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CHESAPEAKE BAY LOW FRESHWATER INFLOW STUDY PHASE II

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BIOA ASSESSMENT MAP..(U) WESTERN ECO-SYSTEMS

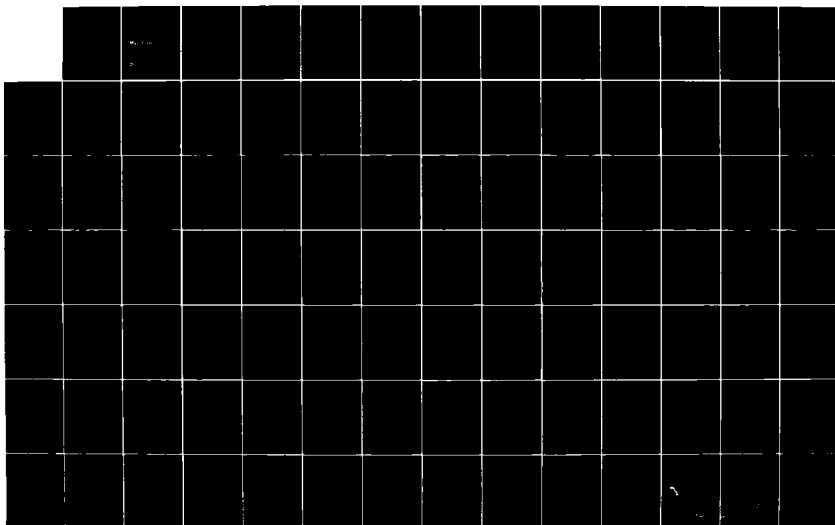
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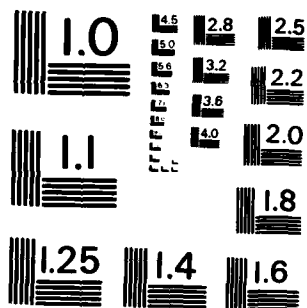
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May 1982

**Chesapeake Bay Low Freshwater Inflow Study
Phase II Biota Assessment**

Map Folio

AD A1200150



**US Army Corps
of Engineers**
Baltimore District

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Prepared for U.S. Army Engineer District Baltimore
by Western Eco-Systems Technology, Inc. 204 215th St., S.E. Bothell, Washington 98011

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) -An assessment of the effects of low freshwater inflow conditions on the biota of Chesapeake Bay was conducted through use of data output from the U.S. Army Corps of Engineers' Chesapeake Bay Hydraulic Model. Four sets of test conditions (scenarios) were used which simulated effects of drought and effects of future consumptive water withdrawal and use as deviations from present average flow conditions. Changes in habitat of over 50 biological organisms were predicted and mapped based on salinity and other variables. Changes in habitat,		

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Estuary

(Block number)

ter inflow conditions on the biota of data output from the U.S. Army Model. Four sets of test connected effects of drought and effects of as deviations from present average r 50 biological organisms were pre-er variables. Changes in habitat,

which were used to delineate the amount of impact from low flow, were found to include increases and decreases depending on the species, its lifecycle, tolerances, and interactions with other organisms. The magnitude of habitat change was found to generally increase as salinity changes increased.



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INTRODUCTION

This folio is a principal product of the Biota Assessment portion of the Corps of Engineers' Chesapeake Bay Low Freshwater Inflow Study. The purpose of the mapping is to portray habitat for selected Chesapeake Bay species under a variety of freshwater inflow conditions. They are based on the results of tests done on the Chesapeake Bay Hydraulic Model simulating four freshwater inflow conditions. These were:

- 1) Base Average -- average freshwater inflow conditions.
- 2) Future Average -- reflective of average inflow conditions reduced by increased water consumption projected for the year 2020.
- 3) Base Drought -- simulating an actual drought in the 1960's.
- 4) Future Drought -- simulated 1960's drought inflows, reduced by increased water consumption projected for the year 2020.

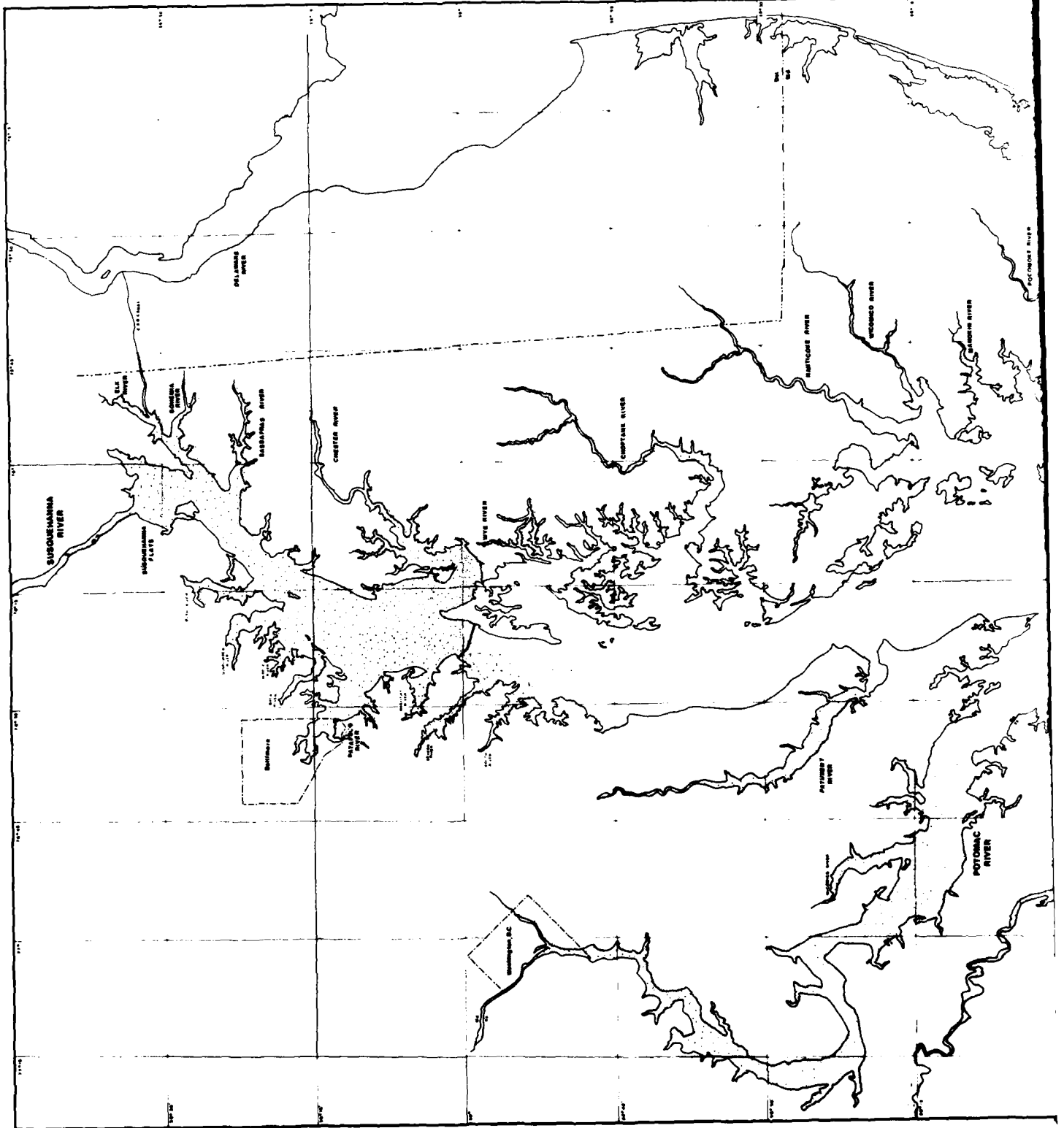
Data from the hydraulic model tests were subsequently used to generate seasonal average salinities at various depths from the mouth of the Bay to the head of tide in each tributary. These salinity data, in conjunction with data on depth, substrate, and dependence on other organisms, was used to create the maps of habitat portrayed in this volume. For further discussion of the information presented herein, the reader is referenced to the Chesapeake Bay Low Freshwater Inflow Study Biota Assessment, Phase II; Final Report, May 1982.

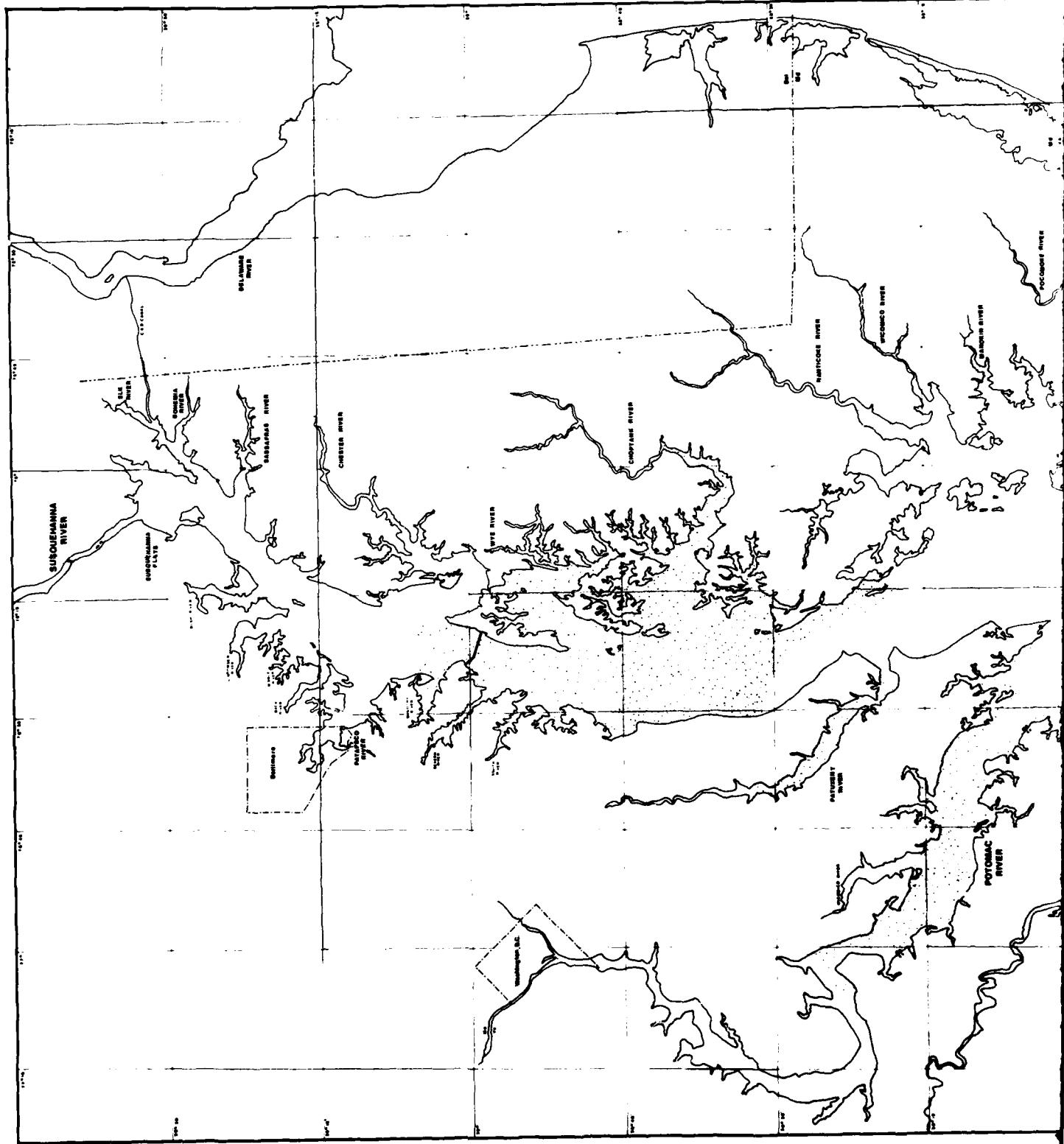
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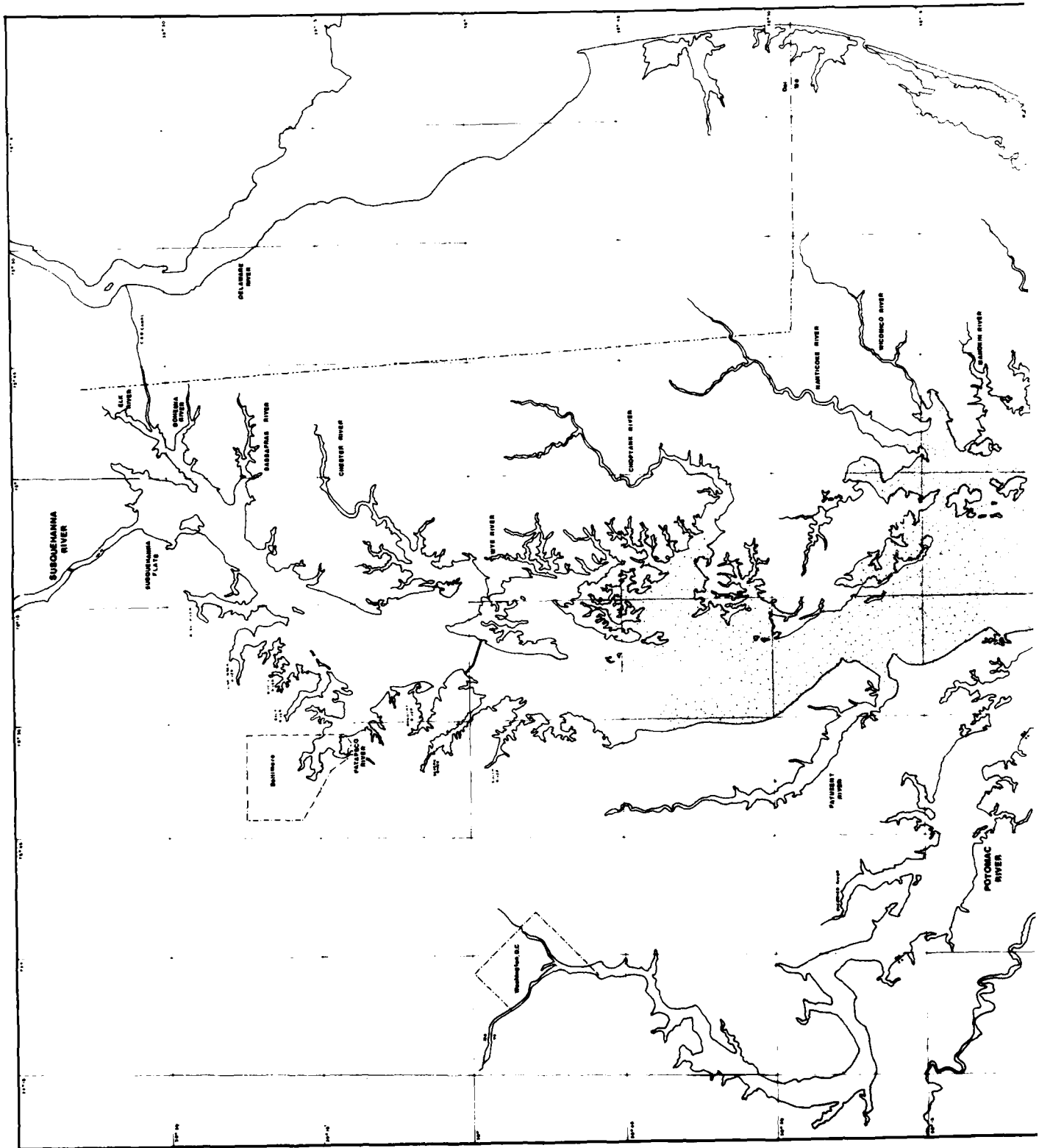
<u>TITLE</u>	<u>Plate No.</u>	<u>TITLE</u>
Base Average		
Tidal Fresh Phytoplankton, Winter/Spring	1	Anchoa mitchilli
Oligo-Low Mesohaline Phytoplankton, Winter/Spring	2	Leiostomus xanthurus
Mesohaline Phytoplankton, Winter/Spring	3	Morone saxatilis
Polyhaline Phytoplankton, Summer/Fall	4	Aythya valisineria
Tidal Fresh Phytoplankton, Summer/Fall	5	
Oligo-Low Mesohaline Phytoplankton, Summer/Fall	6	Future Average
Mesohaline Phytoplankton, Summer/Fall	7	Potamogeton pectinatus
Prorocentrum minimum (Dinoflagellate)	8	Potamogeton perfoliatus
Ceratophyllum demersum (Coontail)	9	Chrysaora quinquecirrha
Ruppia maritima (Widgeon Grass)	10	Eurytemora affinis
Zostera marina (Eelgrass)	11	Urosalpinx cinerea
Zannichellia palustris (Horned Pondweed)	12	Crassostrea virginica
Emergent Aquatic Vegetation (Coastal Fresh Marsh)	13	Macoma balthica
Mnemiopsis leidyi Summer (Ctenophore - Sea Walnut)	14	Mercenaria mercenaria
Mnemiopsis leidyi Winter (Ctenophore - Sea Walnut)	15	Mya arenaria
Brachionis calyciflorus (Rotifer)	16	Callinectes sapidus
Acartia clausi (Copepod)	17	Callinectes sapidus
Acartia tonsa (Copepod)	18	Alosa sapidissima
Scottolana canadensis (Copepod)	19	Brevoortia tyrannus
Bosmina longirostris (Cladoceran)	20	Anchoa mitchilli
Evadne tergestina (Cladoceran)	21	Leiostomus xanthurus
Podon polyphemoides (Cladoceran)	22	Morone saxatilis
Limnodrilus hoffmeisteri (Oligochaete Worm)	23	Aythya valisineria
Heteromastus filiformis (Polychaete Worm)	24	
Pectinaria gouldii (Polychaete Worm)	25	Base Drought (M)
Scolecopides viridis (Polychaete Worm)	26	Potamogeton pectinatus
Streblospio benedicti (Polychaete Worm)	27	Potamogeton perfoliatus
Mulinia lateralis (Coot Clam)	28	Chrysaora quinquecirrha
Rangia cuneata (Brackish Water Clam)	29	Eurytemora affinis
Ampelisca abdita (Amphipod)	30	Urosalpinx cinerea
Balanus improvisus (Acorn Barnacle)	31	Crassostrea virginica
Cyathura polita (Isopod)	32	Macoma balthica
Gammarus daiberi (Amphipod)	33	Mercenaria mercenaria
Leptocheirus plumulosus (Amphipod)	34	Mya arenaria
Palaemonetes pugio (Grass Shrimp)	35	Callinectes sapidus
Alosa pseudoharengus (Alewife - Eggs & Larvae)	36	Callinectes sapidus
Alosa pseudoharengus (Alewife - Juveniles)	37	Alosa sapidissima
Micropogonias undulatus (Atlantic Croaker)	38	Brevoortia tyrannus
Menidia menidia (Atlantic Silverside)	39	Anchoa mitchilli
Morone americana (White Perch)	40	Leiostomus xanthurus
Perca flavescens (Yellow Perch)	41	Morone saxatilis
		Aythya valisineria
Base Average (Major 15 Species)		
Potamogeton pectinatus (Sago Pondweed)	42	Future Drought
Potamogeton perfoliatus (Redhead Grass)	42	Potamogeton pectinatus
Chrysaora quinquecirrha (Sea Nettle)	43	Potamogeton perfoliatus
Eurytemora affinis (Copepod)	44	Chrysaora quinquecirrha
Urosalpinx cinerea (Oyster Drill)	45	Eurytemora affinis
Crassostrea virginica (American Oyster)	46	Urosalpinx cinerea
Macoma balthica (Baltic Macoma)	47	Crassostrea virginica
Mercenaria mercenaria (Hard Clam)	48	Macoma balthica
Mya arenaria (Soft Clam)	49	Mercenaria mercenaria
Callinectes sapidus (Blue Crab - Summer males)	50	Mya arenaria
Callinectes sapidus (Blue Crab - Summer females)	51	Callinectes sapidus
Alosa sapidissima (American Shad)	52	Callinectes sapidus
Brevoortia tyrannus (Menhaden)	53	Alosa sapidissima

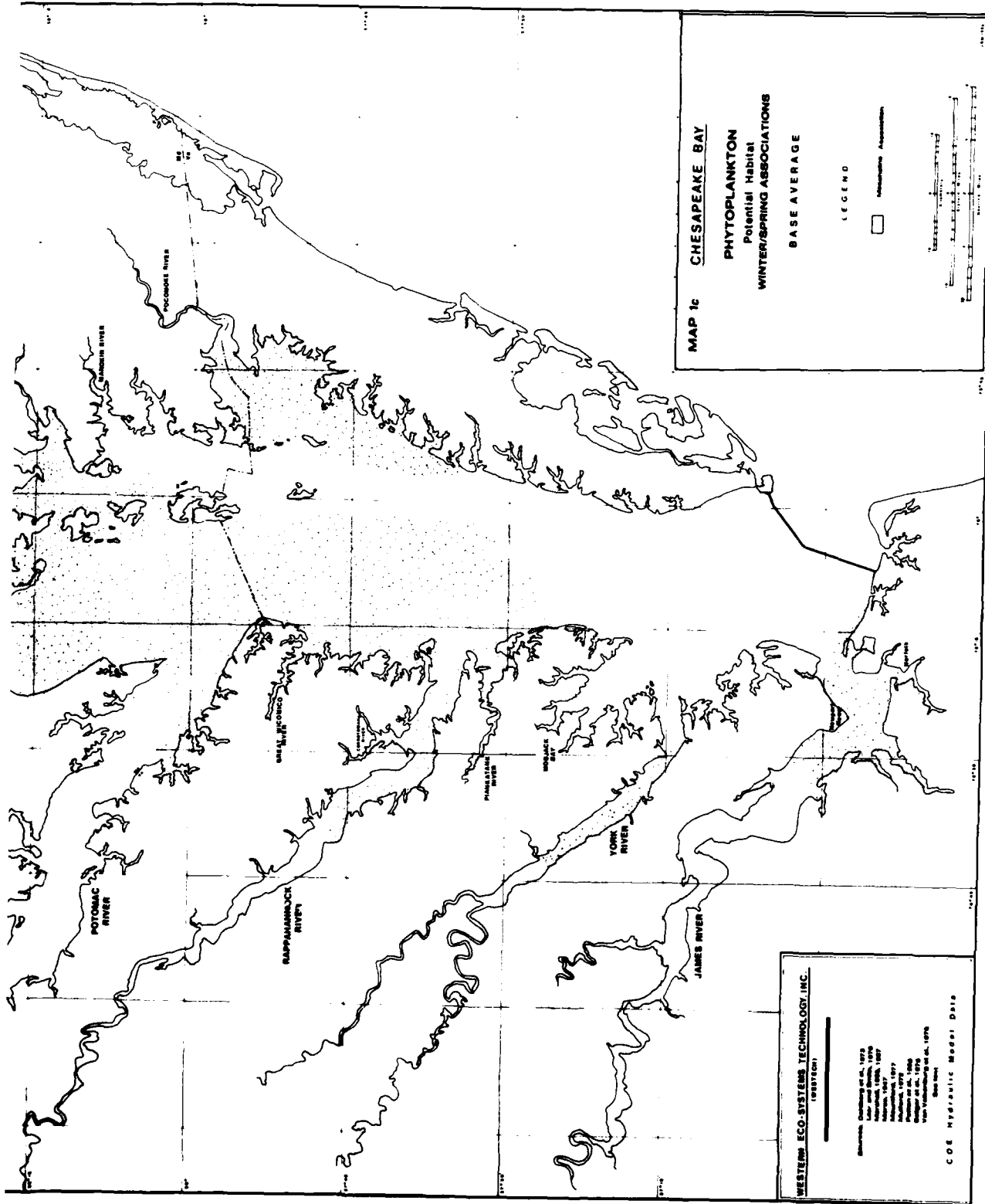
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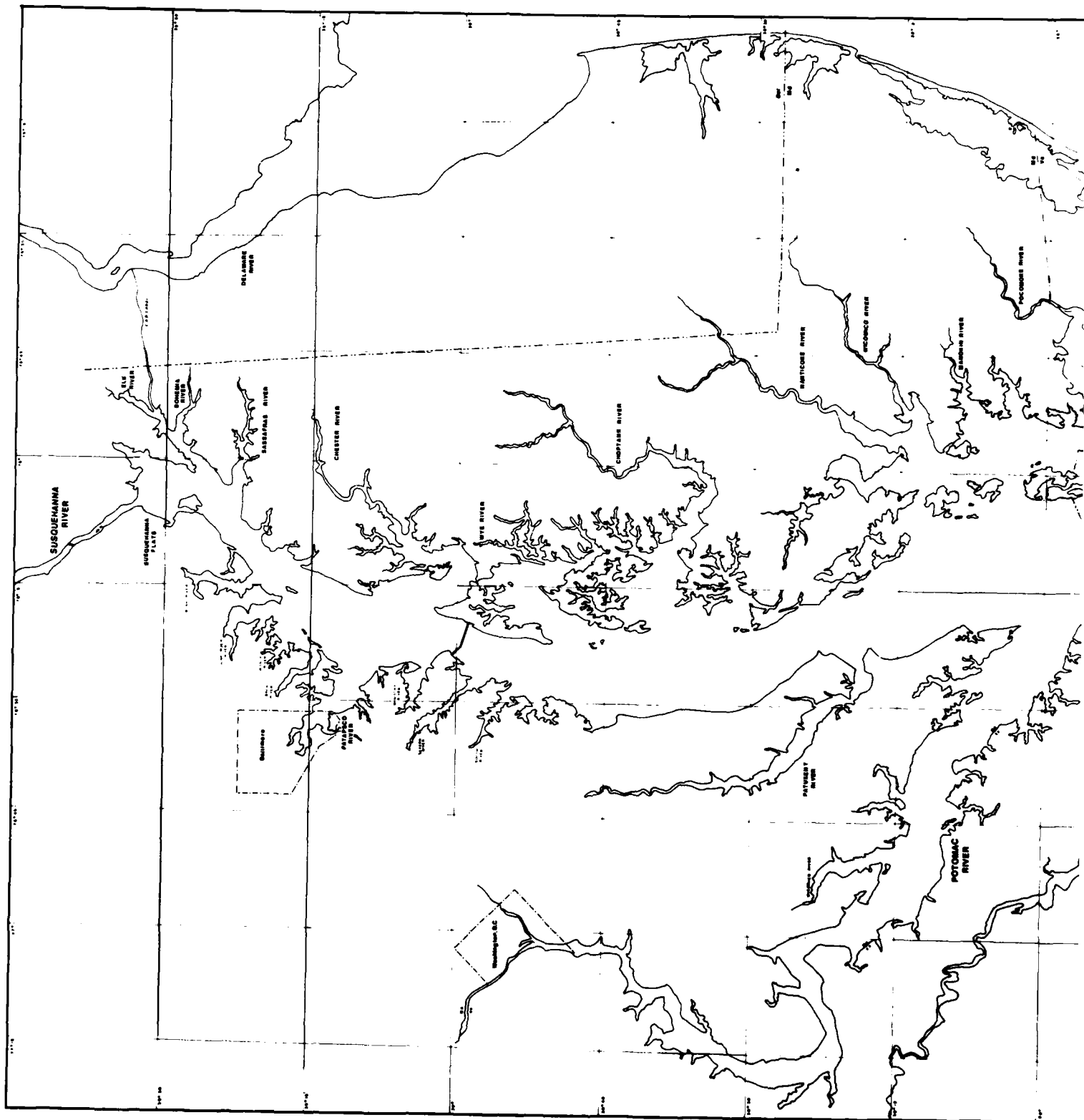
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2	<u>Leiostomus xanthurus</u> (Spot)	55
3	<u>Morone saxatilis</u> (Striped Bass)	56
4	<u>Aythya valisineria</u> (Canvasback Duck)	57
5		
6	Future Average (Major 15 Species)	
7	<u>Potamogeton pectinatus</u> (Sago Pondweed)	58
8	<u>Potamogeton perfoliatus</u> (Redhead Grass)	58
9	<u>Chrysaora quinquecirrha</u> (Sea Nettle)	59
10	<u>Eurytemora affinis</u> (Copepod)	60
11	<u>Urosalpinx cinerea</u> (Oyster Drill)	61
12	<u>Crassostrea virginica</u> (American Oyster)	62
13	<u>Macoma balthica</u> (Baltic Macoma)	63
14	<u>Mercenaria mercenaria</u> (Hard Clam, Quahog)	64
15	<u>Mya arenaria</u> (Soft-Shell Clam)	65
16	<u>Callinectes sapidus</u> (Blue Crab - summer males)	66
17	<u>Callinectes sapidus</u> (Blue Crab - summer females)	67
18	<u>Alosa sapidissima</u> (American Shad)	68
19	<u>Brevoortia tyrannus</u> (Menhaden)	69
20	<u>Anchoa mitchilli</u> (Bay Anchovy)	70
21	<u>Leiostomus xanthurus</u> (Spot)	71
22	<u>Morone saxatilis</u> (Striped Bass)	72
23	<u>Aythya valisineria</u> (Canvasback Duck)	73
24		
25	Base Drought (Major 15 Species)	
26	<u>Potamogeton pectinatus</u> (Sago Pondweed)	74
27	<u>Potamogeton perfoliatus</u> (Redhead Grass)	74
28	<u>Chrysaora quinquecirrha</u> (Sea Nettle)	75
29	<u>Eurytemora affinis</u> (Copepod)	76
30	<u>Urosalpinx cinerea</u> (Oyster Drill)	77
31	<u>Crassostrea virginica</u> (American Oyster)	78
32	<u>Macoma balthica</u> (Baltic Macoma)	79
33	<u>Mercenaria mercenaria</u> (Hard Clam, Quahog)	80
34	<u>Mya arenaria</u> (Soft-Shell Clam)	81
35	<u>Callinectes sapidus</u> (Blue Crab - summer males)	82
36	<u>Callinectes sapidus</u> (Blue Crab - summer females)	83
37	<u>Alosa sapidissima</u> (American Shad)	84
38	<u>Brevoortia tyrannus</u> (Menhaden)	85
39	<u>Anchoa mitchilli</u> (Bay Anchovy)	86
40	<u>Leiostomus xanthurus</u> (Spot)	87
41	<u>Morone saxatilis</u> (Striped Bass)	88
	<u>Aythya valisineria</u> (Canvasback Duck)	89
42		
42	Future Drought (Major 15 Species)	
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49	<u>Macoma balthica</u> (Baltic Macoma)	95
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51	<u>Mya arenaria</u> (Soft-Shell Clam)	97
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53	<u>Callinectes sapidus</u> (Blue Crab - summer females)	99
	<u>Alosa sapidissima</u> (American Shad)	100

