day					
Species	4-6-2	4-12	4-20	4-28	5-3	No. of Occurrences
Notemigonus crysoleucas					1	1
Amieurus nebulosus				1	1	2
Morone americana		2				1
Lepomis gibbosus				1	3	2
Total No. Species	0	1	0	2	3	

Table 3 (cont)

Taylor Branch (Station 5)								
	Month-Day							
Species	3-23*	3-30	4-6	4-12	4-20	4-28	5-3	No. of Occurrences
Notemigonus crysoleucas		1						1
Morone americana			4	37		1		3
Lepomis gibbosus	1							1
Total No. Species	1	1	1	1	0	1	0	

* - Station 4

Dividing Creek (Station 7)								
	Month-Day							
Species	3-23	3-30	4-6	4-12	4-20	4-28	5-3	No. Occur
Aphredoderus sayanus	5						2	2
Total No. Species	1	0	0	0	0	0	1	

Rehobeth Branch (Station 9)						
	Month-Day					
Species	3-23	3-30	4-6	4-12	4-20	No. Occur
Aphredoderus sayanus			1			1
Lepomis gibbosus		1				1
Lepomis macrochirus	1		1			2
Total No. Species	1	1	2	0	0	

Table 3 (cont)

Marumsco Branch (Station 11)								
	Month-Day							
Species	3-23	3-30	4-6	4-12	4-20	4-28	5-3	No. Occur
Umbra pygmaea							1	1
Esox americanus							1	1
Erimyzon oblongus						1	1	2
Aphredoderus sayanus	1	1	1	1		1	1	6
Lepomis gibbosus	1					1		2
Total No. Species	2	1	1	1	0	3	4	

Kings Creek (Station 12)					
	Month-Day				
Species	3-30	4-20	4-28	5-3	No. Occur
Morone americana			15		1
Total No. Species	0	0	1	0	

Table 4. Results of electrofishing catches at Somerset Creek (Station 1, * - Station 2, see Table 1).

Species	Month - Day													No. of
	3-4	3-11	3-13*	3-22*	3-30	4-5	4-12	4-20	4-27	4-27*	5-2	5-11	5-17	Occurrenc
Anguilla rostrata	X	X	X	X	X	X	X	X	X	X	X	X	X	13
Alosa aestivalis									X		X			2
Alosa pseudoharengus							X							1
Dorosoma cepedianum										X				1
Esox americanus						X		X					X	3
Notemigonus crysoleucas			X			X		X	X	X	X		X	7
Erimyzon oblongus						X		X	X		X		X	5
Amieurus nebulosus	X	X						X		X			X	6
Ictalurus catus									X					1
Noturus gyrinus	X													2
Aphredoderus sayanus				X			X	X	X					4
Noturus gyrinus	X													1
Fundulus diaphanus	X	X	X	X						X				5
Fundulus heteroclitus	X		X	X						X				4
Fundulus majalis				X										1
Morone americana			X	X		X	X		X	X	X	X	X	9
Enneacanthus obesus	X							X					X	3
Lepomis gibbosus	X	X	X	X	X	X	X	X	X	X	X		X	12
Lepomis macrochirus	X	X	X	X	X	X		X	X	X	X			10
Micropterus salmoides								X	X	X				4
Pomoxis nigromaculatus				X			X		X	X				4
Etheostoma olmstedi	X	X	X	X	X	X	X	X		X	X		X	11
Perca flavescens			X	X	X	X		X	X	X	X	X	X	10
Total No. Species (23)	10	6	9	11	6	9	7	12	14	13	10	3	10	

Table 5. Results of electrofishing at Manokin Branch (Station 3, see Table 1).

Species	Month-Day											No. of Occurrence
	3-4	3-11	3-13	3-22	3-29	4-12	4-19	4-27	5-2	5-11	5-17	
Anguilla rostrata	X	X	X	X	X	X	X	X	X	X	X	11
Umbra pygmaea					X				X		X	3
Esox americanus					X		X				X	3
Notemigonus crysoleucas		X			X	X	X	X	X	X	X	8
Erimyzon oblongus	X	X		X	X	X	X	X	X	X	X	10
Amieurus nebulosus		X		X	X	X	X	X				6
Fundulus diaphanus			X		X							2
Morone americana			X			X	X	X	X	X		6
Enneacanthus gloriosus					X		X	X	X	X	X	6
Enneacanthus obesus	X					X					X	3
Lepomis gibbosus	X	X		X	X	X	X	X	X	X	X	10
Lepomis macrochirus					X				X			2
Micropterus salmoides						X						1
Total No. Species (13)	4	5	3	4	10	8	8	7	8	6	8	

Table 6. Results of electrofishing at Taylor Branch (Stations 4, 5-*, 6-#, see Table 1).

Species	Month-Day 3-4	3-11	3-13	3-22	4-11*	4-11	4-19*	4-27*	5-3*	5-11*	5-17*	5-17	No. of Occurrences
Lepisosteus osseus											X		1
Anguilla rostrata	X	X			X	X	X	X	X	X			8
Alosa pseudoharengus			X										1
Dorosoma cepedianum											X		1
Umbra pygmaea				X						X			2
Esox americanus					X		X	X	X		X	X	7
Notemigonus crysoleucas	X	X			X			X	X	X		X	8
Erimyzon oblongus		X			X			X	X		X		5
Amieurus nebulosus	X	X						X	X				4
Aphredoderus sayanus	X	X		X	X		X		X	X			7
Fundulus diaphanus	X	X	X					X					4
Fundulus heteroclitus	X				X		X	X	X	X			6
Fundulus majalis								X					1
Morone americana					X	X	X	X	X	X	X	X	8
Lepomis gibbosus	X	X	X		X	X	X	X	X	X	X	X	12
Lepomis macrochirus	X				X	X	X		X	X	X		7
Micropterus salmoides									X				1
Etheostoma fusiforme	X												3
Perca flavescens			X		X		X	X	X				5
Total No. Species (20)	9	7	4	6	10	4	8	11	12	9	7	4	

Table 7. Results of electrofishing at Dividing Creek (Station 7, see Table 1).

Species	Month-Day 3-11	3-23	3-30	4-11	4-19	4-27	5-3	No. of Occurrences
Anguilla rostrata	X	X	X	X	X	X	X	7
Umbra pygmaea		X			X		X	3
Esox americanus		X			X			2
Esox niger		X						1
Notemigonus crysoleucas				X		X		2
Erimyzon oblongus	X	X				X		3
Amieurus natalis		X			X			2
Noturus gyrinus	X	X					X	3
Aphredoderus sayanus	X	X	X	X	X	X	X	7
Enneacanthus gloriosus					X	X	X	3
Lepomis gibbosus					X			1
Lepomis macrochirus		X						1
Micropterus salmoides					X			1
Etheostoma fusiforme	X	X						2
Total No Species (14)	5	10	2	3	8	5	5	

Table 8. Results of electrofishing at Rehobeth Branch (Station 9, see Table 1).

Species	Month-Day 3-4	3-11	3-22	No. of Occurrences
Anguilla rostrata	X	X	X	3
Umbra pygmaea			X	1
Esox americanus	X			1
Notemigonus crysoleucas			X	1
Erimyzon oblongus		X	X	2
Enneacanthus gloriosus		X		1
Enneacanthus obesus		X		1
Lepomis gibbosus		X	X	2
Lepomis macrochirus		X	X	2
Etheostoma fusiforme			X	1
Etheostoma olmstedi	X	X		2
Total No Species (11)	3	7	7	

Table 9. Results of electrofishing at Marumsco Creek (Station 11, * - Station 10, see Table 1).

Species	Month-Day									No. of Occurrences
	3-4*	3-4	3-11	3-22	3-30	4-11	4-20	4-27	5-2	
Anguilla rostrata		X	X	X		X	X		X	6
Umbra pygmaea		X			X	X	X		X	5
Esox americanus		X		X		X		X	X	5
Notemigonus crysoleucas				X	X	X	X	X	X	6
Erimyzon oblongus			X		X	X	X		X	5
Aphredoderus sayanus		X		X		X				3
Fundulus diaphanus	X	X								2
Fundulus heteroclitus	X									1
Lepomis gibbosus	X	X	X	X	X	X	X	X	X	9
Lepomis macrochirus	X	X	X		X	X	X	X	X	8
Pomoxis nigromaculatus	X									1
Total No Species (12)	5	7	4	5	5	8	6	4	7	

Table 10. Results of electrofishing at Kings Creek (Station 12, * - Station 13, $ - Station 14, see Table 1).

Species	Month - Day 3-30	4-11	4-12	4-20	4-27	5-3	5-11	5-17	5-22*	5-22$	No. of Occurrences
Anguilla rostrata	X	X	X	X		X			X		6
Alosa aestivalis					X	X		X			3
Alosa pseudoharengus		X	X								2
Dorosoma cepedianum					X						1
Umbra pygmaeae				X				X	X	X	4
Esox americanus		X		X		X	X	X	X	X	7
Cyprinus carpio							X				1
Notemigonus crysoleucas		X		X	X	X	X	X	X		7
Erimyzon oblongus	X			X		X		X	X		5
Amieurus nebulosus		X									1
Ictalurus catus								X			1
Aphredoderus sayanus									X		1
Fundulus diaphanus	X		X			X	X	X			5
Fundulus heteroclitus				X							1
Morone americana		X	X	X	X	X	X	X			7
Acantharchus pomotis									X	X	2
Enneacanthus gloriosus						X	X		X	X	4
Enneacanthus obesus	X	X						X	X	X	5
Lepomis gibbosus	X	X	X	X	X	X	X	X	X		9
Lepomis macrochirus	X	X	X	X	X	X	X	X			8
Micropterus salmoides					X						1
Perca flavescens	X	X	X	X	X	X	X	X			8
Total No.Species (22)	7	10	7	10	8	11	9	12	10	5	

Table 11. Results of electrofishing at Wicomico Creek (Station 16, see Table 1).

Species	Month-Day 3-13	3-22	4-11	4-27	5-2	5-11	No. of Occurrences
Anguilla rostrata	X	X	X	X			4
Alosa aestivalis				X	X		2
Alosa pseudoharengus	X		X				2
Dorosoma cepedianum						X	1
Notemigonus crysoleucas		X		X			2
Amieurus natalis						X	1
Fundulus heteroclitus		X					1
Fundulus diaphanus		X					1
Morone americana	X		X	X	X	X	5
Lepomis gibbosus	X	X	X	X	X	X	6
Lepomis macrochirus	X	X	X	X			4
Micropterus salmoides					X		1
Perca flavescens						X	1
Total No Species (13)	5	6	5	6	4	5	

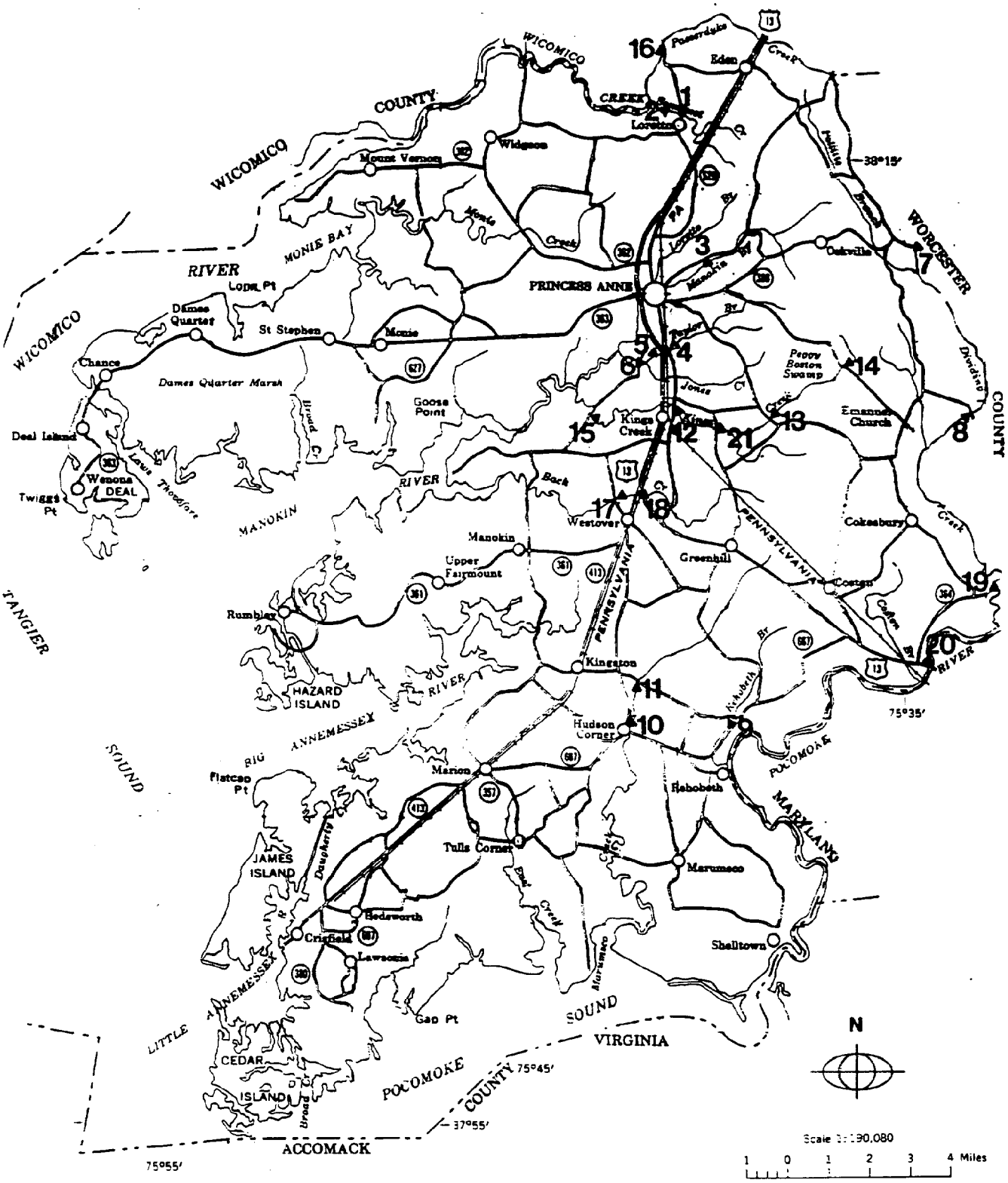


Figure 1. Locations of anadromous fish sampling locations in Somerset County, Maryland.