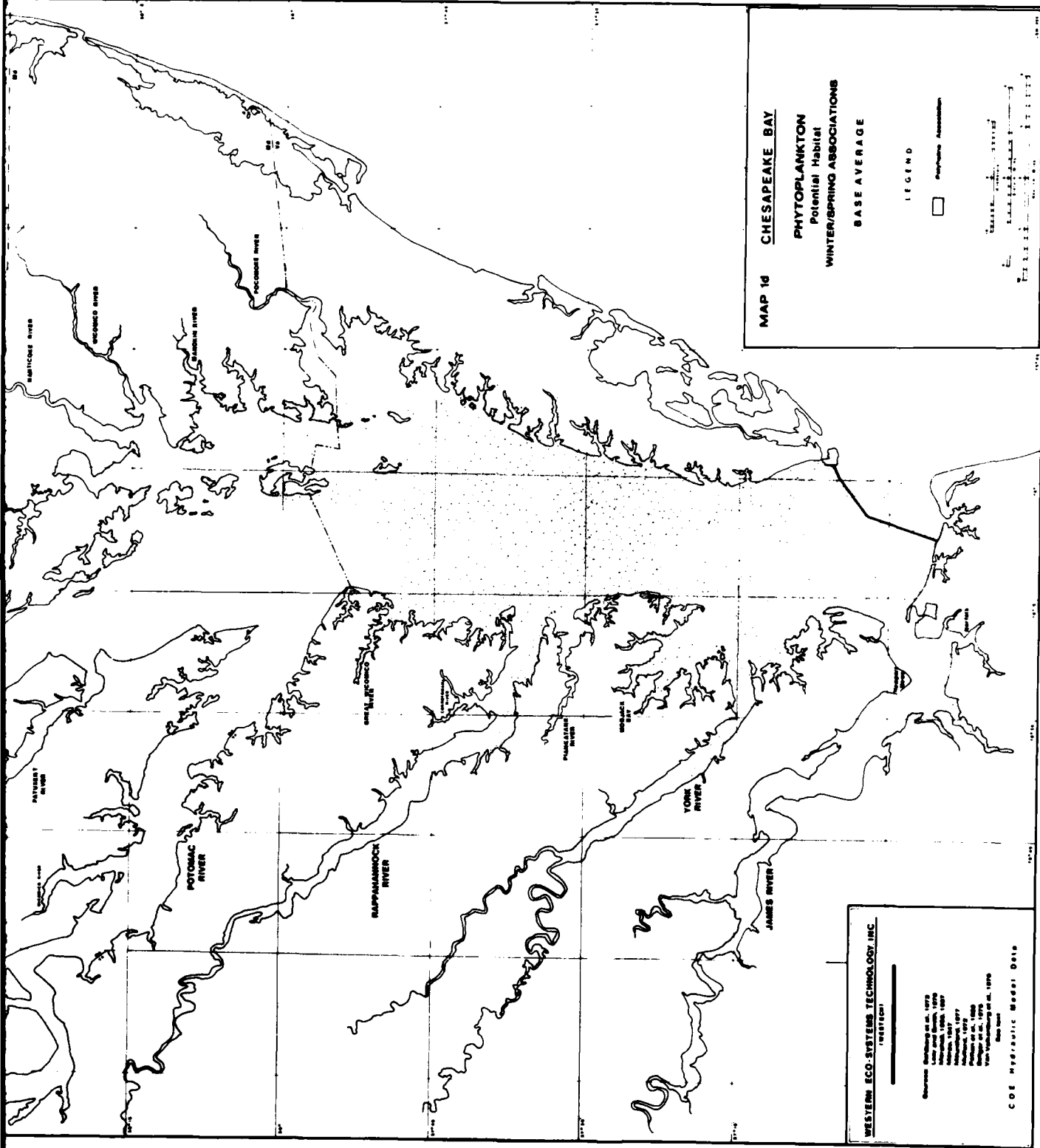


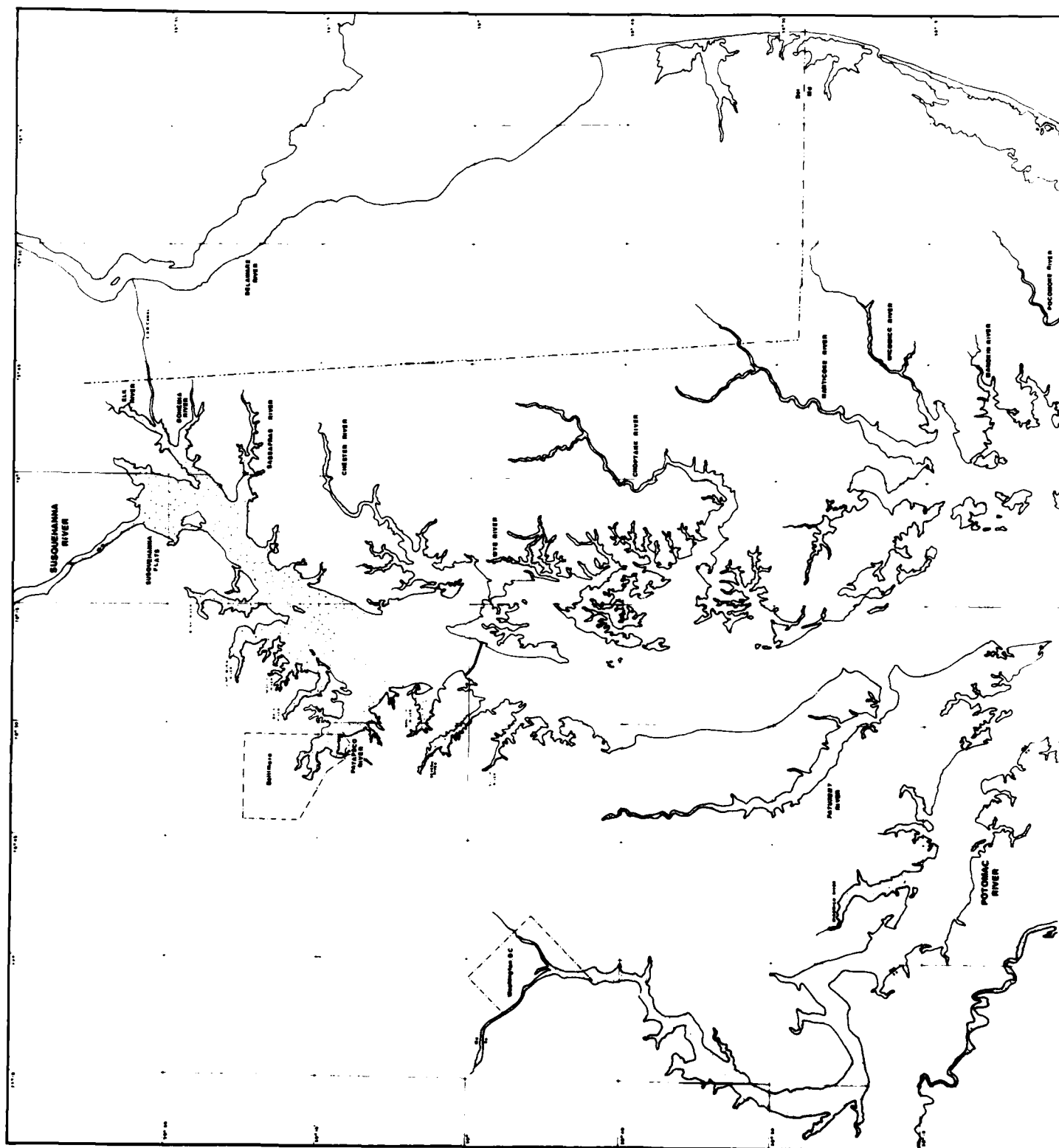


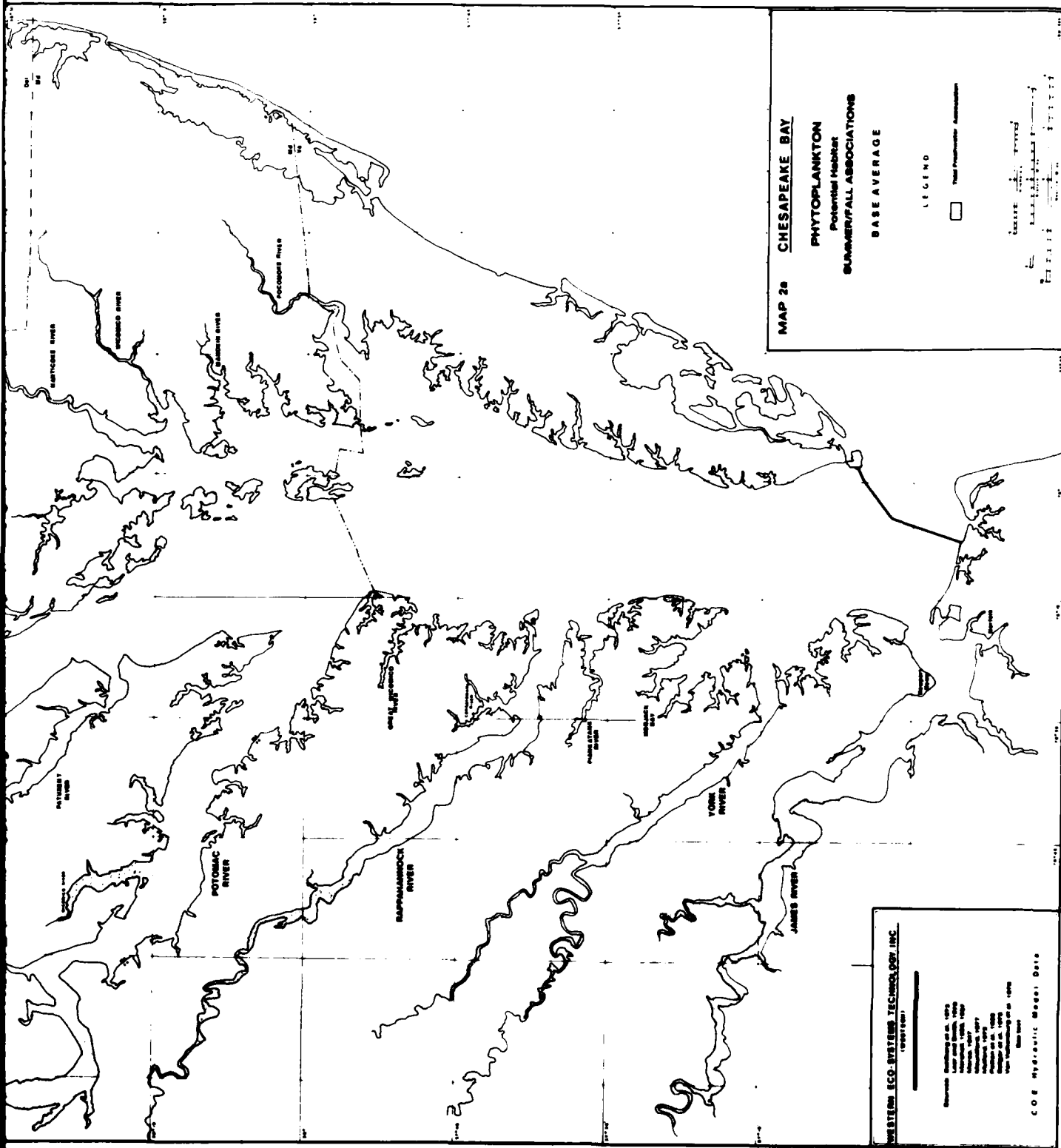


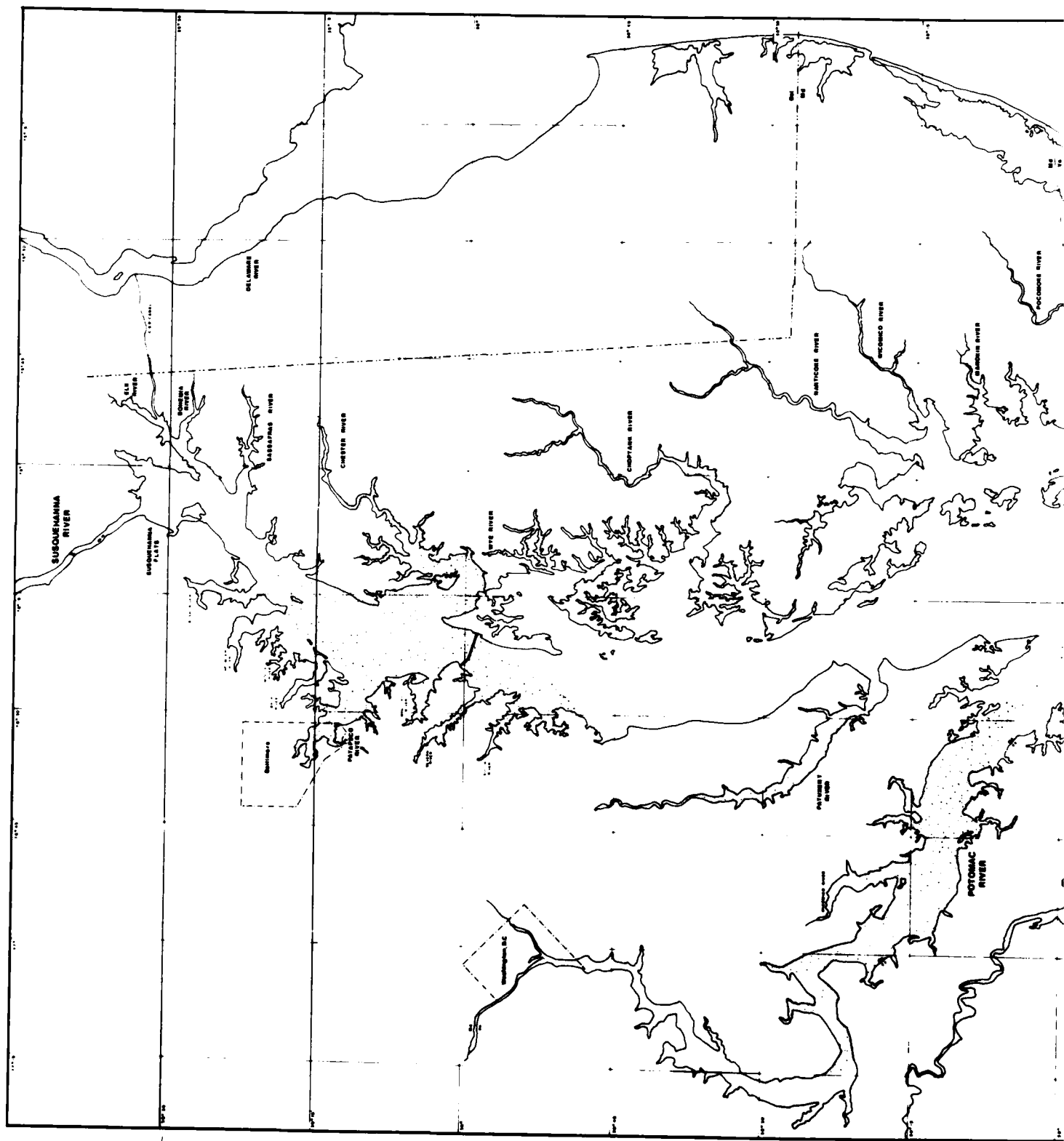


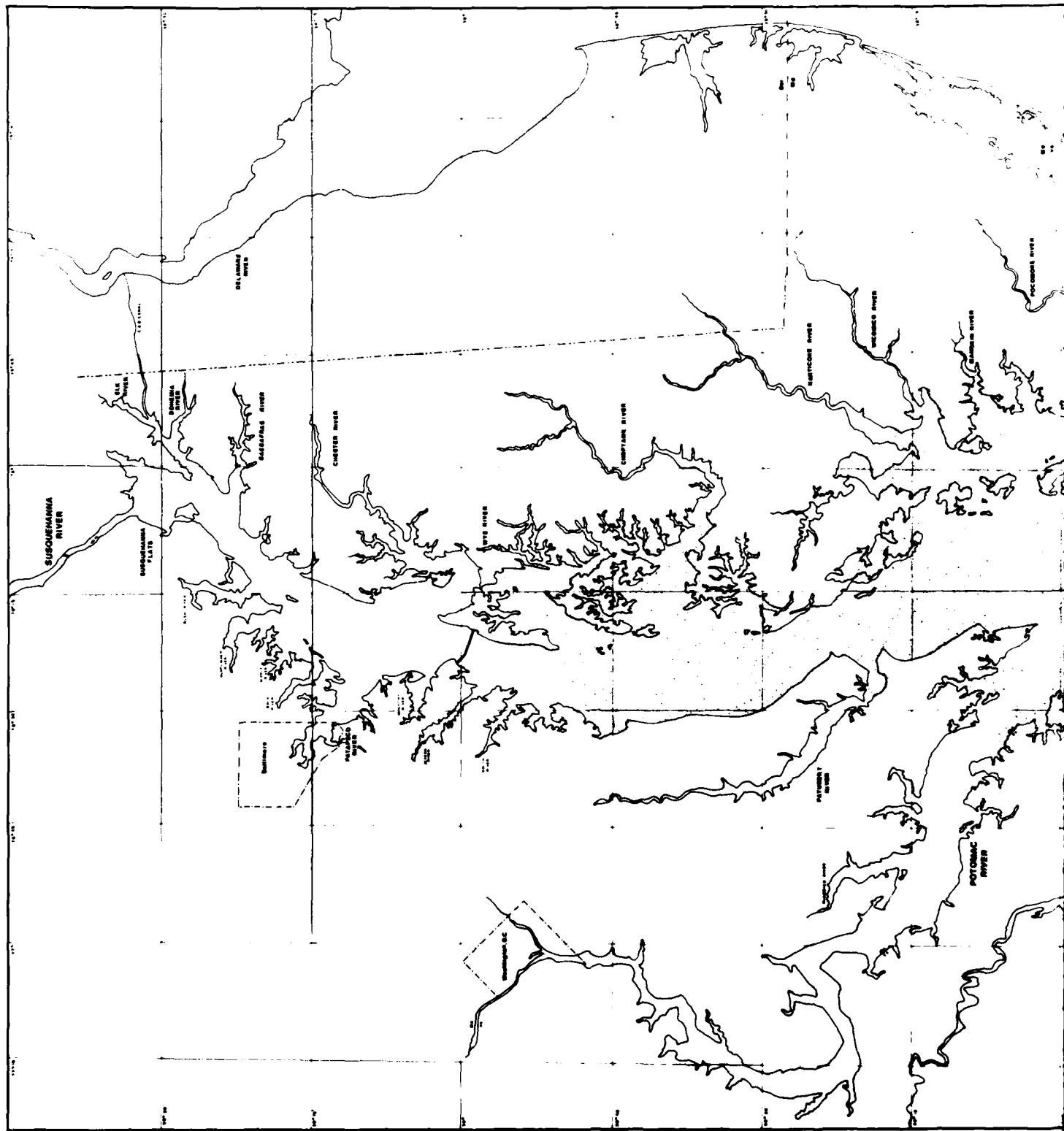


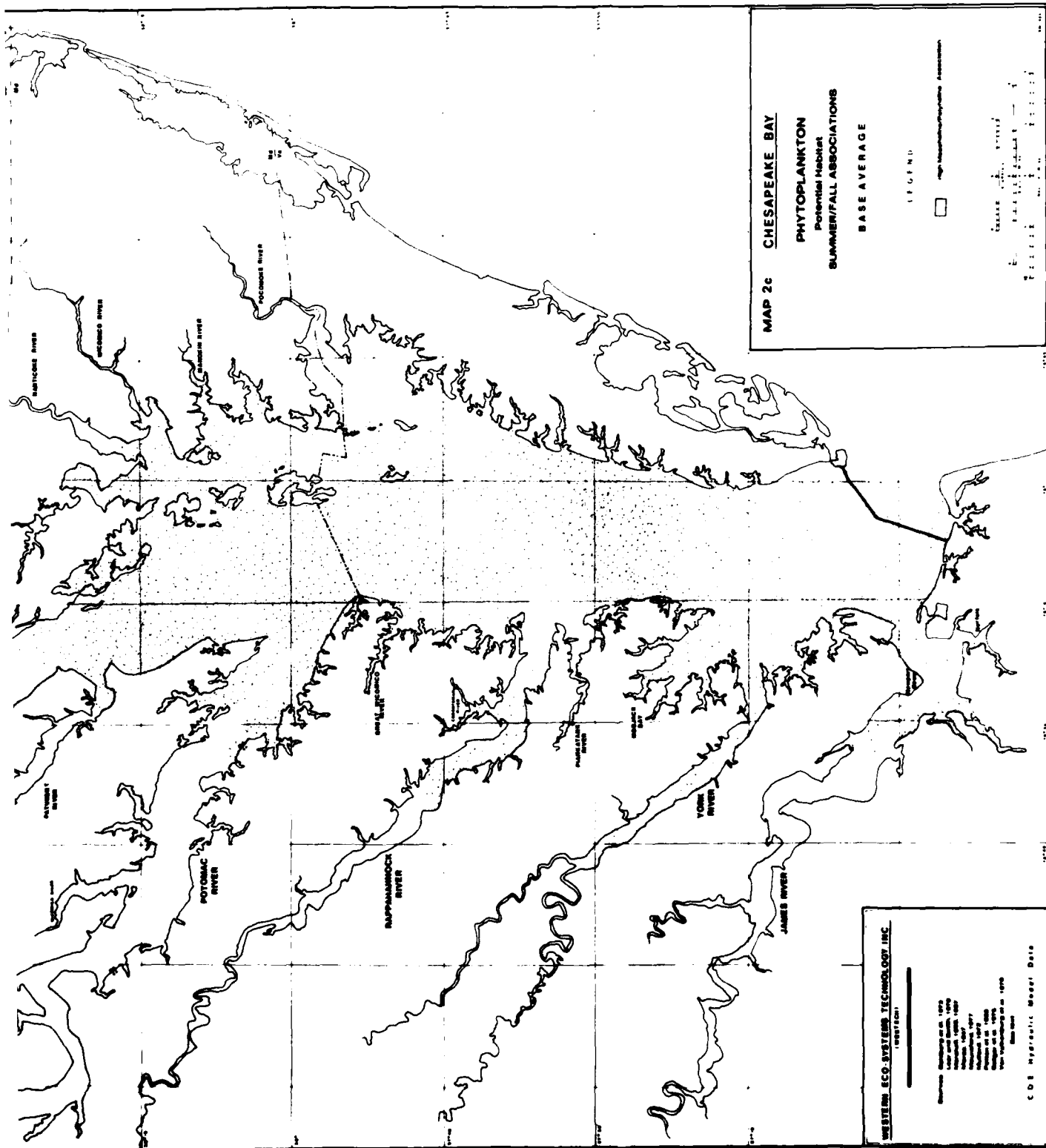


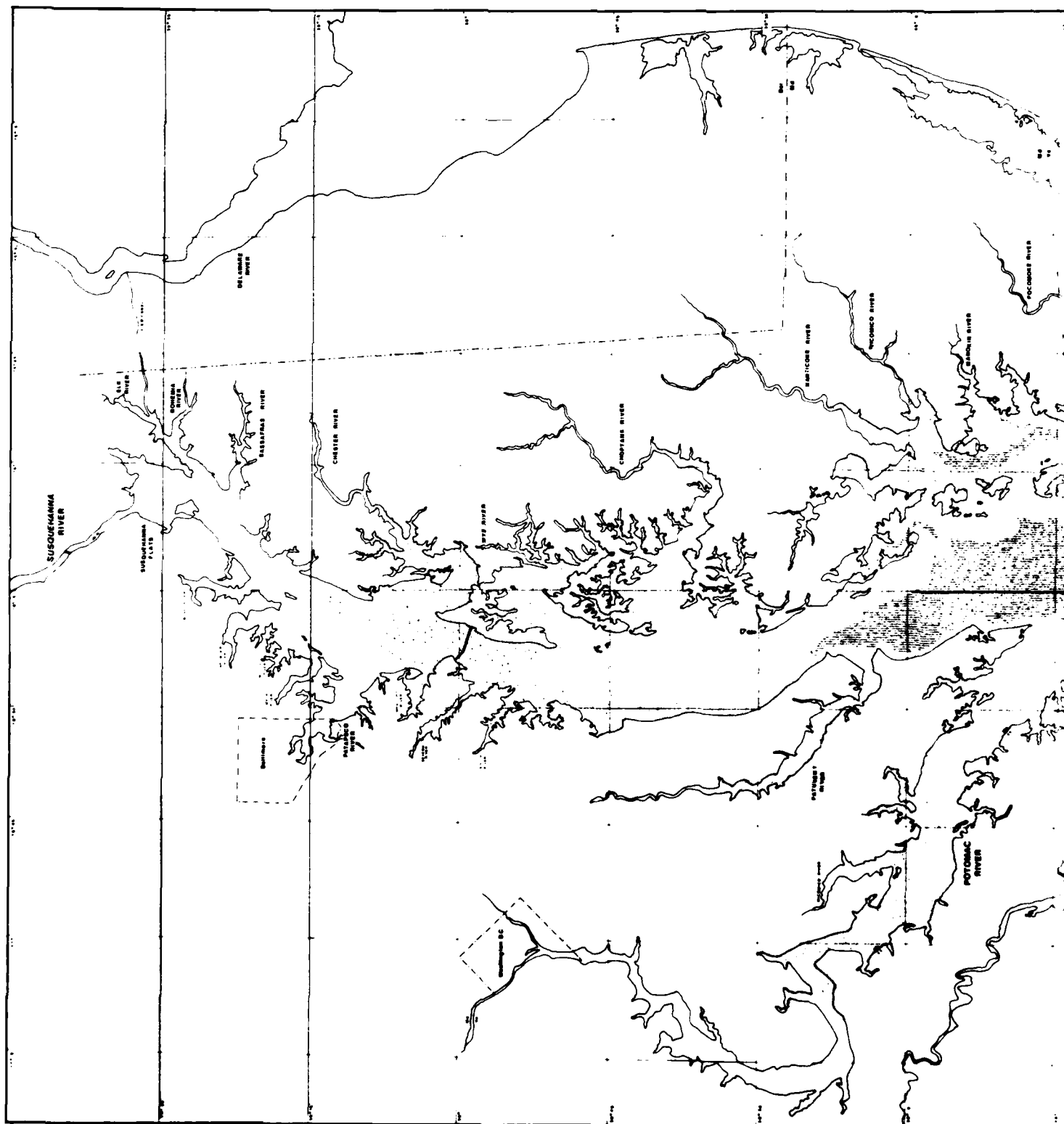


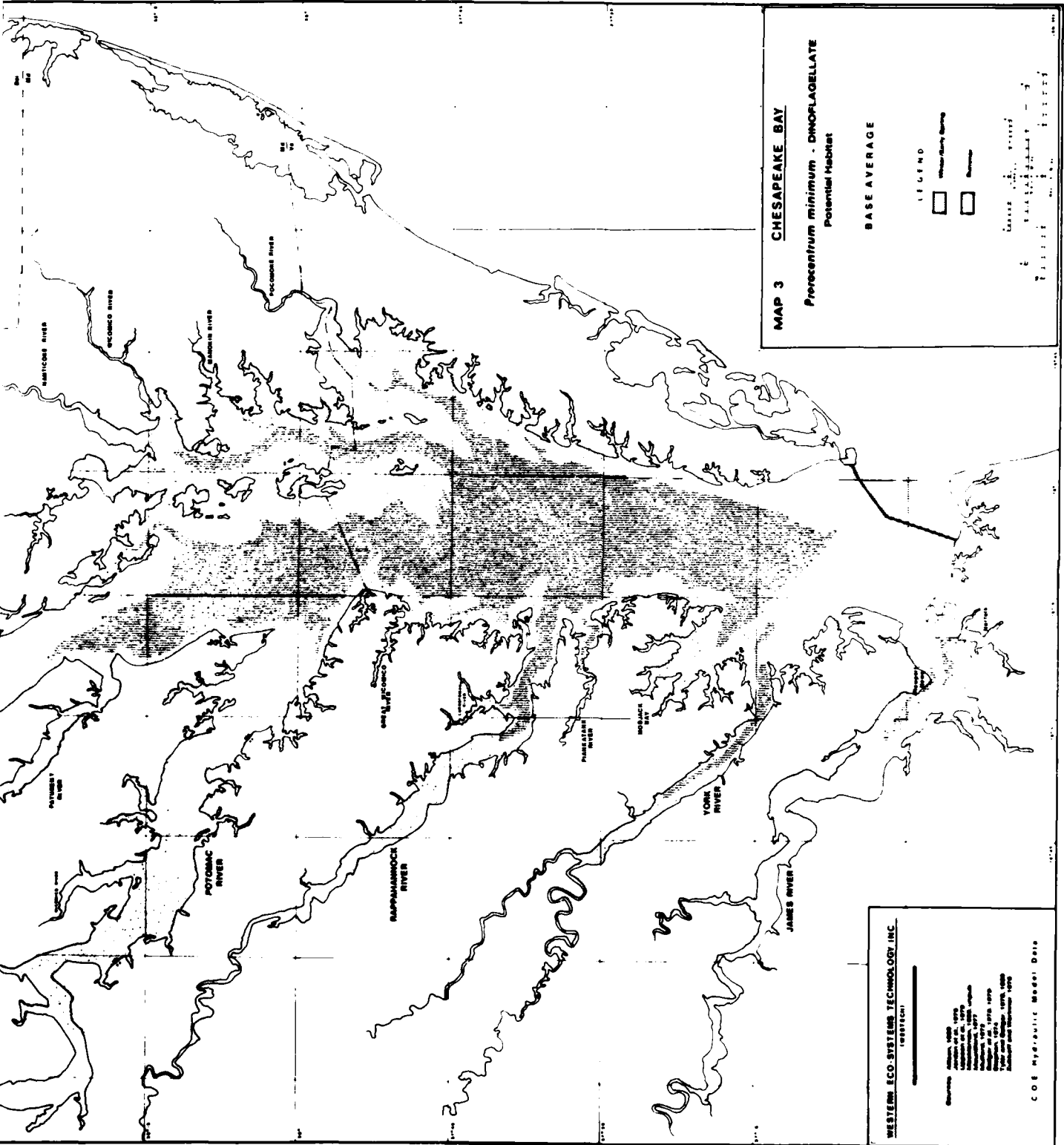


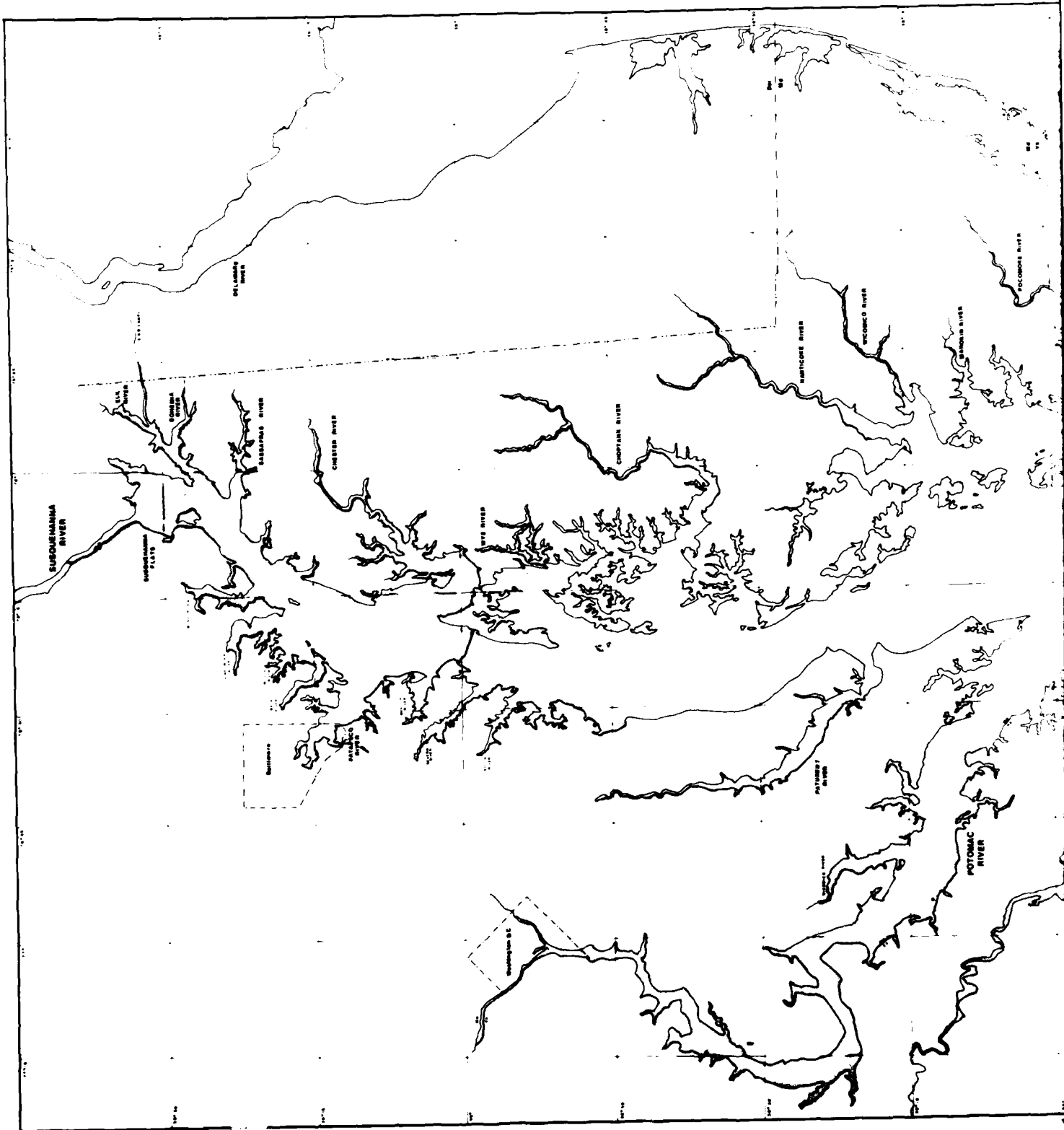


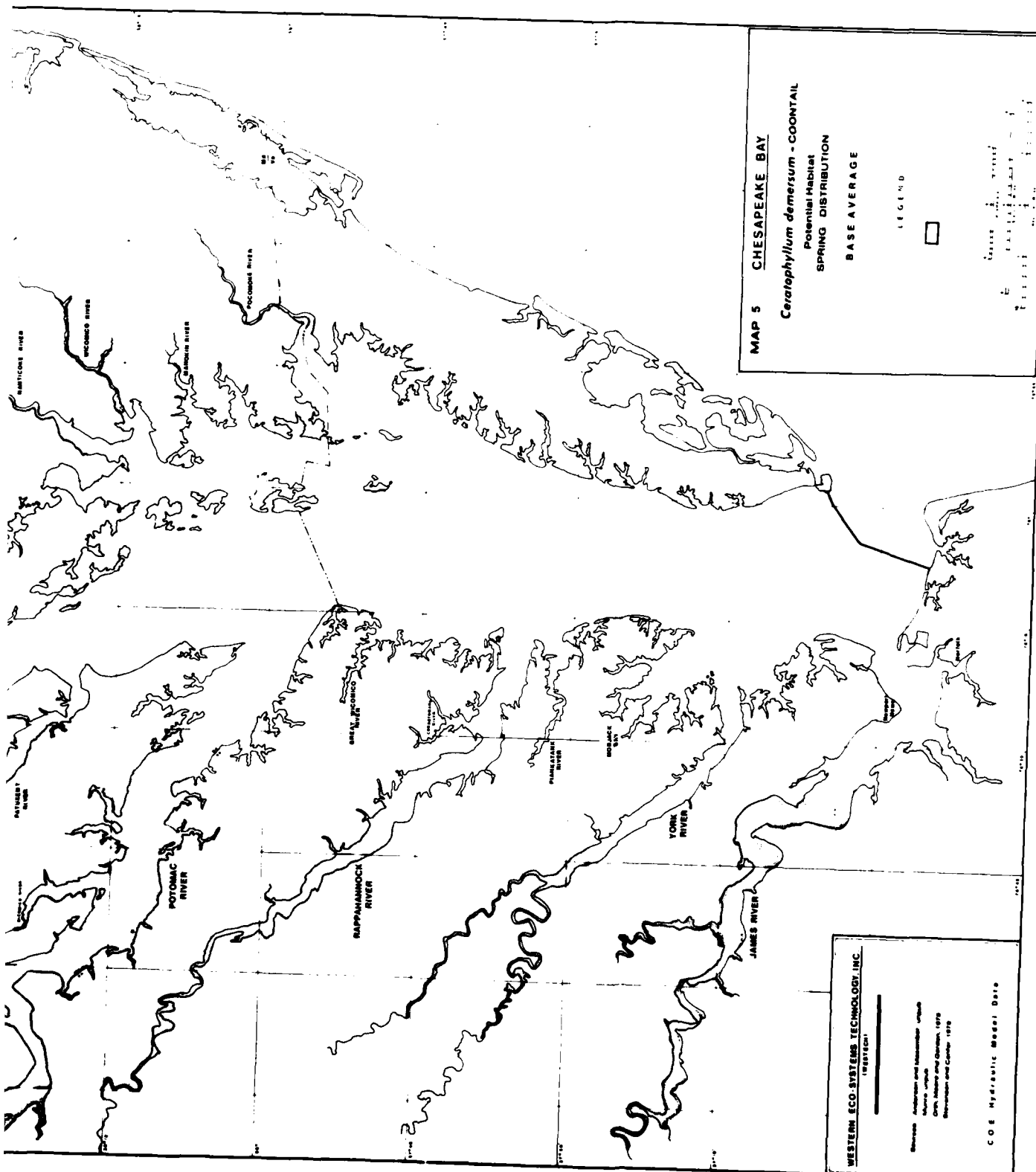












MAP 5 CHESAPEAKE BAY
Ceratophyllum demersum - COONTAIL
Potential Habitat
SPRING DISTRIBUTION
BASE AVERAGE

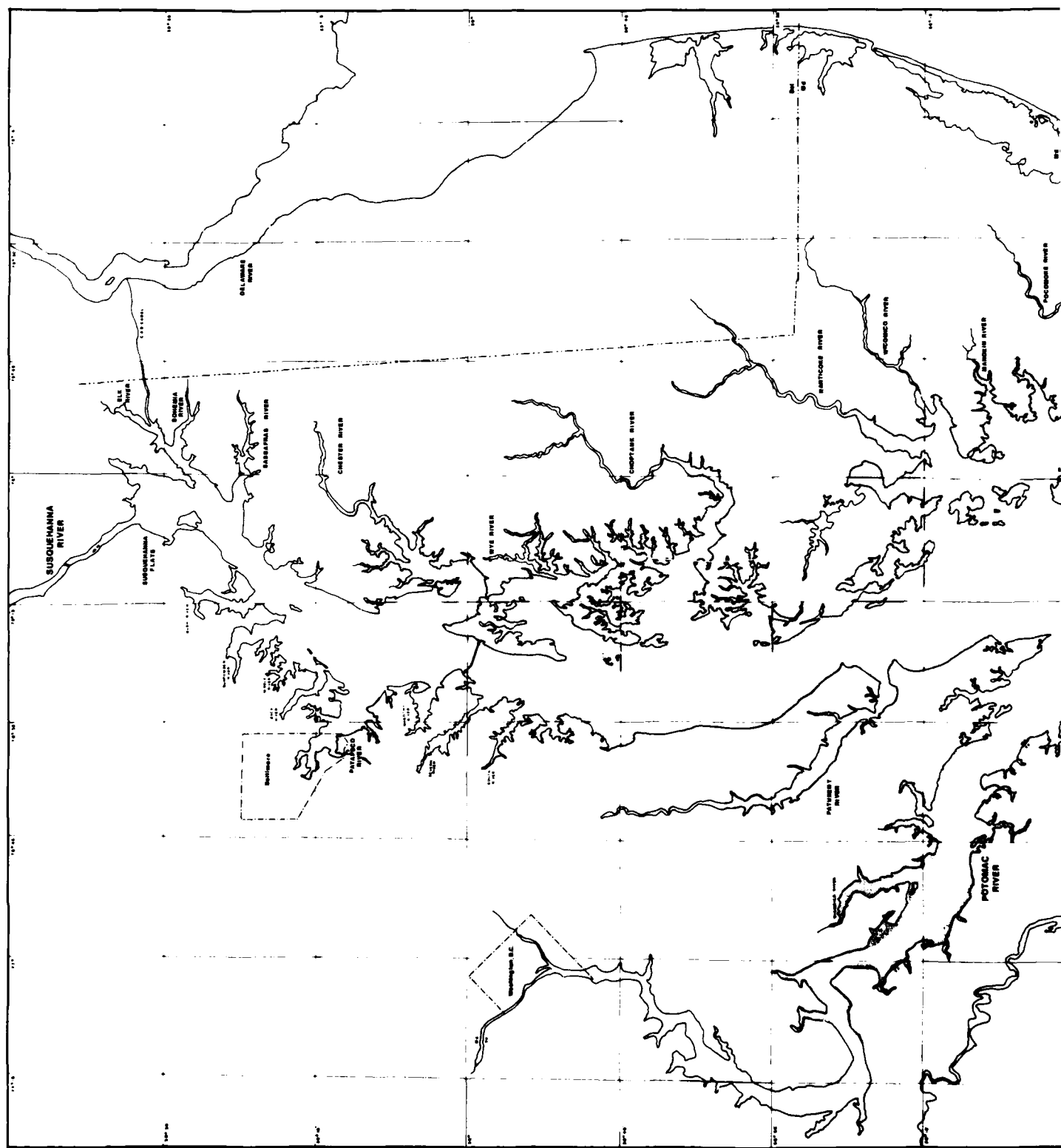
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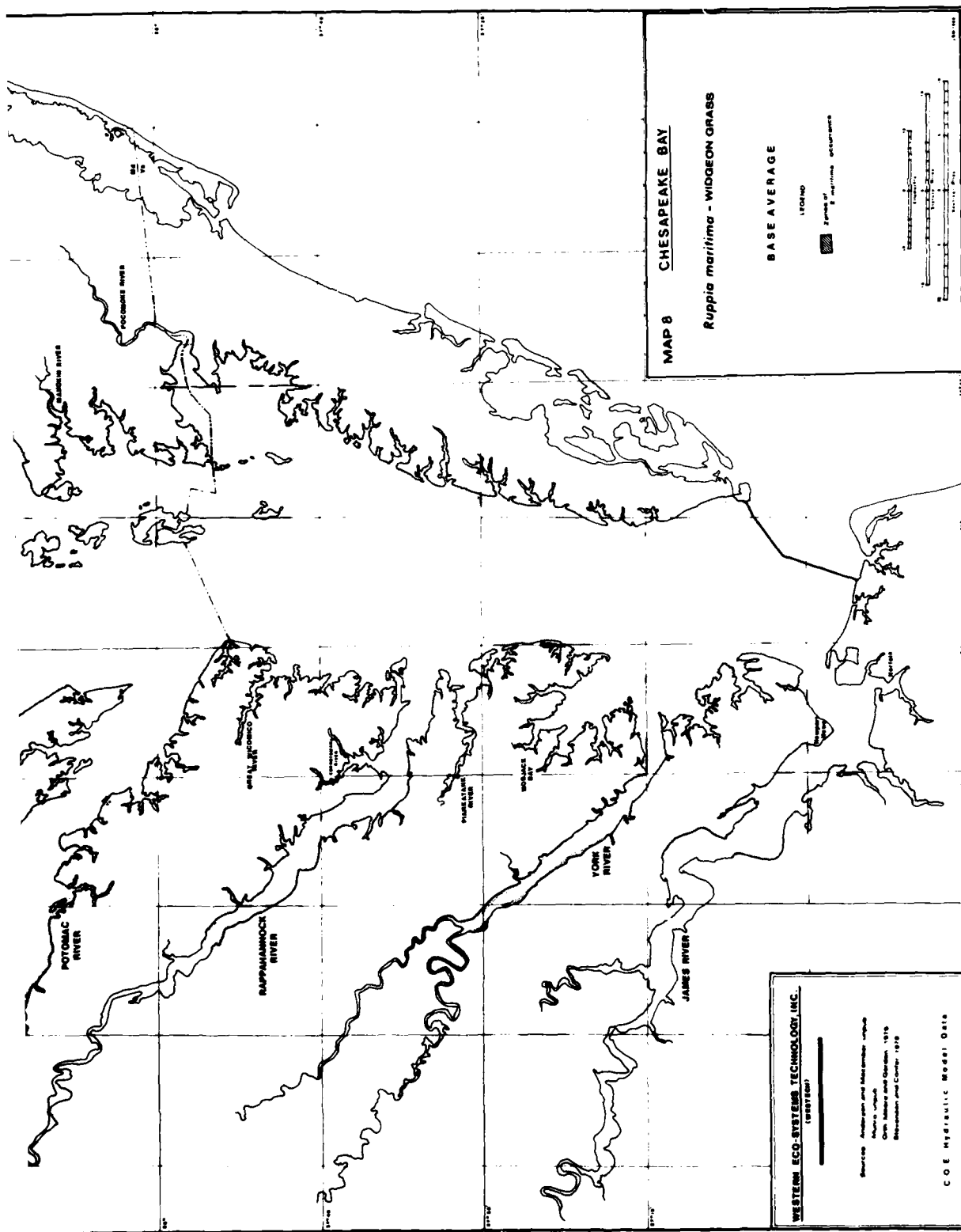
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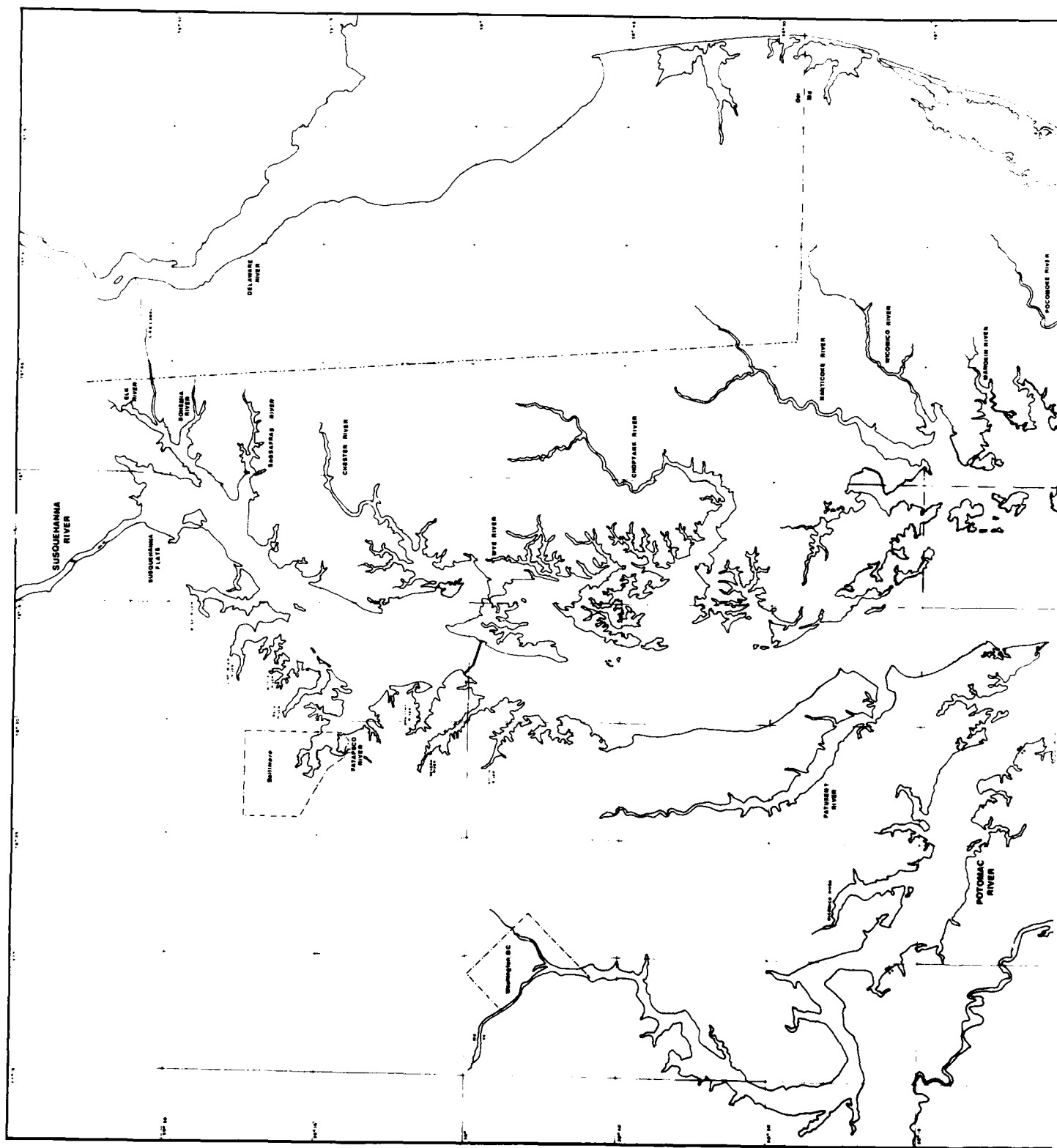
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CENTRAL

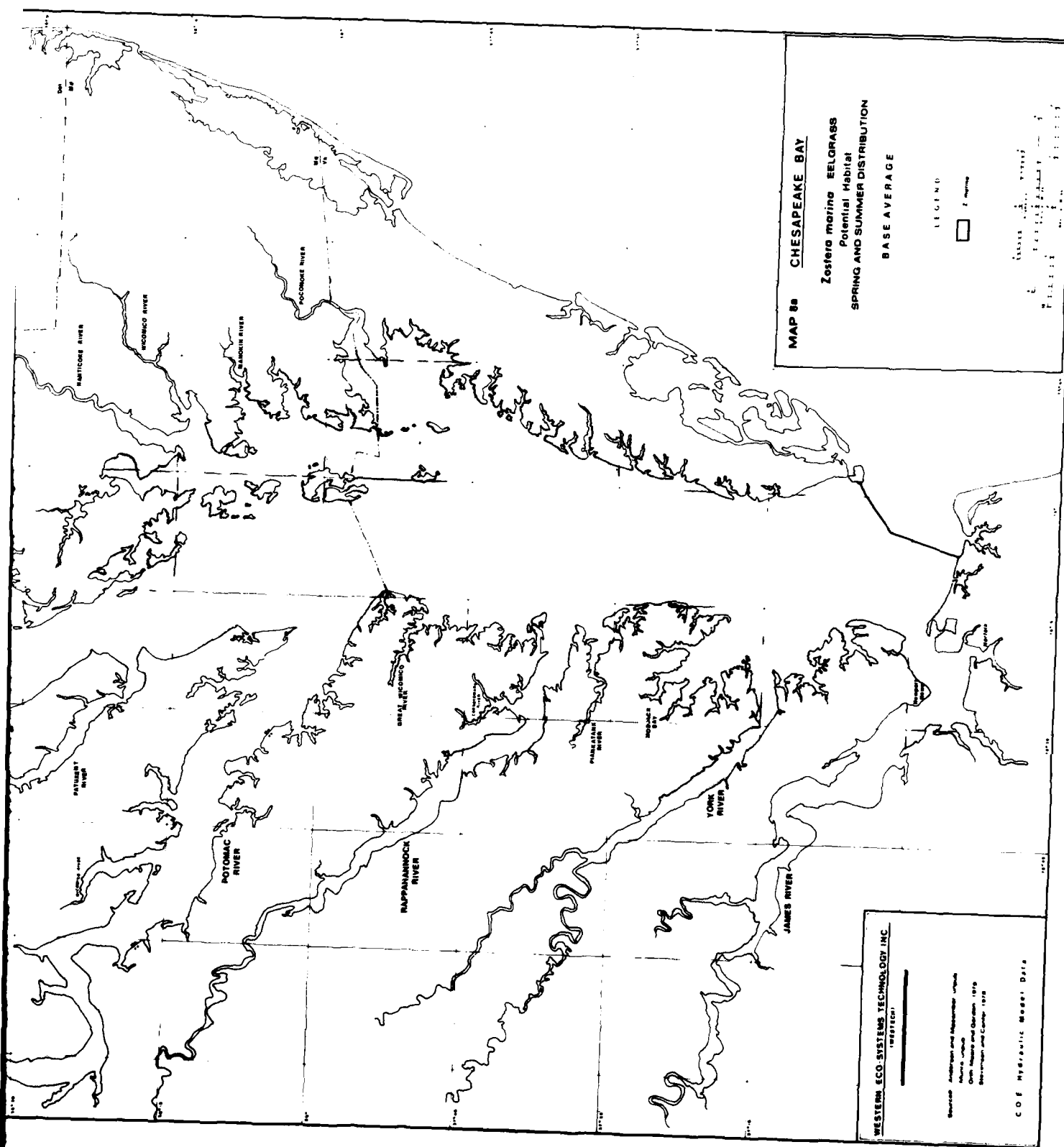
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COE Hydraulic Model Data