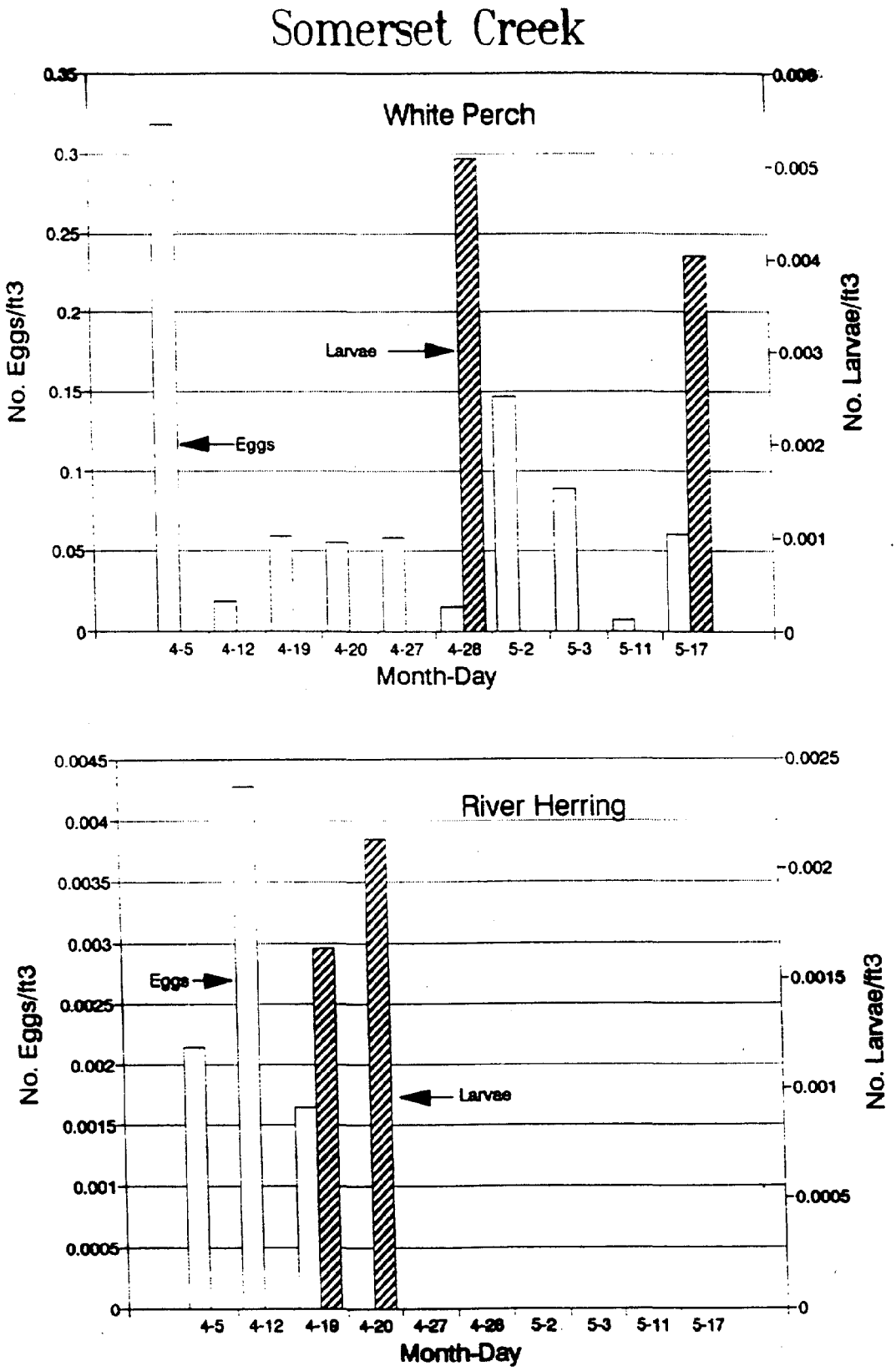


Figure 2. Density (No./ft^3) of eggs and larvae of white perch and river herring collected at Somerset Creek (Station 1), Somerset County, Maryland.

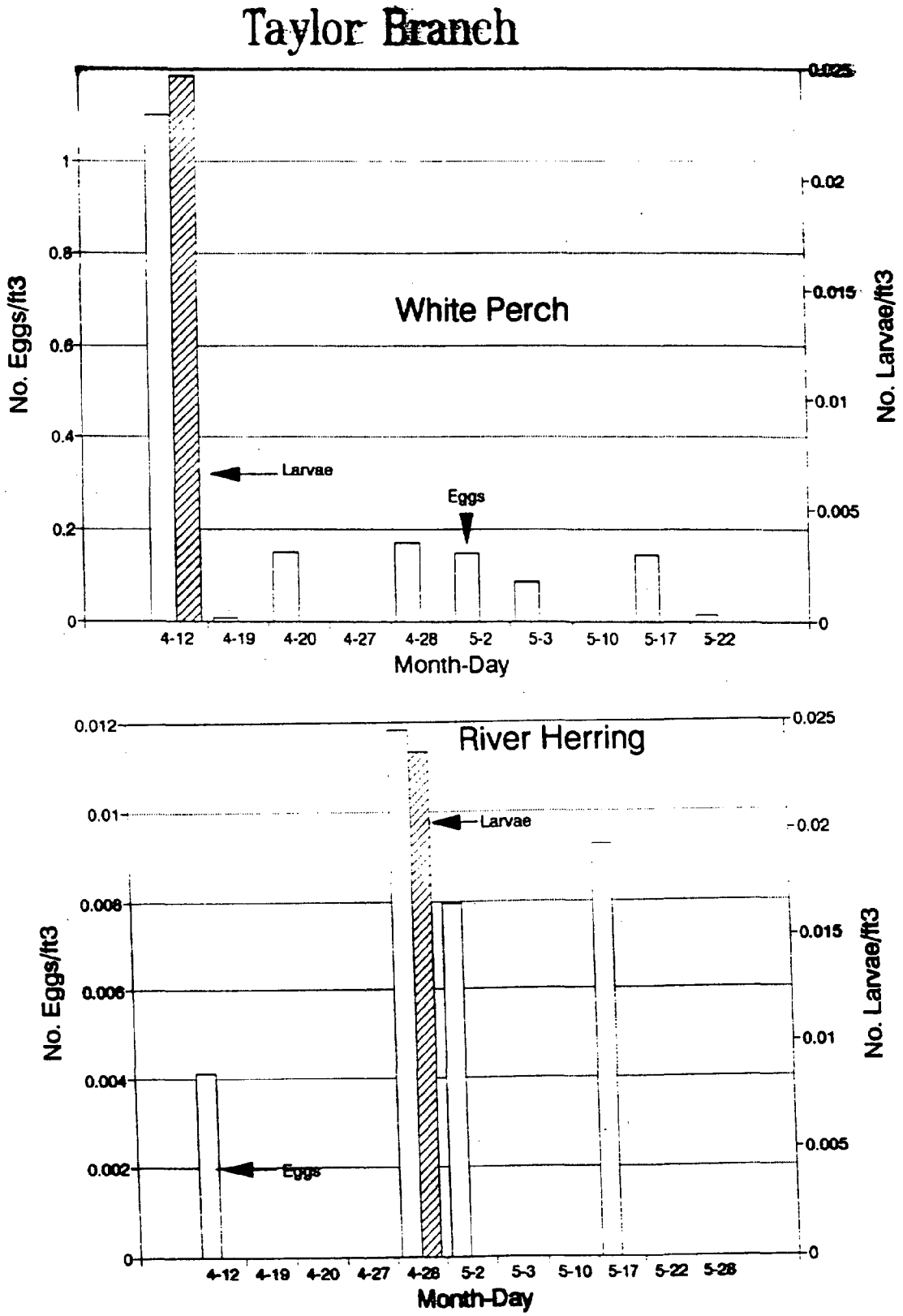


Figure 3. Density (No./ft^3) of eggs and larvae of white perch and river herring collected at Taylor Branch (Station 5), Somerset County, Maryland.

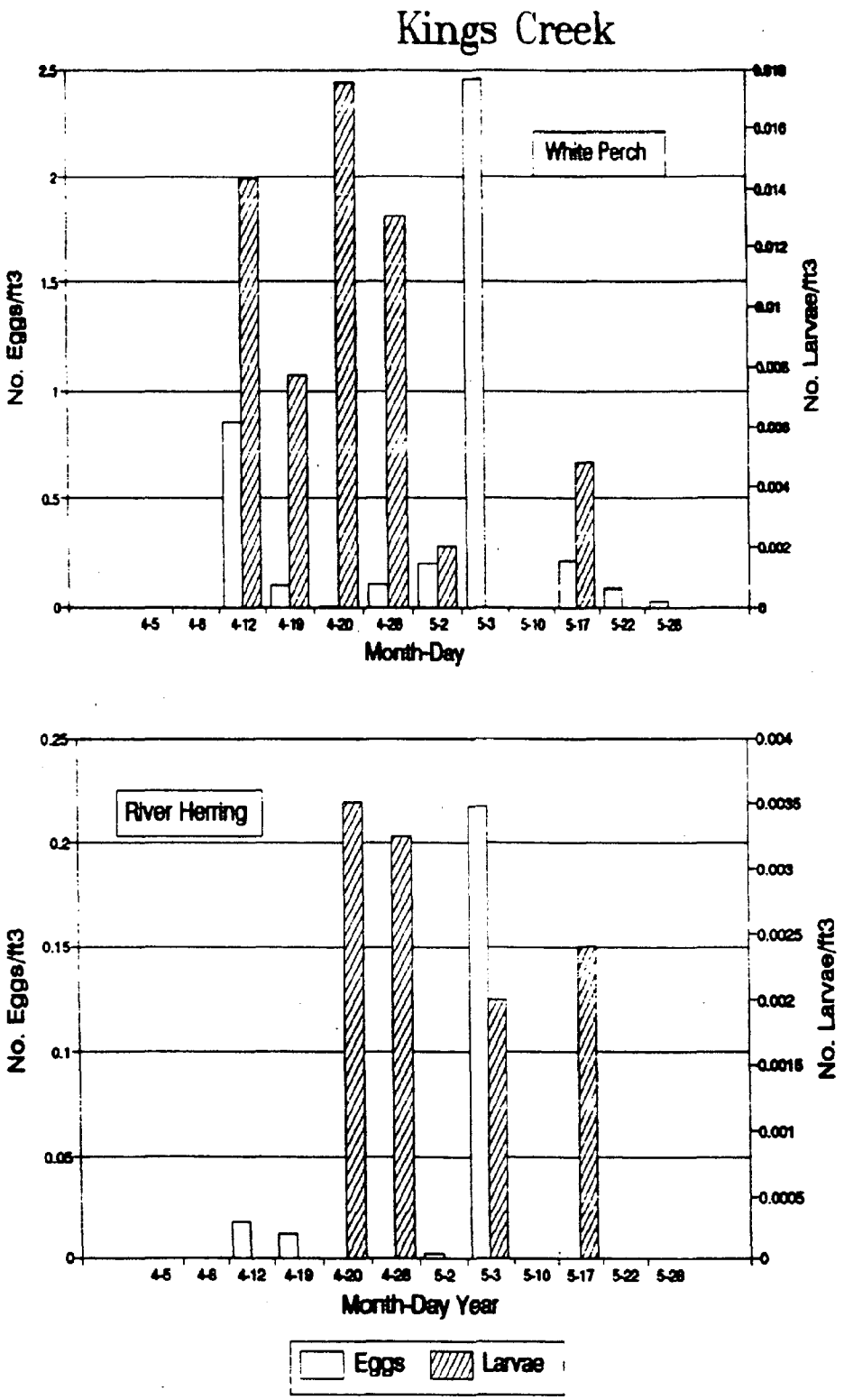


Figure 4. Density (No./ft^3) of eggs and larvae of white perch and river herring collected at Kings Creek, Somerset County, Maryland.

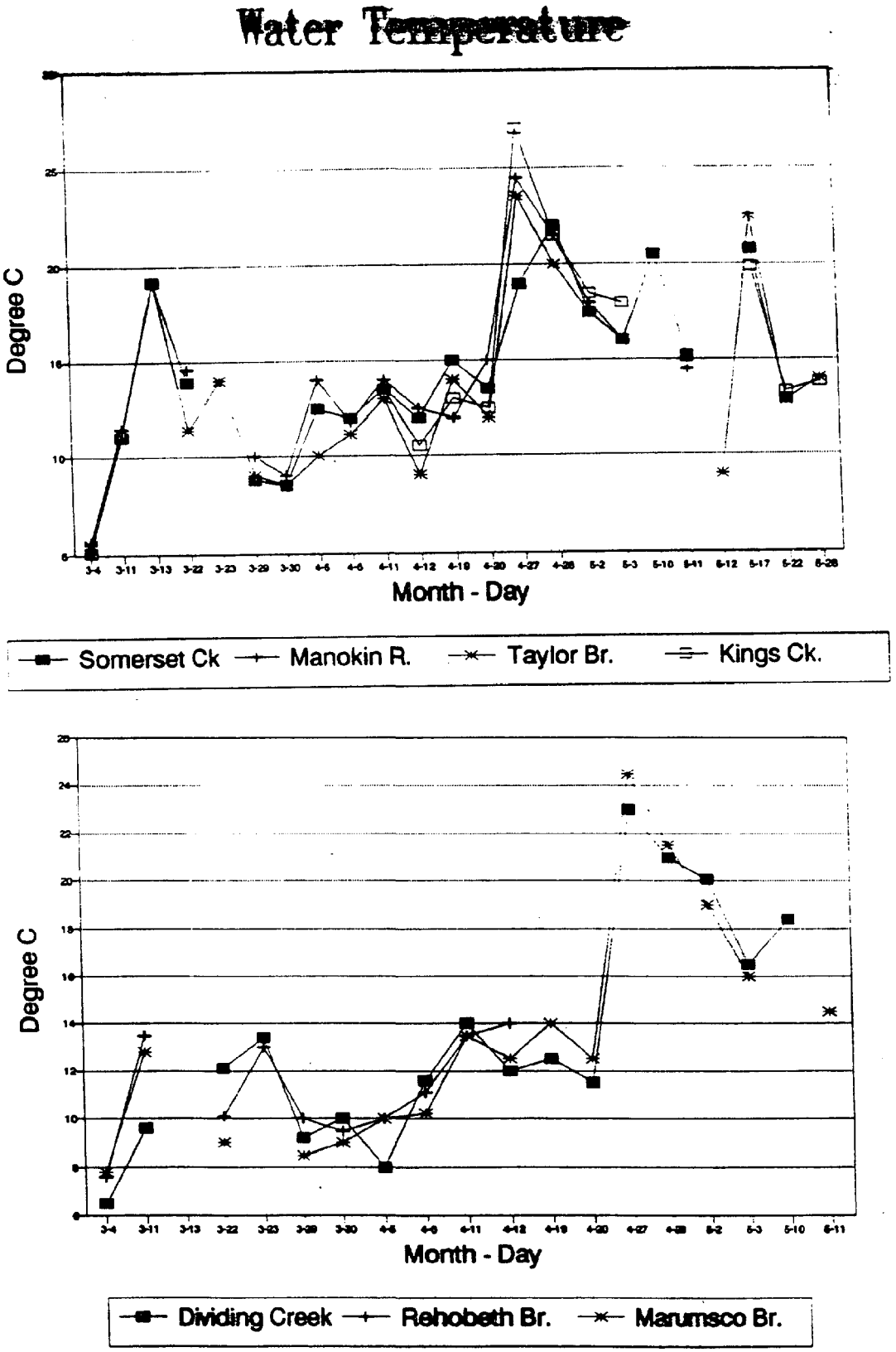


Figure 5. Water temperatures (°C) at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), Somerset County County, Maryland during spring 1990.