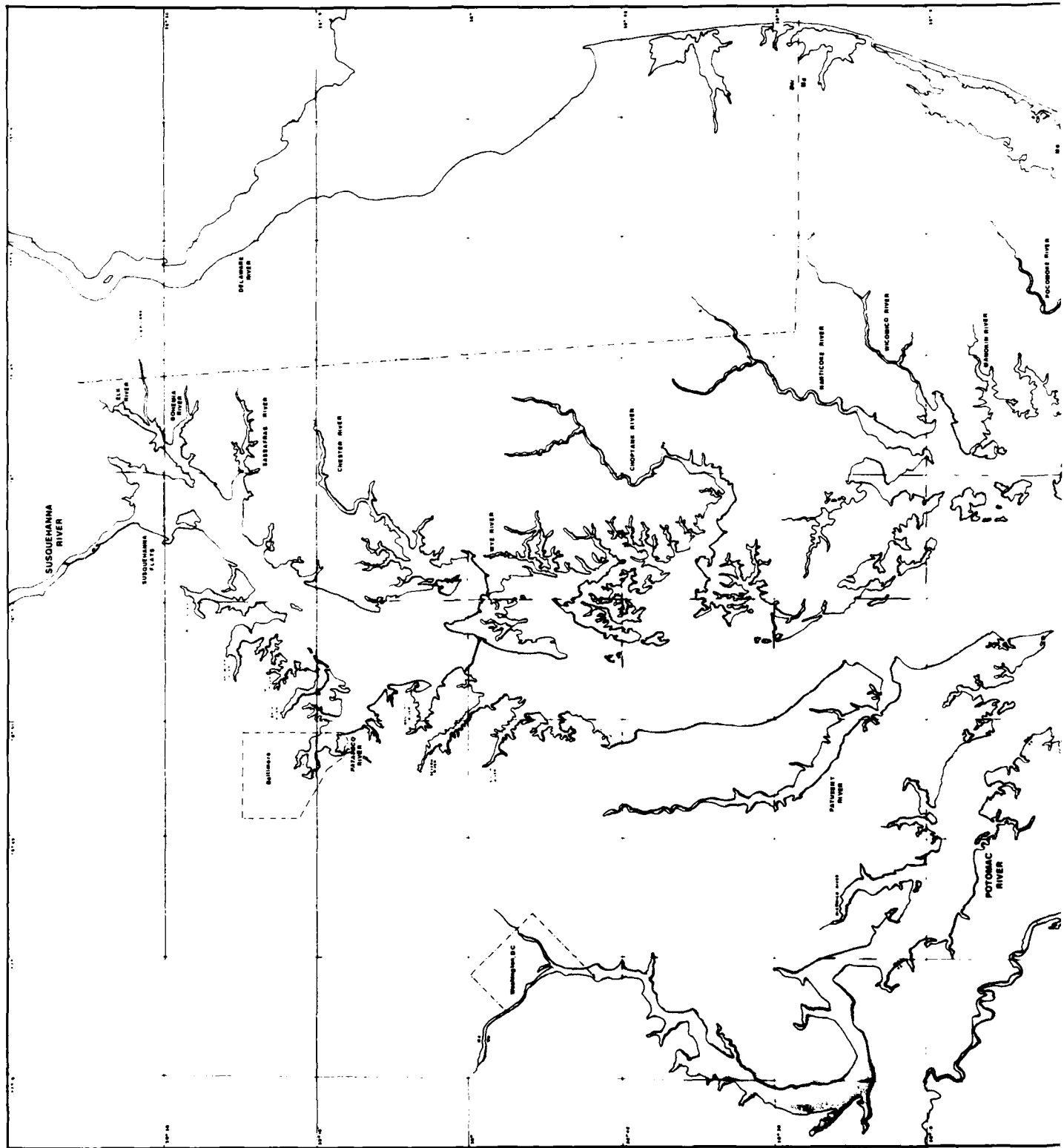


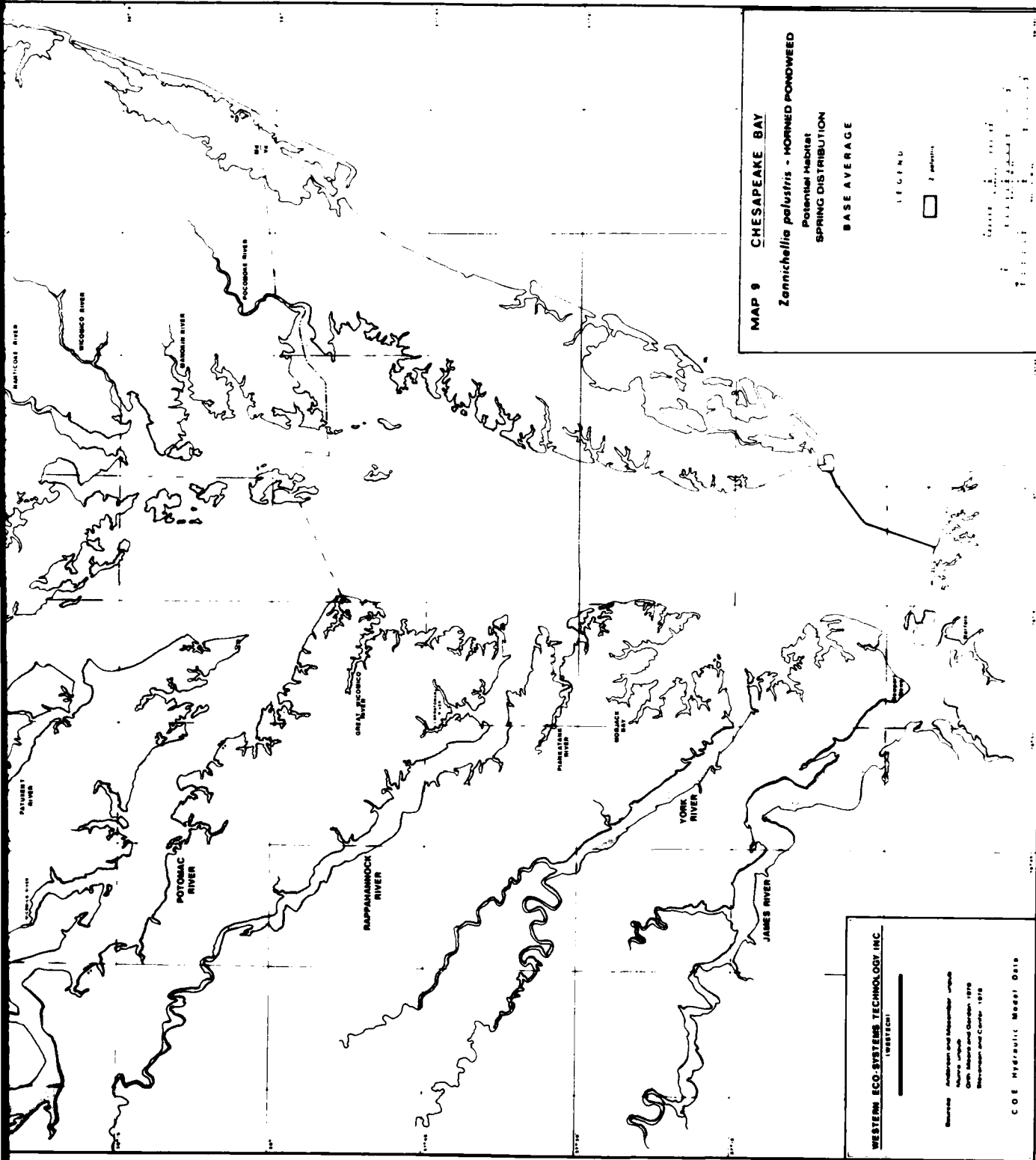


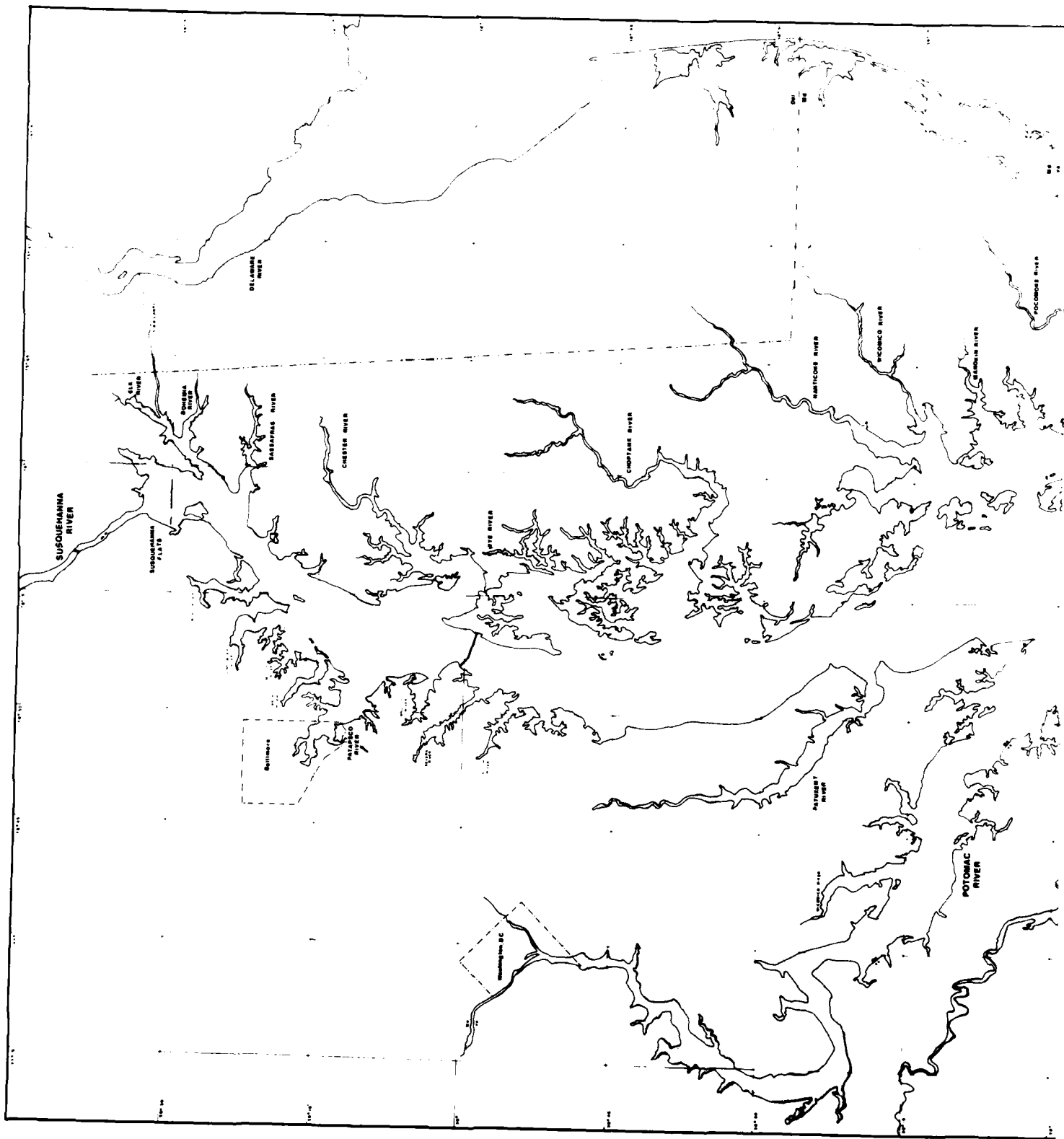


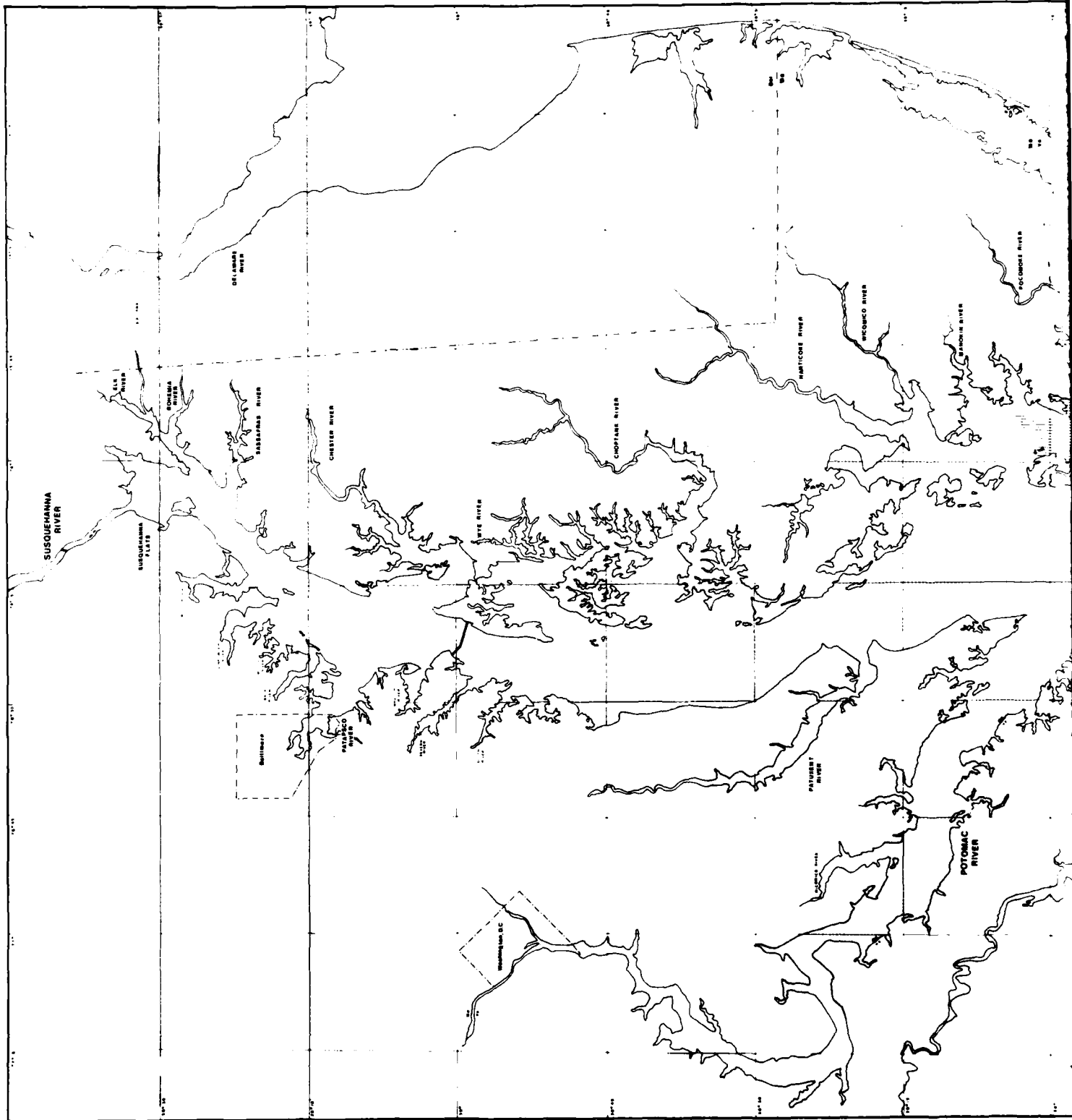


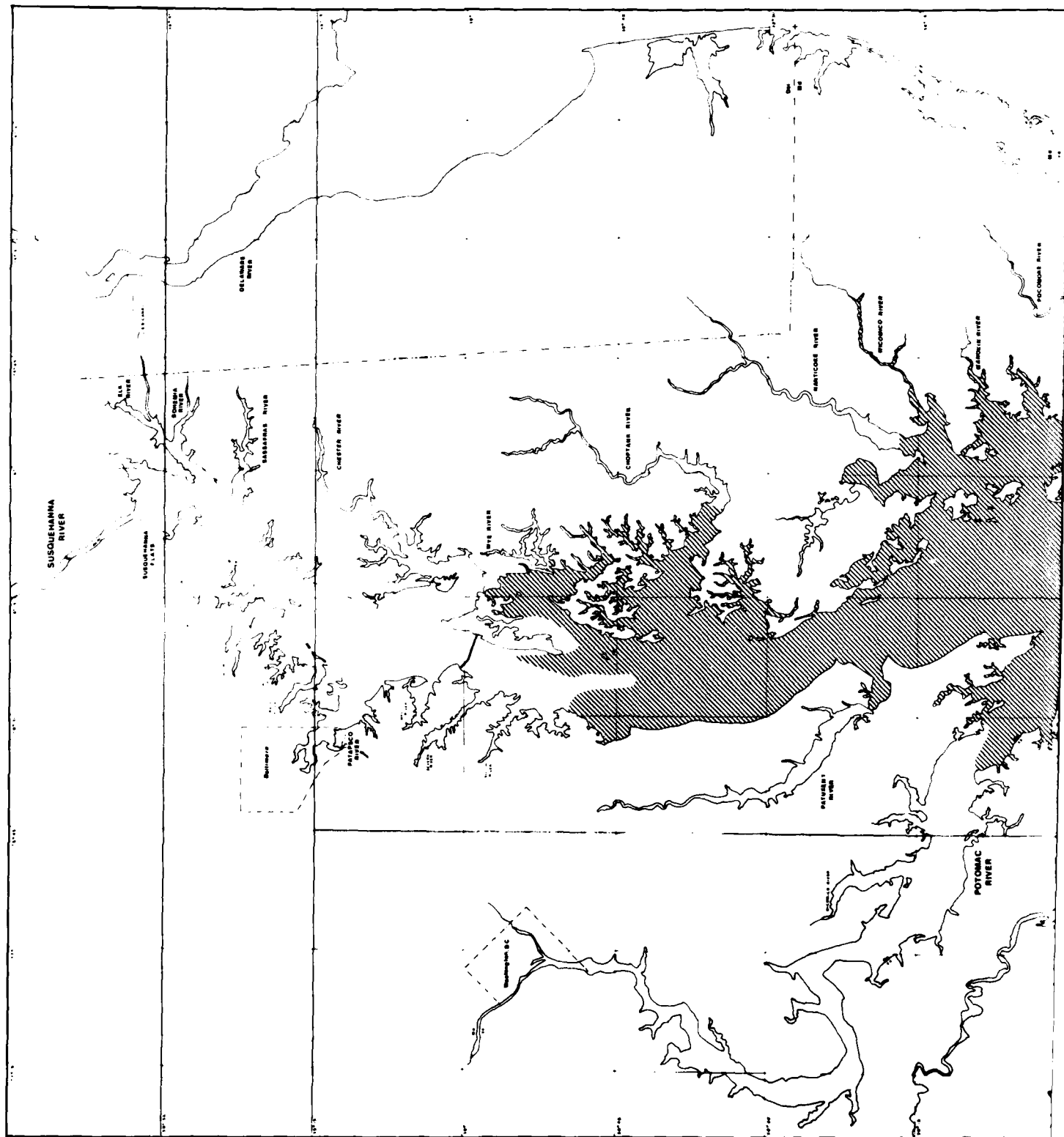
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 Harris, 1974
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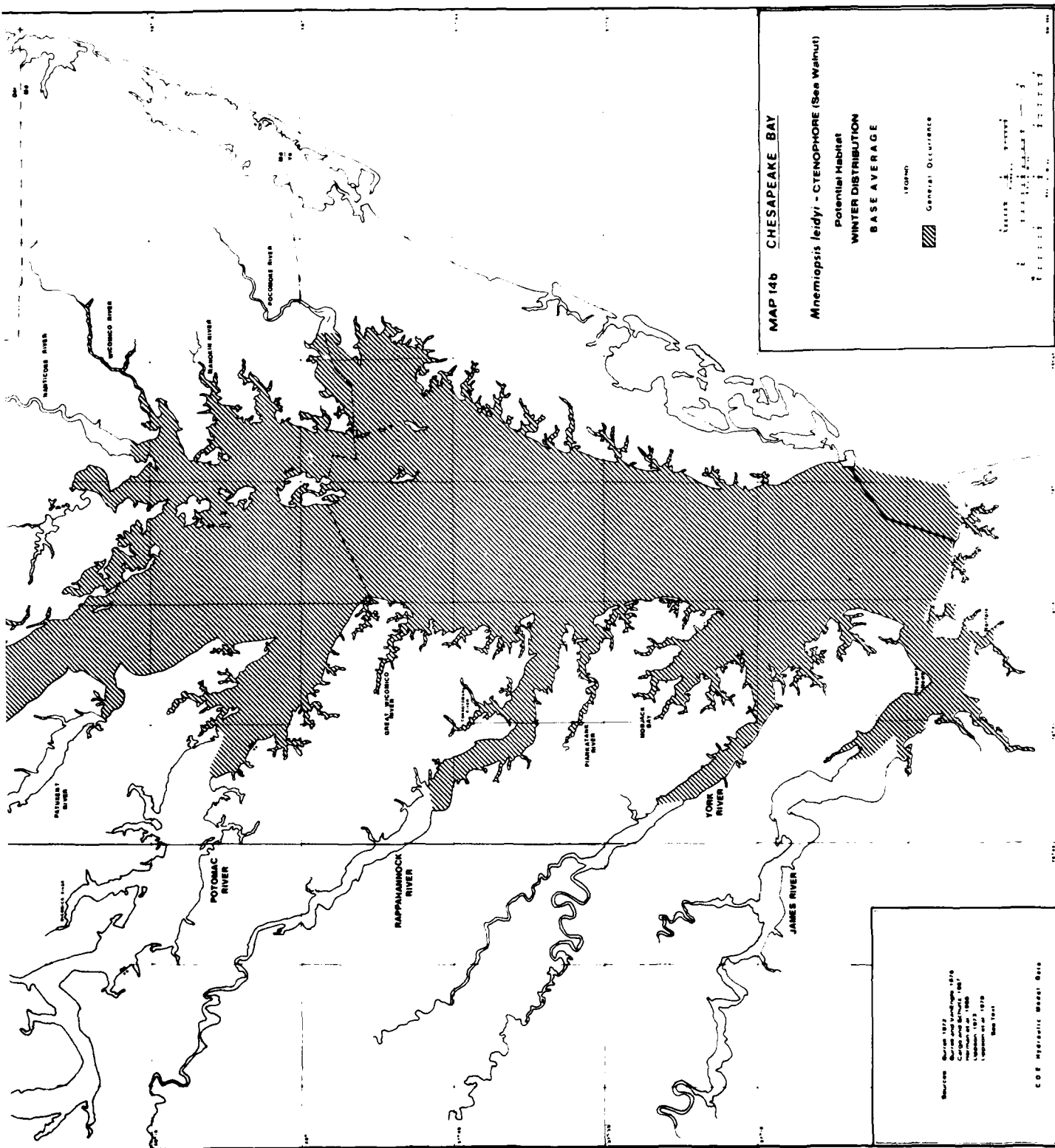