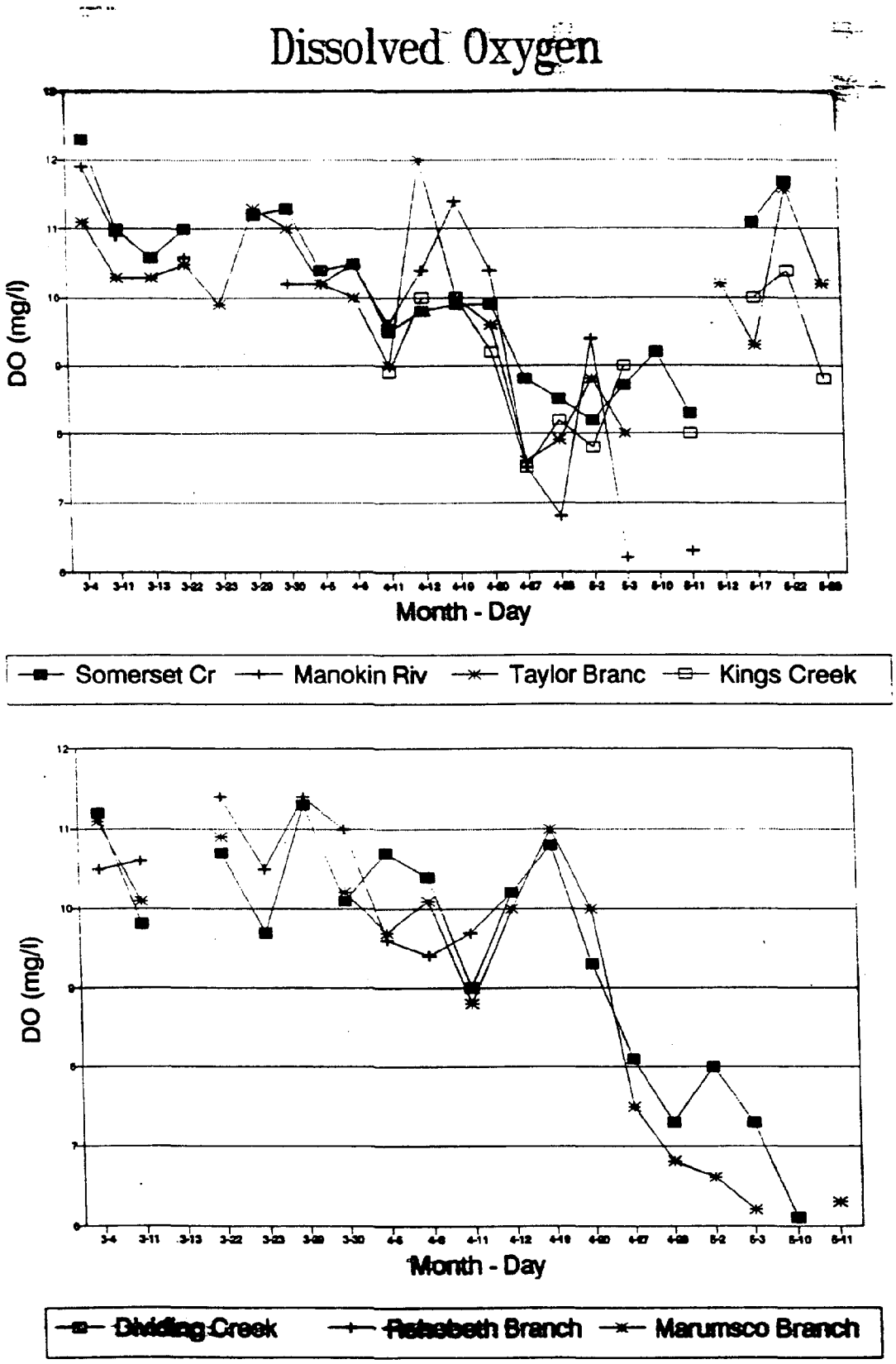


Figure 6. Dissolved oxygen (mg/l) at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), **Somerset County County, Maryland during spring 1990.**

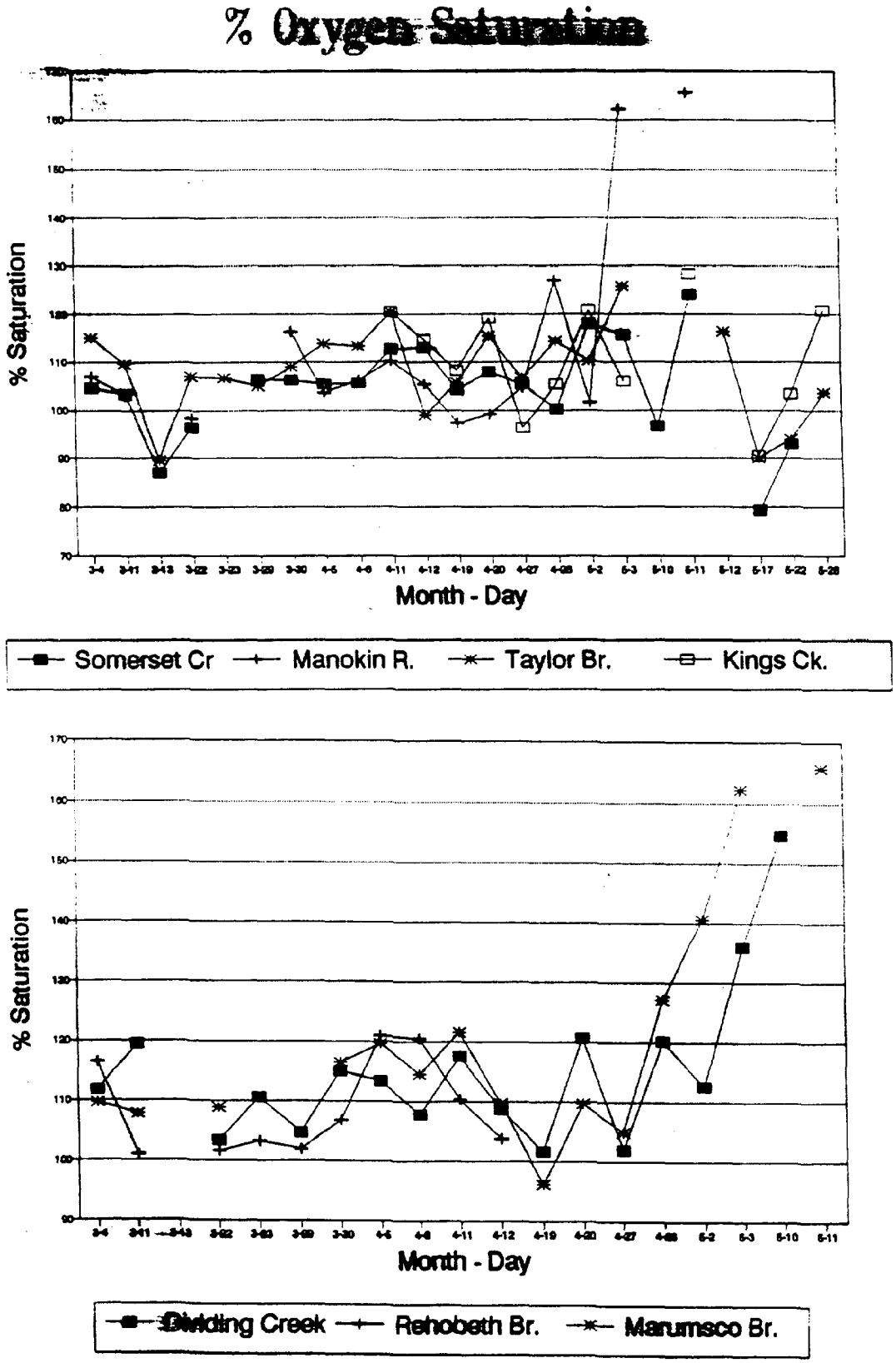
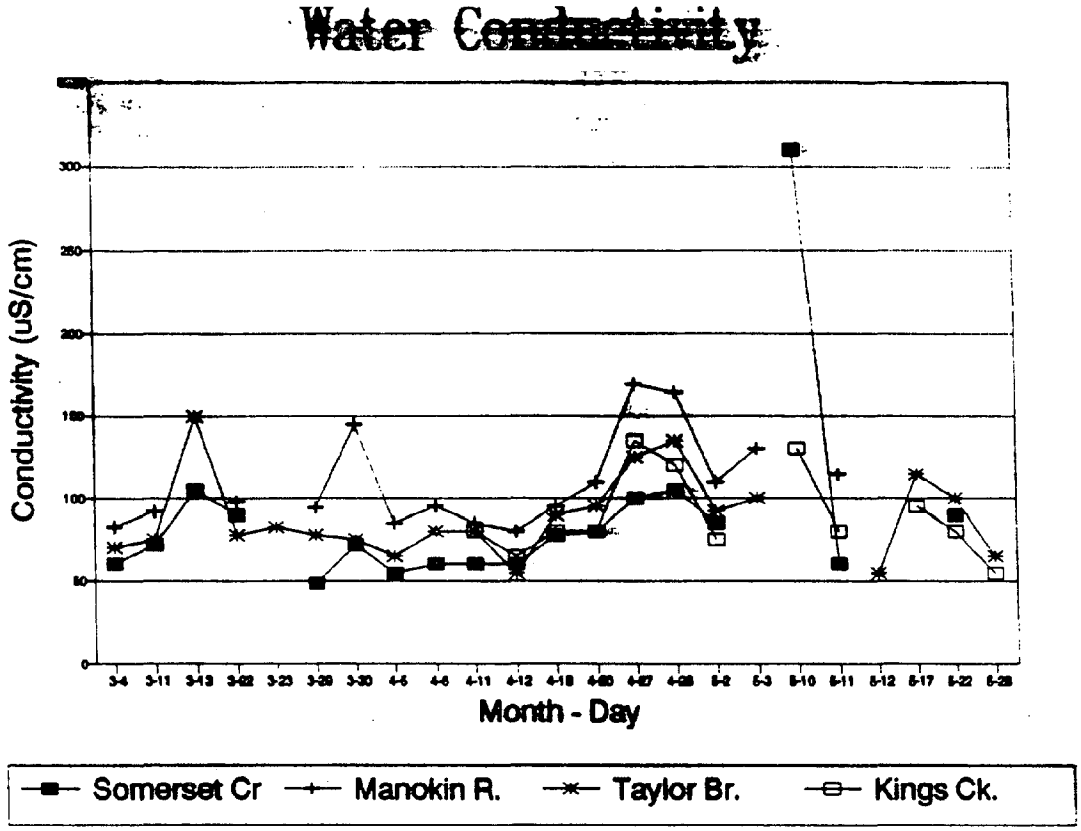


Figure 7. Percent oxygen saturation at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), **Somerset County County, Maryland during spring 1990.**



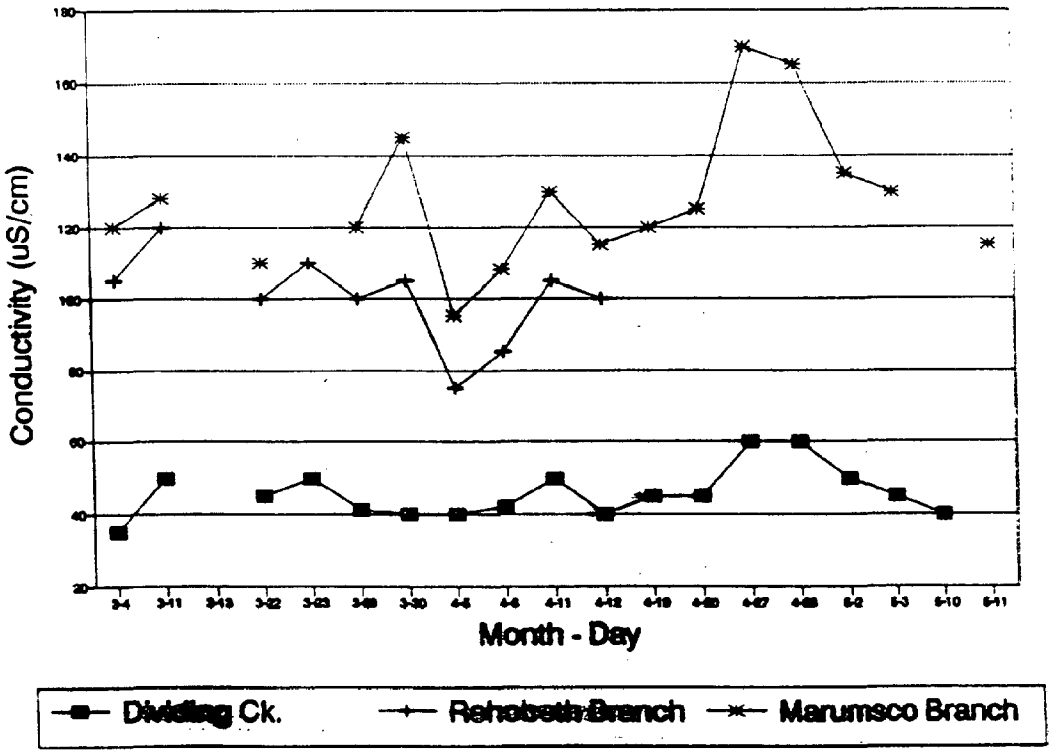


Figure 8. Water conductivity (uS/cm) at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), Somerset County County, Maryland during spring 1990.