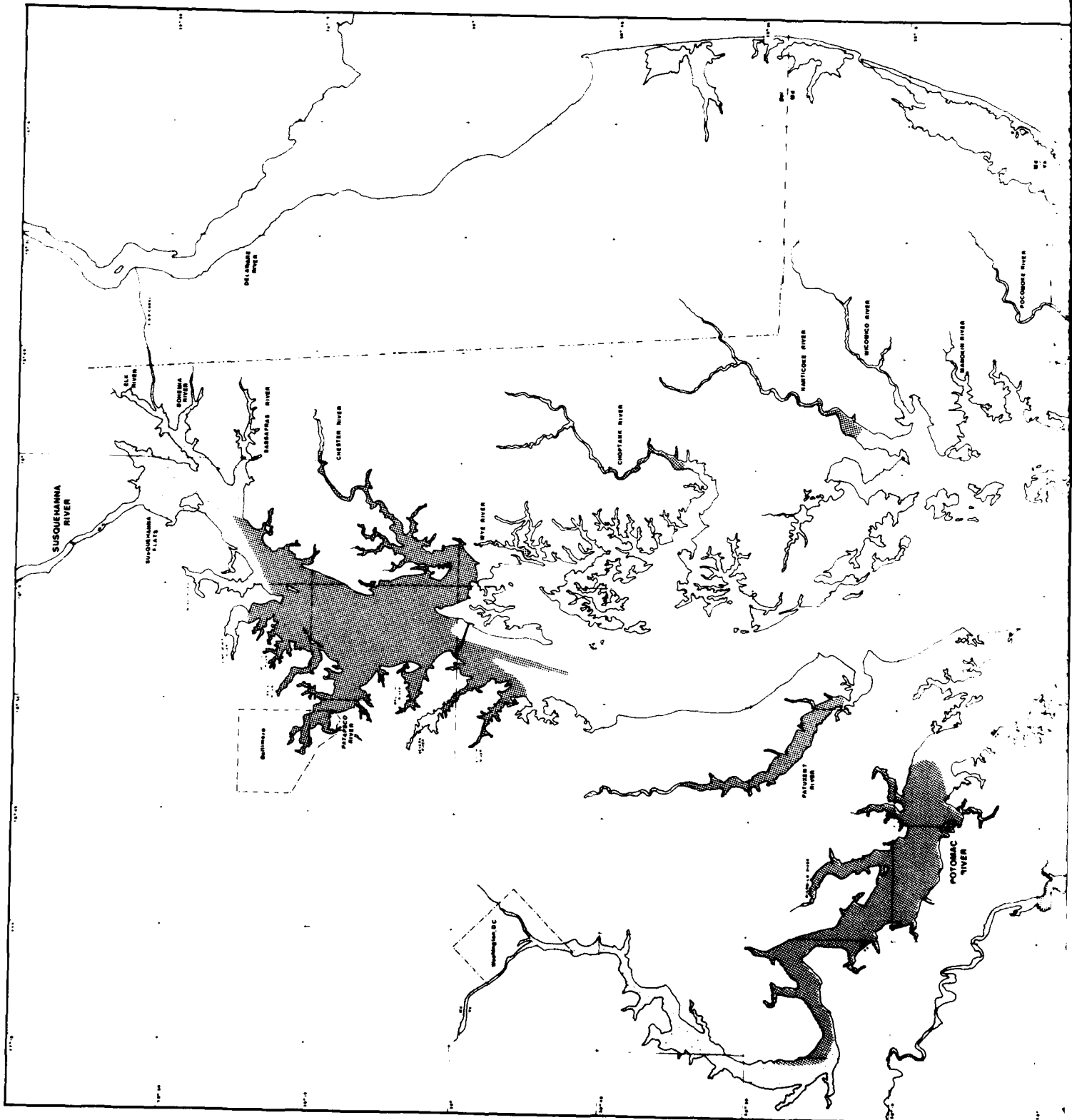


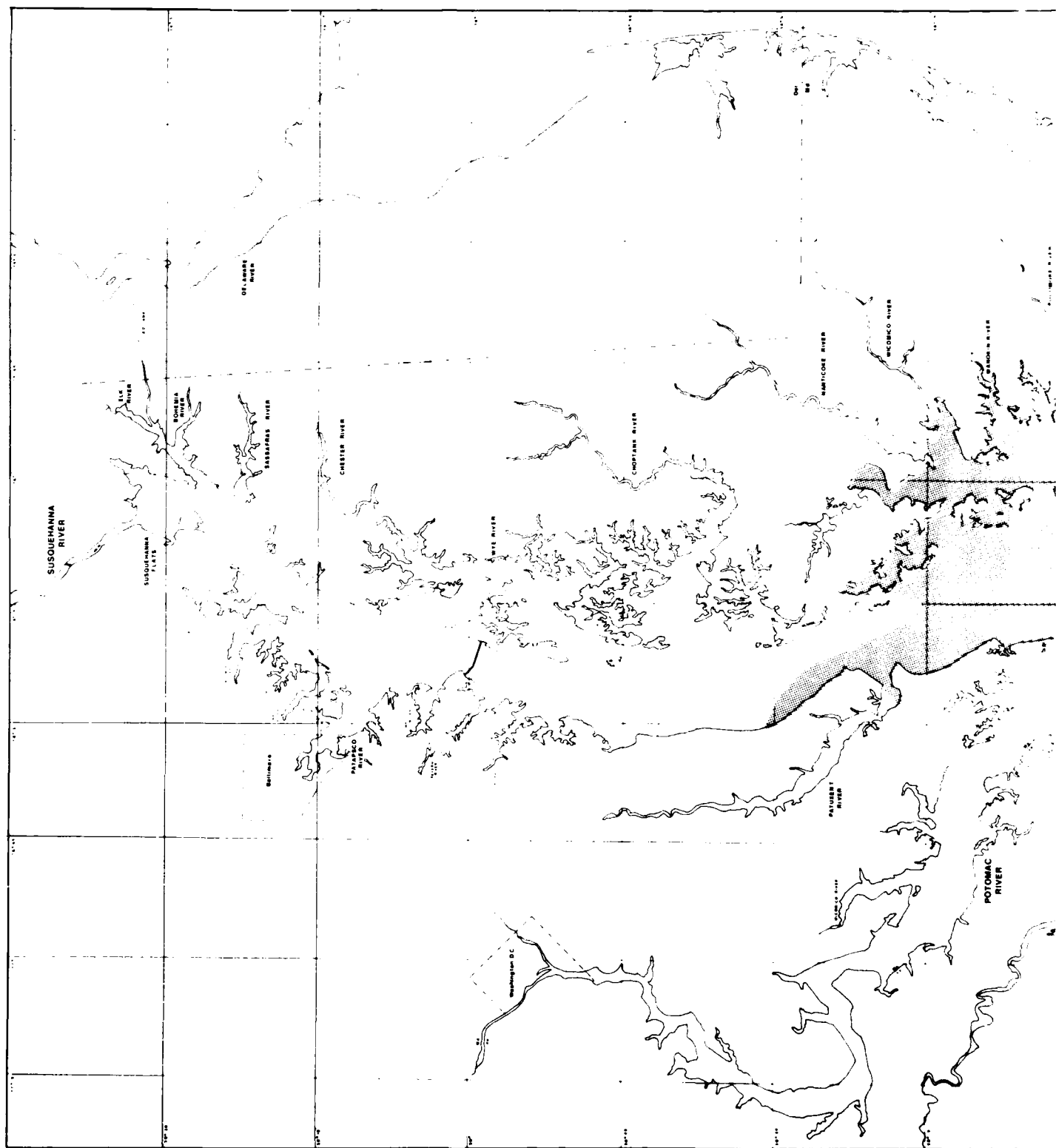


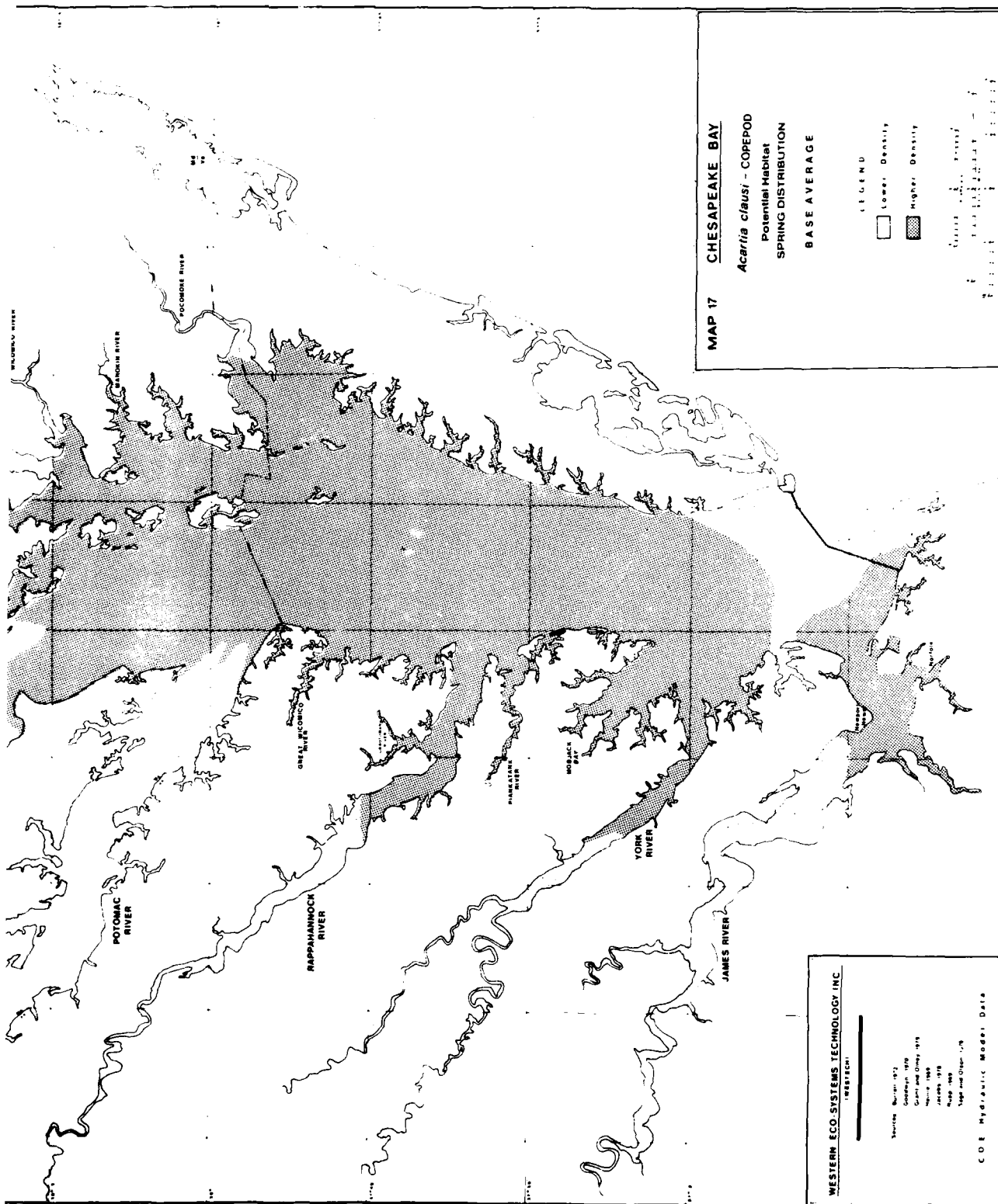


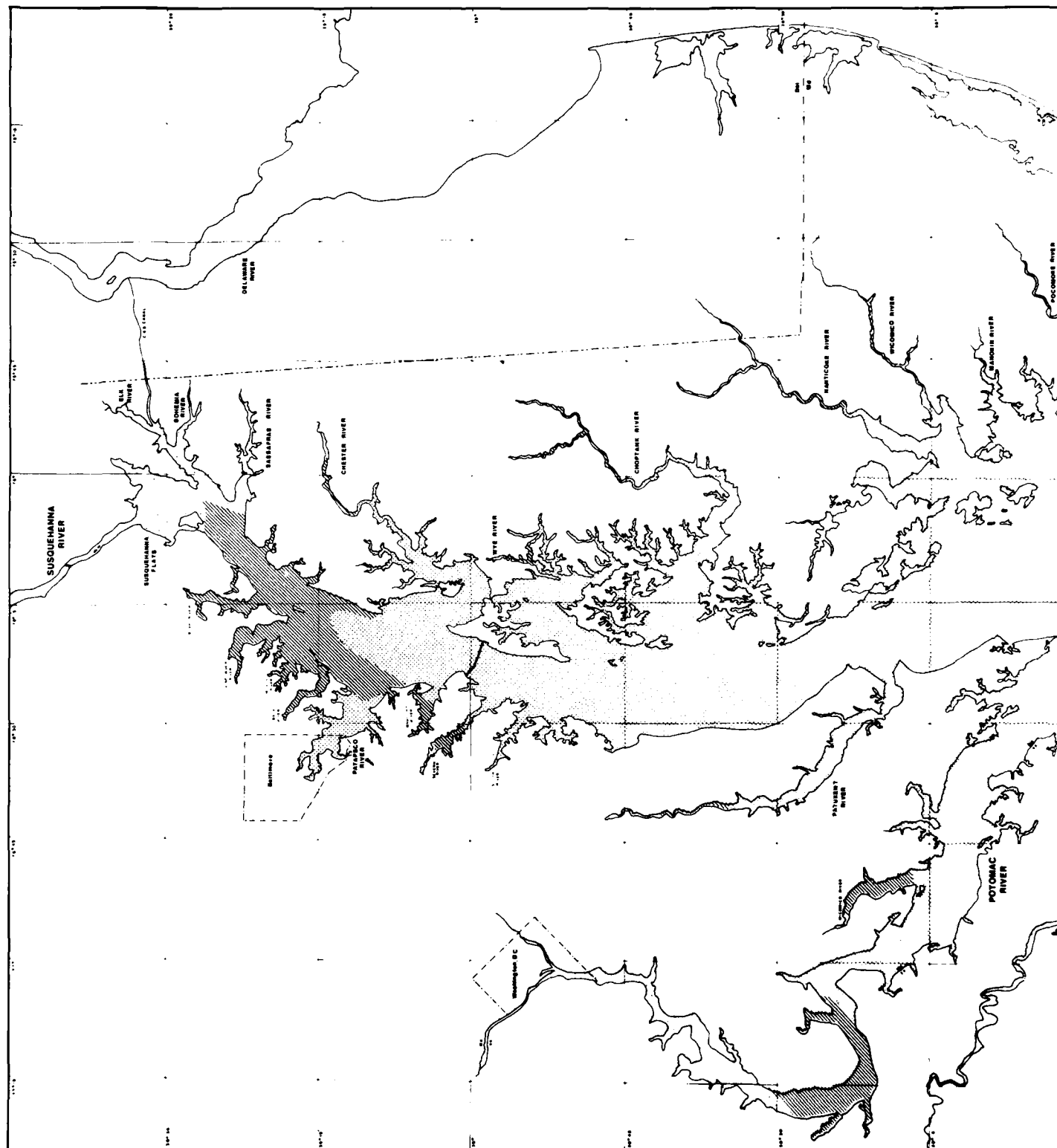


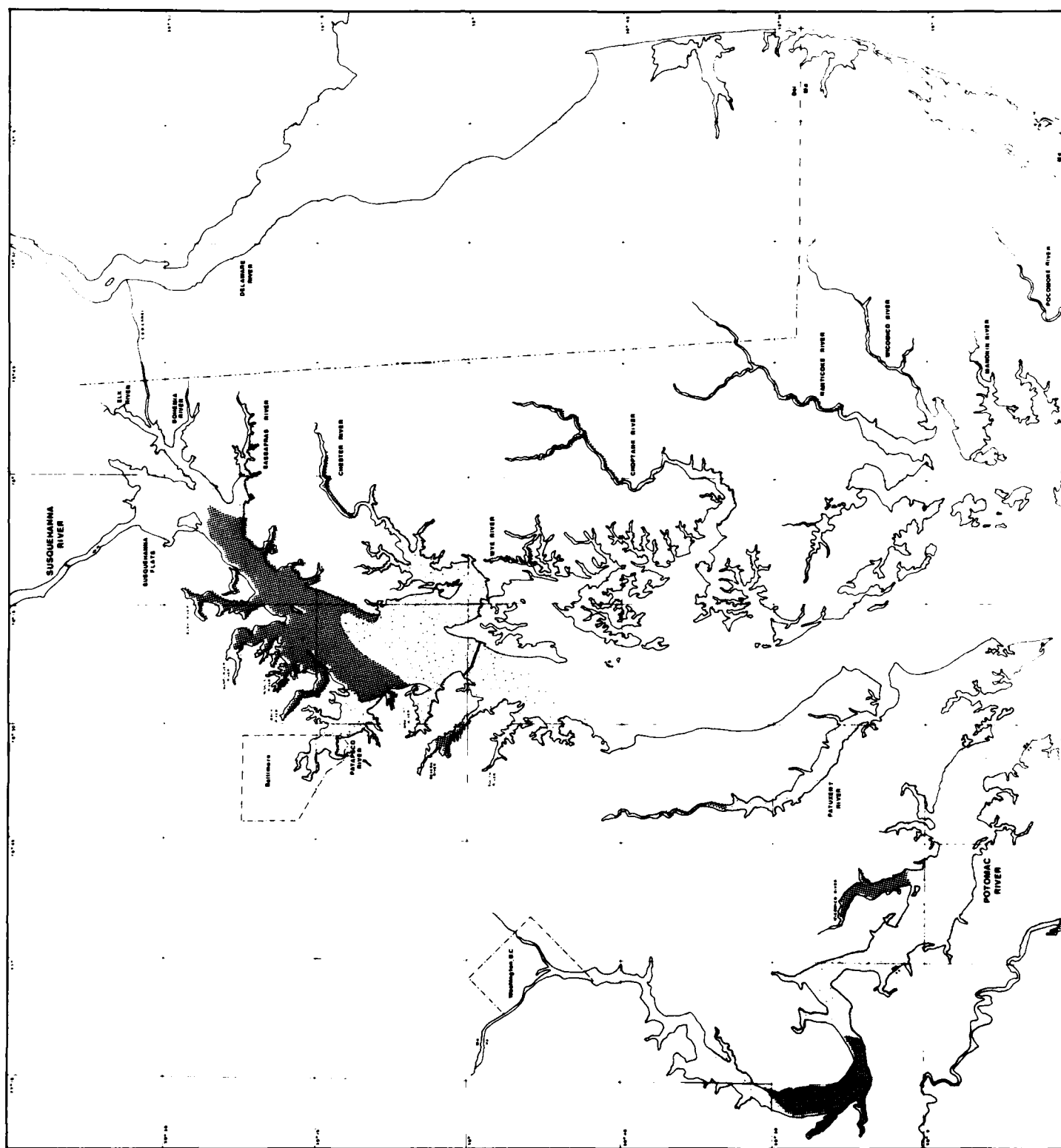


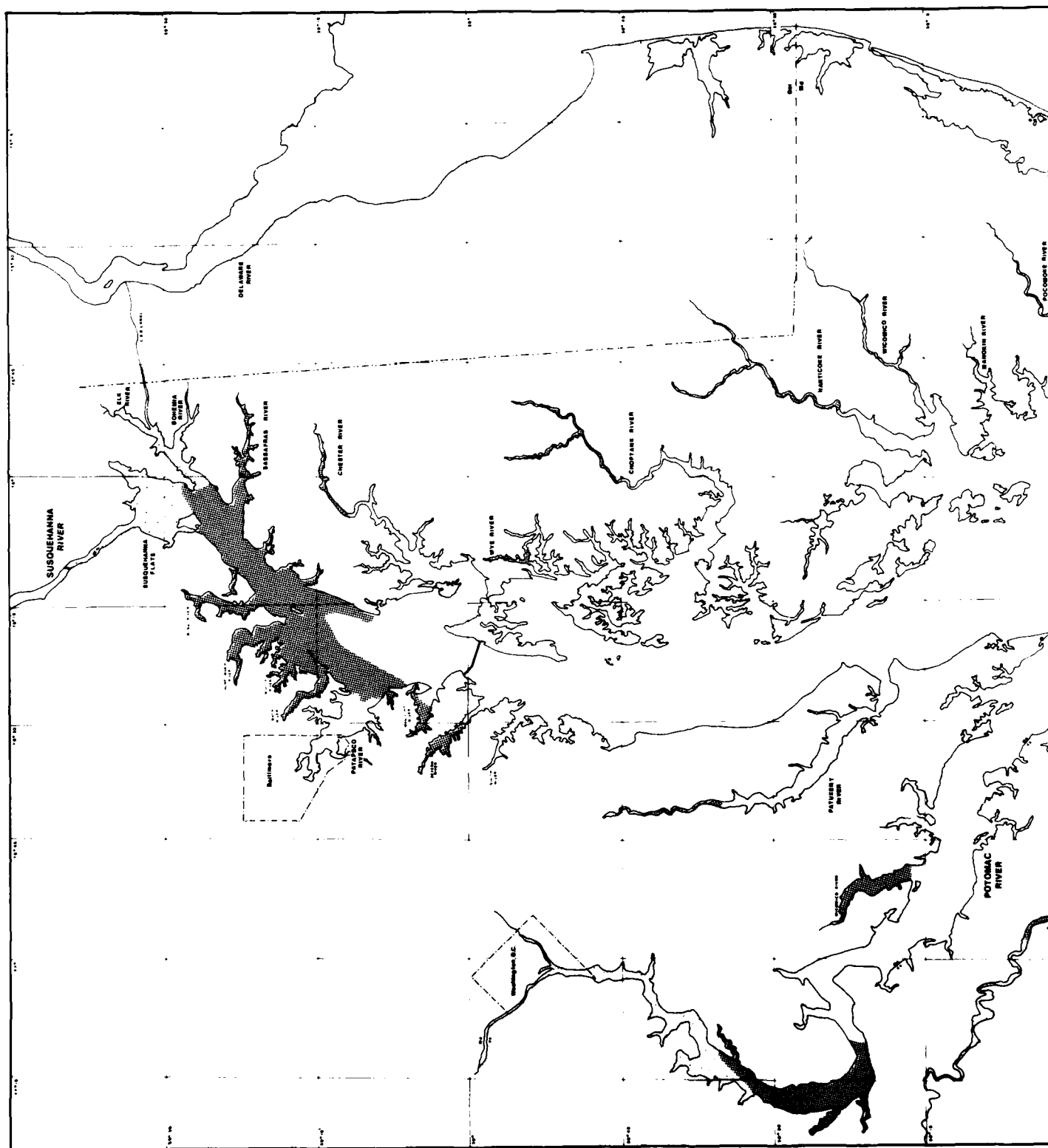


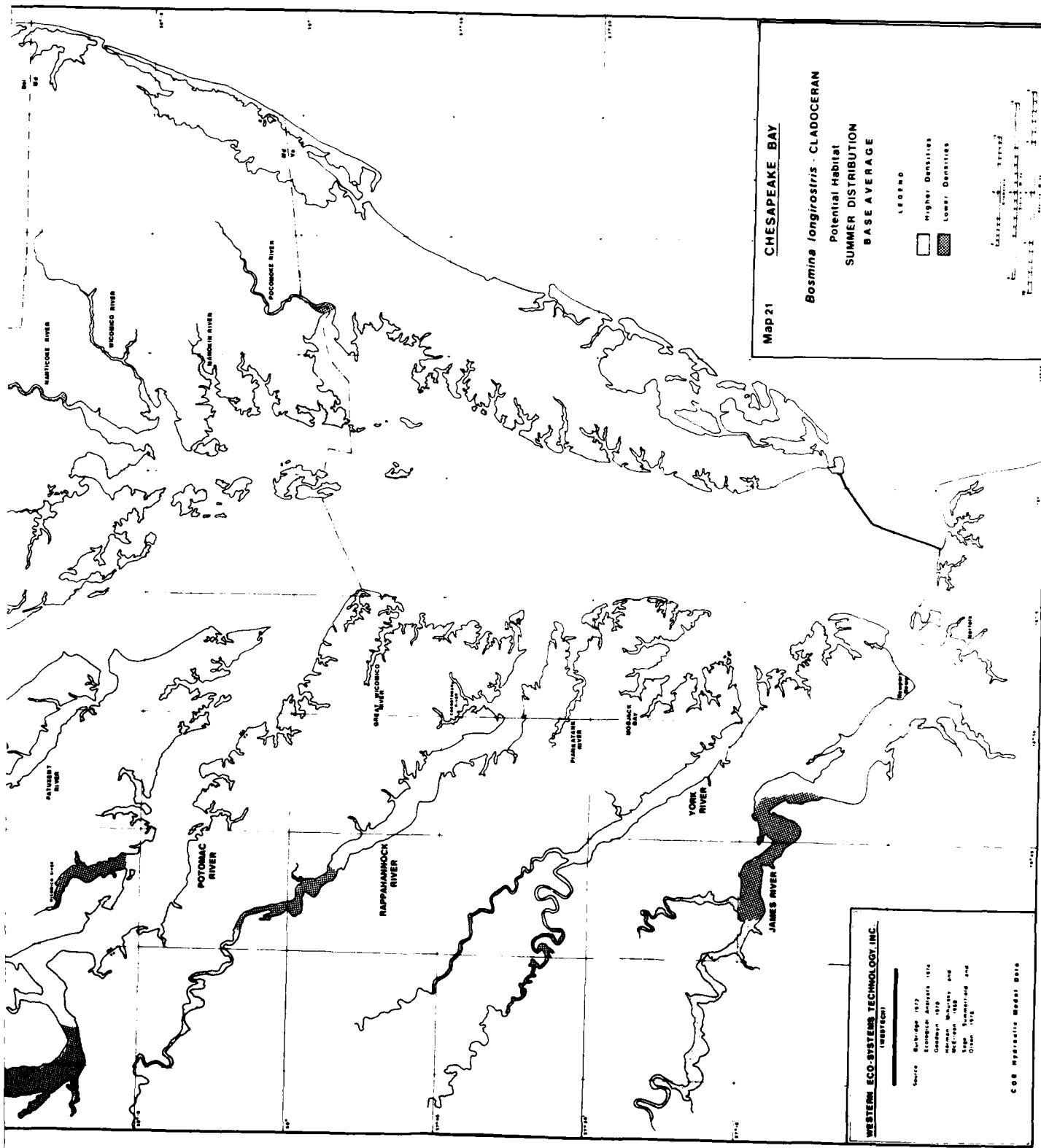


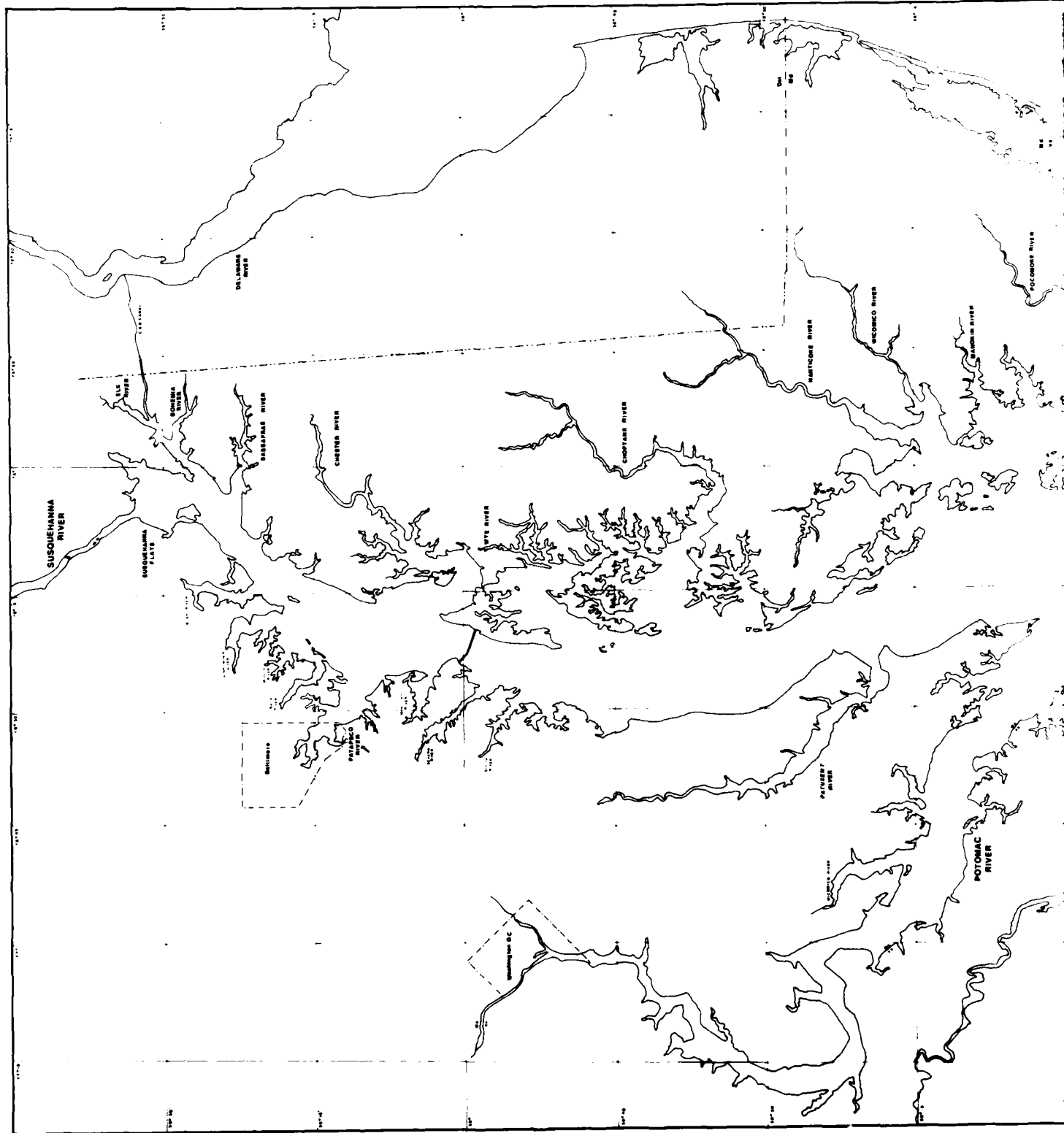


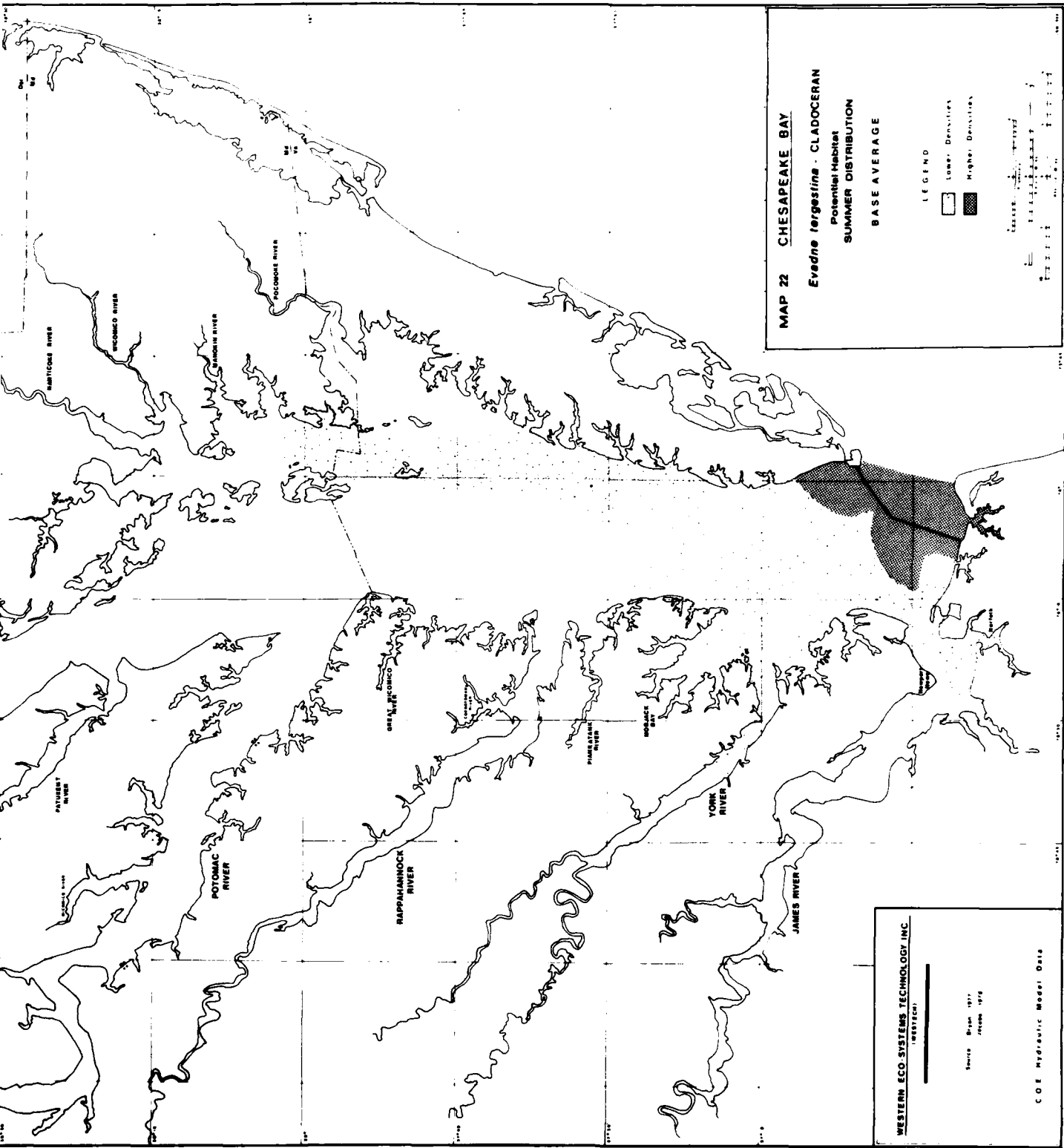


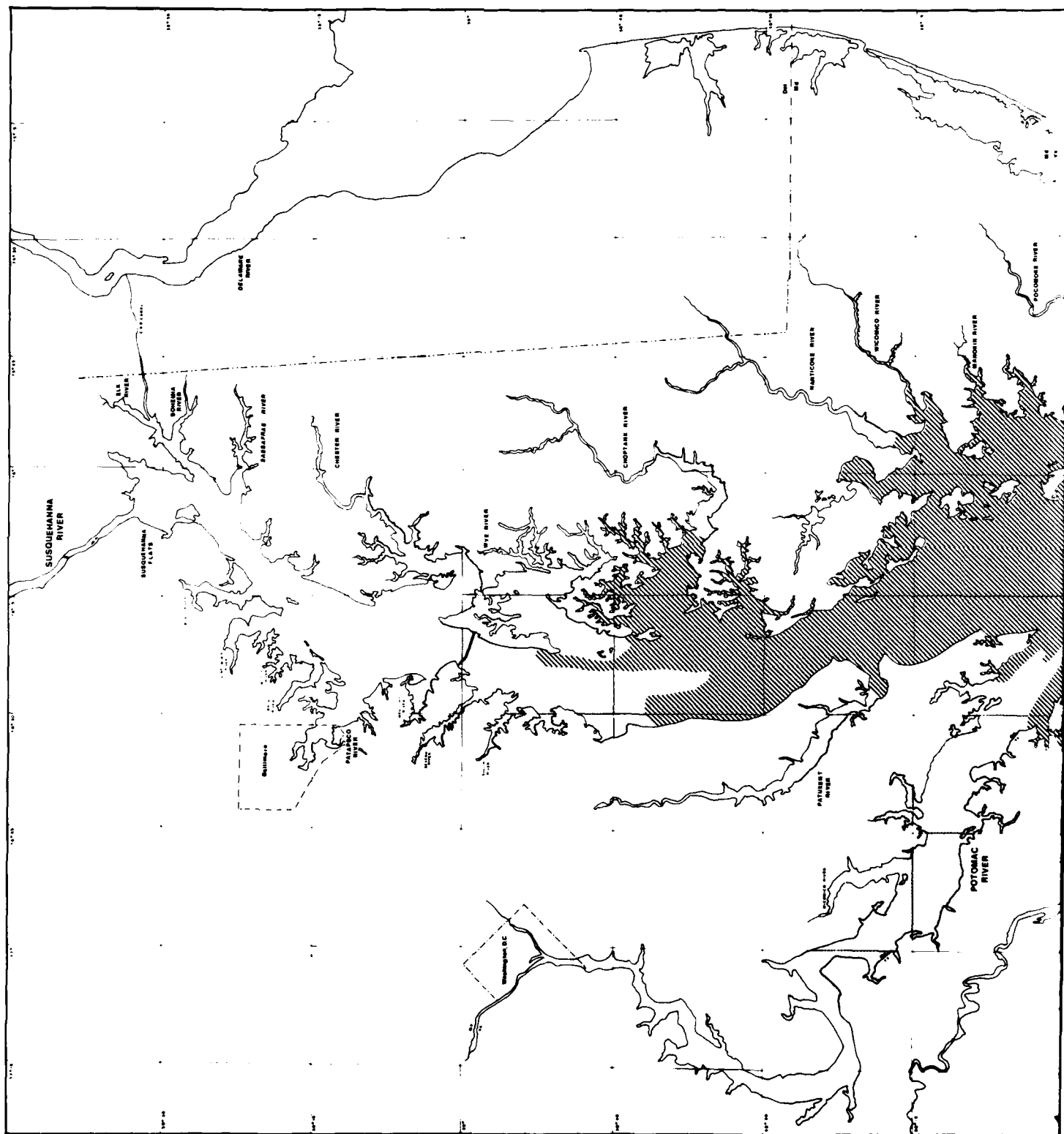


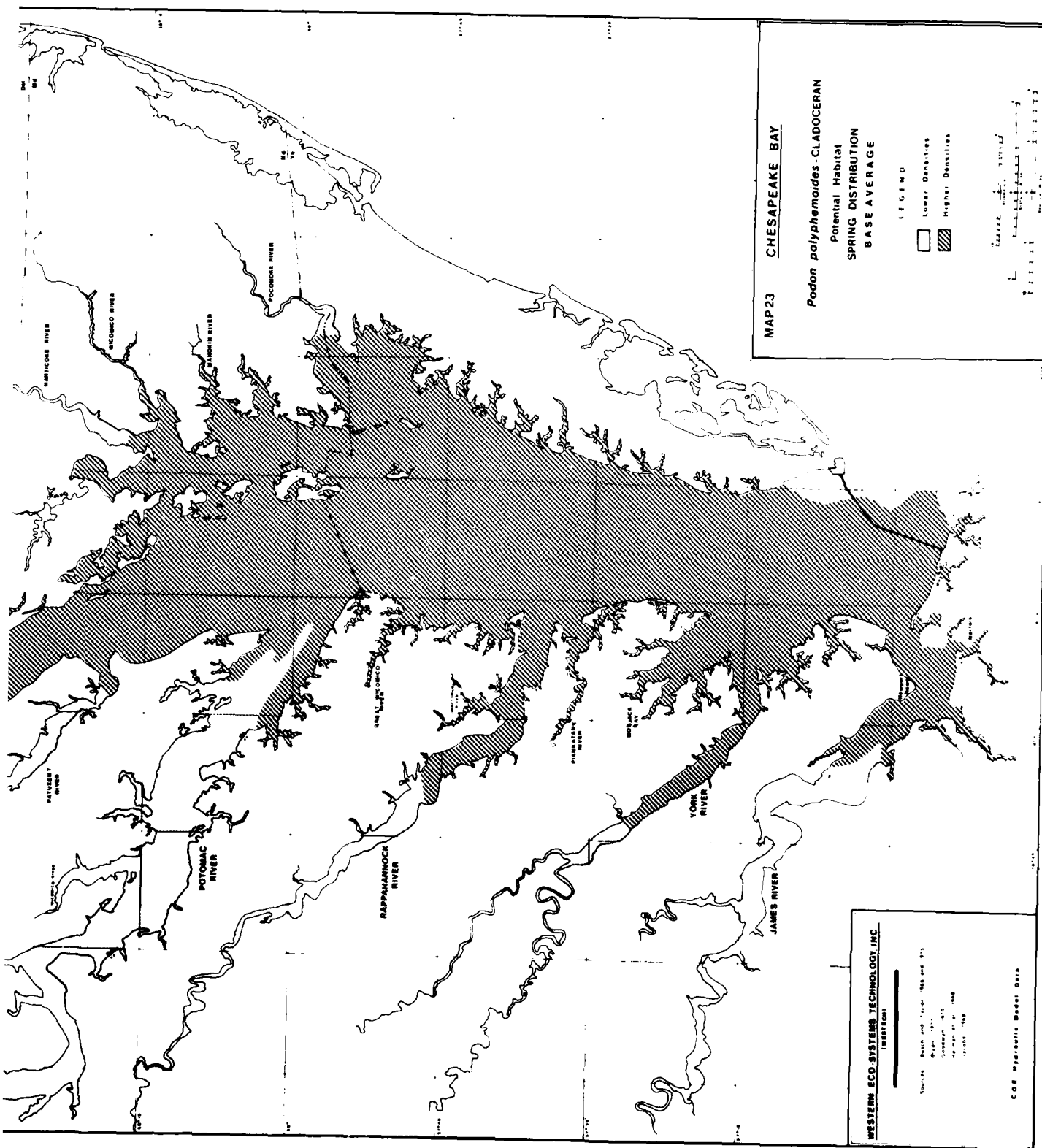


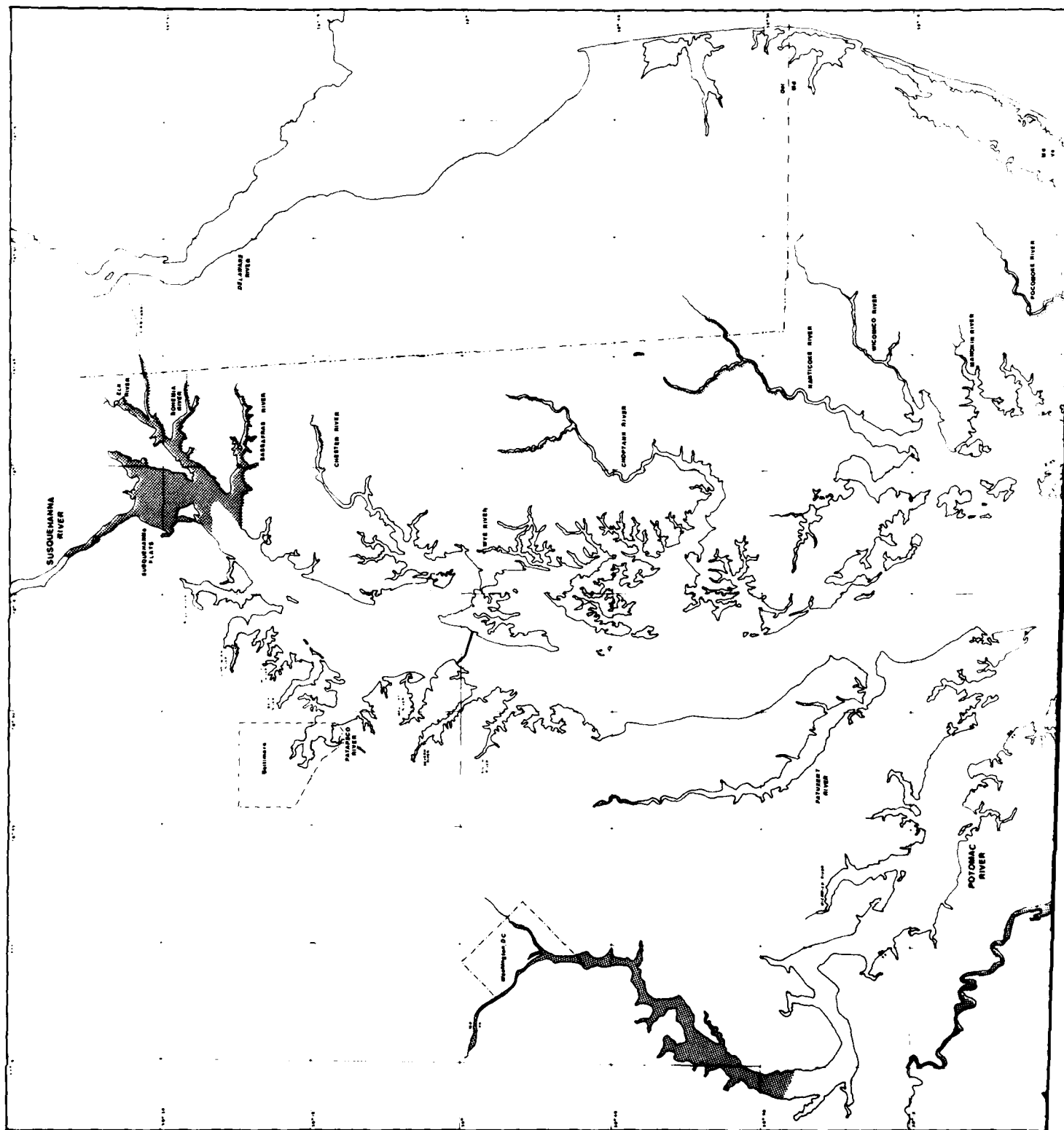


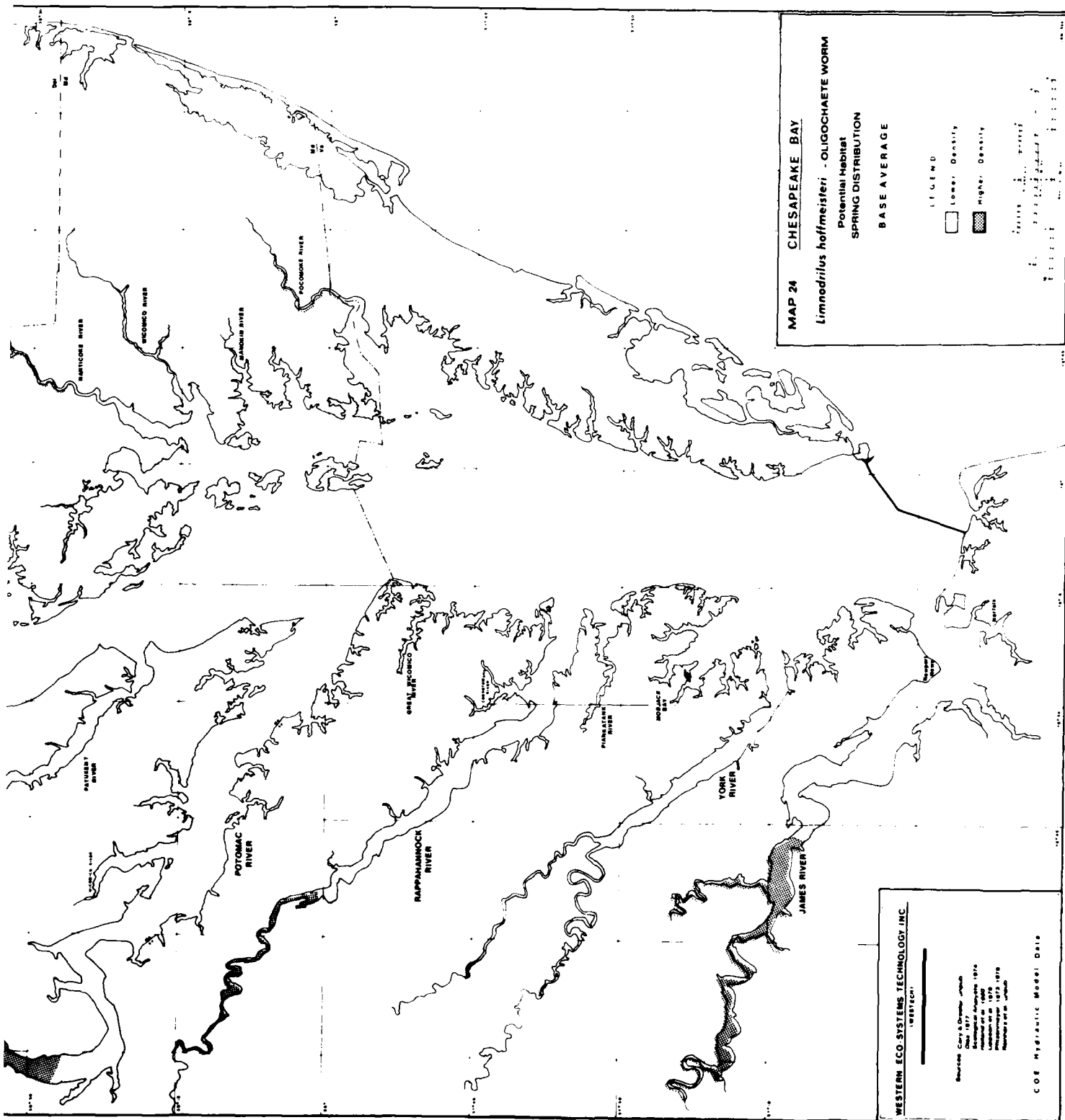












MAP 24 CHESAPEAKE BAY

***Limnodrilus hoffmeisteri* - OLIGOCHAETE WORM**

Potential Habitat
SPRING DISTRIBUTION

BASE AVERAGE

LEGEND

Low Density: [White box]

High Density: [Shaded box]

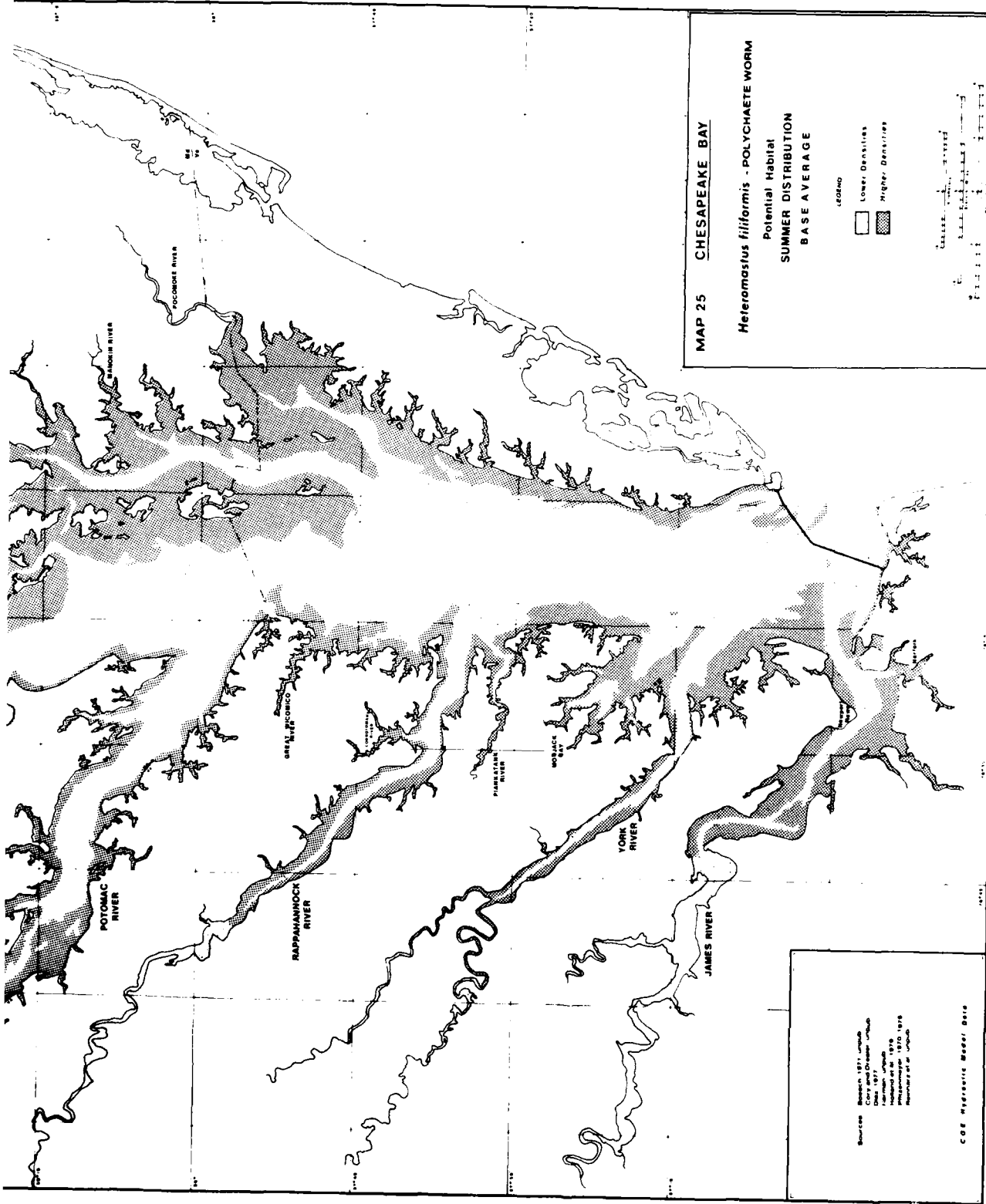
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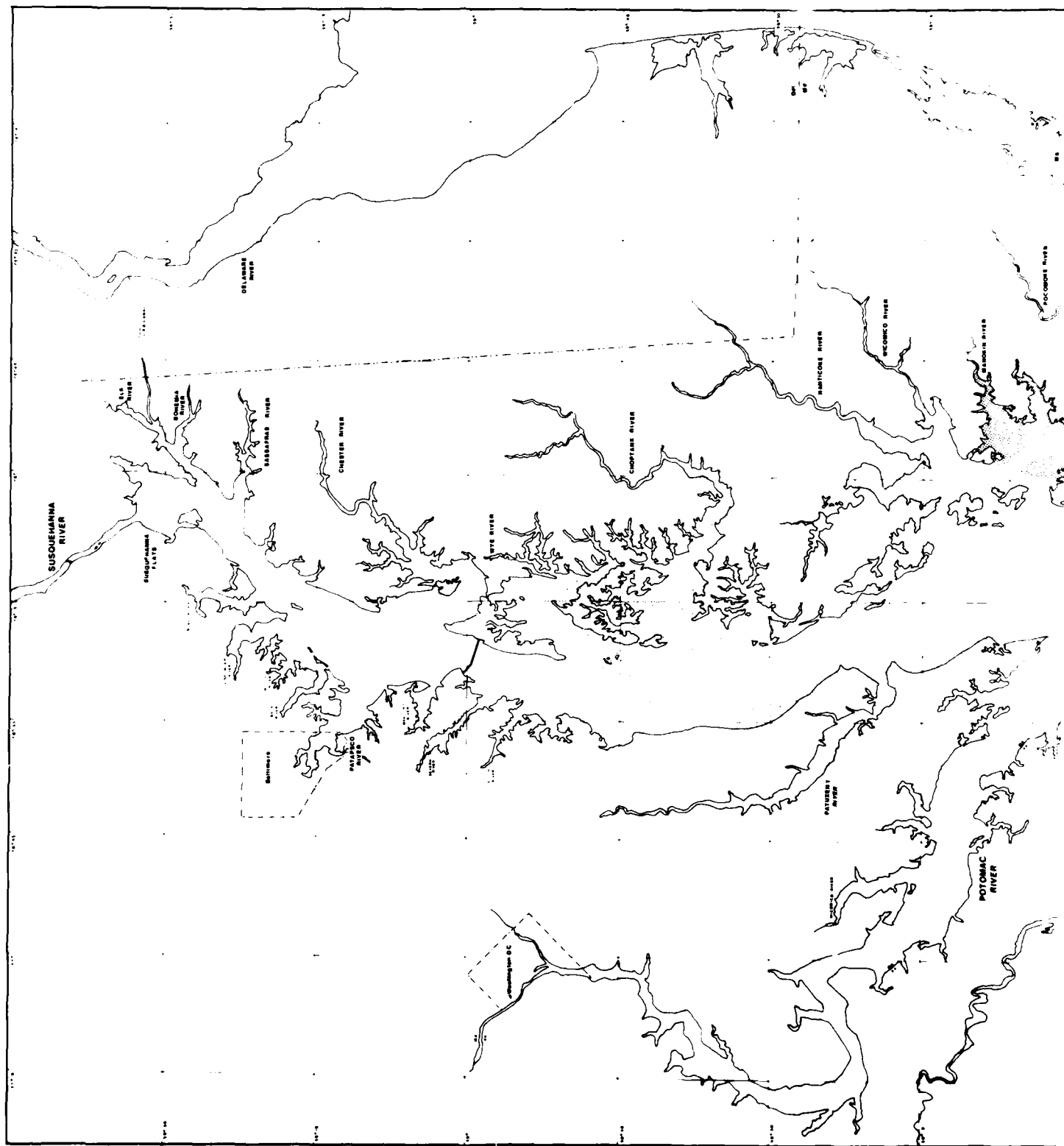
WESTERN ECO-SYSTEMS TECHNOLOGY, INC.
(WESTTECH)

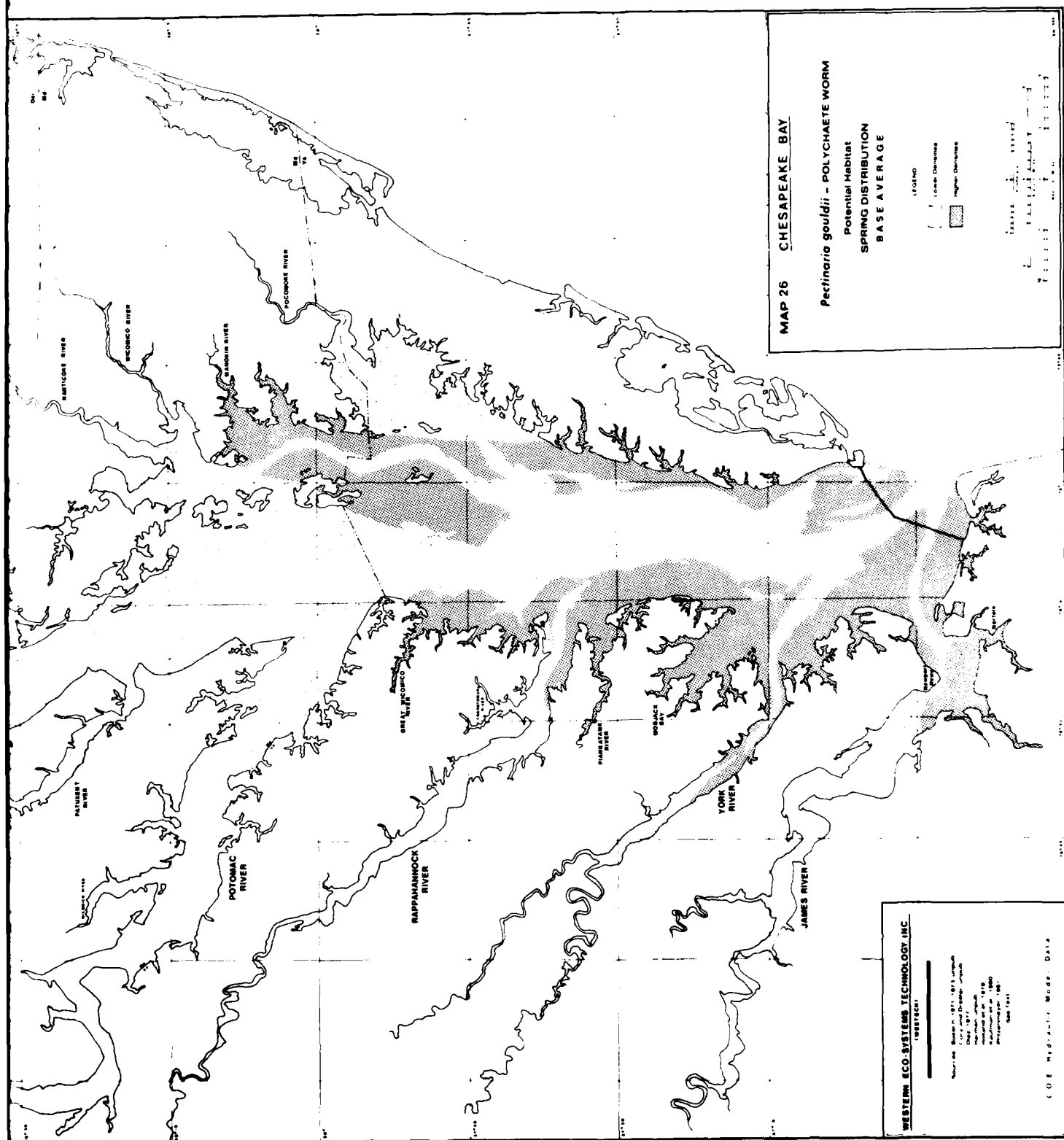
Source: Gray & Dwyer, 1974
 Data: 1974
 Estimated Population: 1974
 Estimated Size: 1974
 Estimated Age: 1974
 Estimated Sex: 1974
 Estimated Species: 1974