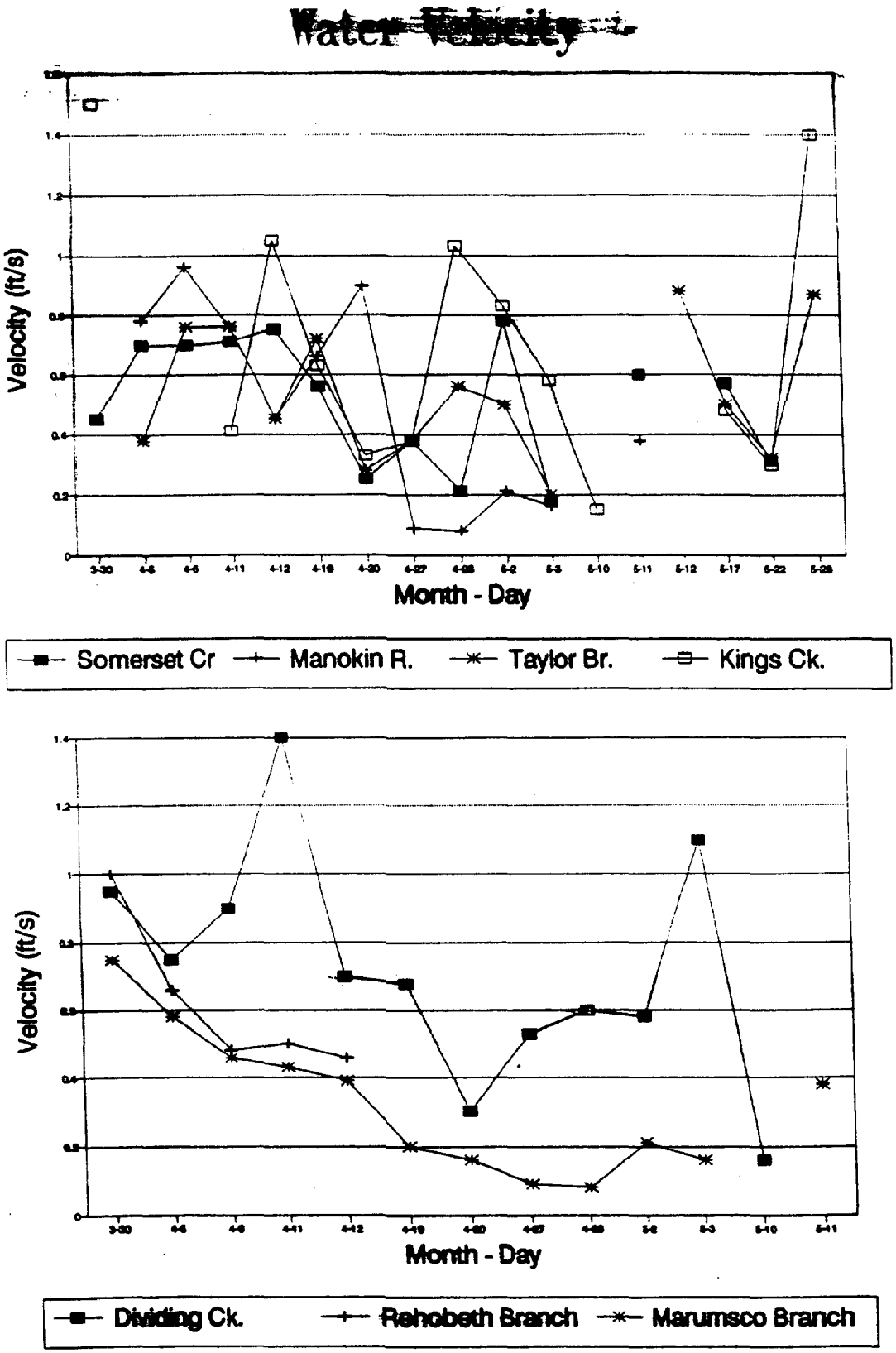


Figure 9. Water velocity (ft/s) at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), **Somerset County County, Maryland during spring 1990.**

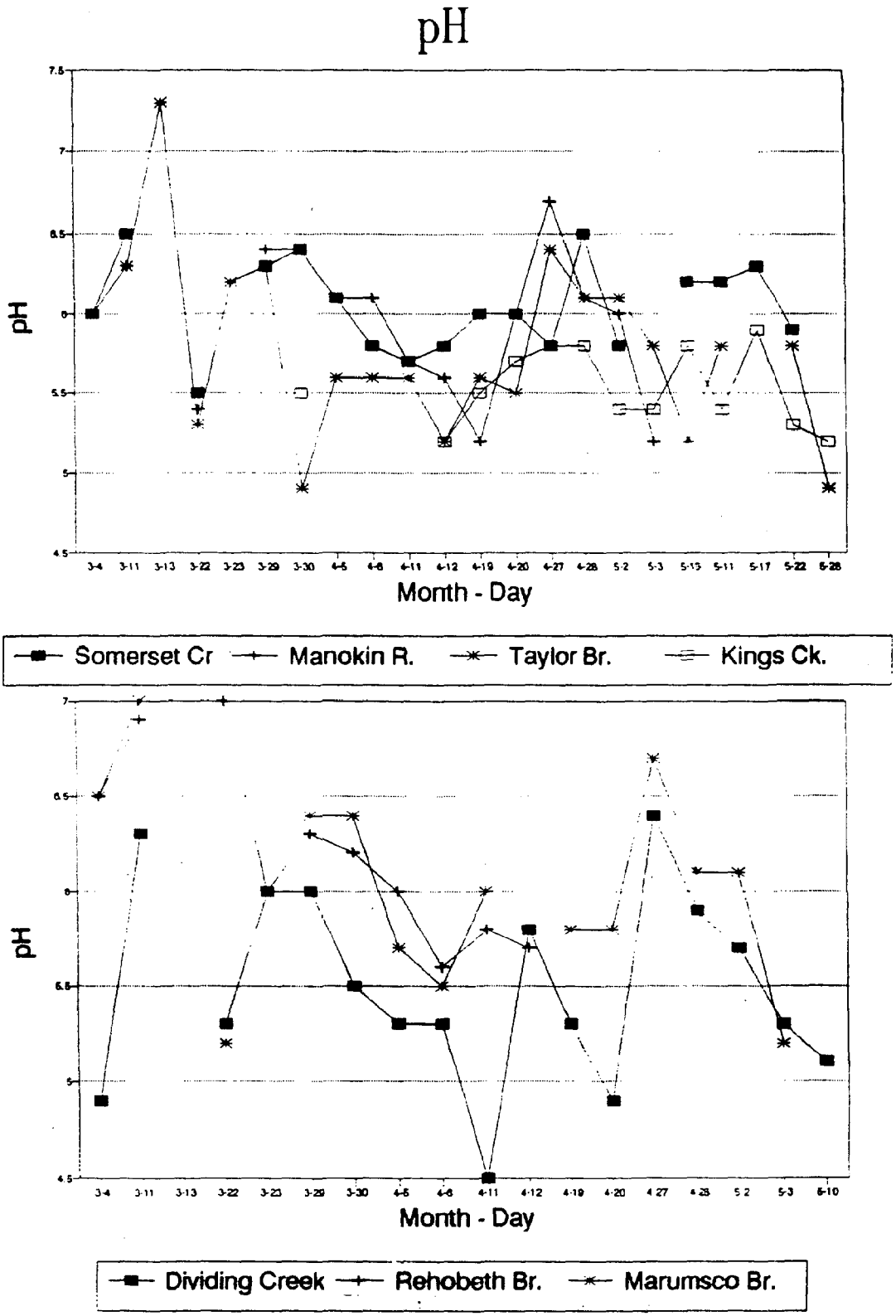


Figure 10. pH at Somerset Creek (Station 1), Manokin Branch (Station 3), Taylor Branch (Station 5), Kings Creek (12), Dividing Creek (Station 7), Rehobeth Branch (Station 9), and Marumsco Creek (Station 11), Somerset County County, Maryland during spring 1990.

APPENDIX

Fish species, density (No/1000ft3) and life stage collected in Somerset County during spring 1990.
Site numbers correspond to Figure 1 and Table 1.

Date (M-D)	Taxonomic Group (Life Stage)	Sites 1	3	5	6	7	8	9	11	12	13	14	15	18	19	20	21
4-5	River herring (eggs)	2															
	Morone americana (eggs)	318															
	Etheostoma olmstedi (prolarvae)	1															
	None found			0		0											
4-6	Morone americana (eggs)		6					4	2								
	Umbra pygmaea (prolarvae)								2								
	None found					0											
4-12	River herring (eggs)	4	2	4						18							
	Morone americana (eggs)	18	15	1,103					4	852							
	Morone americana (prolarvae)			25						14							
	Unidentified (eggs)			4		2											
	None found							0									
4-19	River herring (eggs)	2								11							
	River herring (prolarvae)	2															
	Morone americana (eggs)	59	3	6						99							
	Morone americana (prolarvae)									8							
	Unid. centrarchidae (larvae)									1							
	Etheostoma olmstedi (prolarvae)	2															
	None found					0			0								
4-20	River herring (larvae)	2															
	Morone. americana (eggs)	56		149						1							
	Morone americana (prolarvae)		1							1							

APPENDIX

Fish species, density (No/1000ft3) and life stage collected in Somerset County during spring 1990.
Site numbers correspond to Figure 1 and Table 1.

Date (M-D)	Taxonomic Group (Life Stage)	Sites 1	3	5	6	7	8	9	11	12	13	14	15	18	19	20	21
	Ethostoma olmstedi (larvae)	2															
	Unidentified (eggs)					5			6								
	Unid.(prolarvae)					5											
	None found				o	20											
4-27	River herring (prolarvae)									3							
	Morone americana (eggs)	59	14														
	Morone americana (prolarvae)									10							
	Unid. centrarchidae	3															
	None found			0					0								
4-28	River herring (eggs)			12													
	River herring (prolarvae)			24						3							
	Morone americana (eggs)	15		171						106							
	Morone americana (prolarvae)	5								13							
	Erimyzon oblongus (prolarvae)			6													
	Unidentified (eggs)					3				6							
	Unidentified (prolarvae)					3											
	None found		0						0								
5-2	River herring (eggs)			8						2							
	Morone americana (eggs)	147		137						202							
	Morone americana (prolarvae)									2							
	Erimyzon oblongus (postlarvae)			4													
	Centrarchid sp.(larvae)	21				2											

APPENDIX

Fish species, density (No/1000ft3) and life stage collected in Somerset County during spring 1990.
Site numbers correspond to Figure 1 and Table 1.

Date (M-D)	Taxonomic Group (Life Stage)	Sites 1	3	5	6	7	8	9	11	12	13	14	15	18	19	20	21
	None found		0			0			0								
5-3	River herring (eggs)									218							
	River herring (prolarvae)									2							
	Morone. americana (eggs)	89		85						2,456							
	Erimyzon oblongus (prolarvae)									2							
	None found		0						0								
5-10	Unidentified (eggs)			14		7				8							
5-11	Morone americana (eggs)	7															
	Notemigonus chrysoleucas (eggs)								1								
	Unidentified (egg)					7			1								
	None found		0														
5-17	River herring (eggs)			9													
	River herring (prolarvae)									2							
	Morone americana (eggs)	61	2	144						212							
	Morone americana (prolarvae)									5							
	Morone americana (postlarvae)	4															
	Cyprinus carpio (eggs)									2							
	Erimyzon oblongus (postlarvae)			2													
	Etheostoma olmstedi (prolarvae)	4															
	Unid. (eggs)	4	3	9													
5-22	River herring (eggs)												2				
	River herring (postlarvae)												67				

APPENDIX

Fish species, density (No/1000ft3) and life stage collected in Somerset County during spring 1990.
Site numbers correspond to Figure 1 and Table 1.

Date (M-D)	Taxonomic Group (Life Stage)	Sites 1	3	5	6	7	8	9	11	12	13	14	15	18	19	20	21
	Alosa aestivalis (juvenile)												1				
	Morone americana (eggs)			14						87							
	Morone americana (postlarvae)												1				
	Morone americana (juvenile)												7				
	Unid. (eggs)	17															
	None found									0	0	0					0
5-28	River herring (prolarvae)				14											X	
	River herring (postlarvae)												74				
	River herring (juvenile)												3				
	Morone americana (eggs)									30						X	
	Morone americana (postlarvae)												7				
	Morone americana (juvenile)												12				
	Cyprinus carpio (eggs)												2				
	Erimyzon oblongus (postlarvae)				1												
	Fundulus heteroclitus (postlarvae)				1								2				
	Menidia beryllina (prolarvae)												3				
	Menidia beryllina (postlarvae)												3				
	Unid. (eggs)			3	2					2				12		X	
	Unid. (postlarvae)															X	
	None found						0								0		

APPENDIX

Fish species, density (No/1000ft3) and life stage collected in Somerset County during spring 1990.
Site numbers correspond to Figure 1 and Table 1.

Date		Sites															
(M-D)	Taxonomic Group (Life Stage)	1	3	5	6	7	8	9	11	12	13	14	15	18	19	20	21

X - Flow not determined, presence data

APPENDIX

FINAL REPORT/ADMINISTRATION OF THE ANADROMOUS FISH SURVEY, SOMERSET COUNTY, MARYLAND SPRING 1990

Somerset County, Maryland signed an agreement with the University of Maryland - Eastern Shore in March 1990 to inventory streams within Somerset to determine use by spawning migratory species. This study was funded by the Coastal Resources Division, Maryland Department of Natural Resources, through a CZM grant.

The University's initial proposal included the services of Roman V. Jesien, a fisheries scientist connected currently with Horn Point Environmental Laboratory, Thomas S. Hopkins, Professor of biology and Clement L. Counts, III, Director of UMES' Coastal Ecology Research Laboratory. After some discussion and modifications, this proposal became the basis for the present survey.

The UMES team began visiting sites and talking with property owners and fishermen even before the contract was finalized. As previously reported, sampling began March 4, 1990 determined by field conditions. Decision as to final sampling stations were altered and moved downstream based on observation. The team had conducted longitudinal transects along streams to determine spawning limits and nursery areas. A decision was also made to focus more on ichthyoplankton than originally planned. Collection then continued until it became clear that the major spawning pulse of the targeted species had occurred.

A no-cost extension was received for the project due to front-end delay in water sampling and additional time needed for ichthyoplankton analysis. A draft report was submitted to CRD in mid-November.

Upon word that DNR fisheries found methods and procedures outlined in the draft report in keeping with their standards, the Department of Technical and Community Services scheduled a final meeting with UMES professors and Dr. Jesien. Suggestion was made to provide the County with more site specific information on sites inside and outside the Critical Area as well as any management information which could form part of a recommendation.

The completed report will be presented to the Planning Commission and the County Commissioners with a recommendation that surveyed areas outside the Chesapeake Bay Critical Area which offered suitable fish habitat receive the similar protections as those afforded anadromous fish streams in the CBCA. These include limitations on the use of concrete or riprap on stream beds, construction activities prohibited during the spawning period (March 1 - June 15) in stream buffers and channelization or blockage of streams.

Consideration will also be given to general stream buffers, particularly in heavily farmed areas. The consultants indicated a 25 foot vegetated buffer should be adequate in the absence of steep slopes. Although no major problems seem to exist on the streams tested, an area in the central part of the County shows signs of degradation due to run-off from farm fields.

Reduction in soil erosion along these banks may be sufficient to bring anadromous fish into these streams in the future.

Any regulations introduced would take the form of special provisions to the Somerset County Zoning Ordinance.

Some kind of follow up to this survey should be considered since such a report provides only a "snap shot" of the 1990 spawning season. A wetter or drier year, for example, could lead to different results. Somerset County should, ideally, plan for a second study in the future. In the interim, local school groups and/or the University should be approached to monitor streams for water quality and record keeping should be coordinated.

December 28, 1990

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