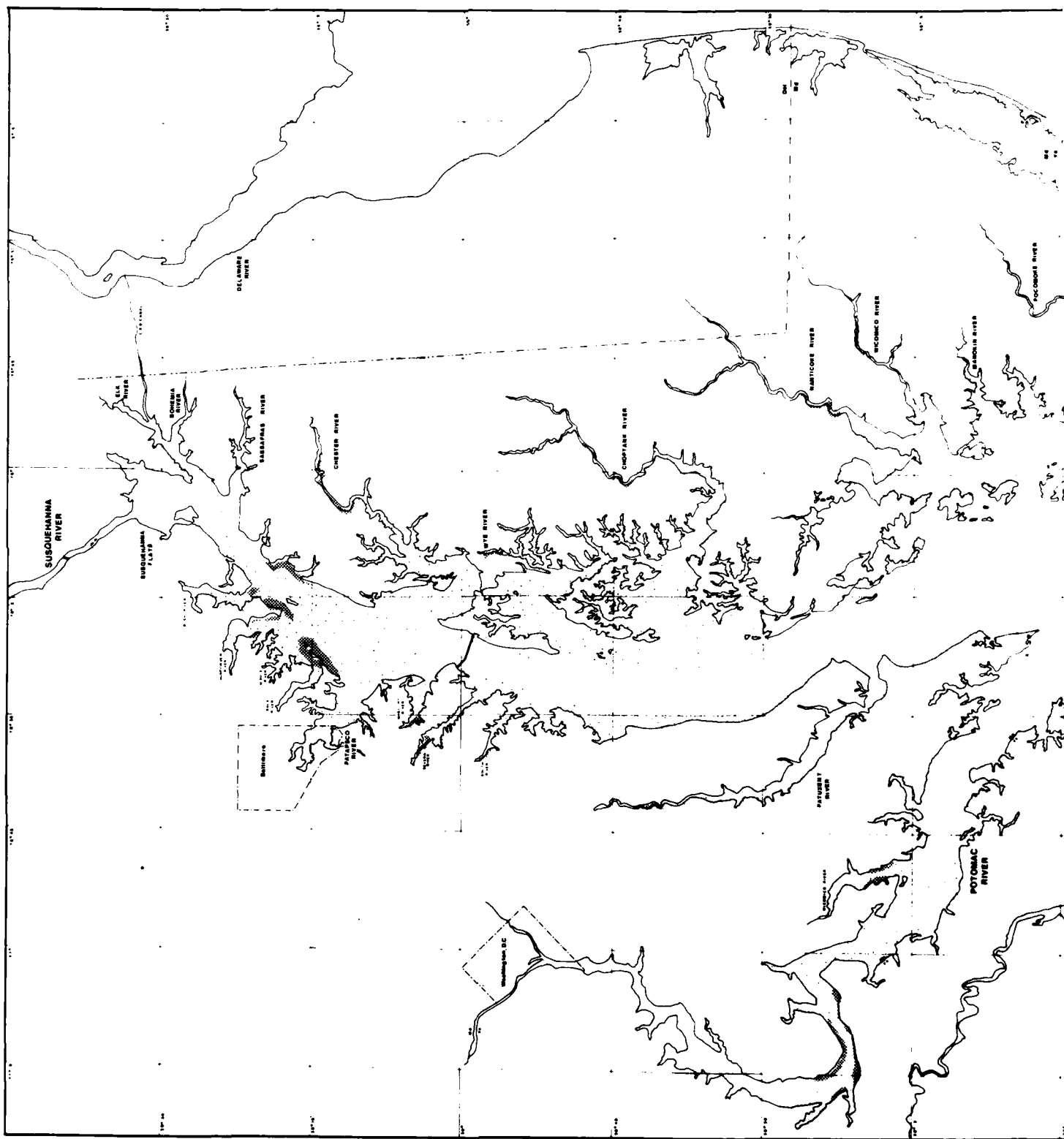
COE Hydraulic Model Data

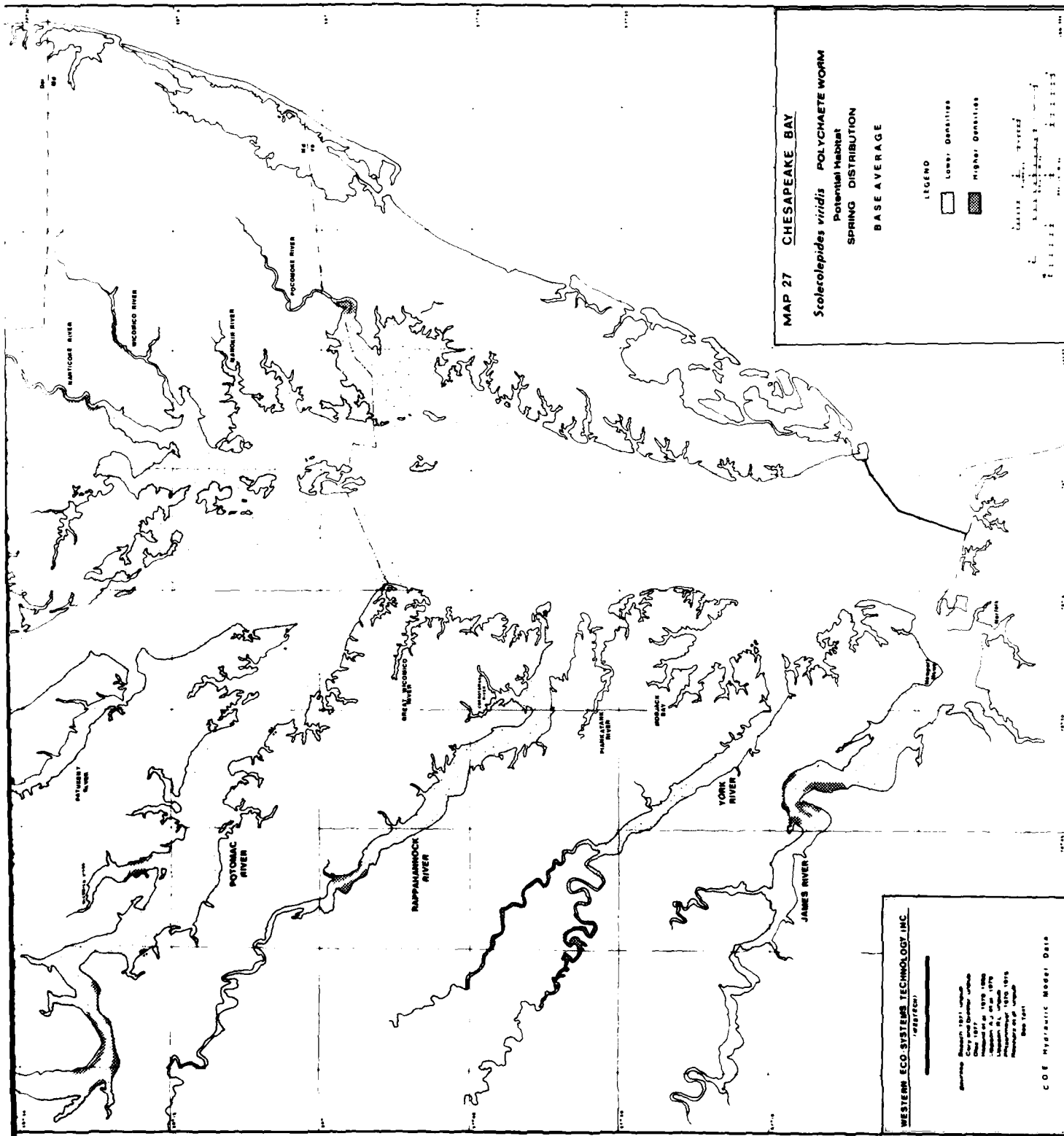


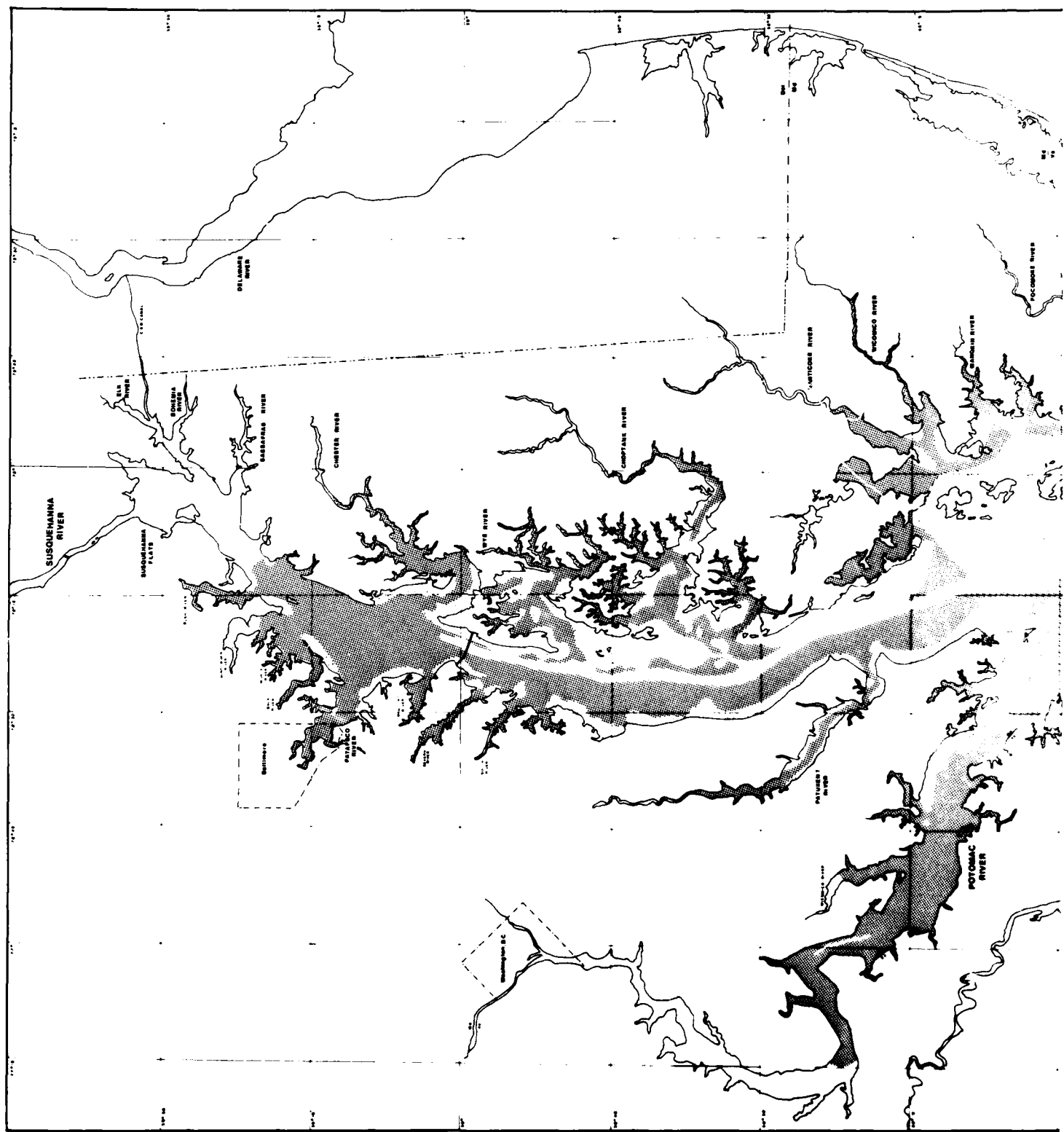


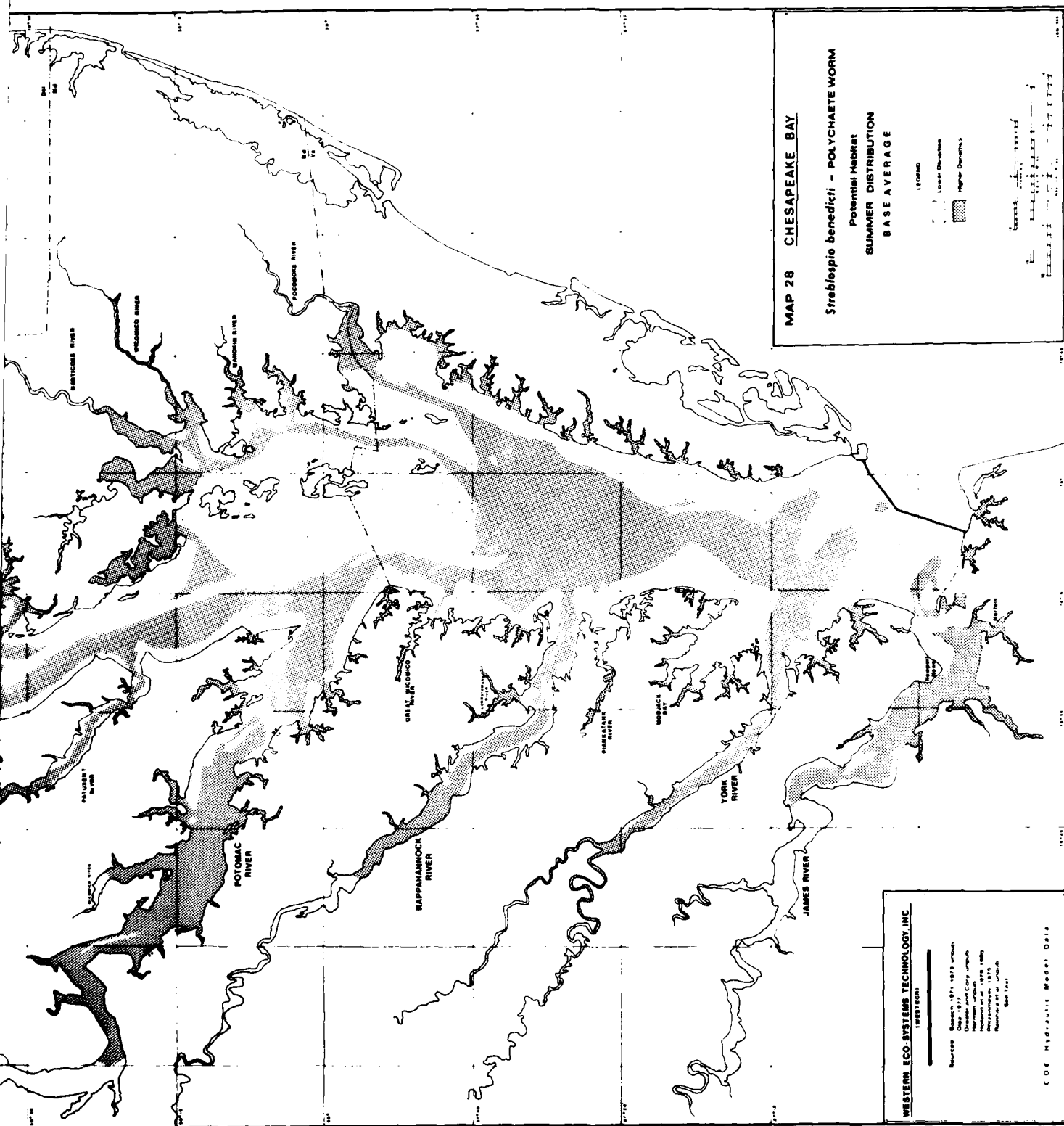


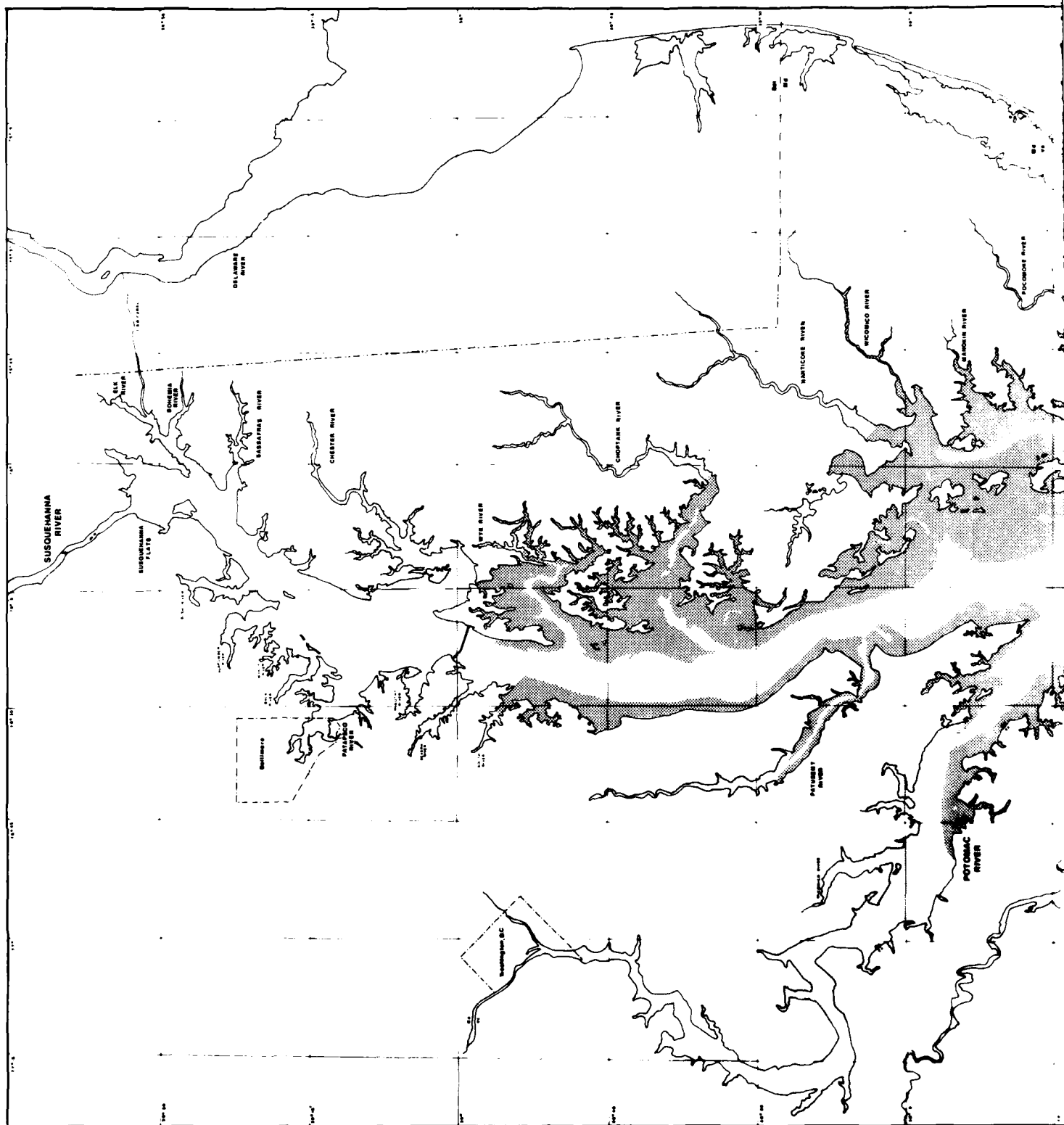


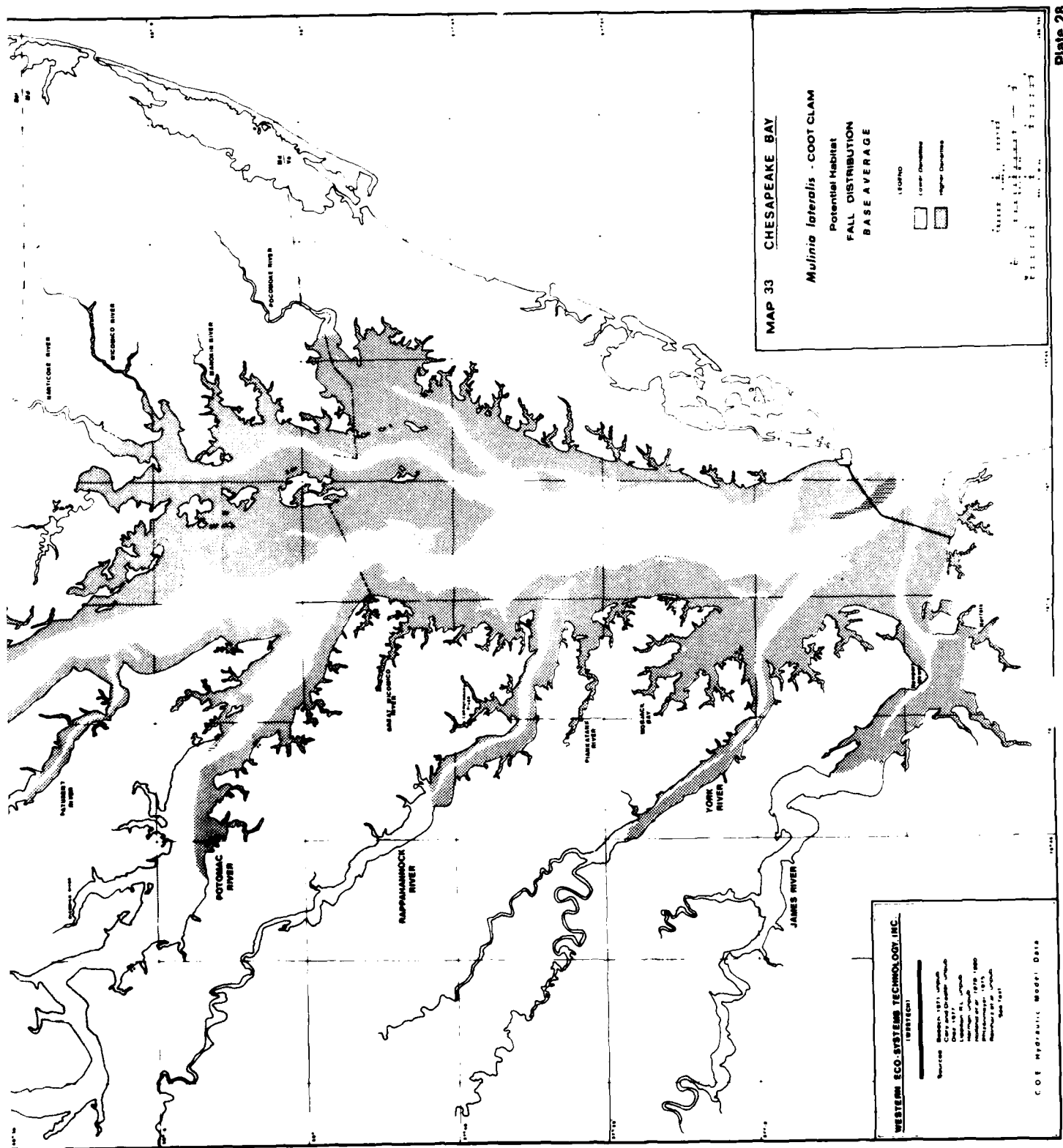


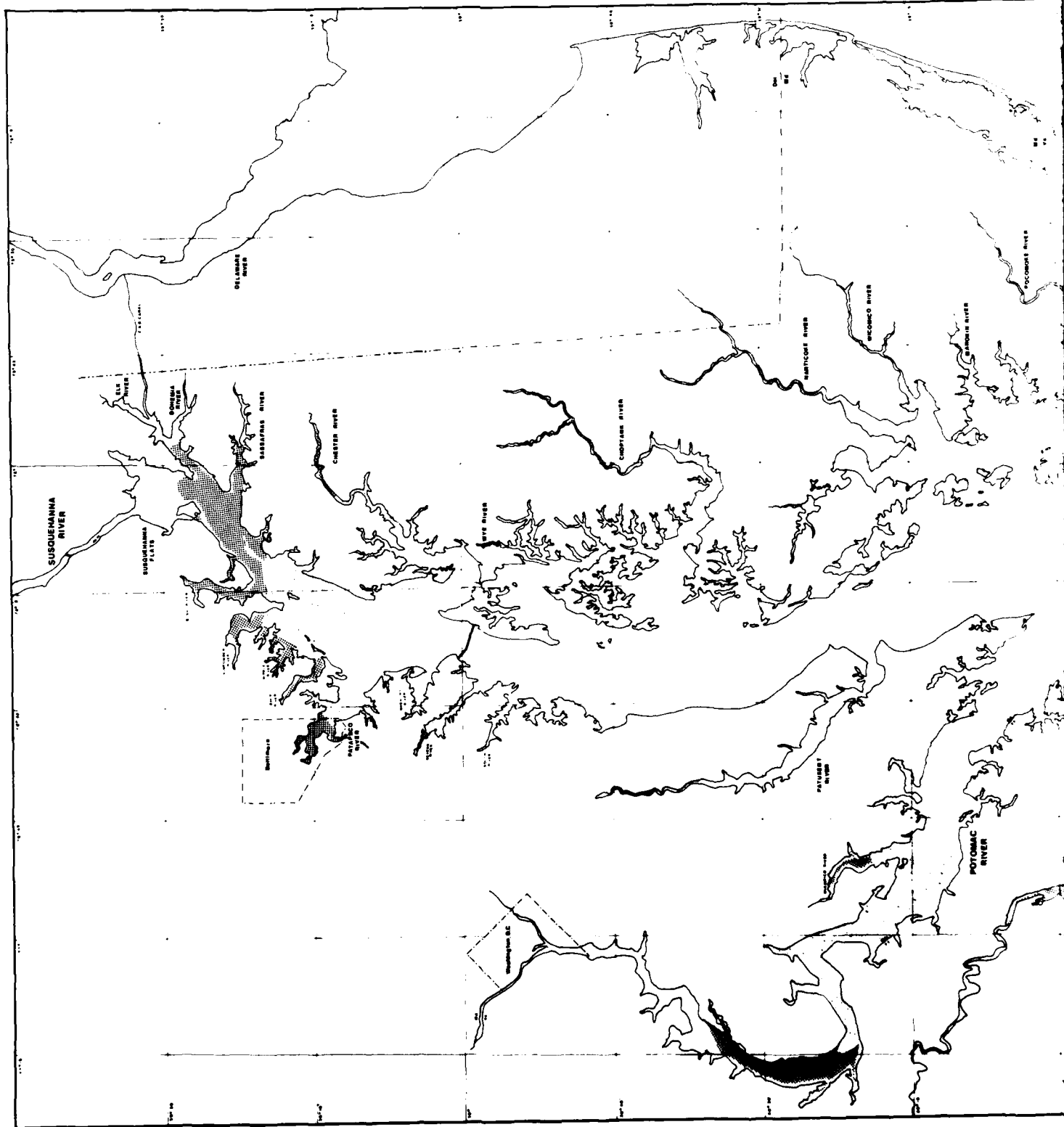




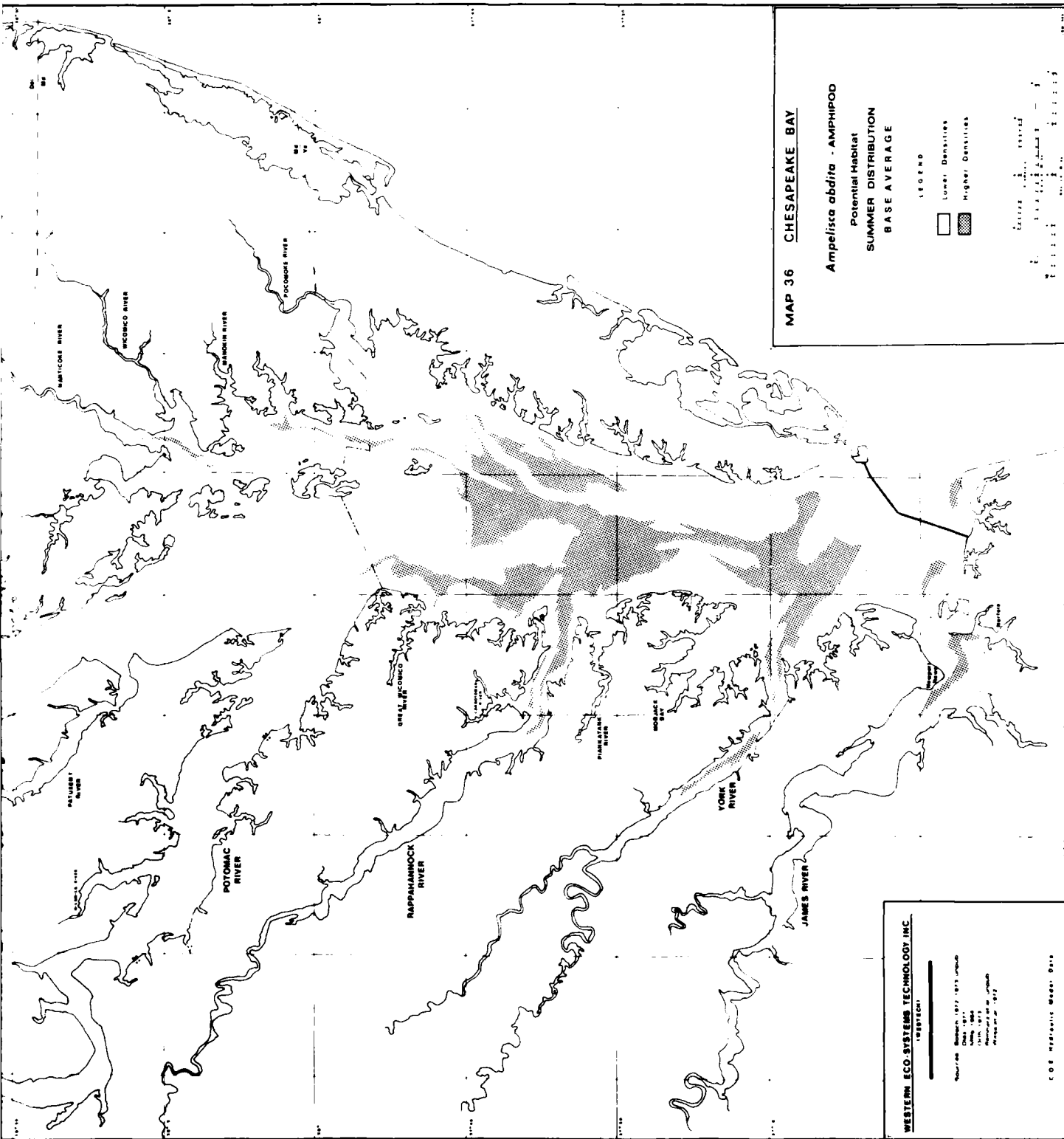












MAP 36 CHESAPEAKE BAY

***Ampelisca abdita* - AMPHIPOD**
 Potential Habitat
 SUMMER DISTRIBUTION
 BASE AVERAGE

LEGEND

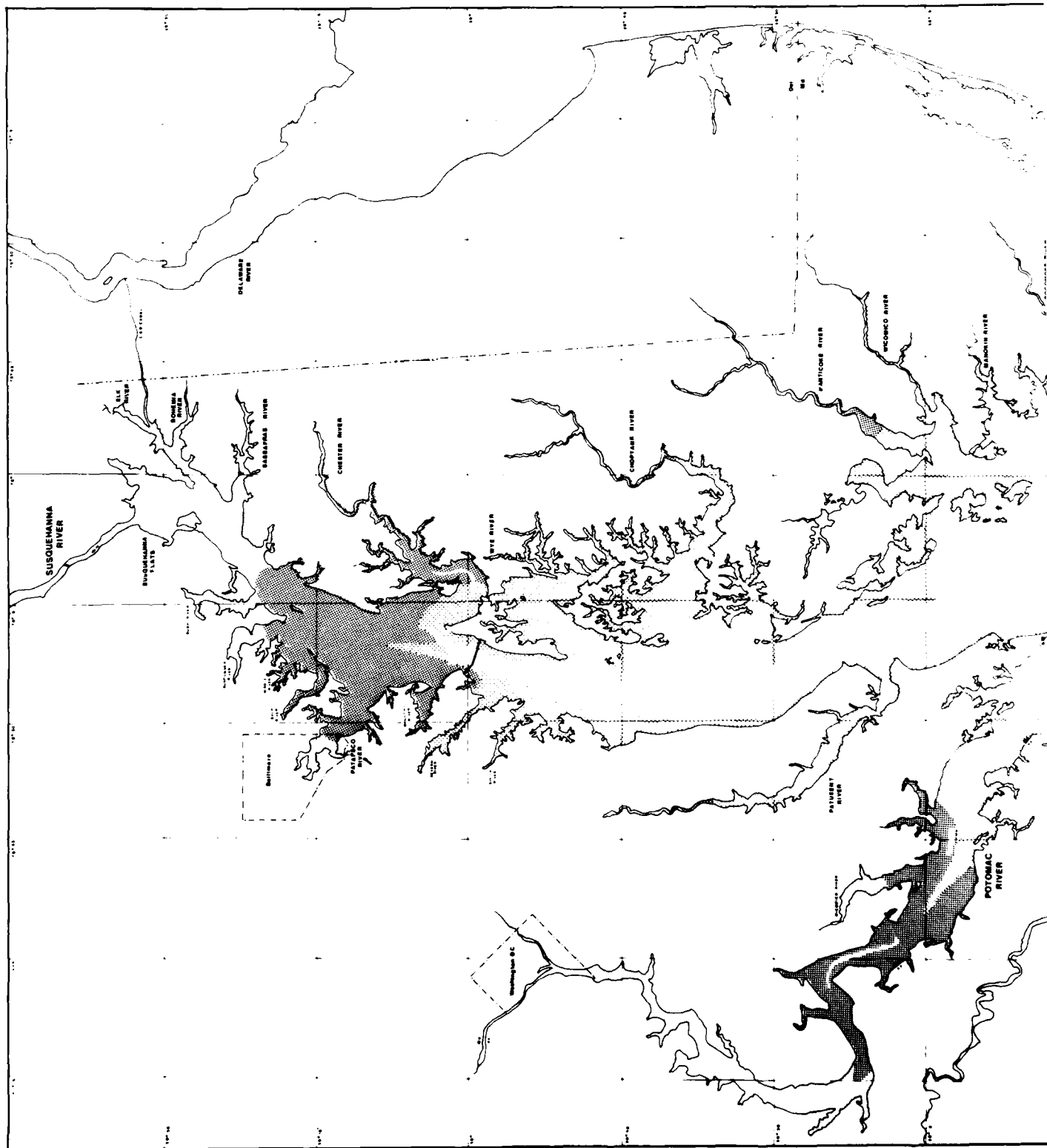
Lower Densities
 Higher Densities

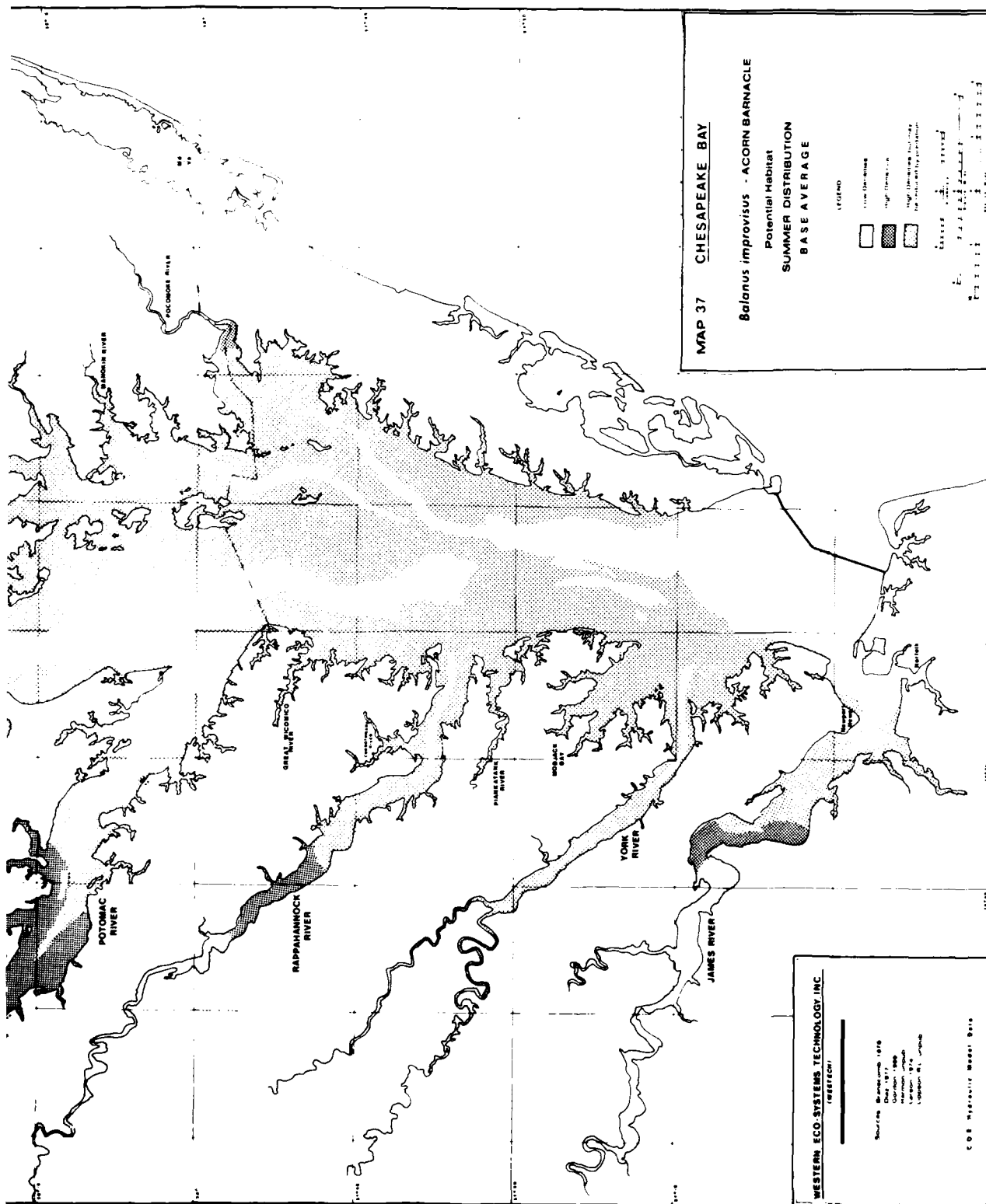
Scale: 1:100,000
 North Arrow

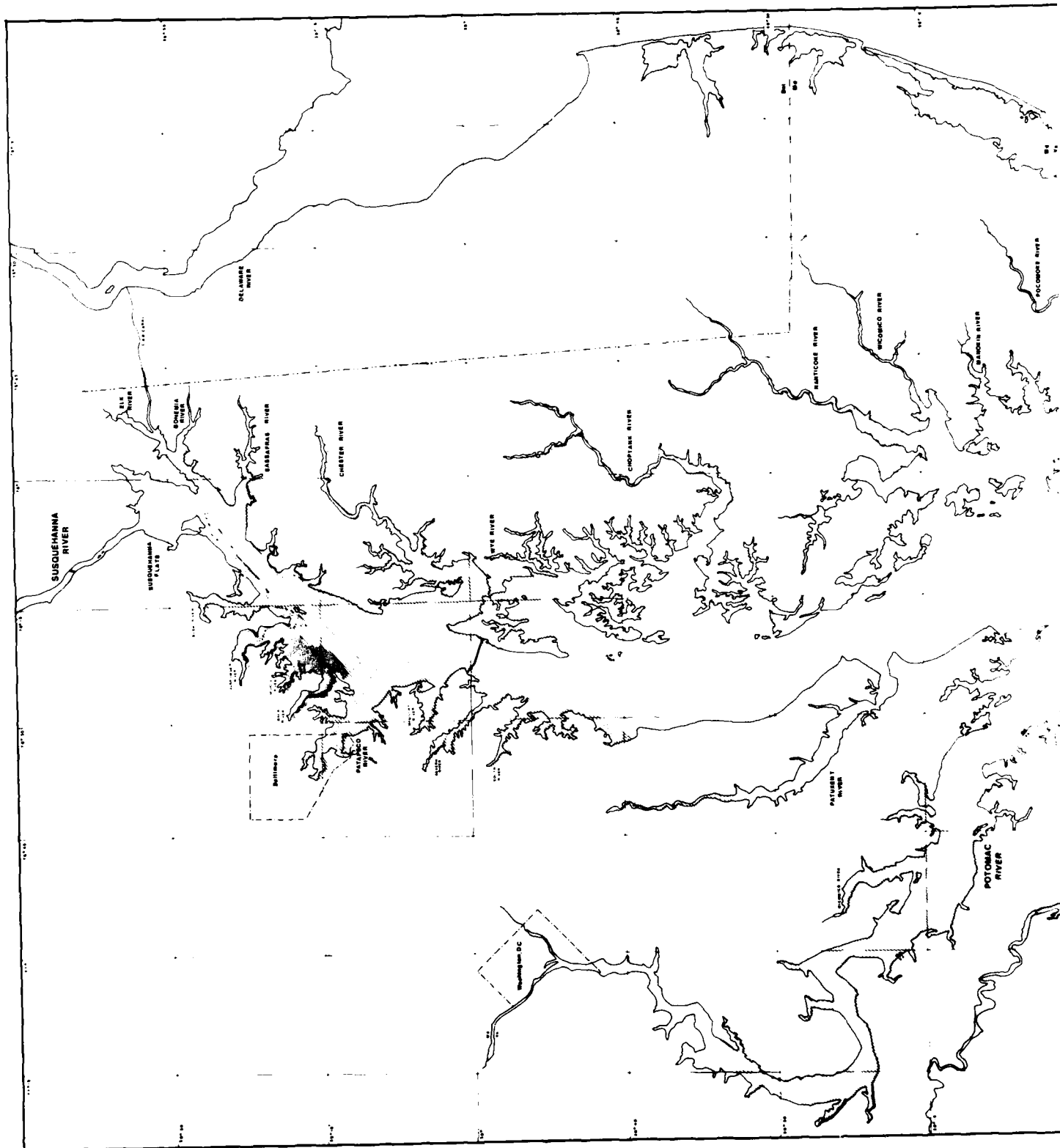
WESTERN ECO-SYSTEMS TECHNOLOGY, INC.
 (WESTECH)

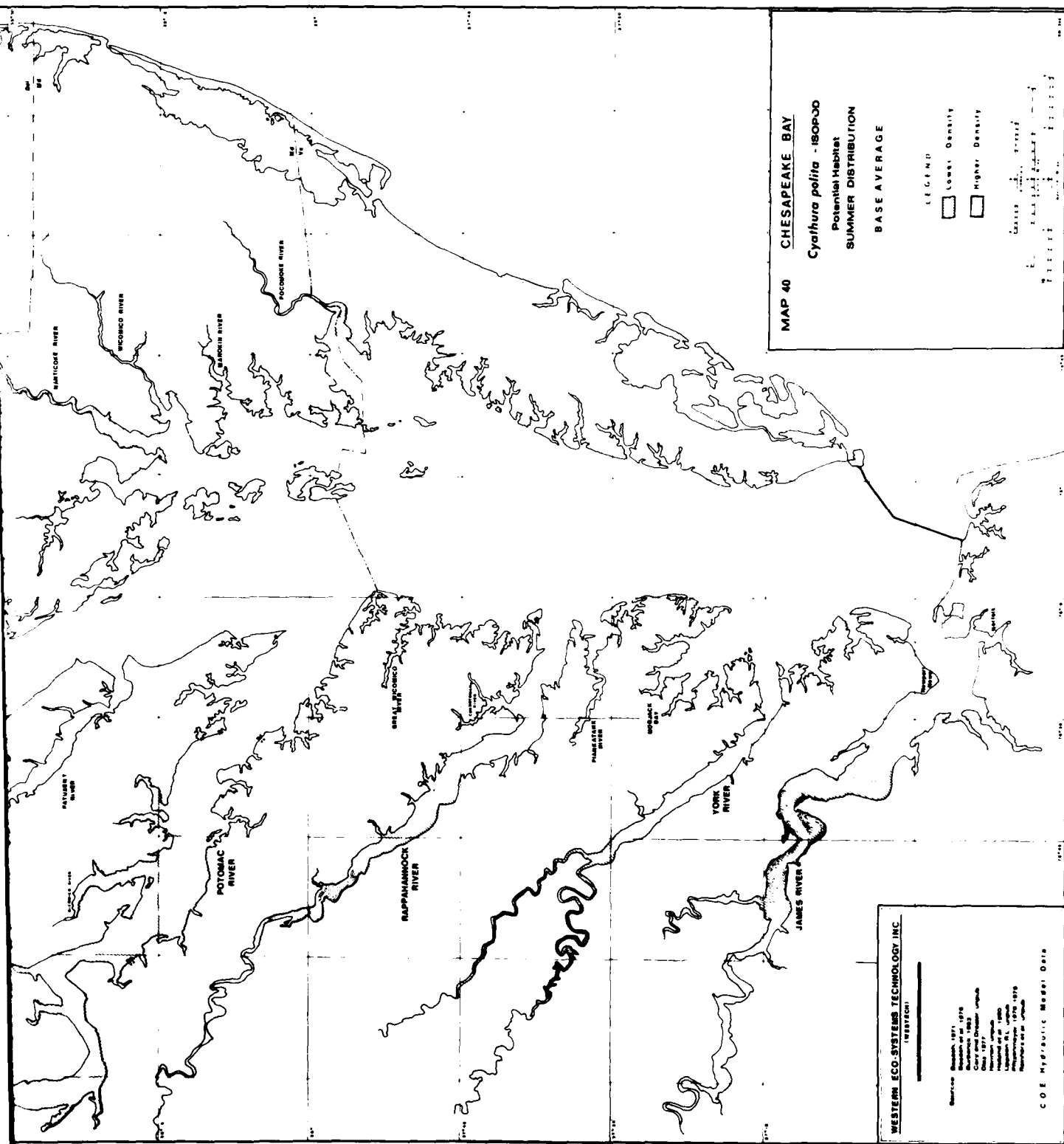
Source: Benthos, 1977, 1978, 1979
 Data: 1980
 Date: 1981
 Project: 1981

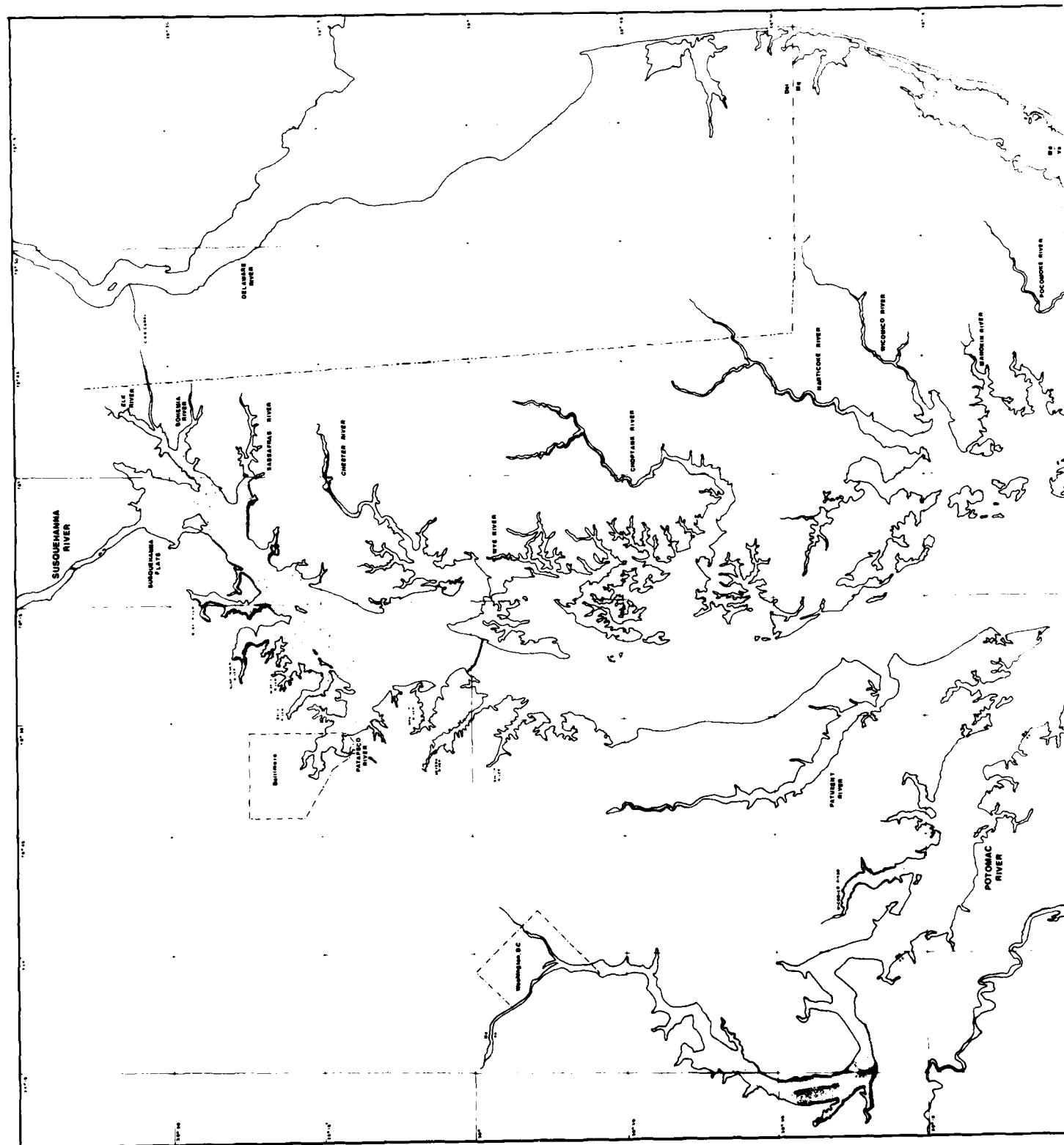
C O S WESTECH Maps: 010

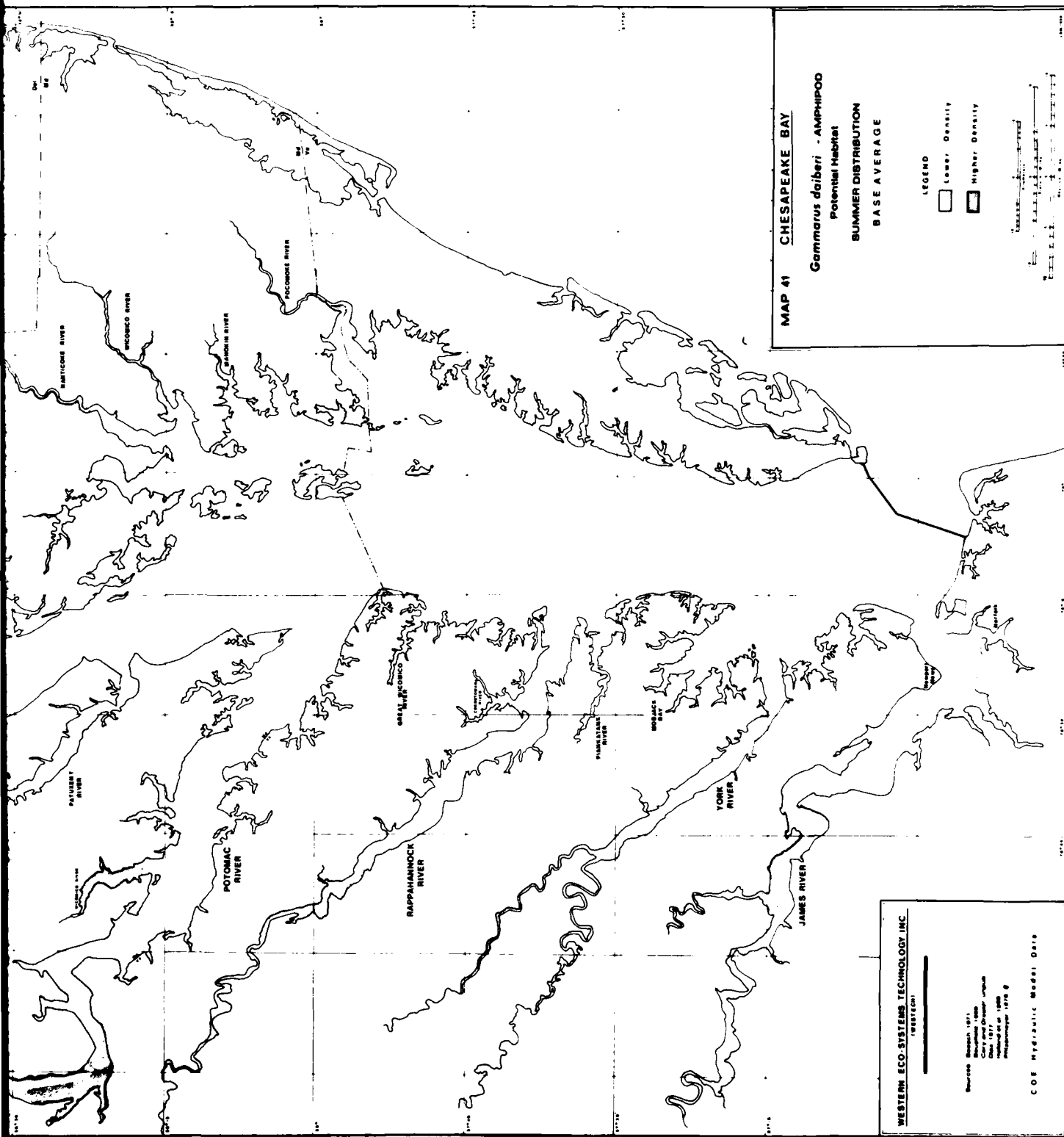


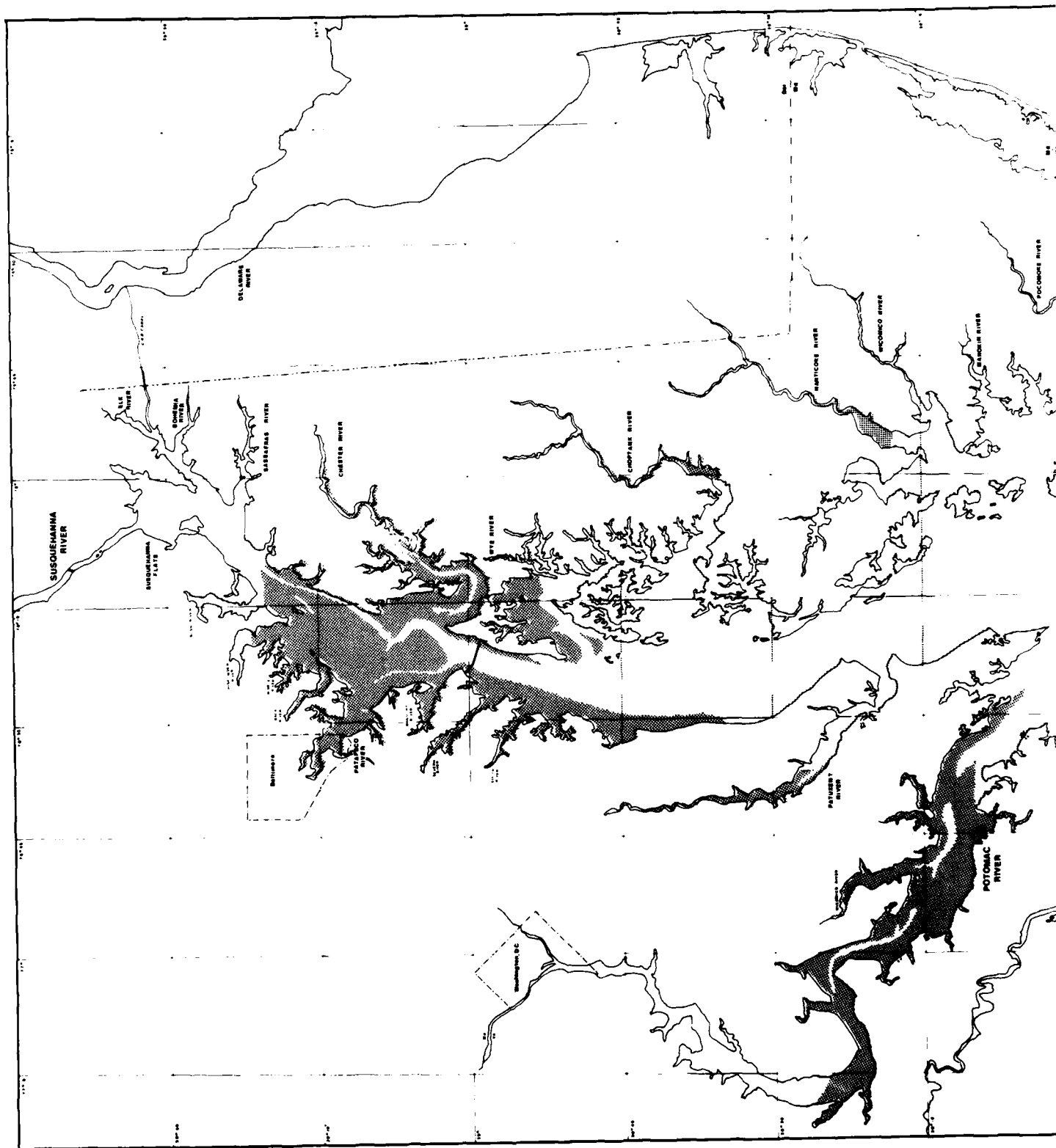


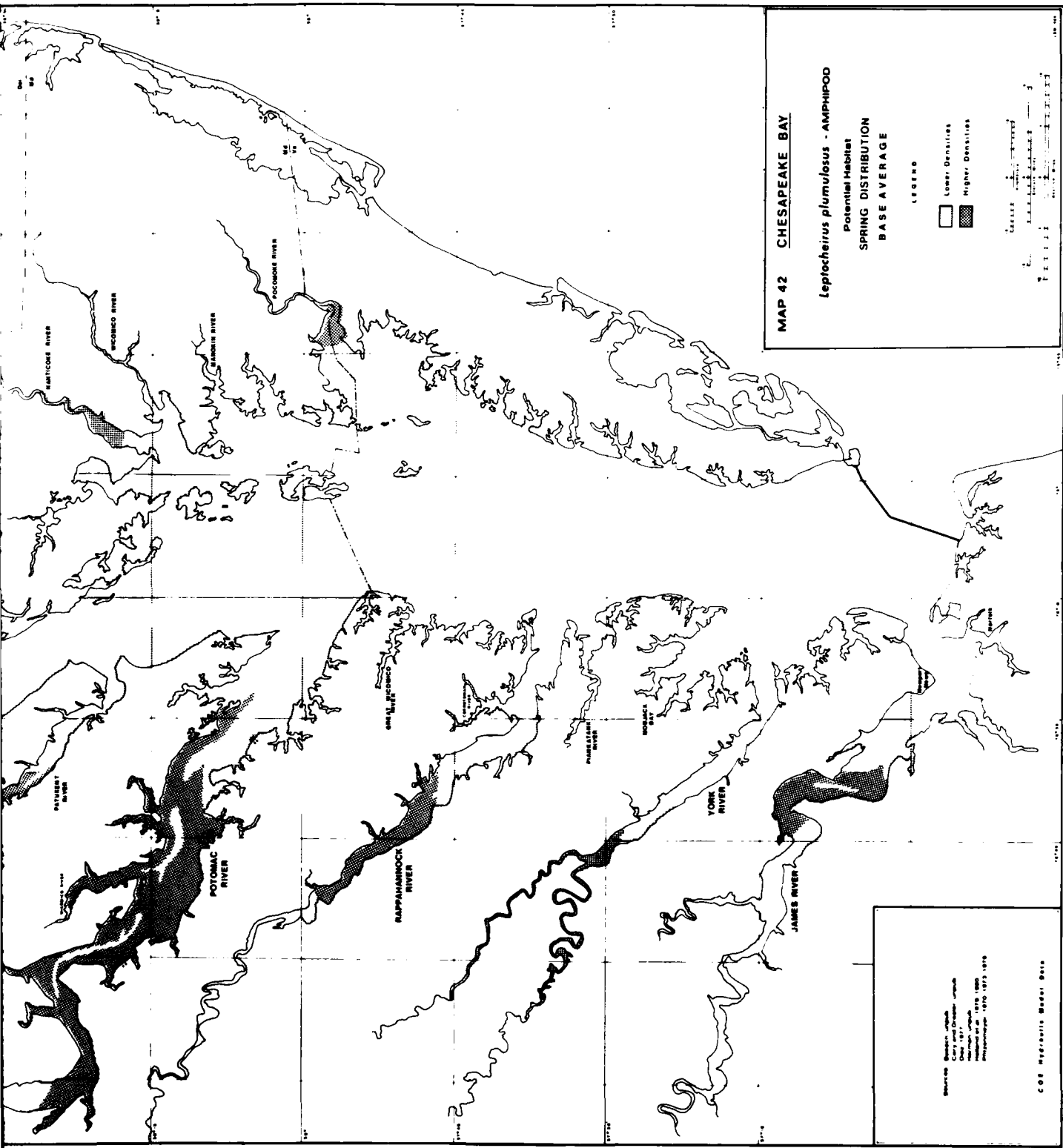


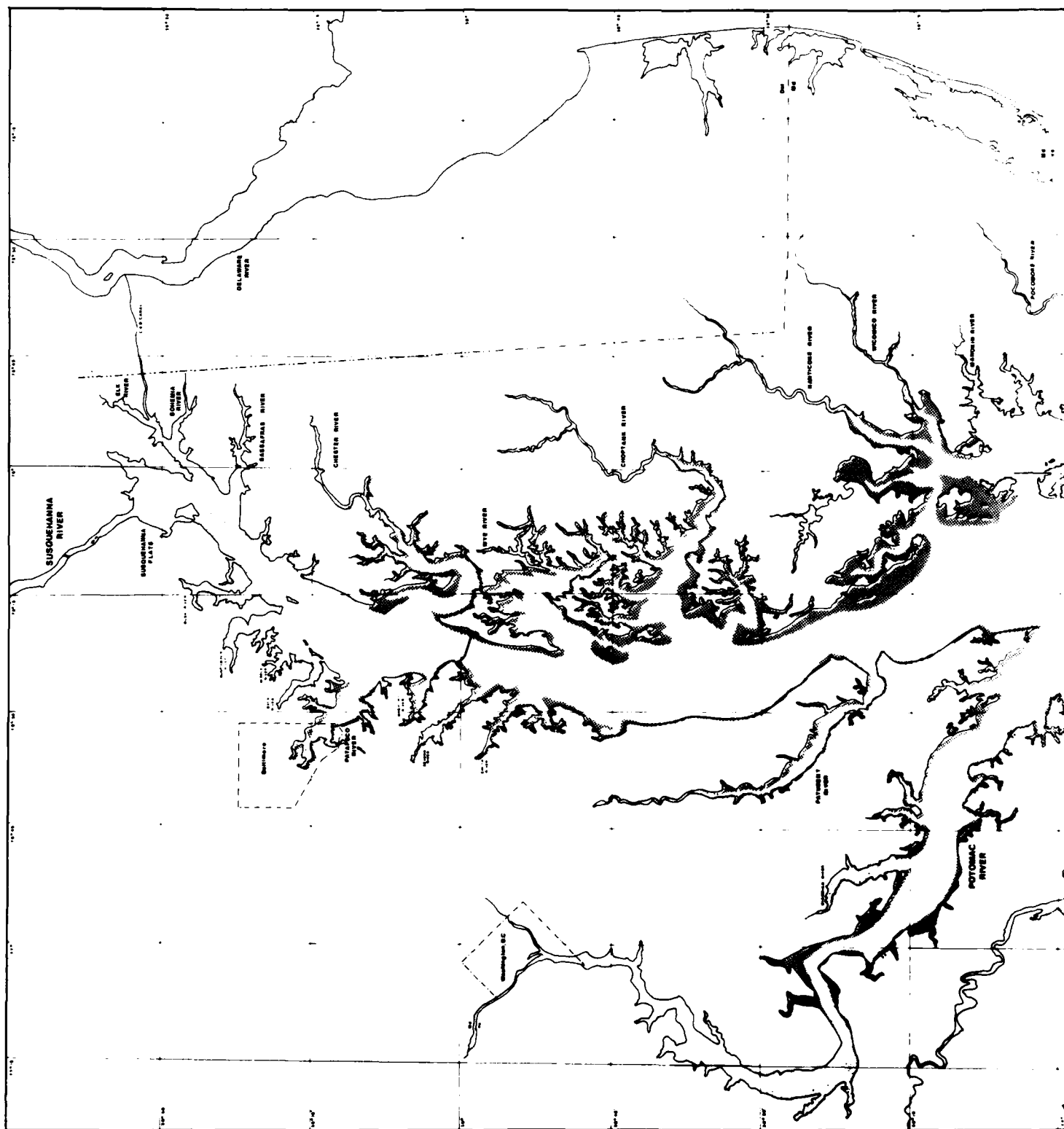


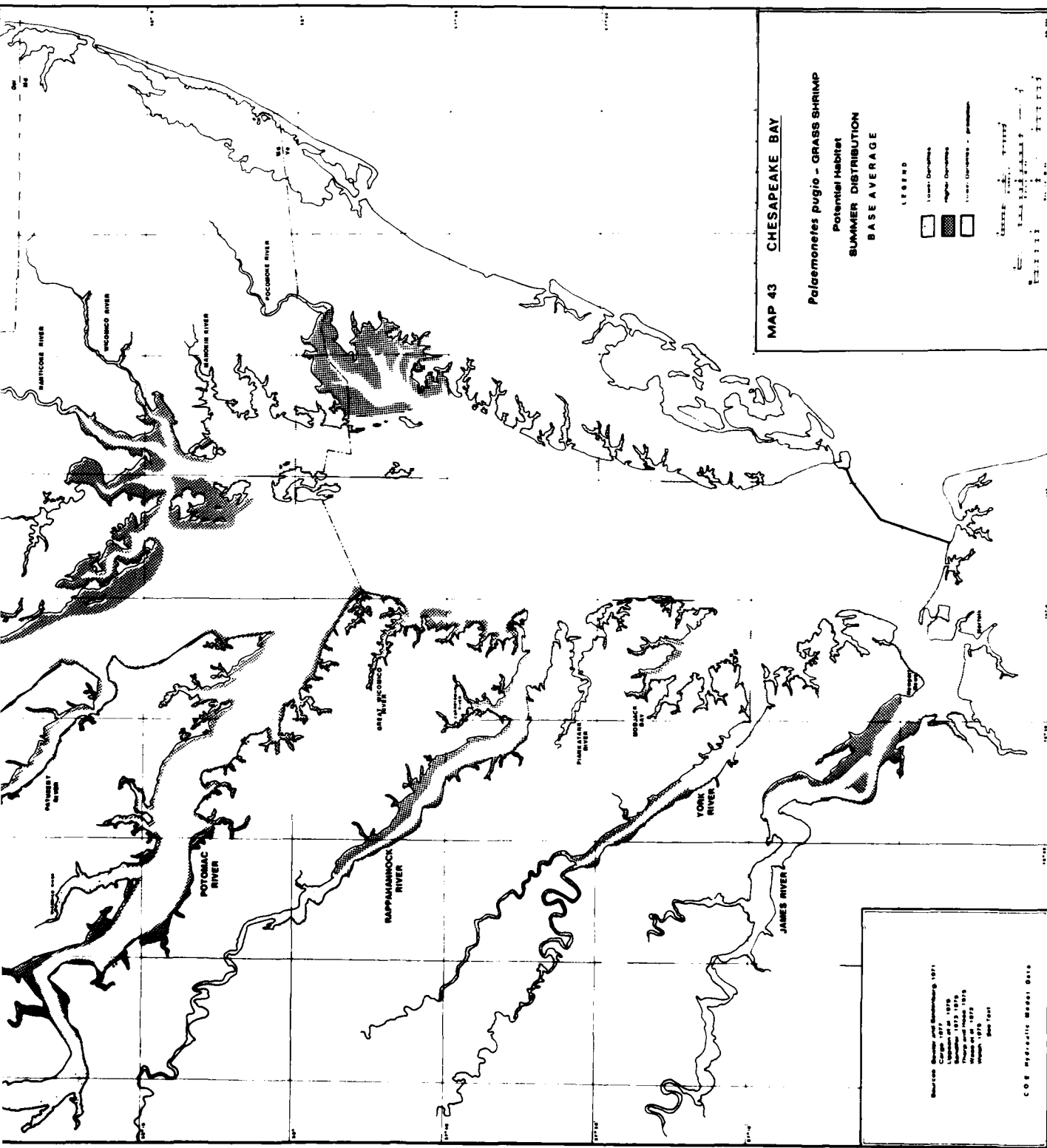


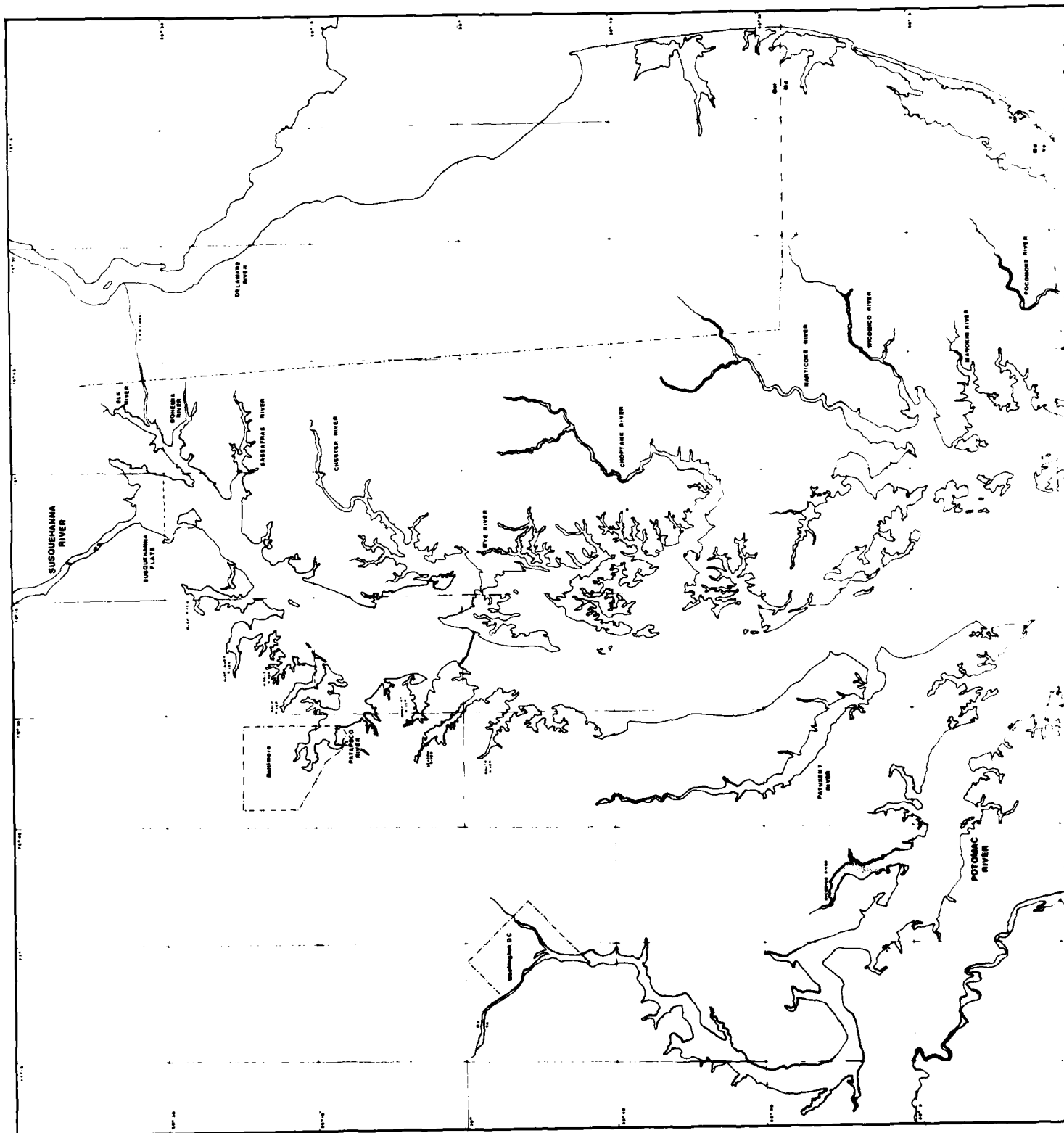


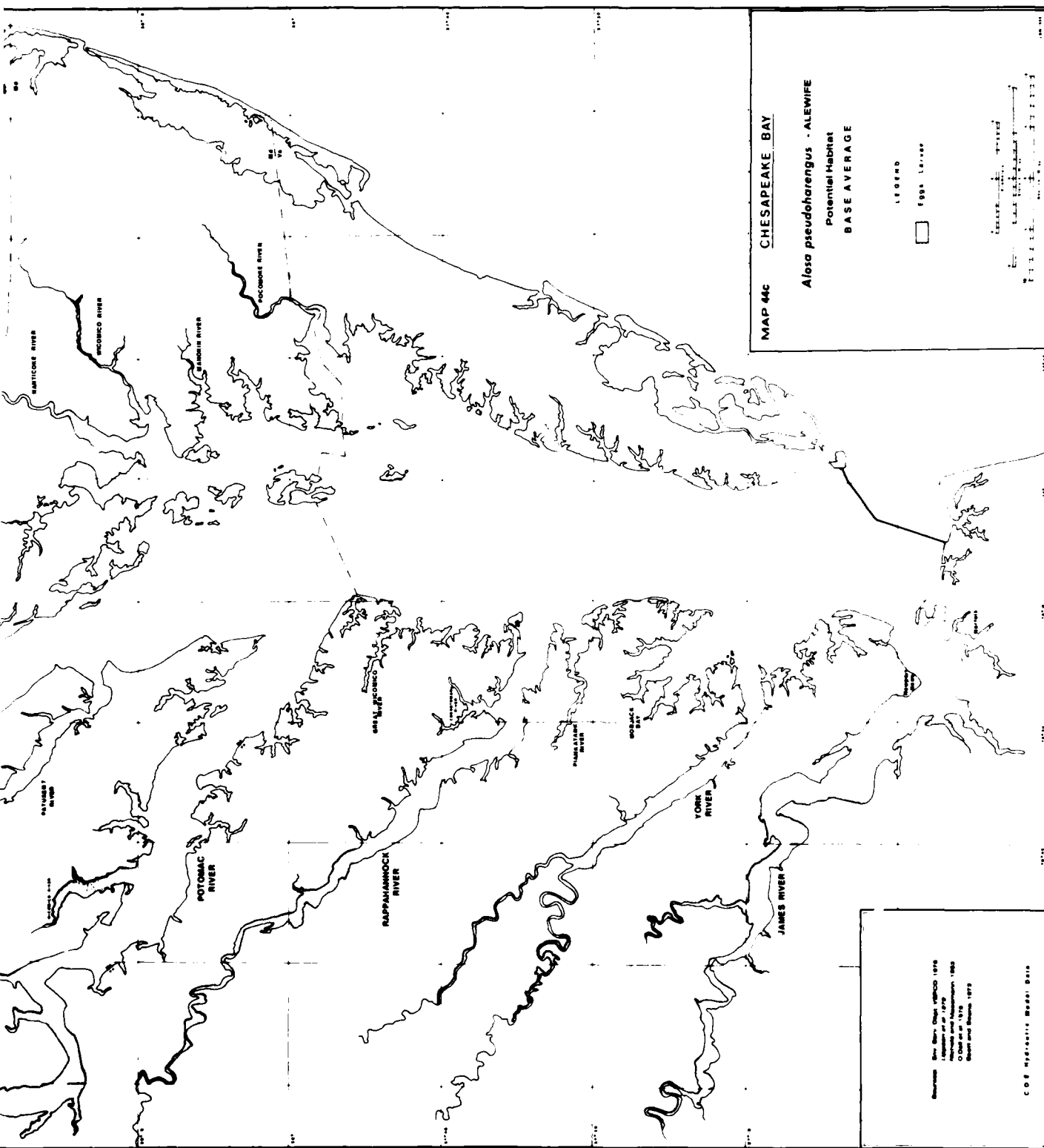


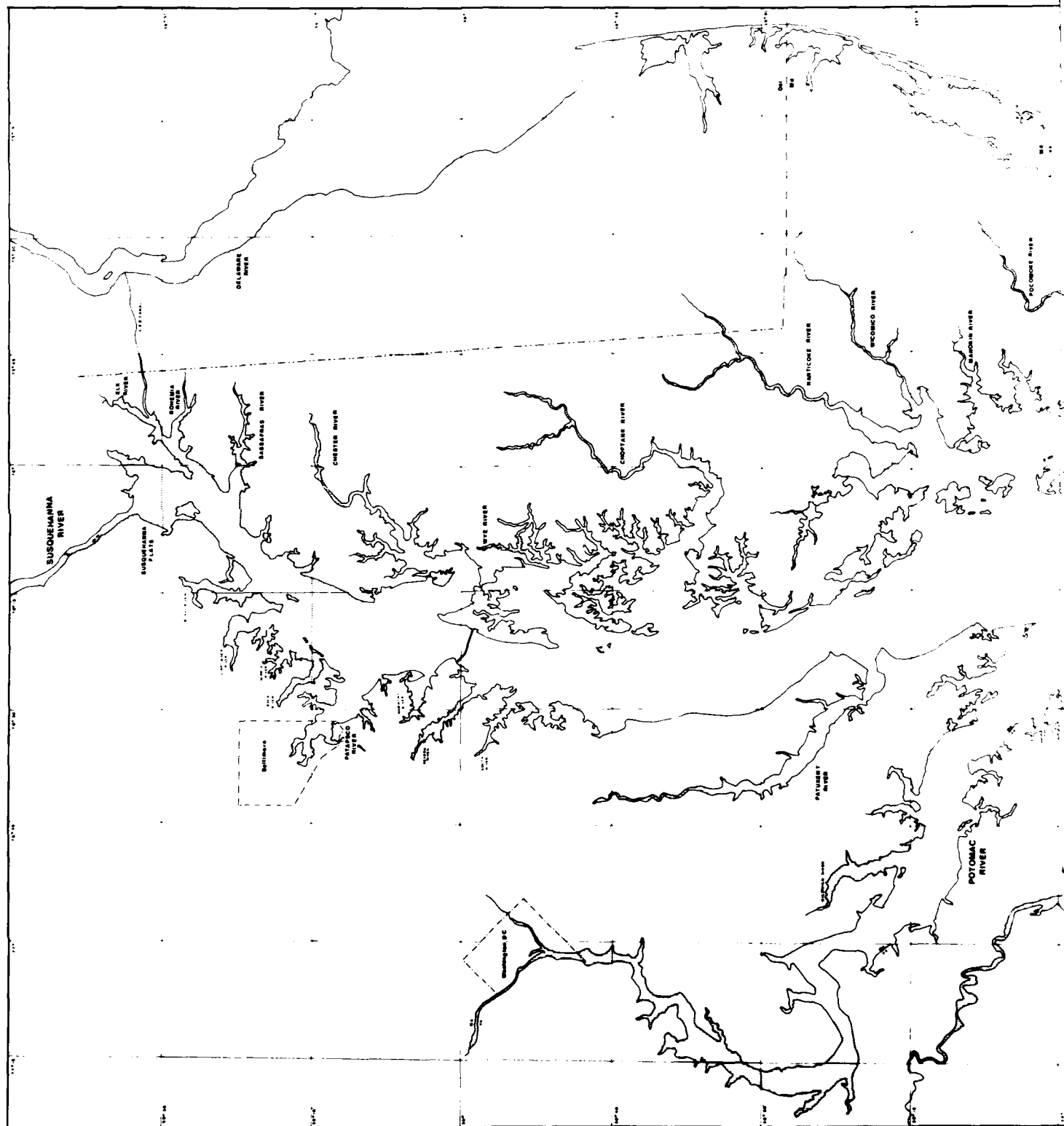


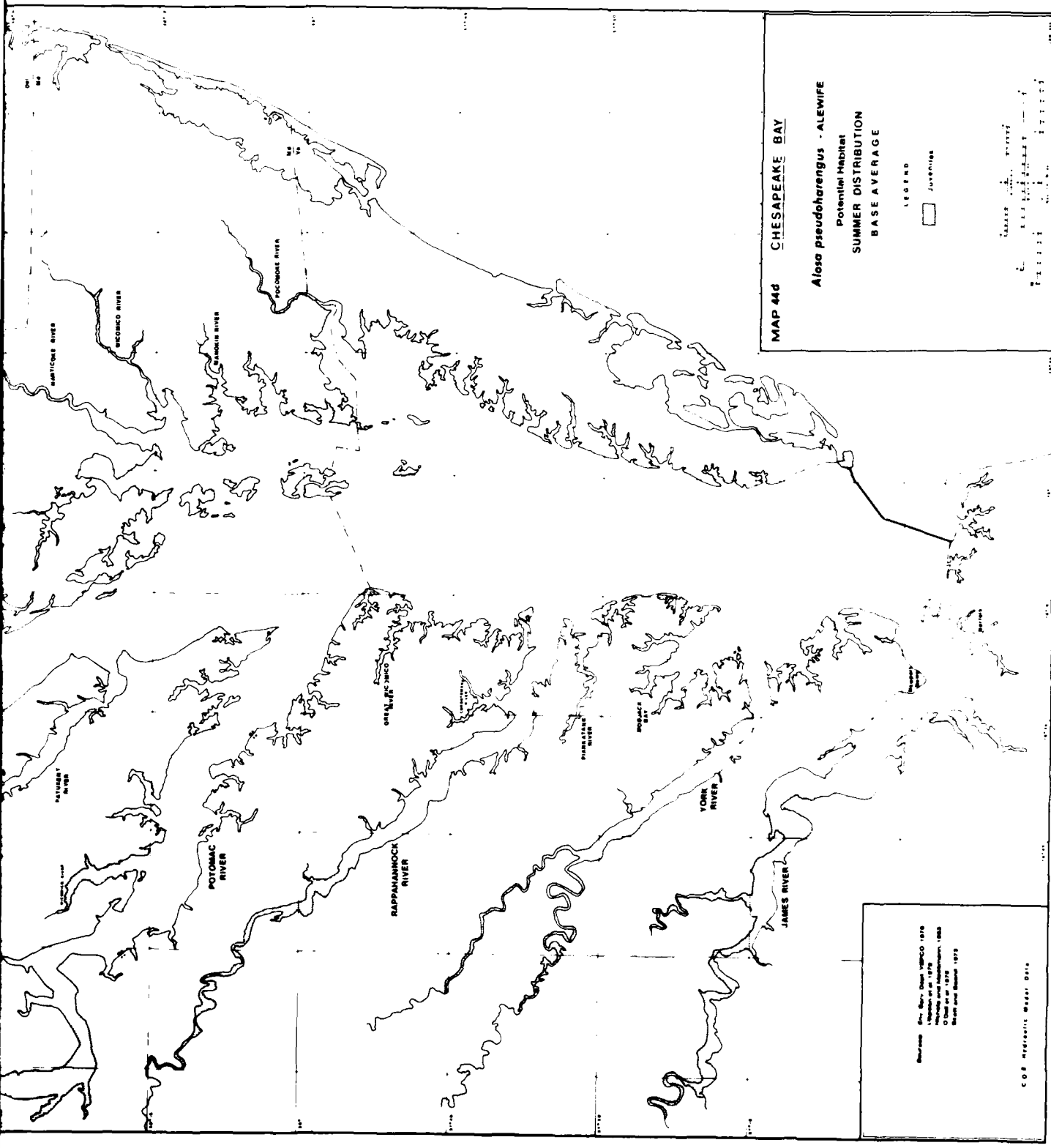


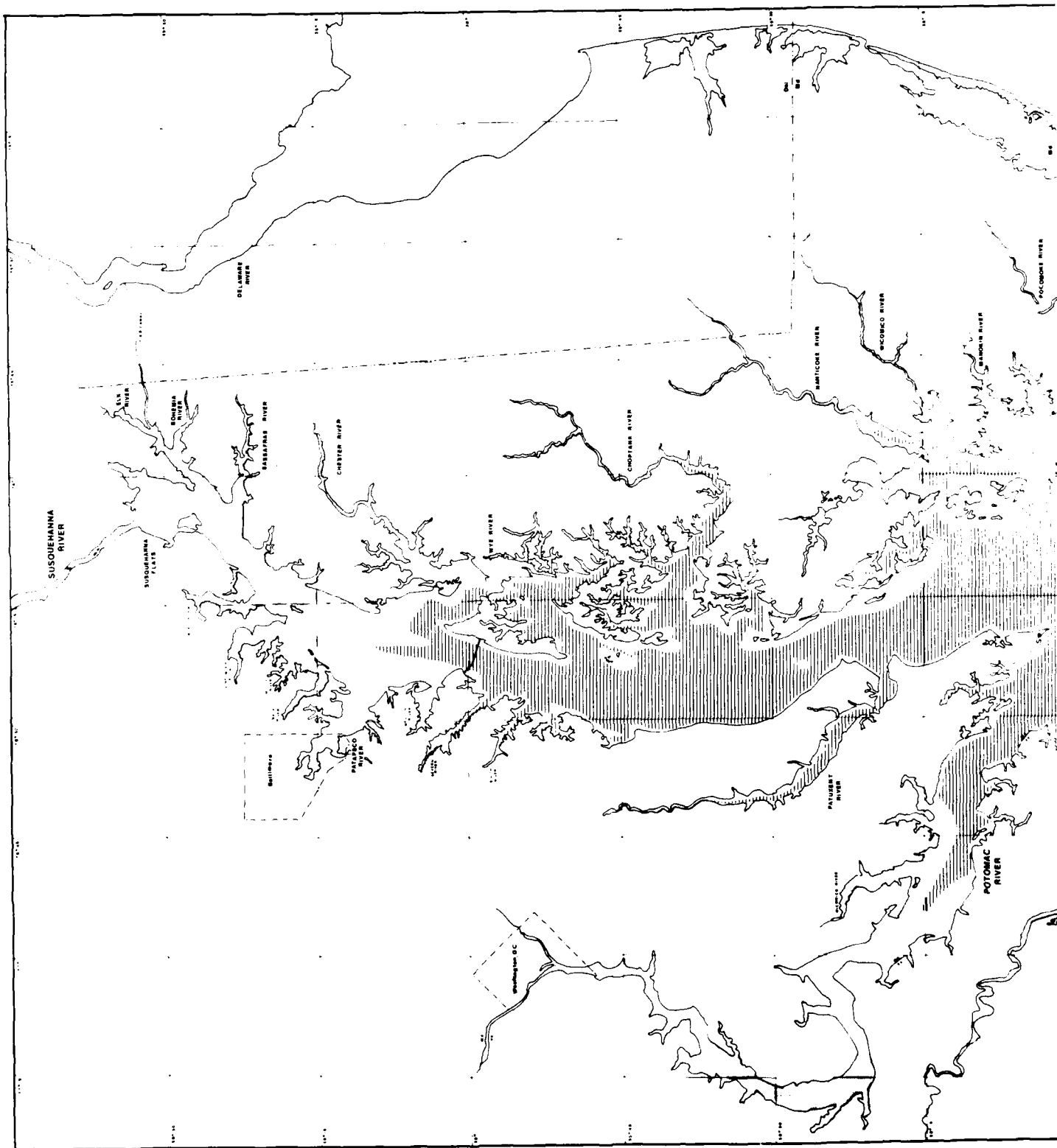


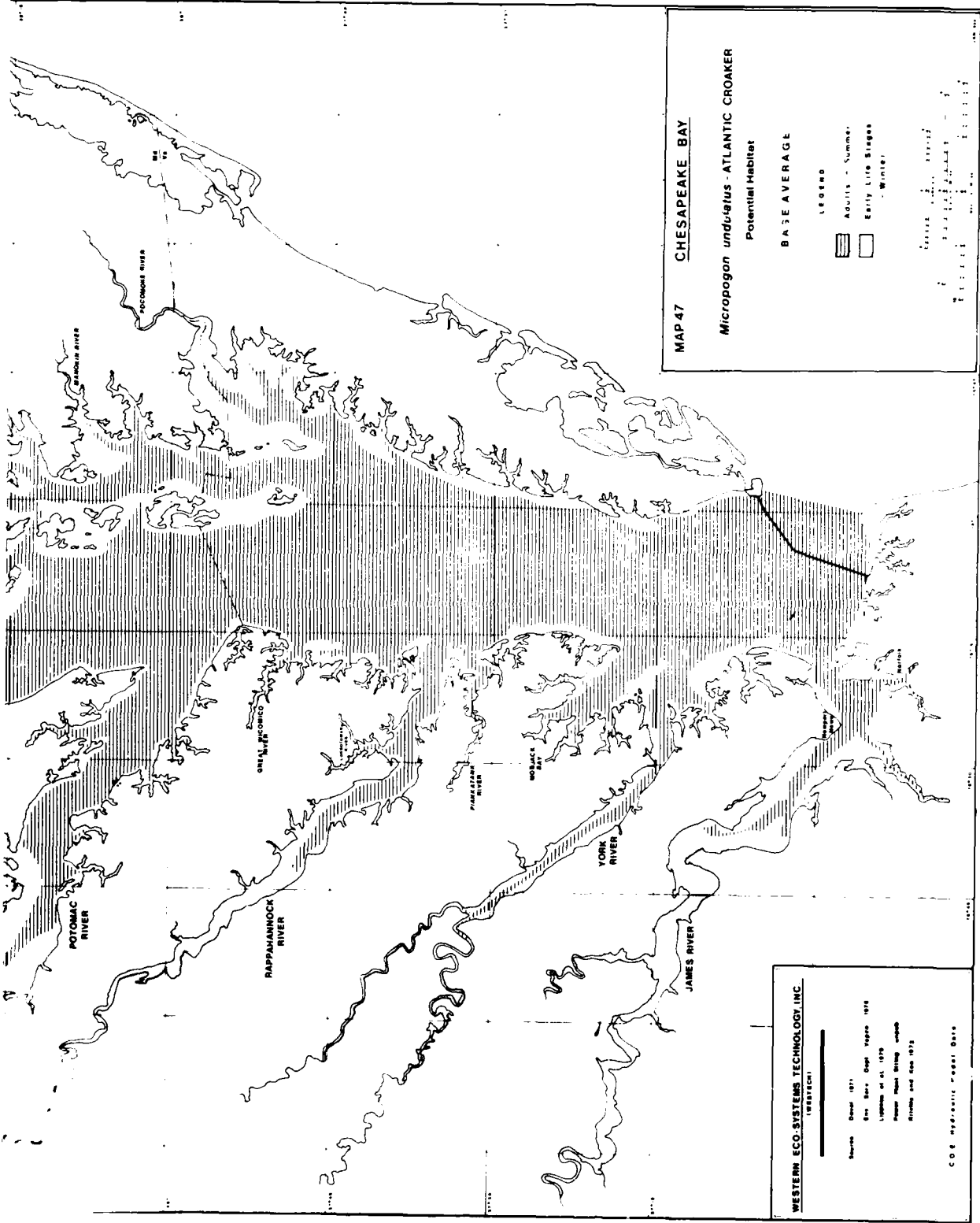












MAP 47 CHESAPEAKE BAY

***Micropogon undulatus* - ATLANTIC CROAKER**

Potential Habitat

BASE AVERAGE

LEGEND

Adults - Summer

Early Life Stages

Winter

Scale: 1:100,000

North Arrow

WESTERN ECO-SYSTEMS TECHNOLOGY, INC.

1985/1986

Source: Data 1971

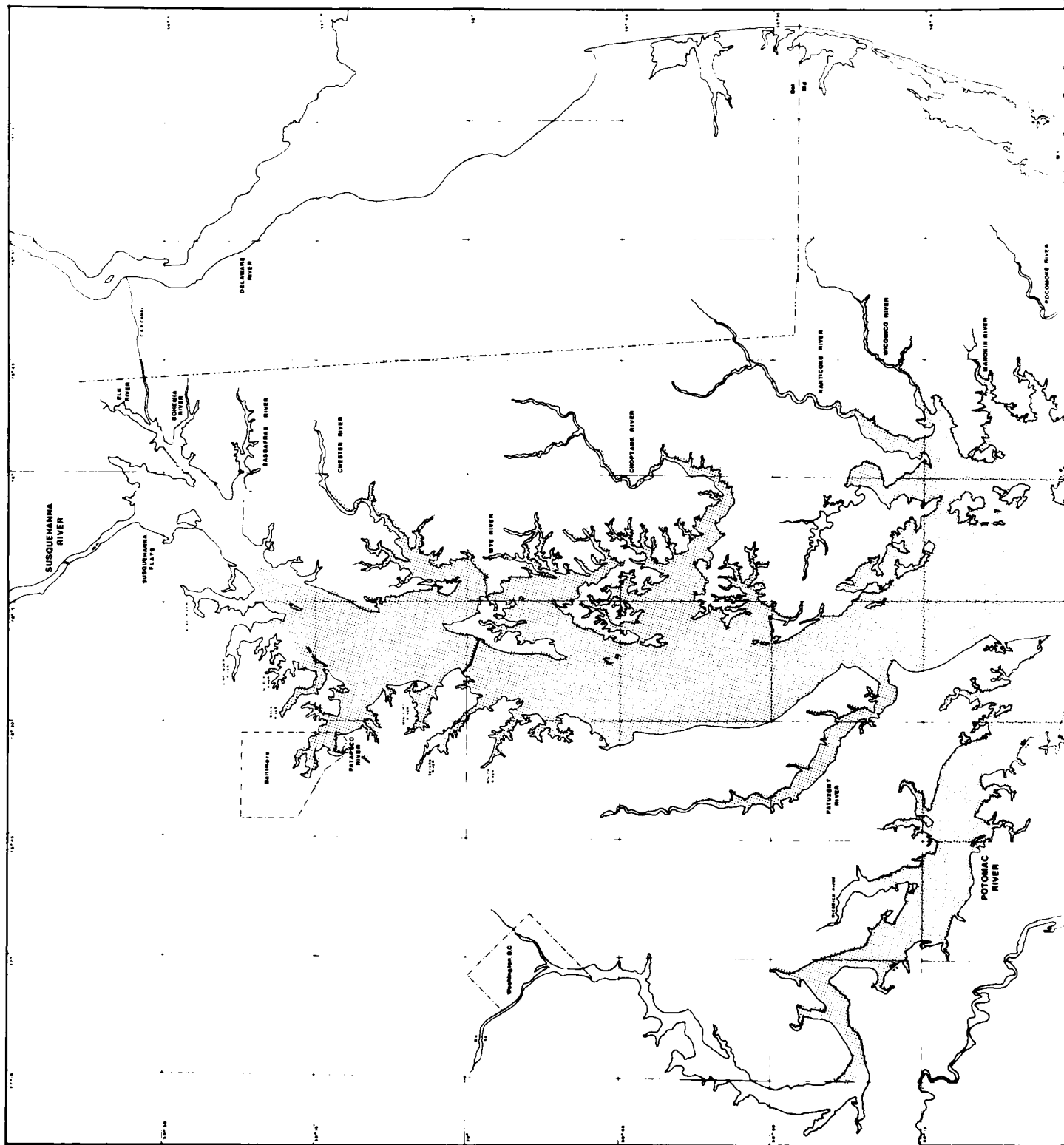
Base Data: Data 1971

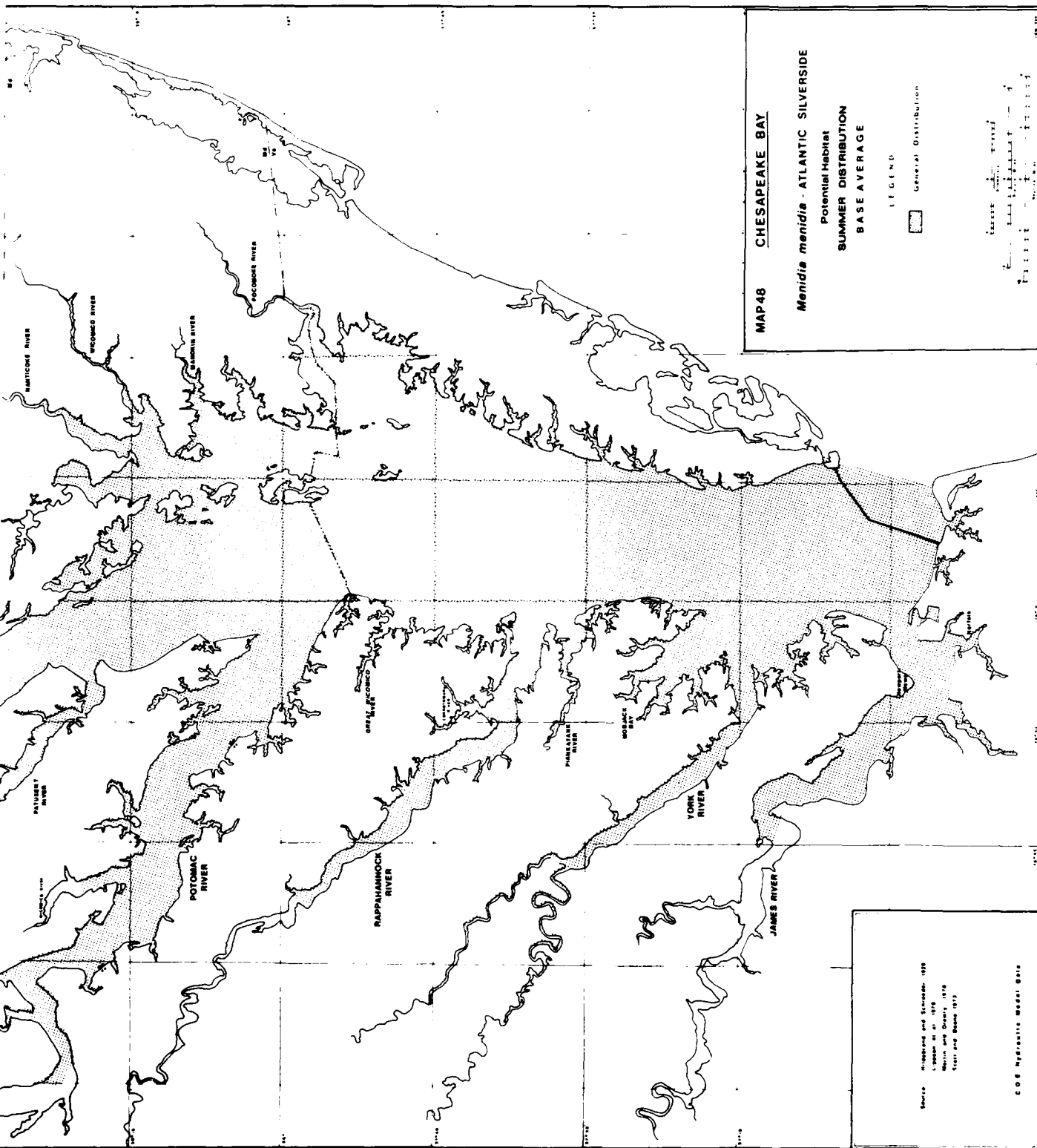
Updated at: 1975

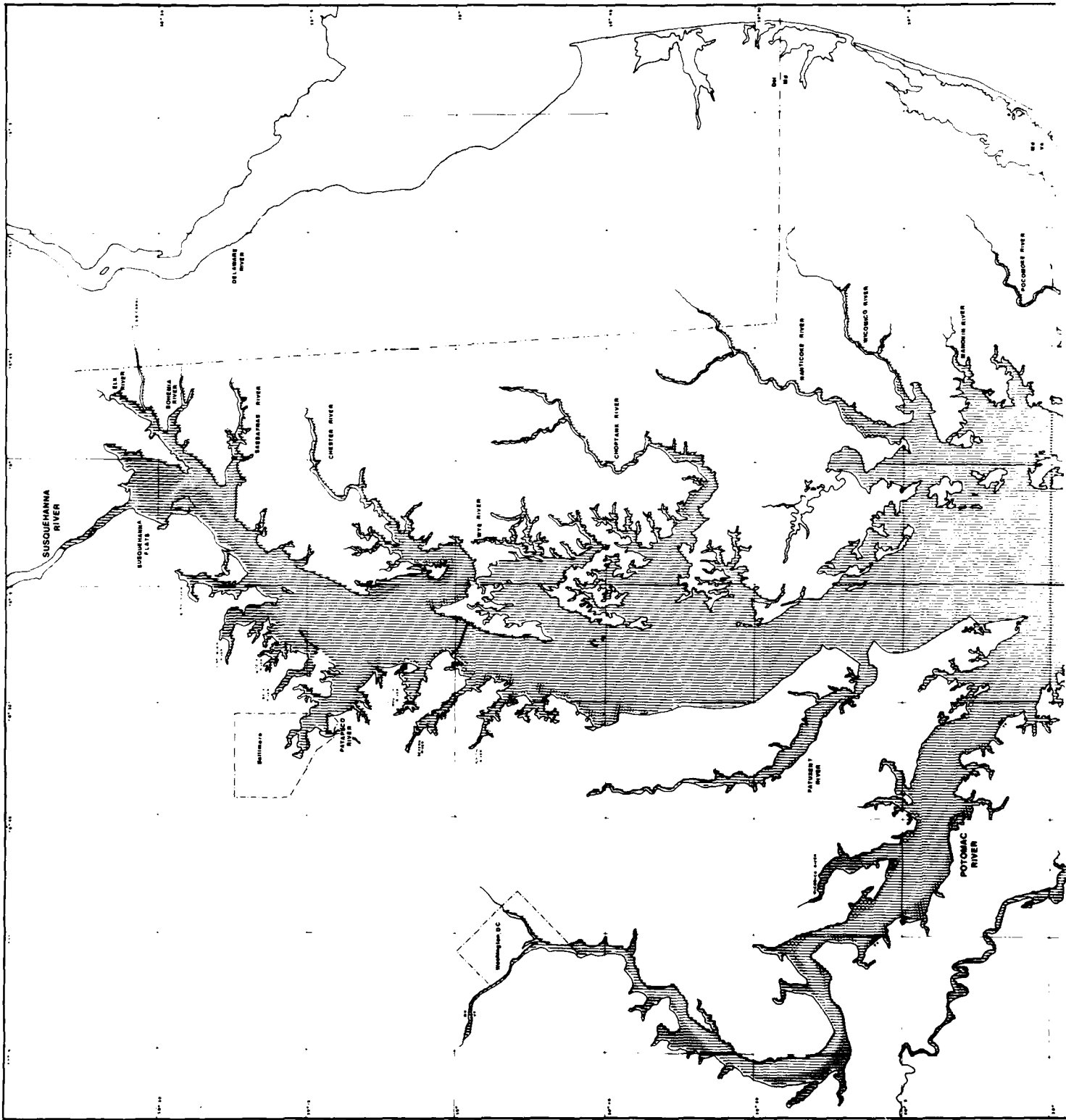
Project: Habitat Mapping

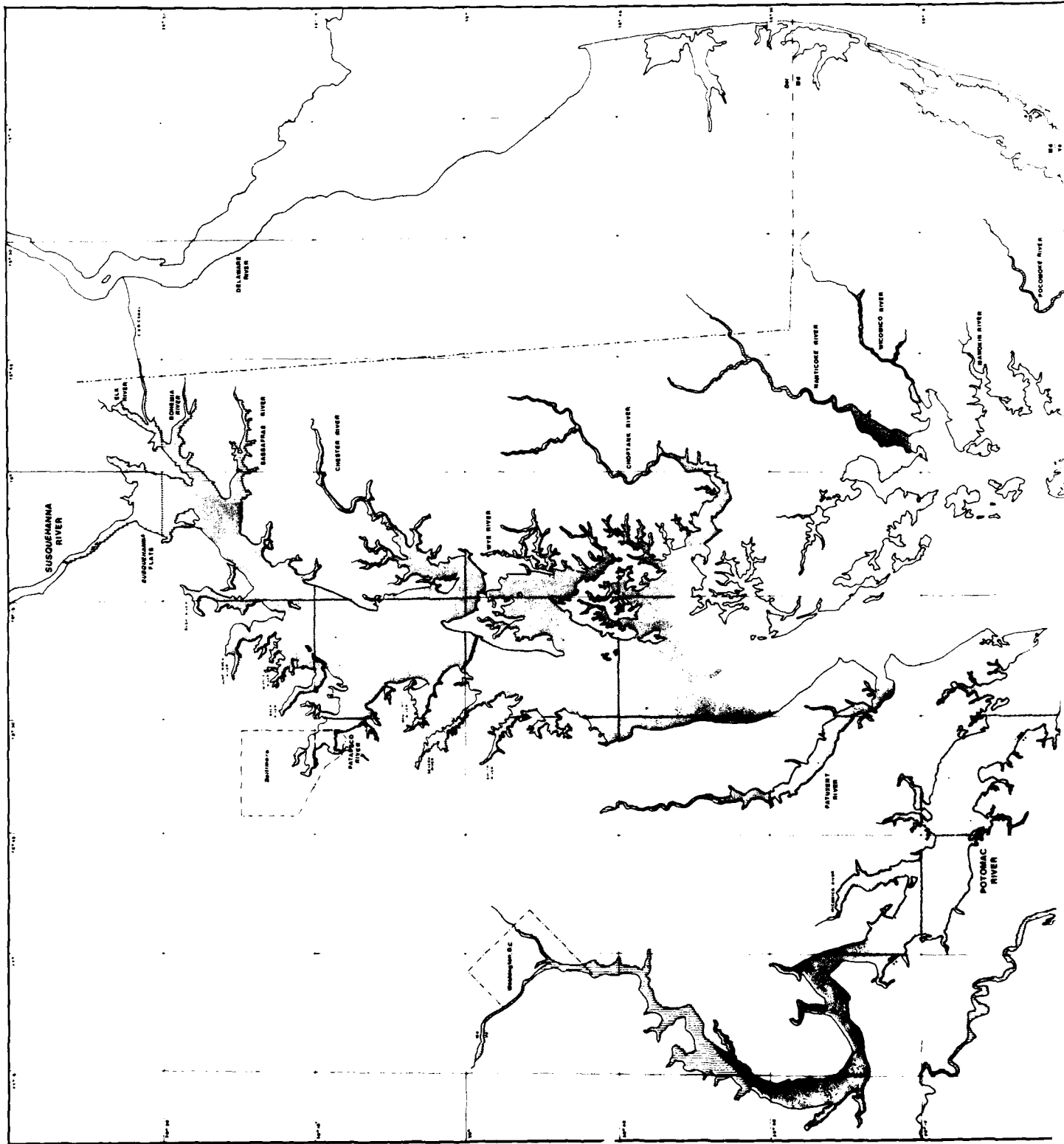
Revised: 1975

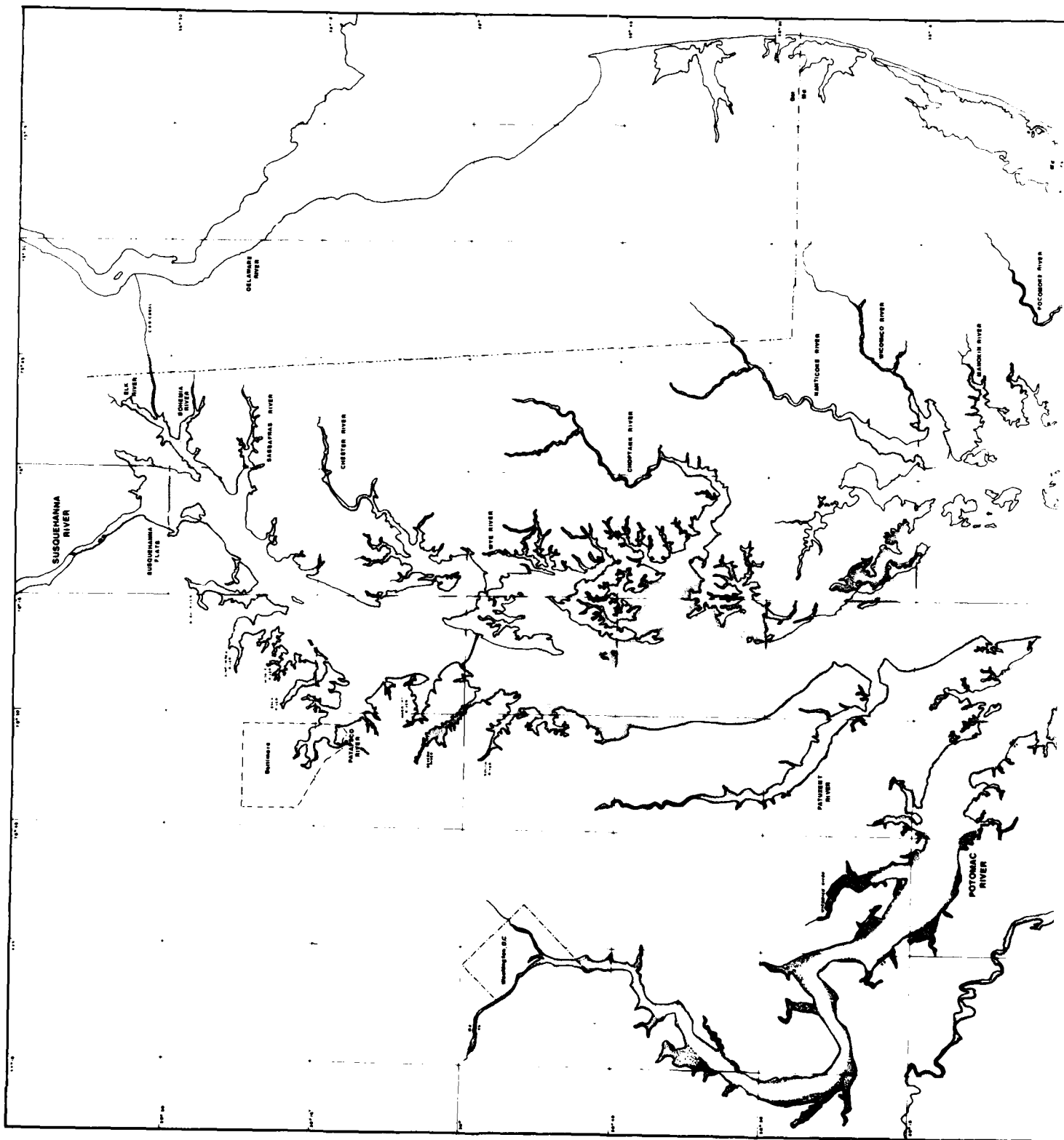
COE Hydrologic Model Data

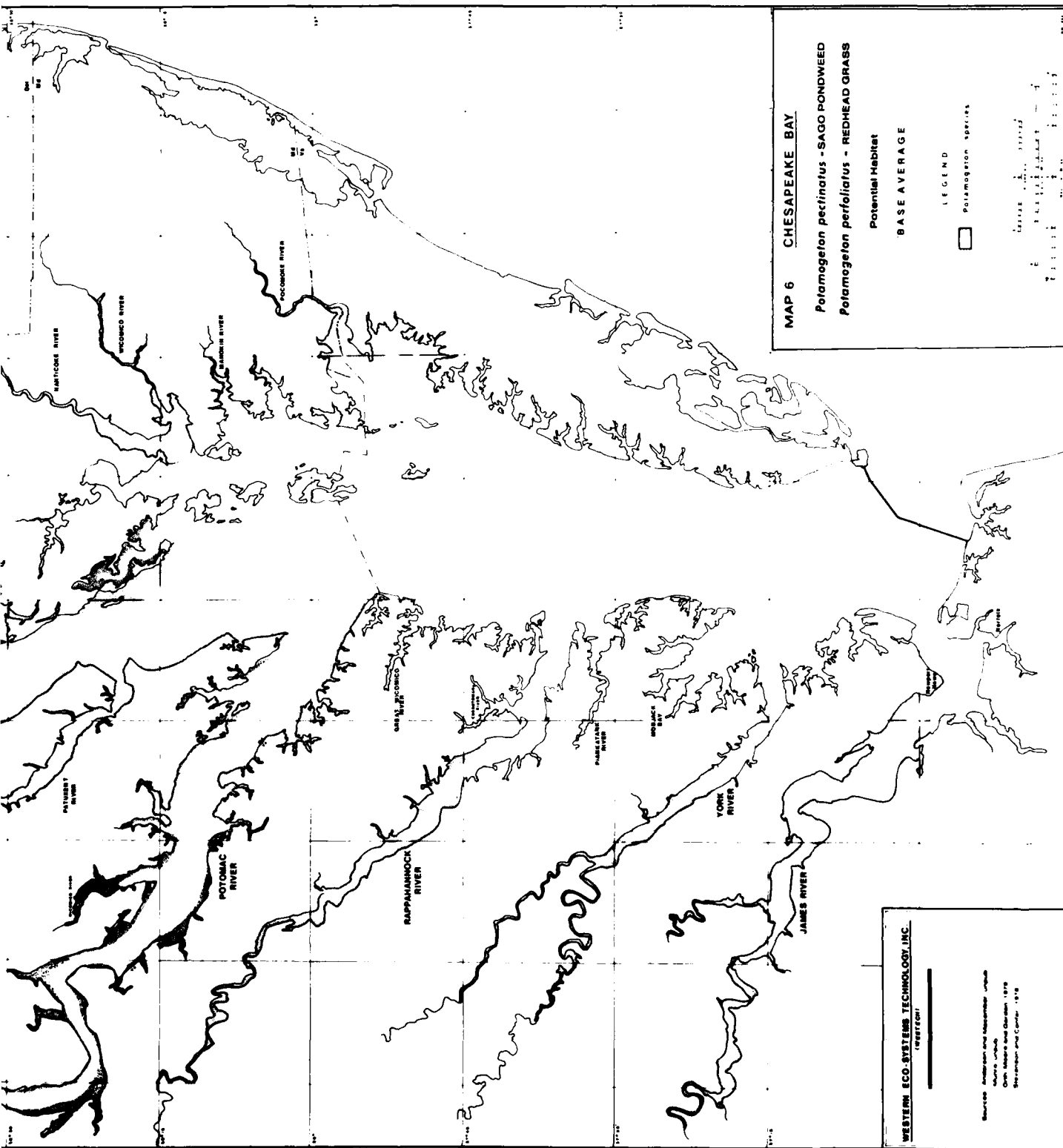


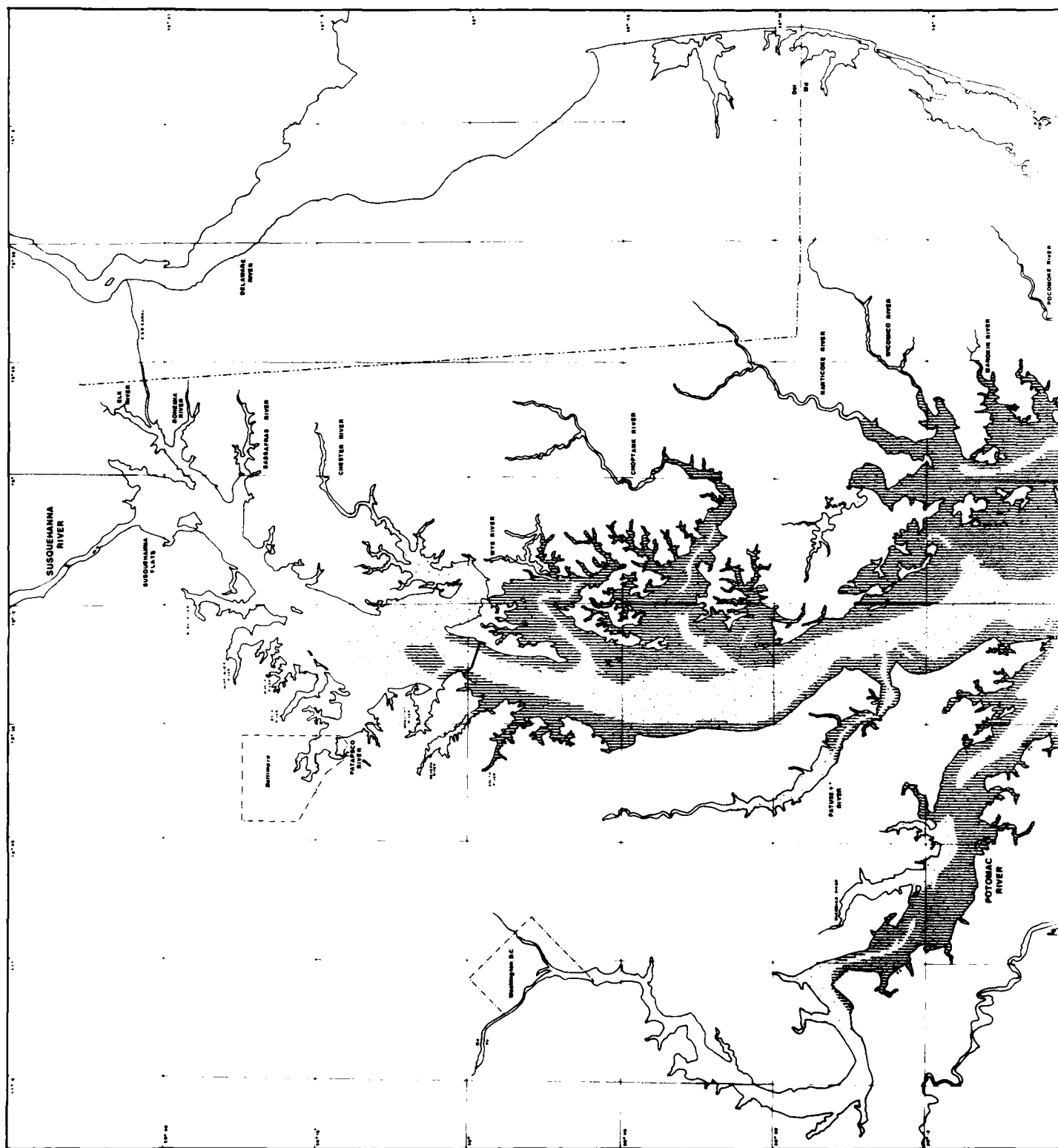


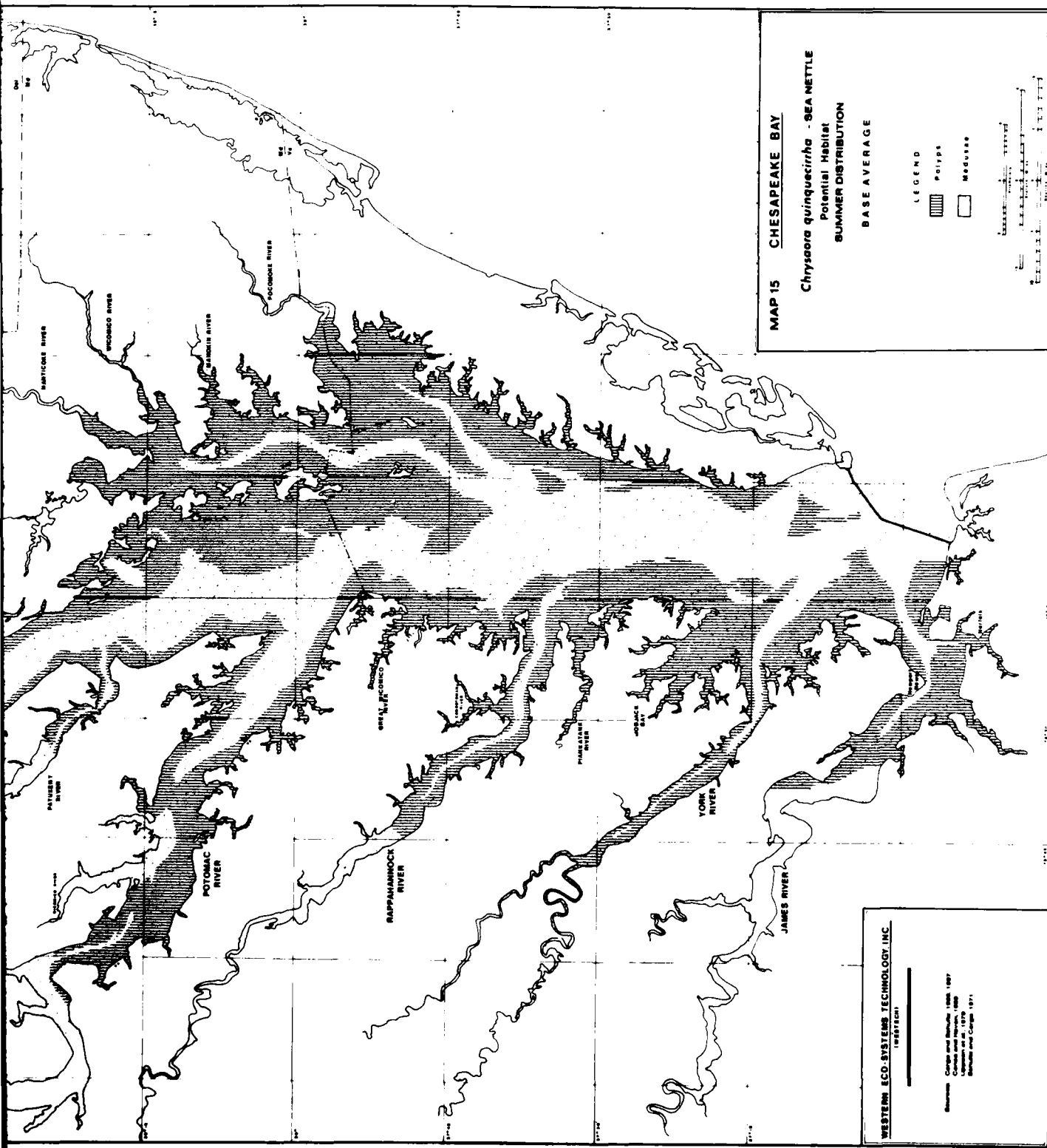


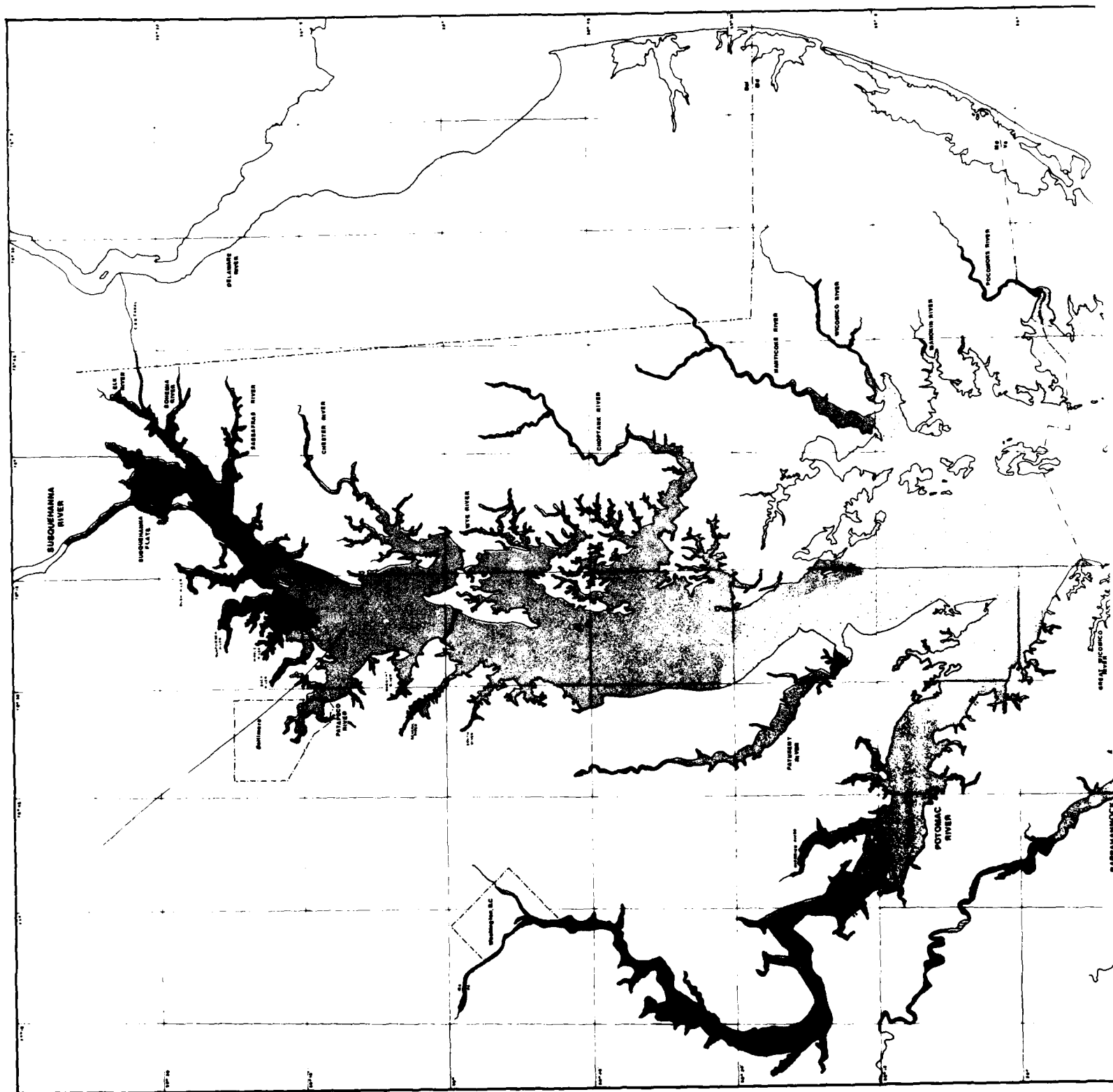


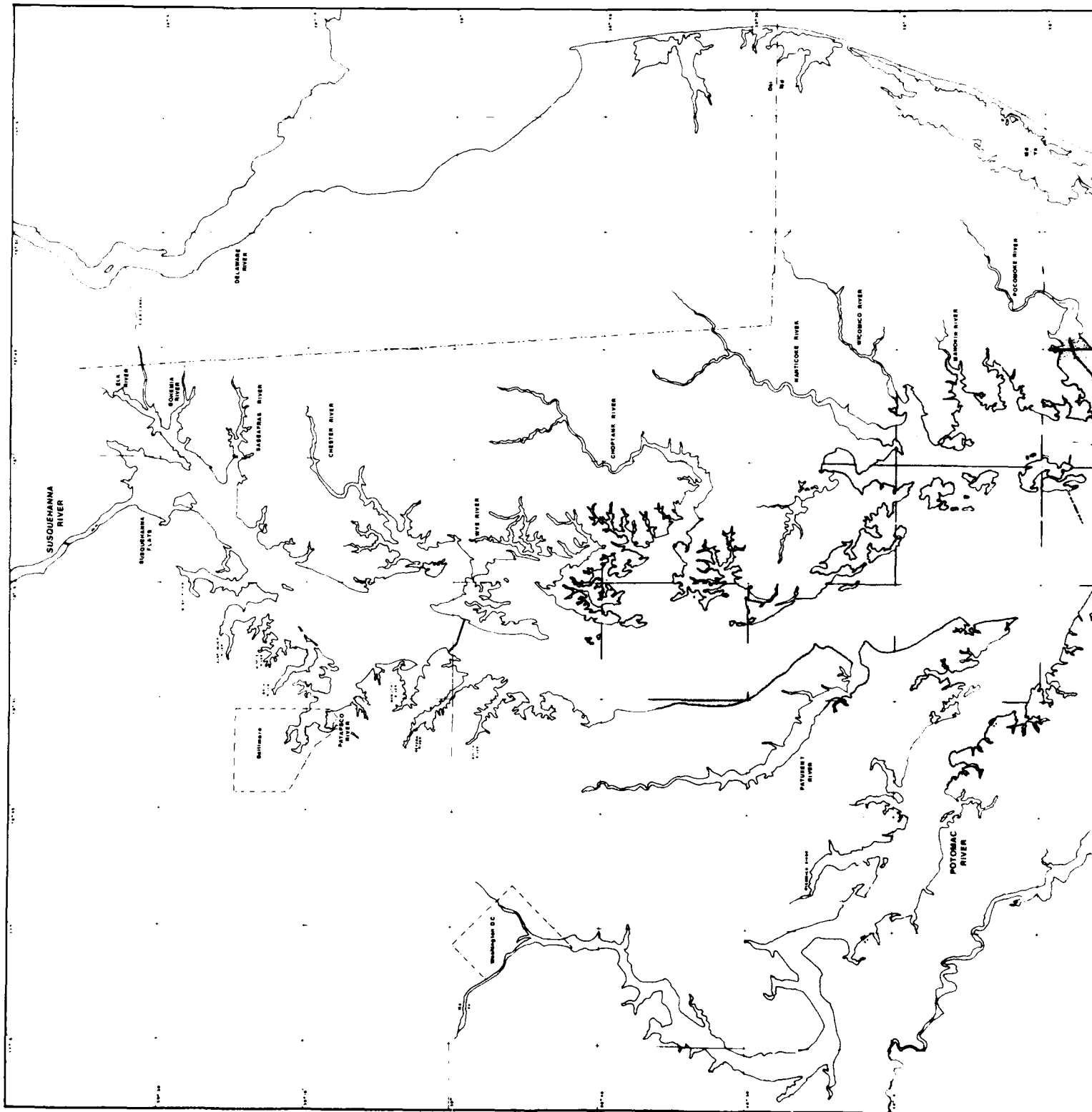












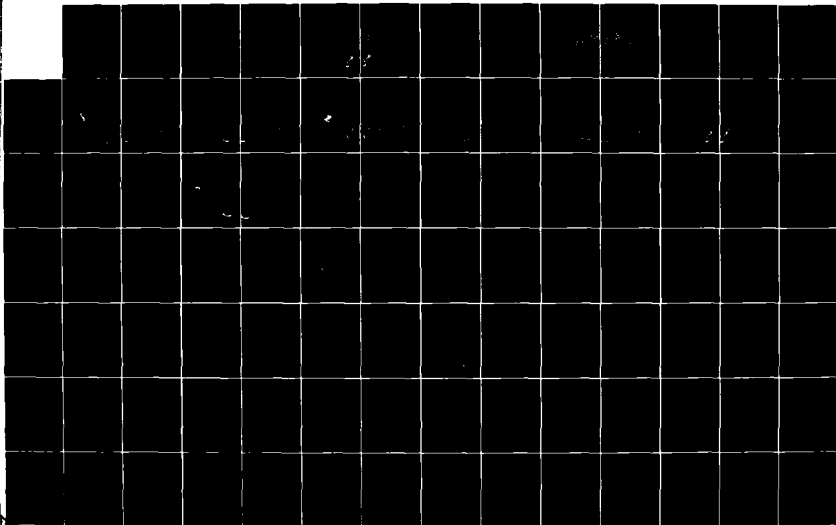
AD-A125 154

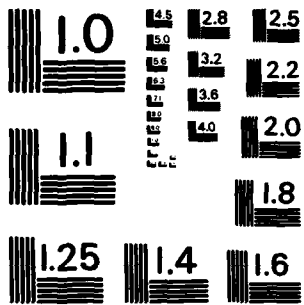
CHESAPEAKE BAY LOW FRESHWATER INFLOW STUDY PHASE II
BIOTA ASSESSMENT MAP... (U) WESTERN ECO-SYSTEMS
TECHNOLOGY INC BOTHELL WA G B MACKIERMAN ET AL. MAY 82
DACW31-79-C-0056

UNCLASSIFIED

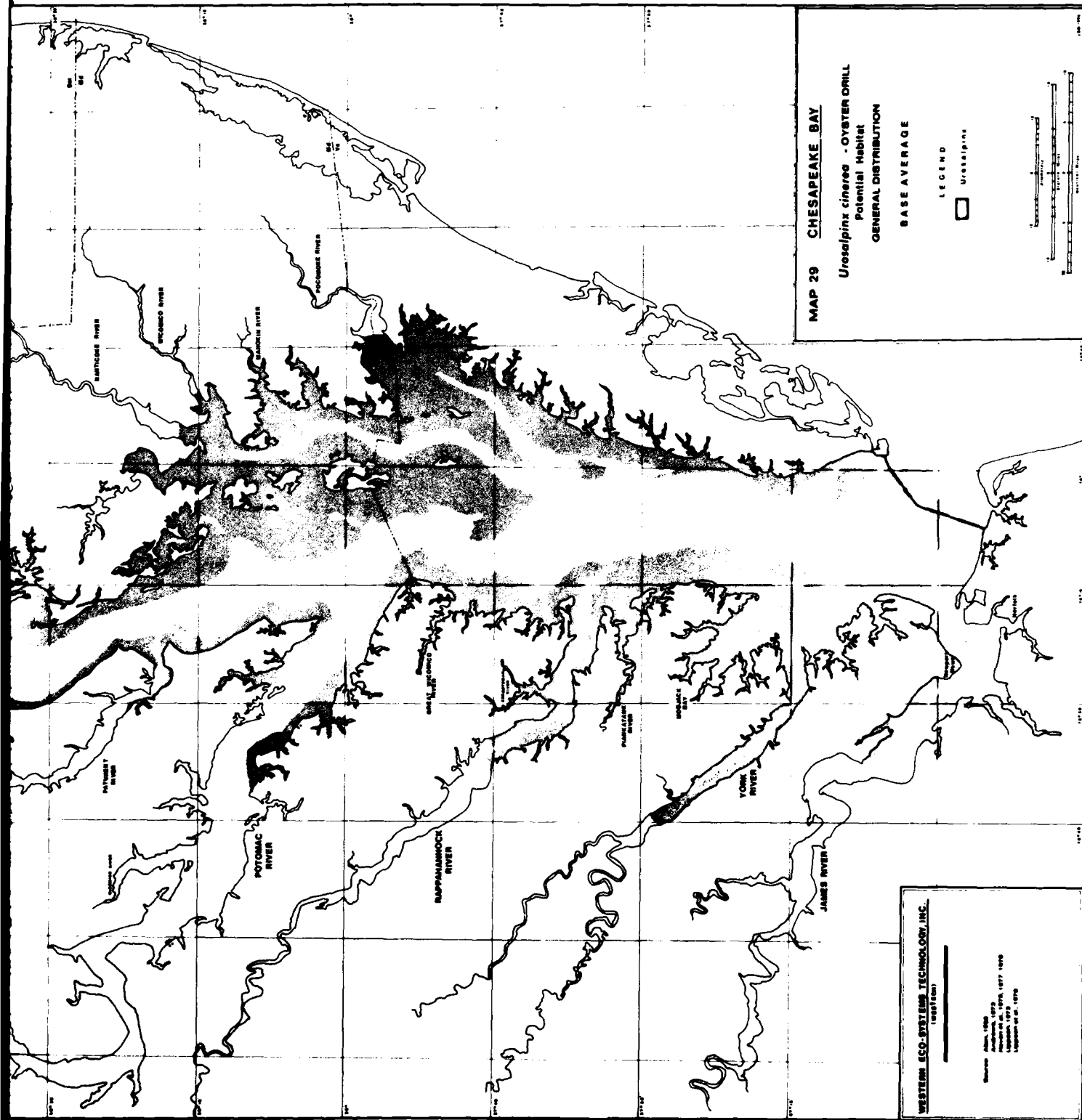
F/G 6/6

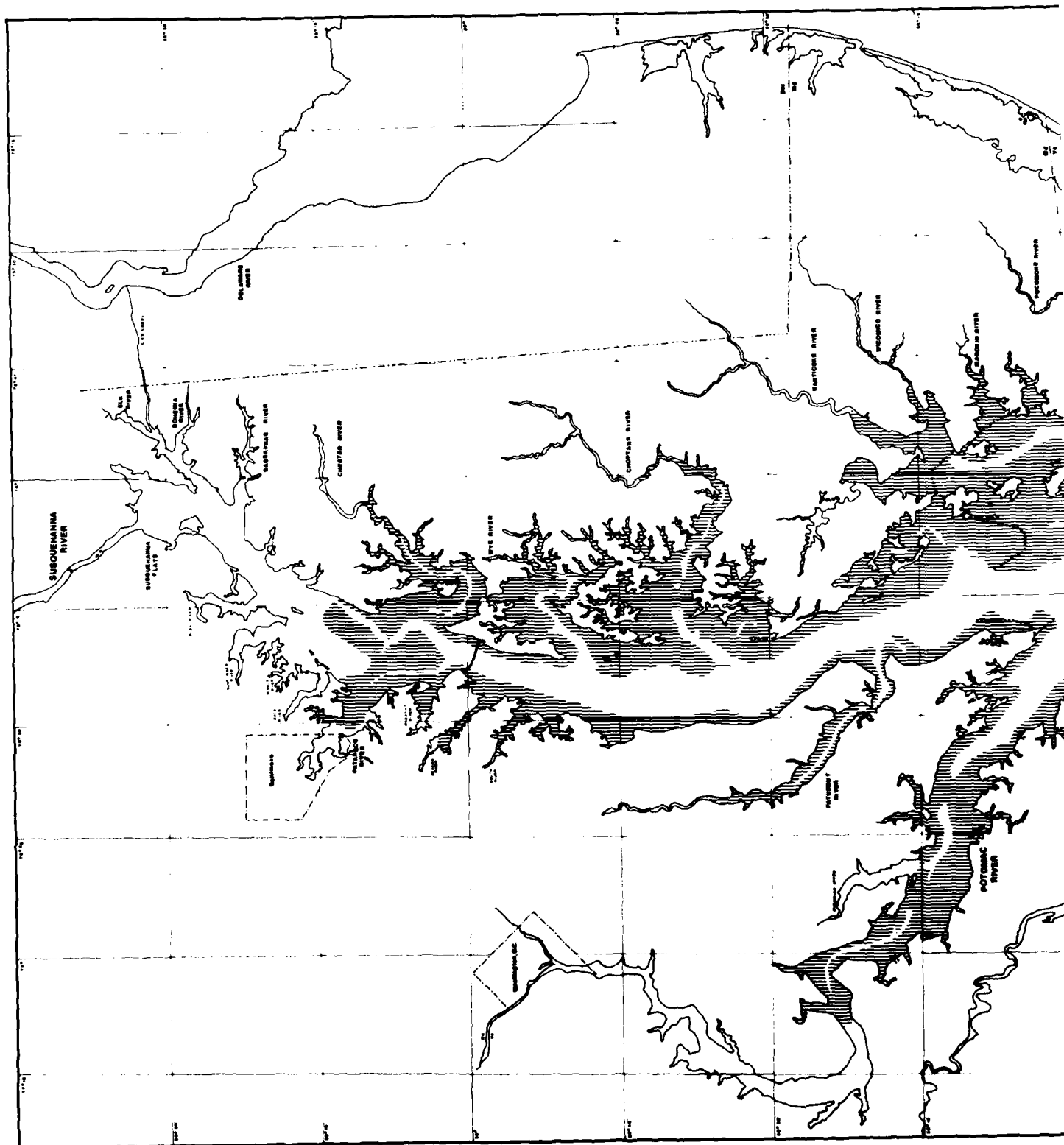
22
NL

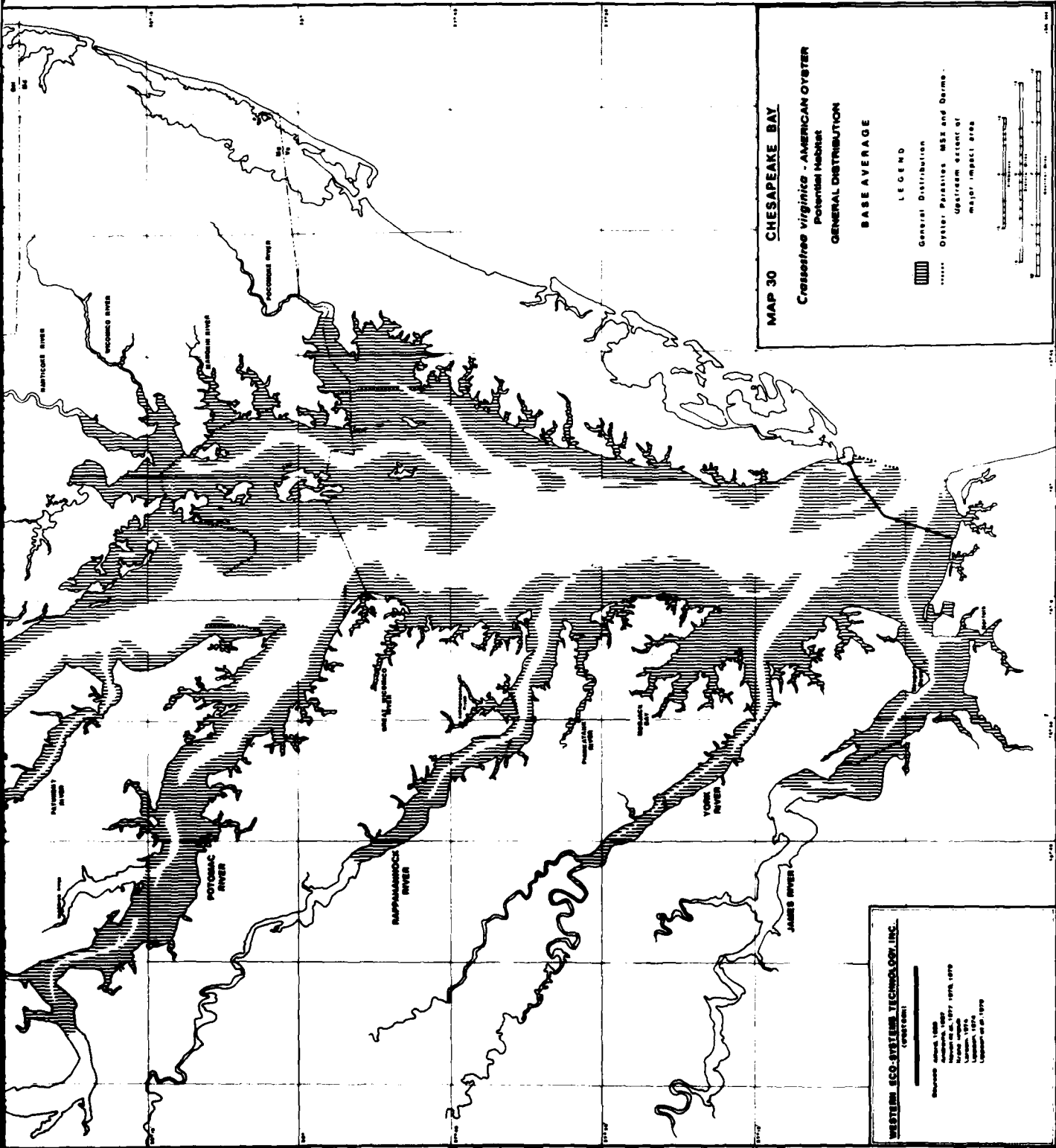


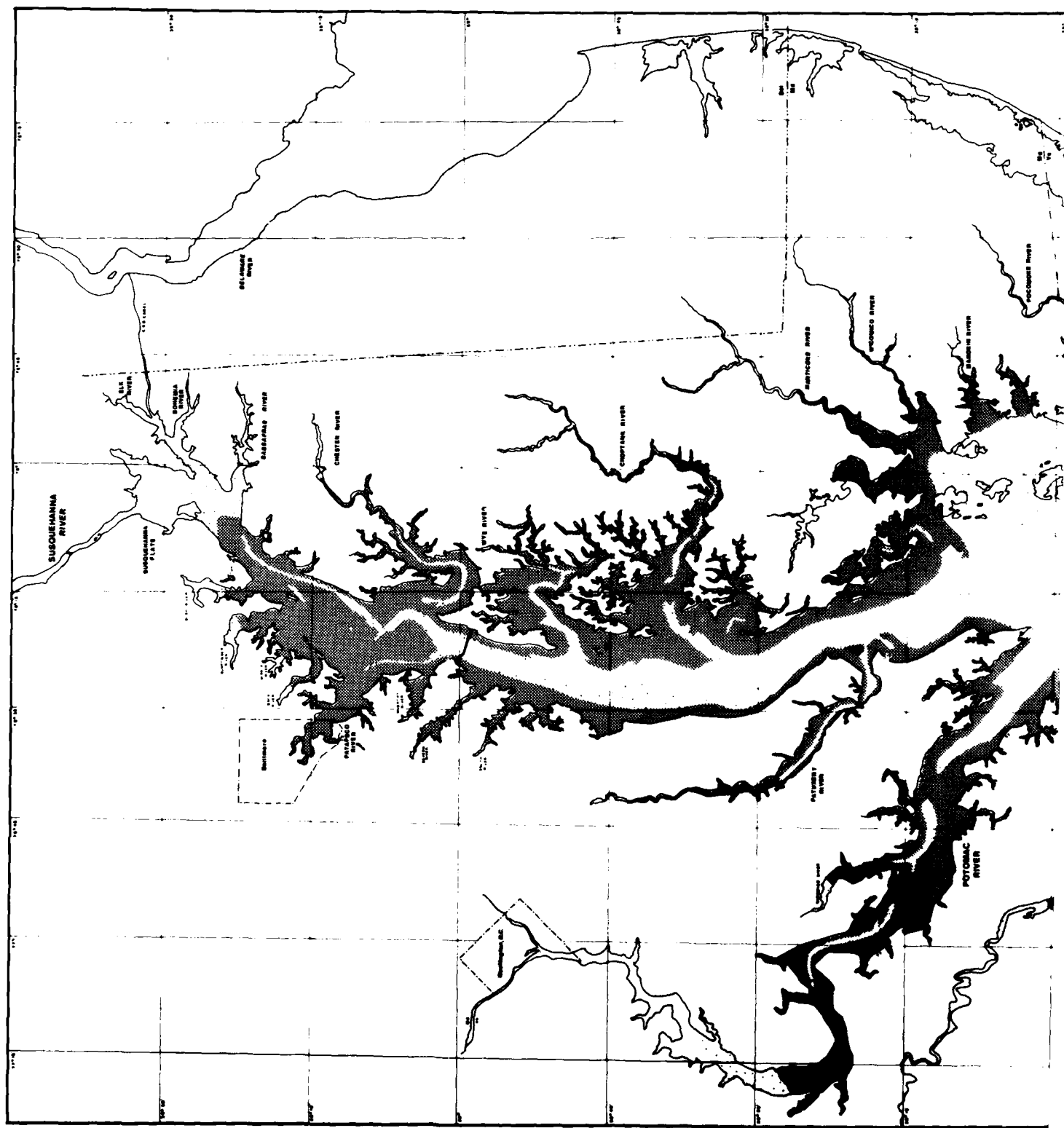


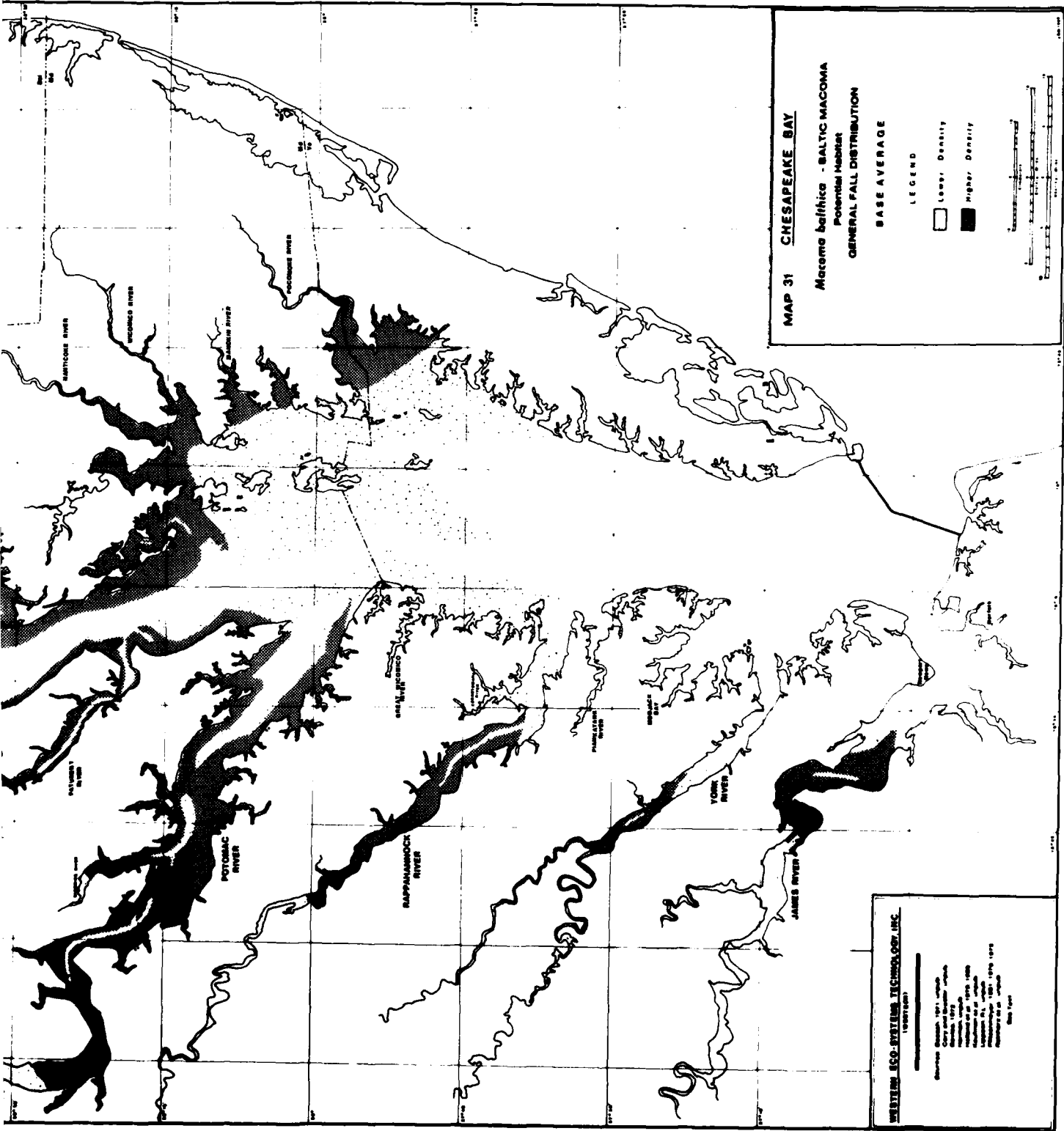
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

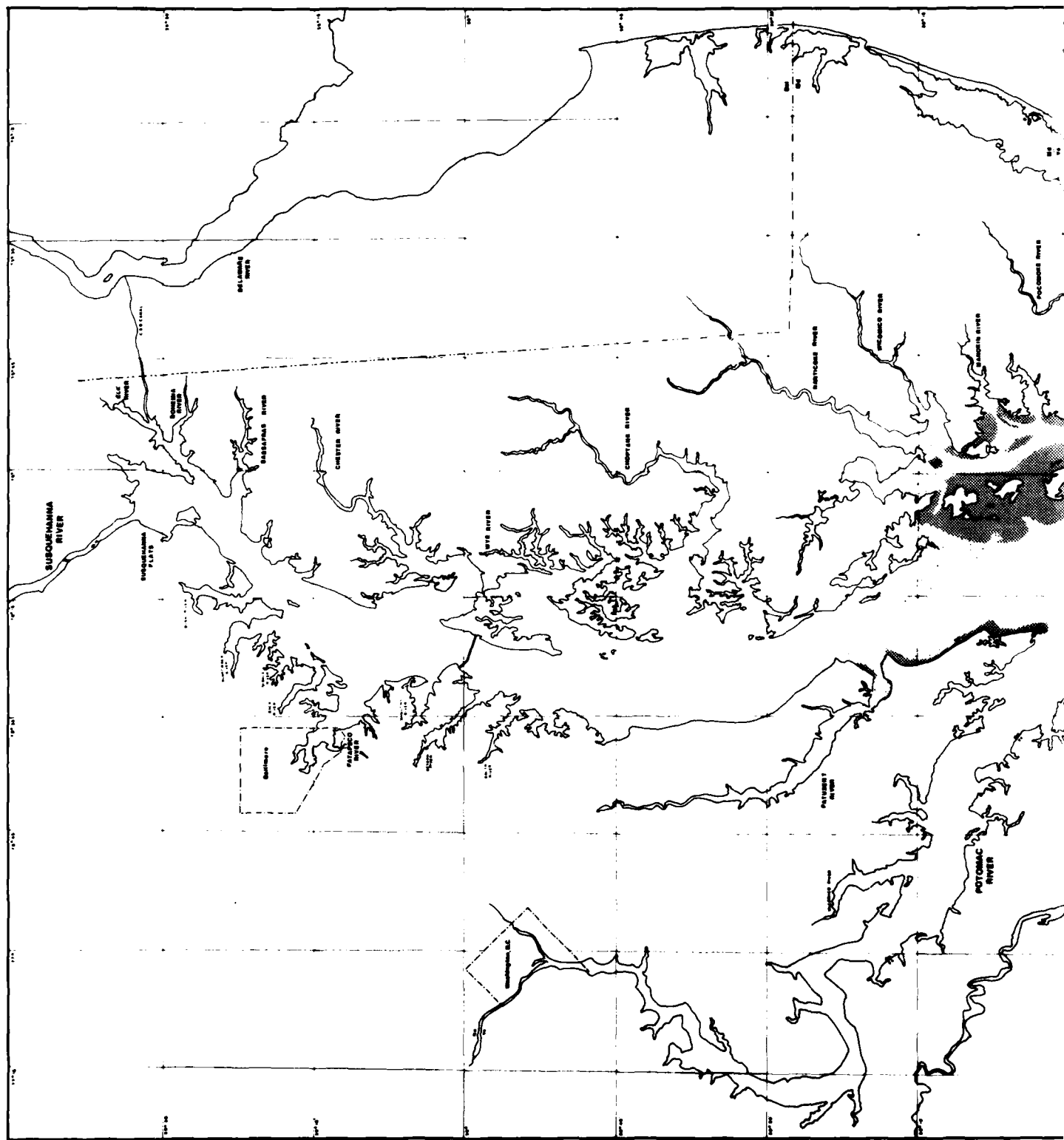


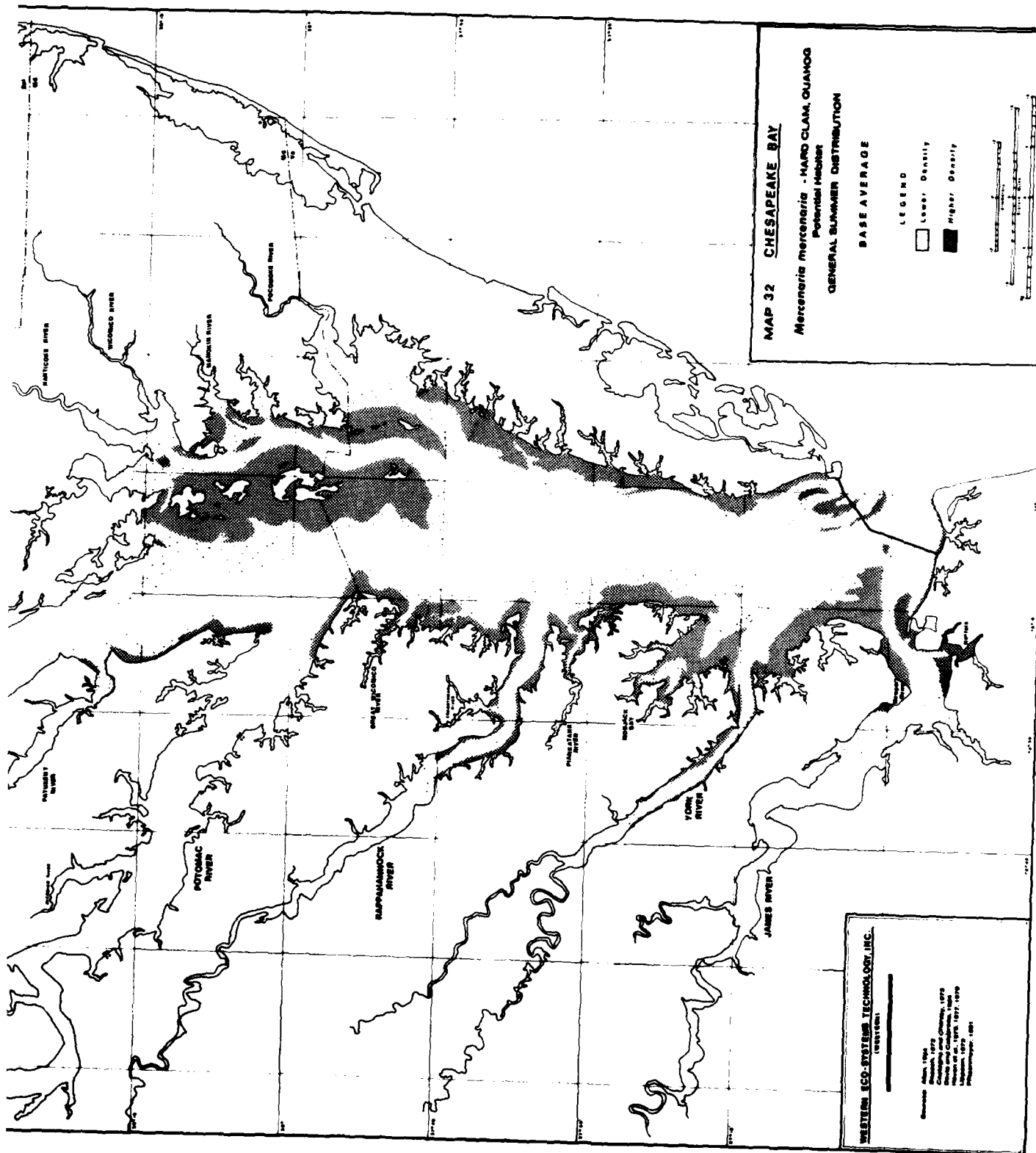


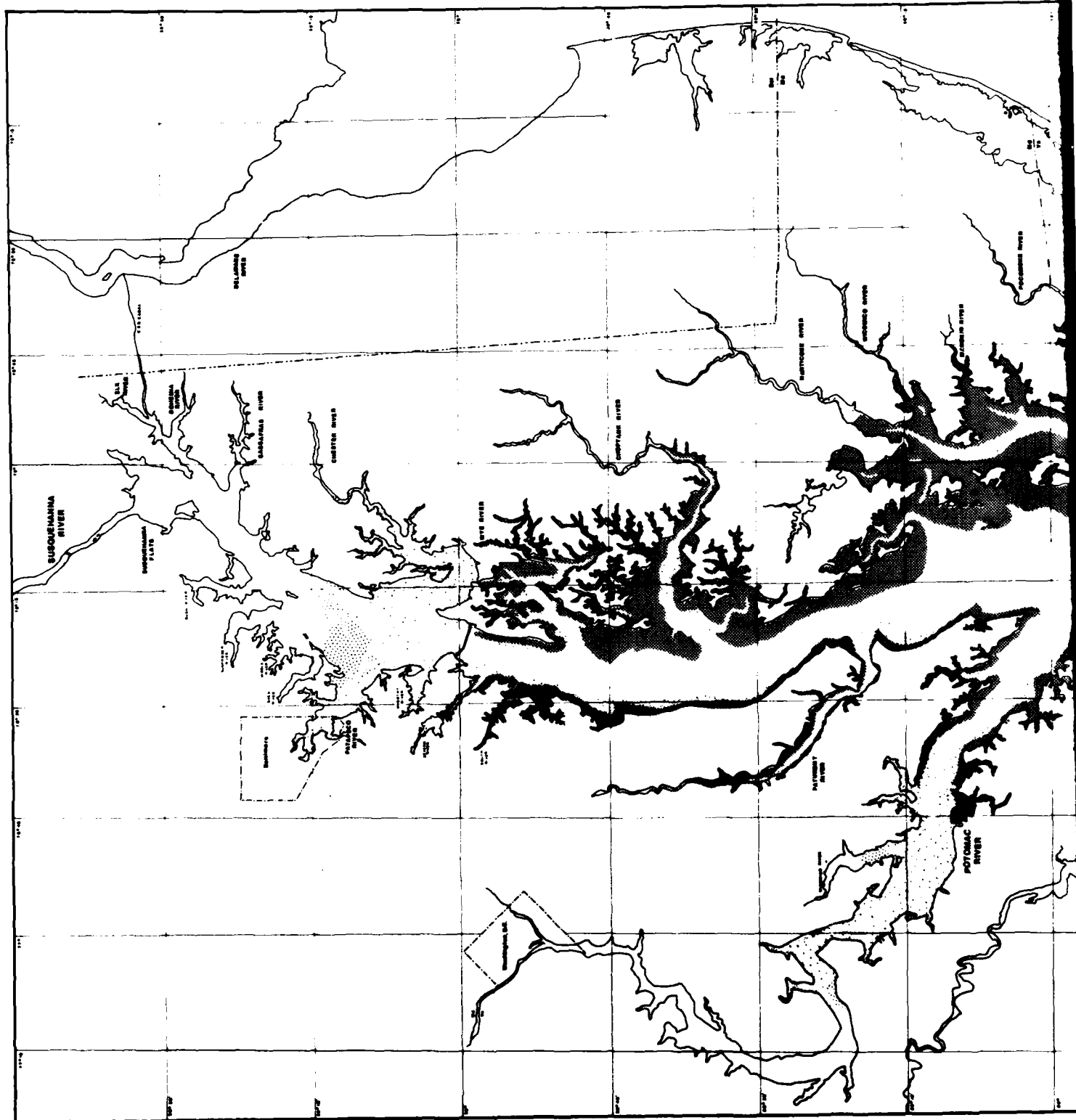


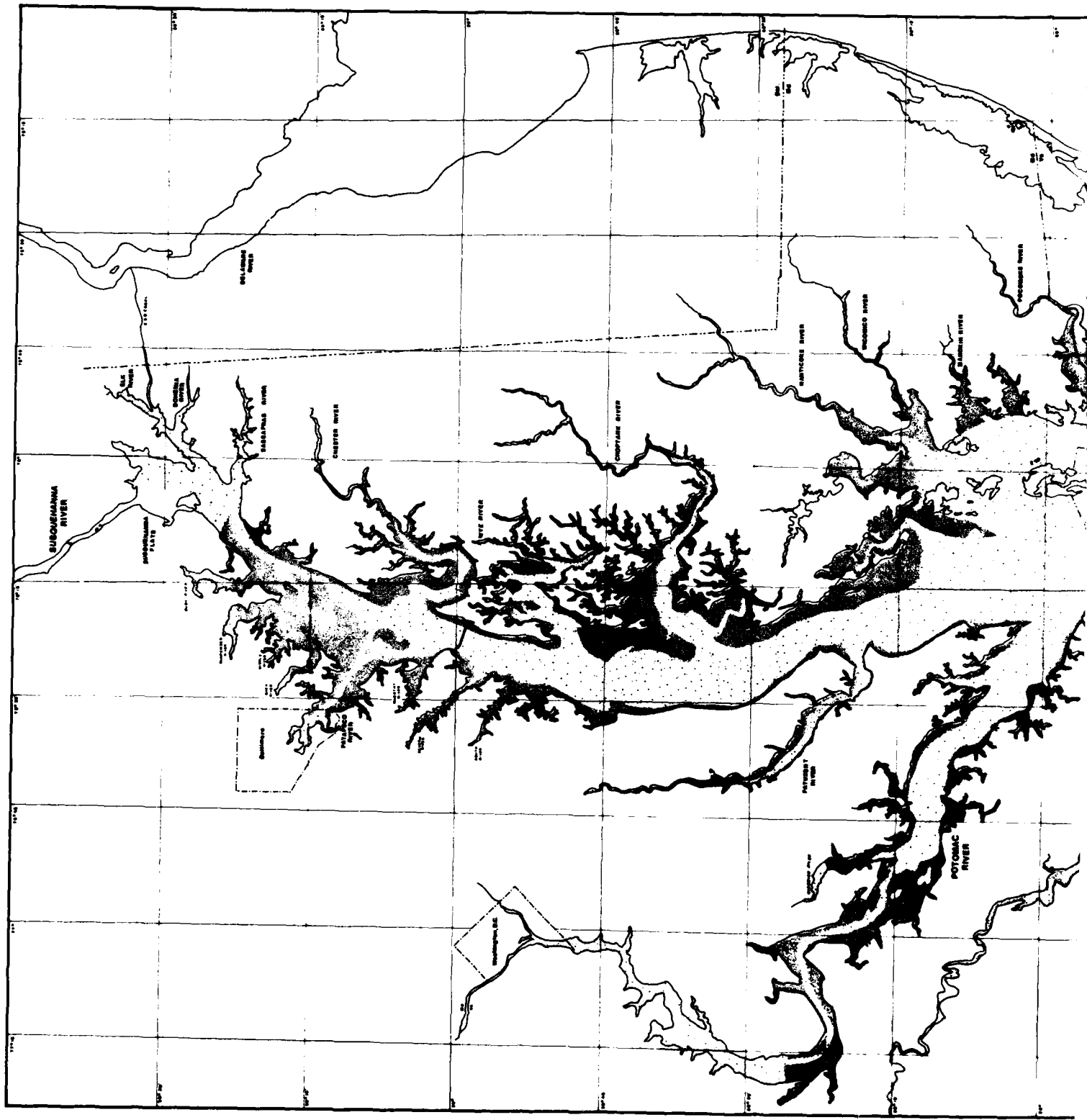


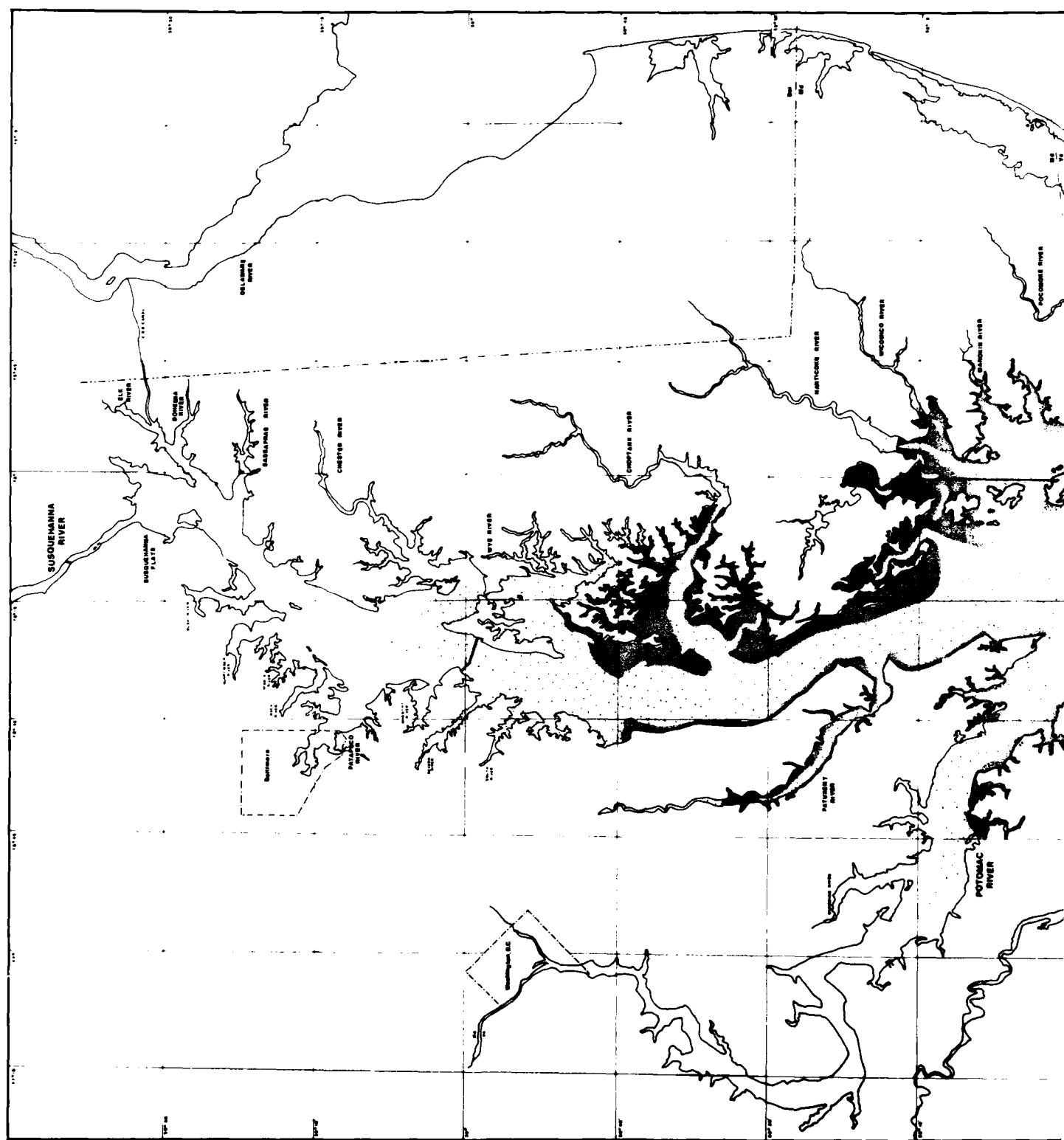


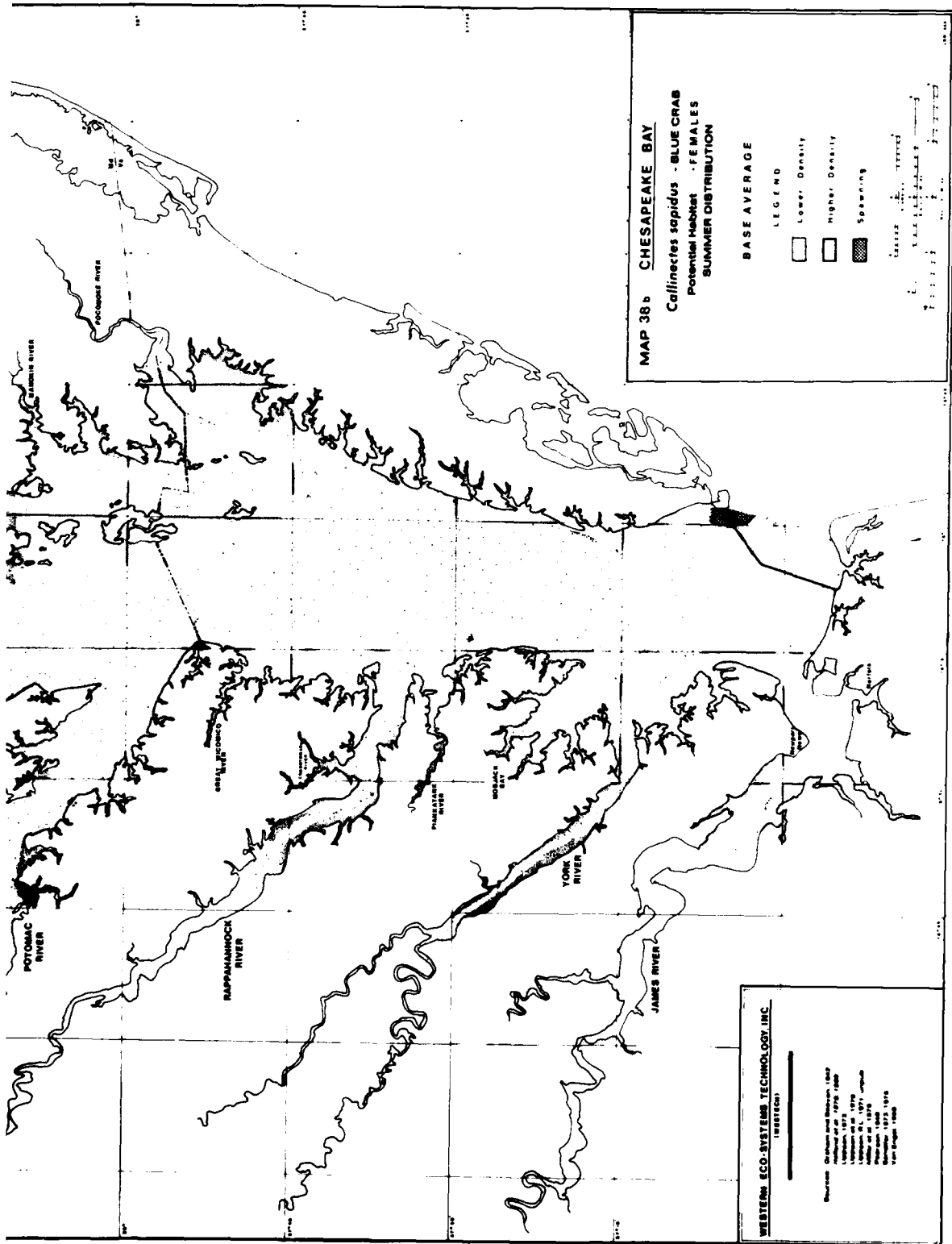












MAP 38b CHESAPEAKE BAY
Callinectes sapidus - BLUE CRAB
 Potential Habitat - FEMALE
 SUMMER DISTRIBUTION

BASE AVERAGE

LEGEND

Lower Density

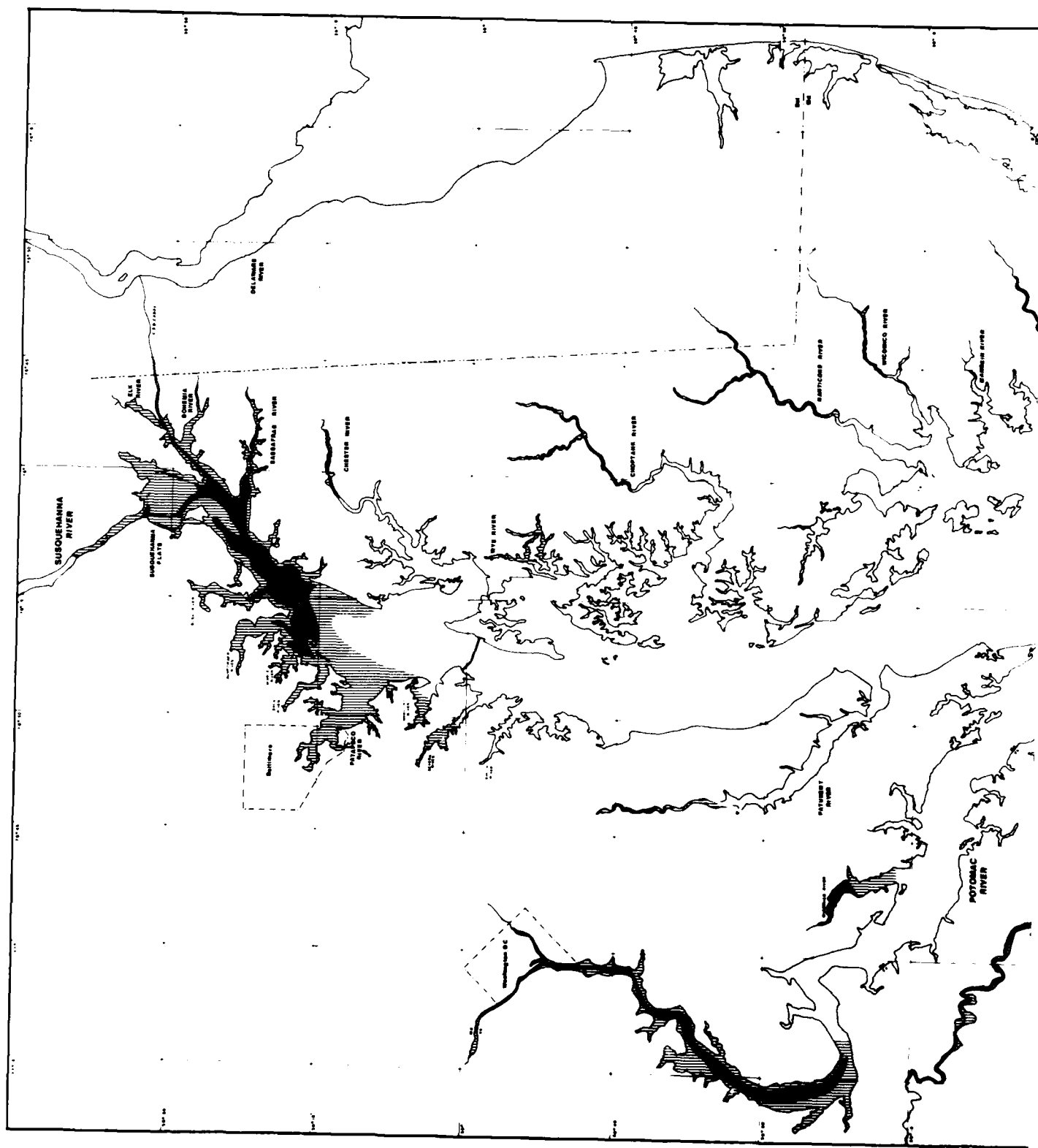
Higher Density

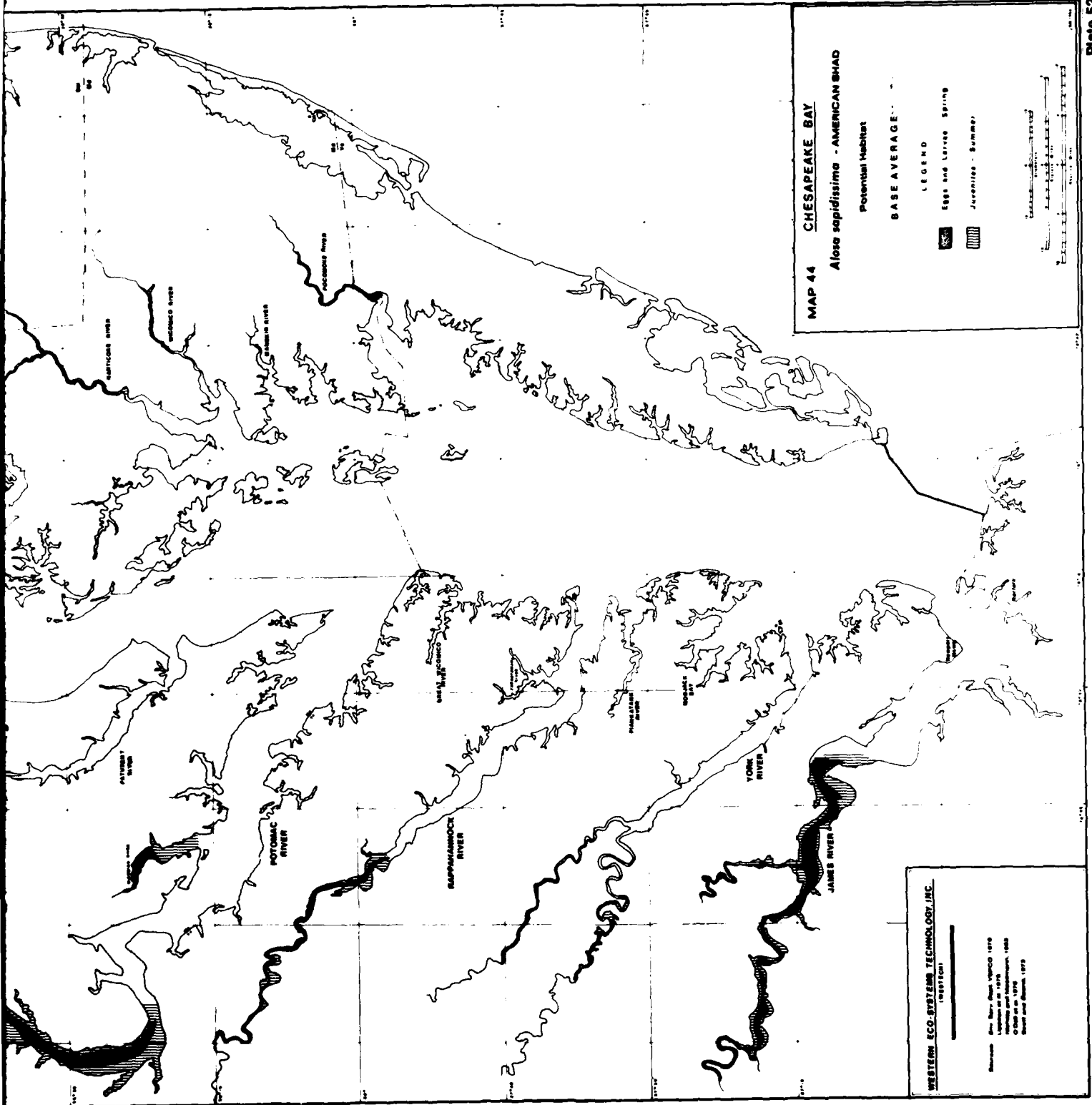
Spawning

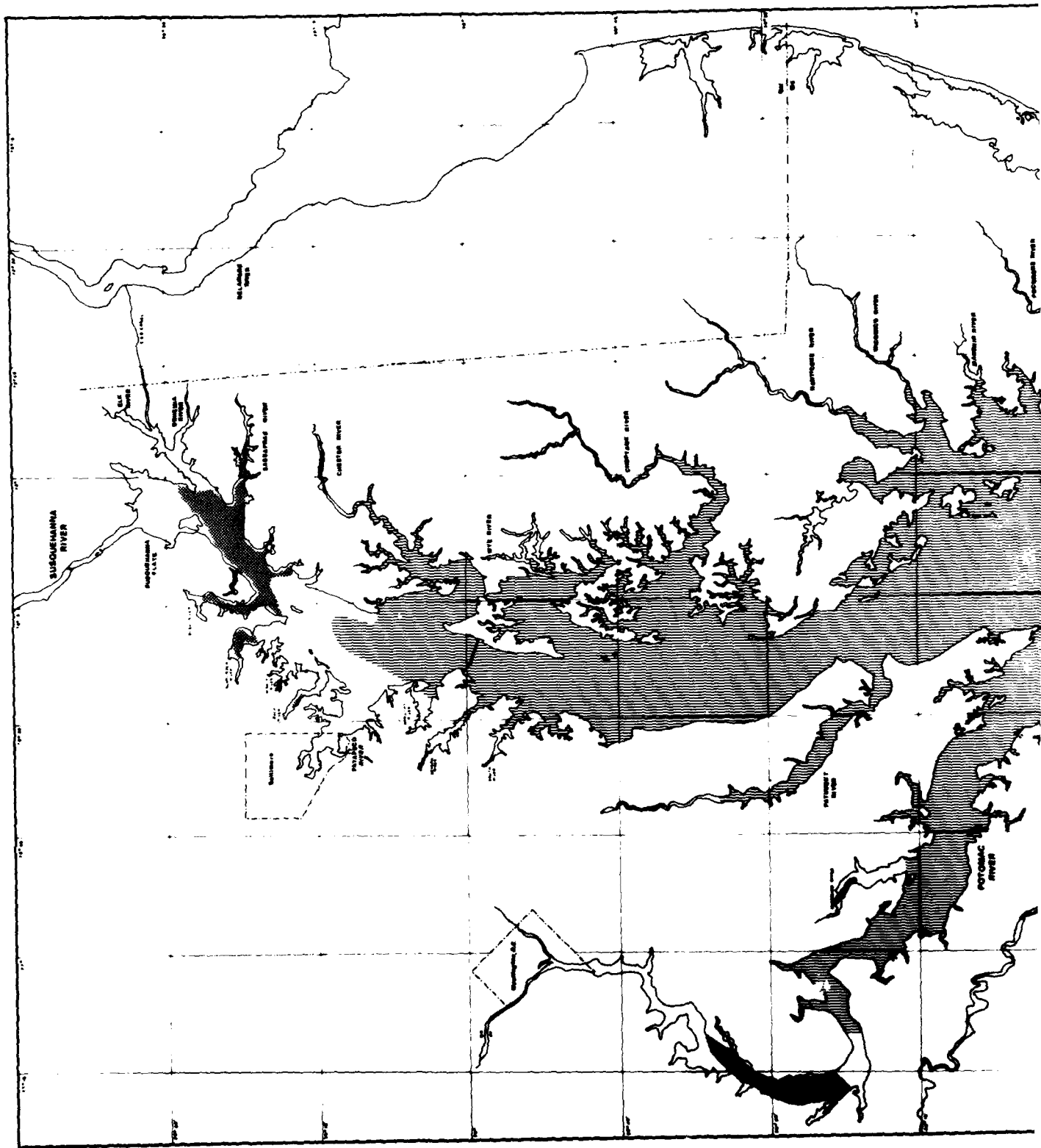


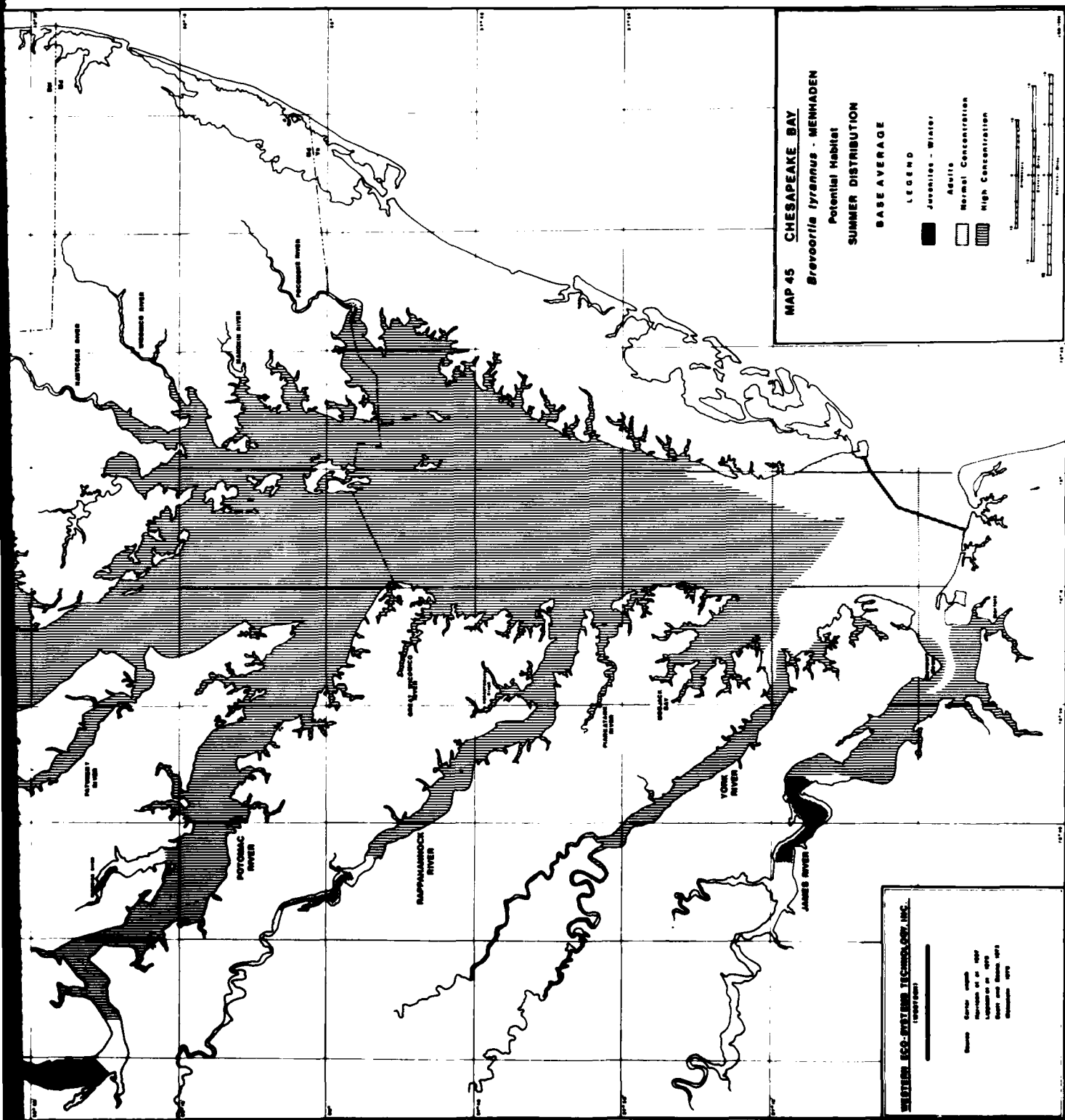
WESTERN ECO-SYSTEMS TECHNOLOGY, INC.
 INVESTIGATOR

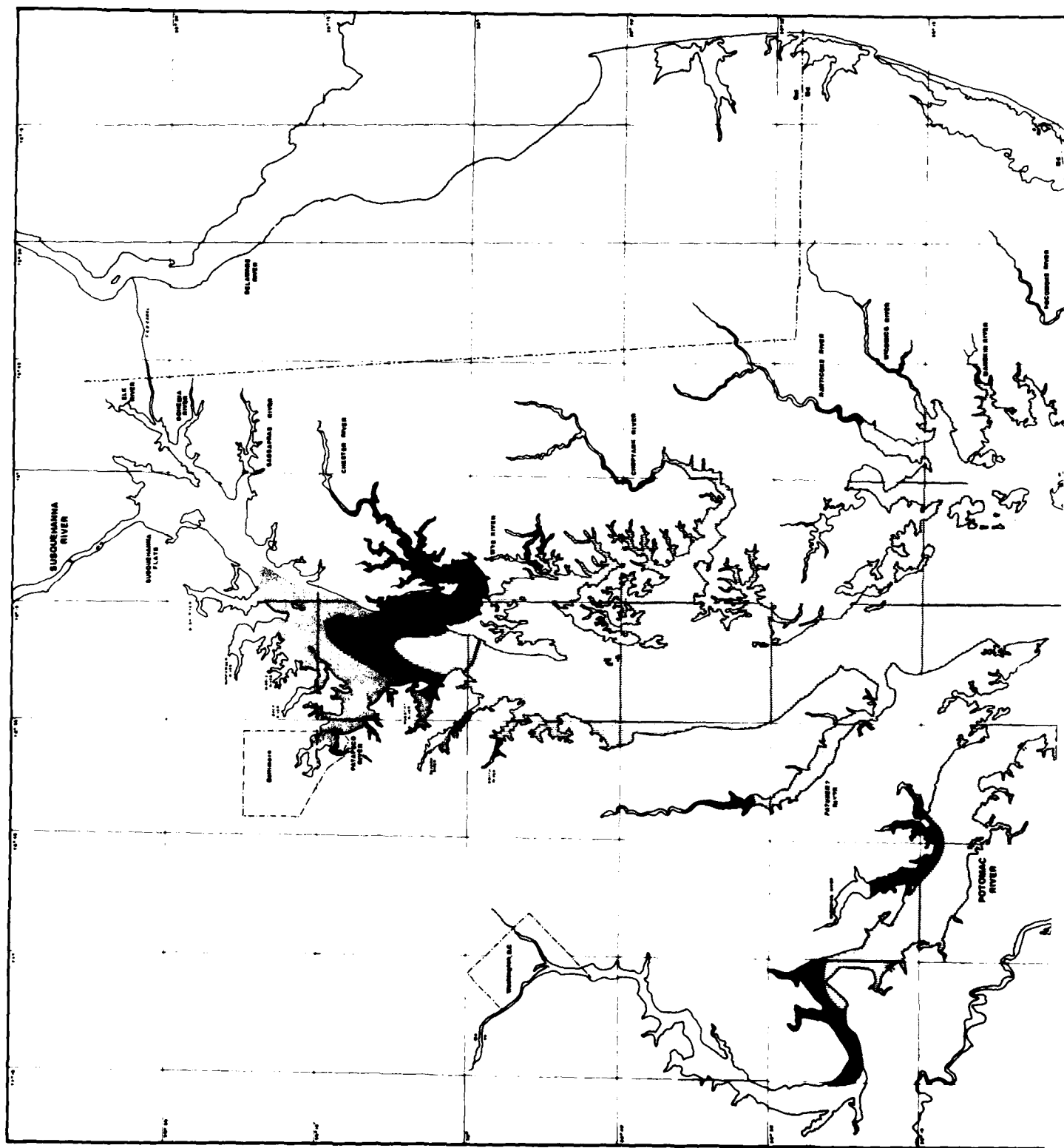
Source: Graham and Bishop, 1967
 Johnson et al., 1970, 1980
 Johnson, 1971
 Johnson, 1972
 Johnson, 1973, 1974, 1975
 Johnson, 1975, 1976
 Johnson, 1977, 1978

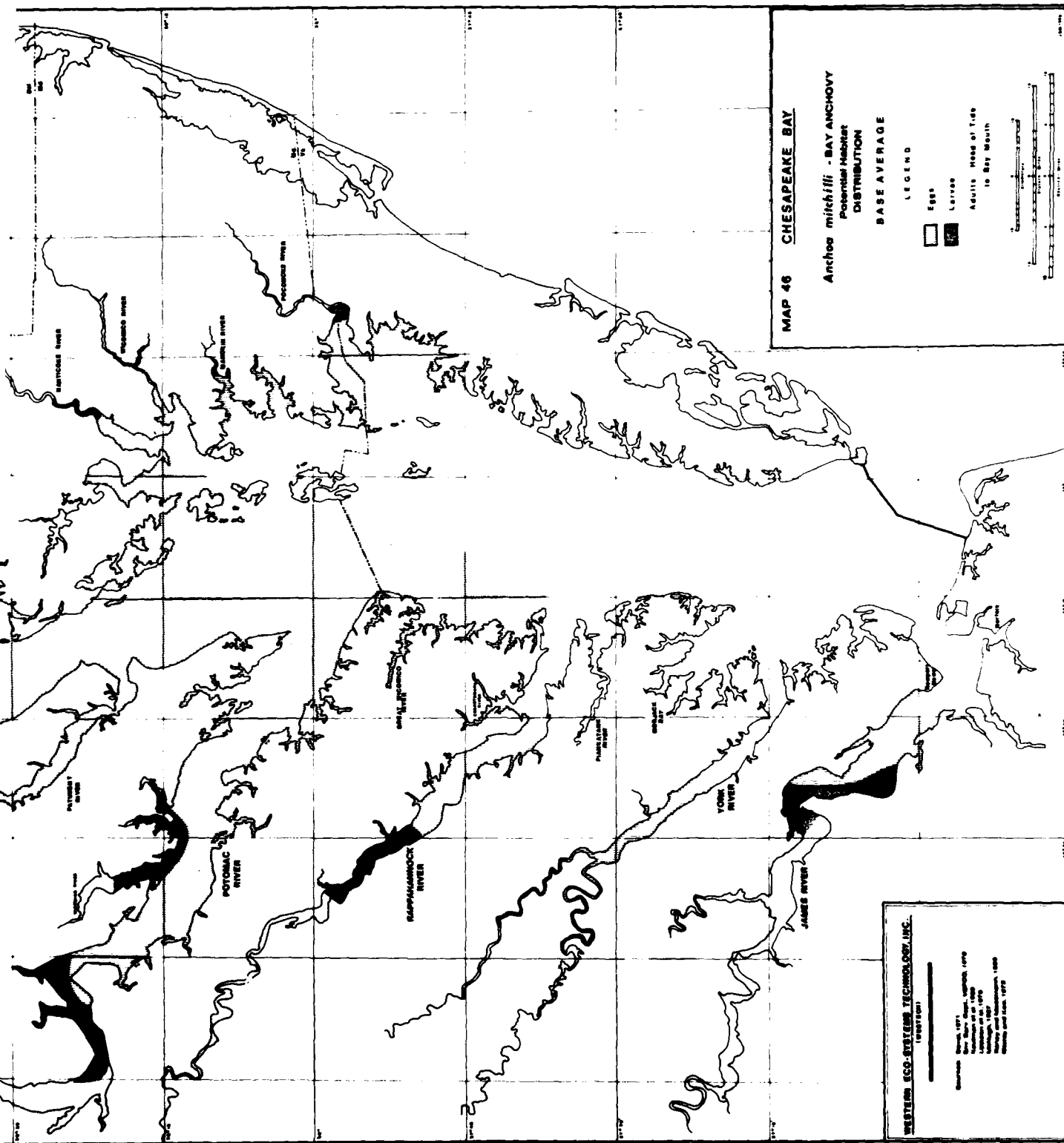


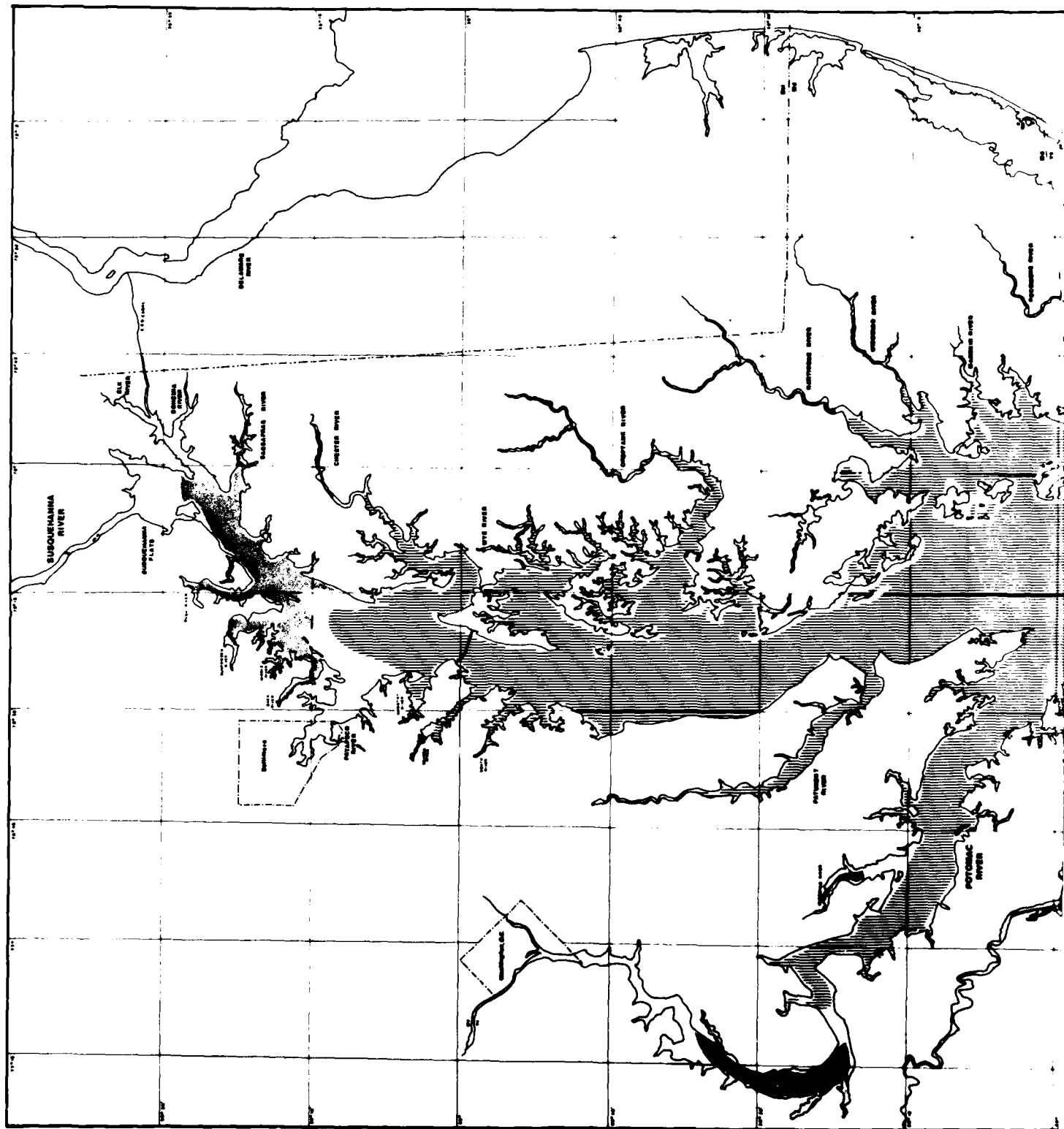


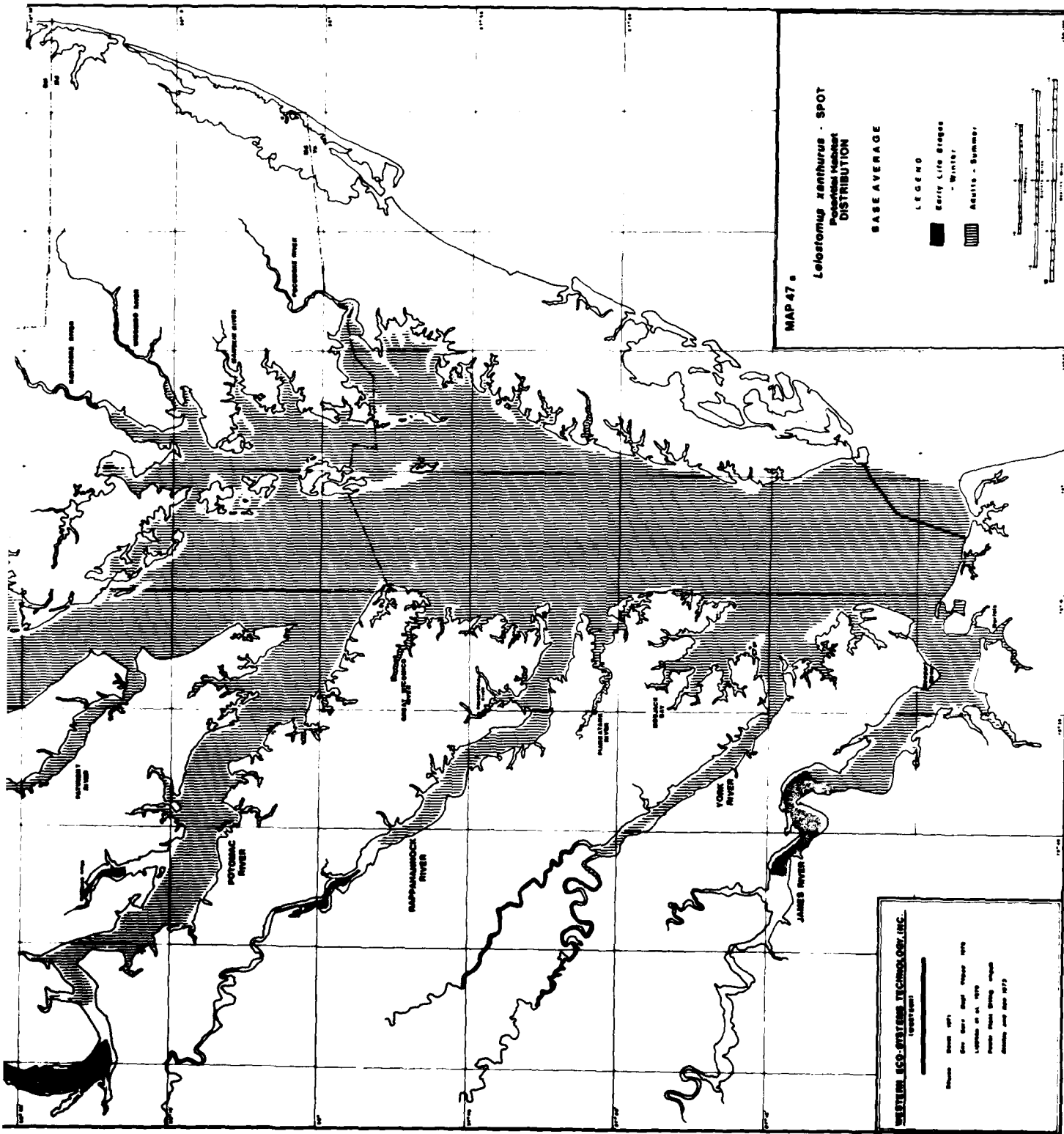


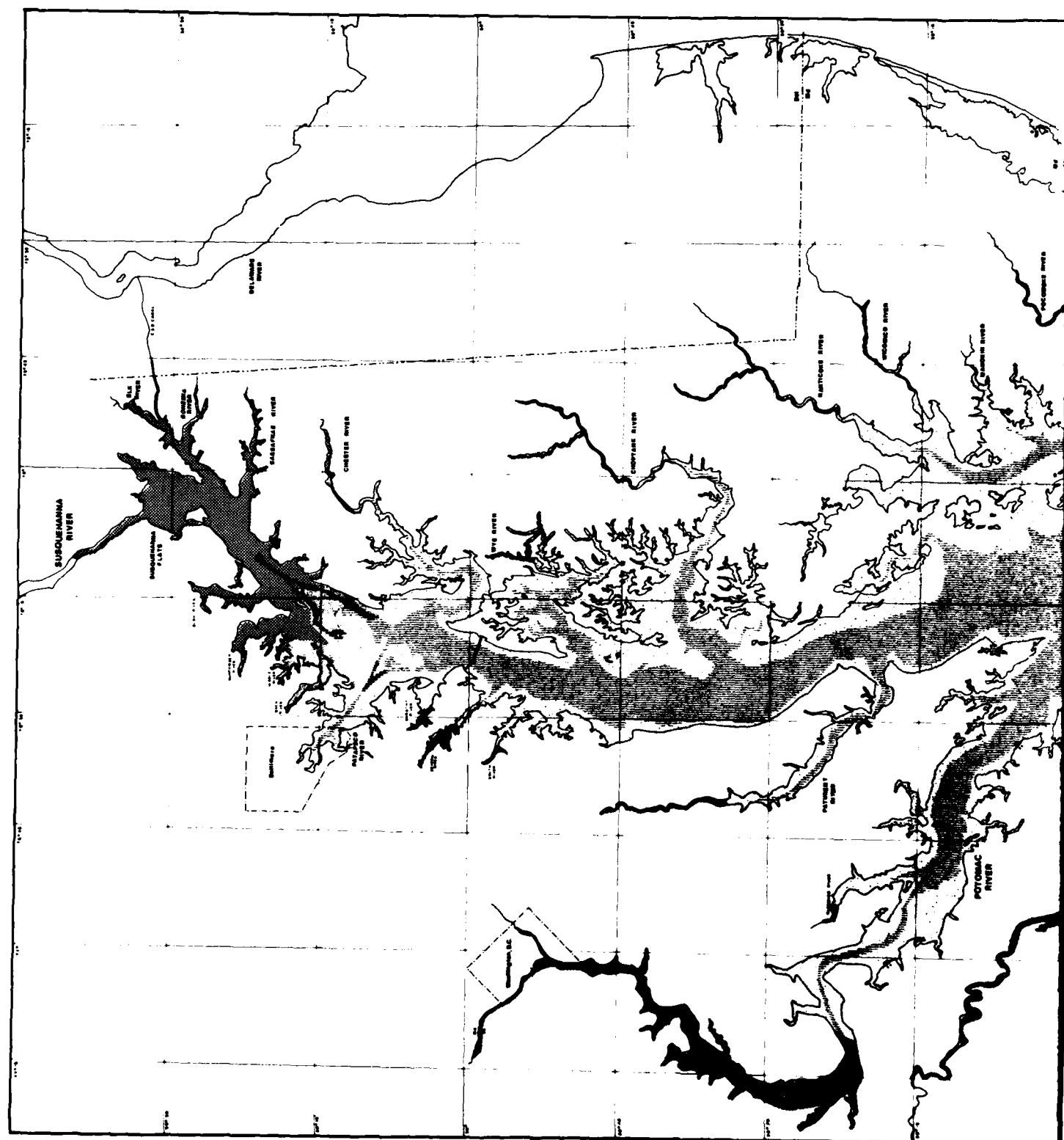


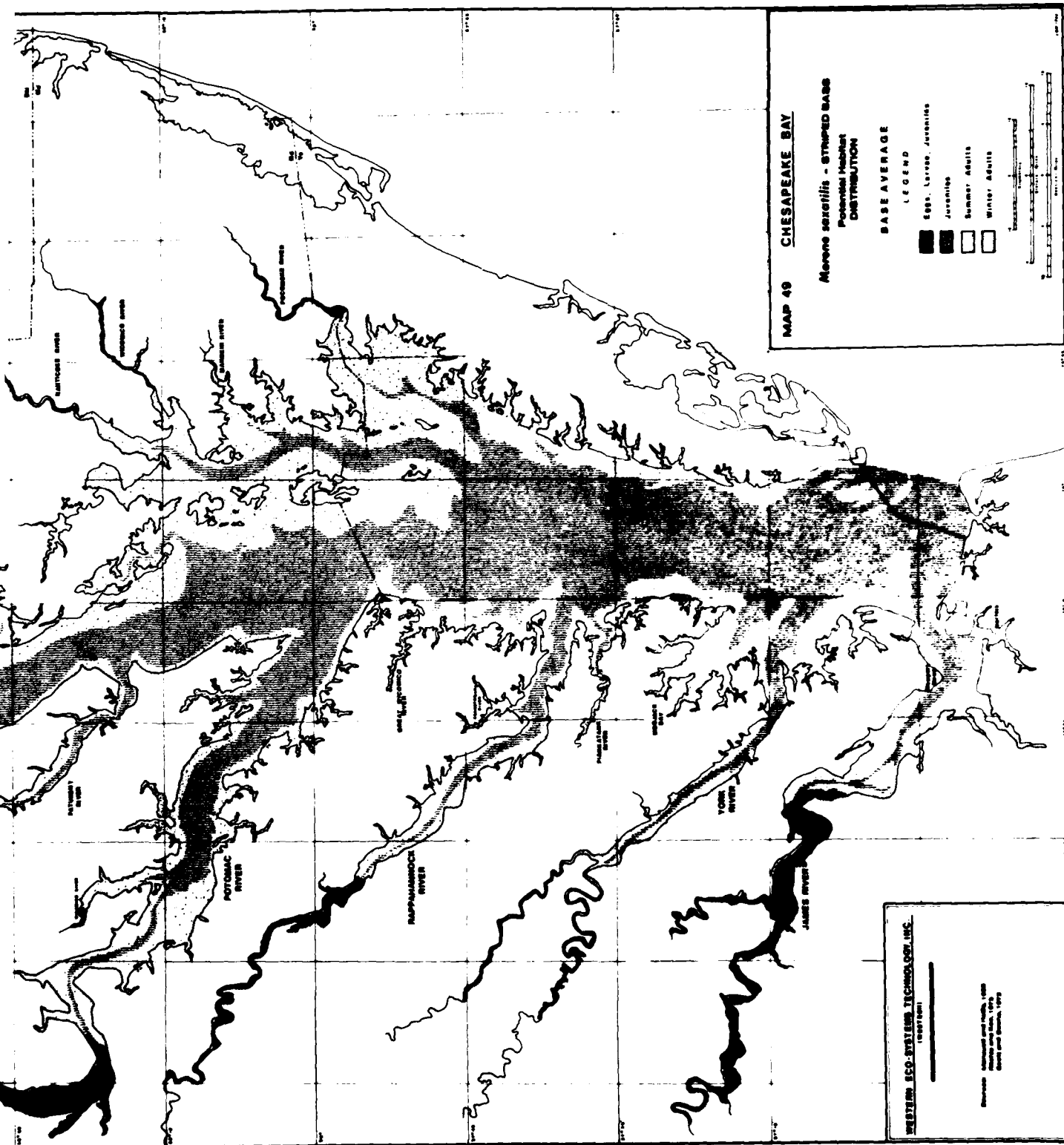












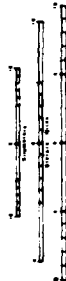
MAP 49 CHESAPEAKE BAY

***Menidia menidia* - STRIPED BASS
Potomac, Rappahannock
DISTRIBUTION**

BASE AVERAGE

LEGEND

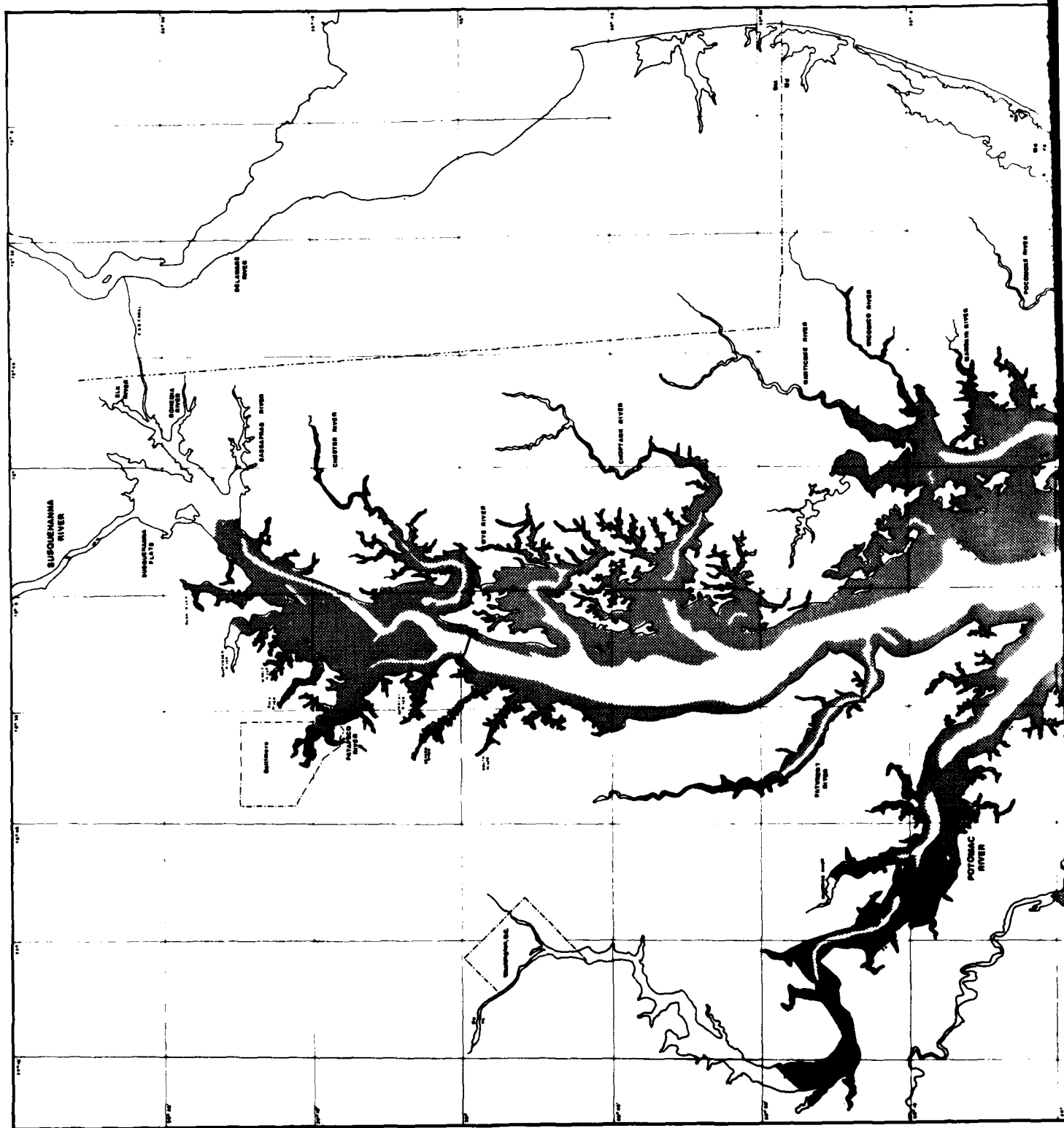
- Eggs, Larvae, Juveniles
- Juveniles
- Summer Adults
- Winter Adults

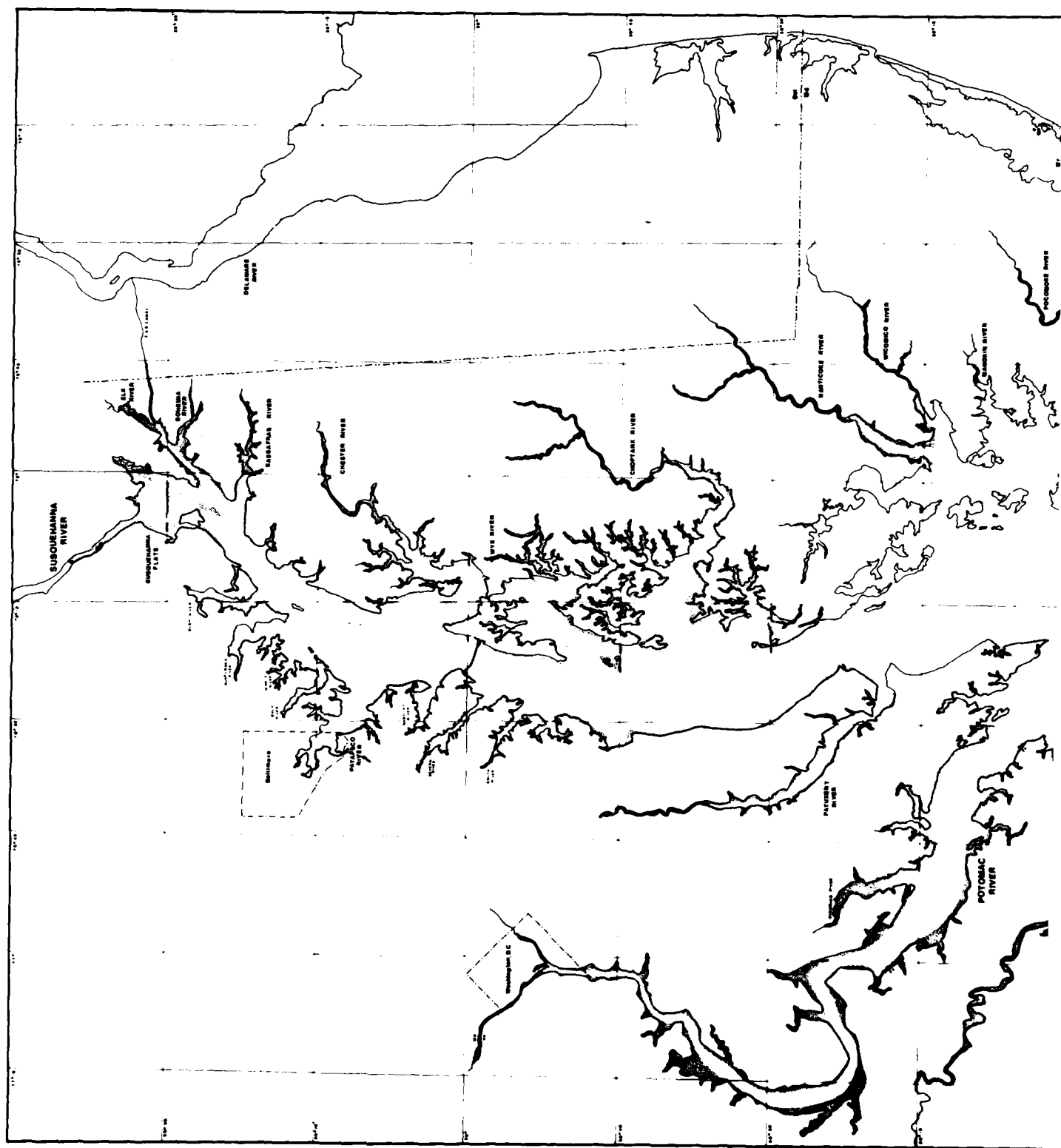


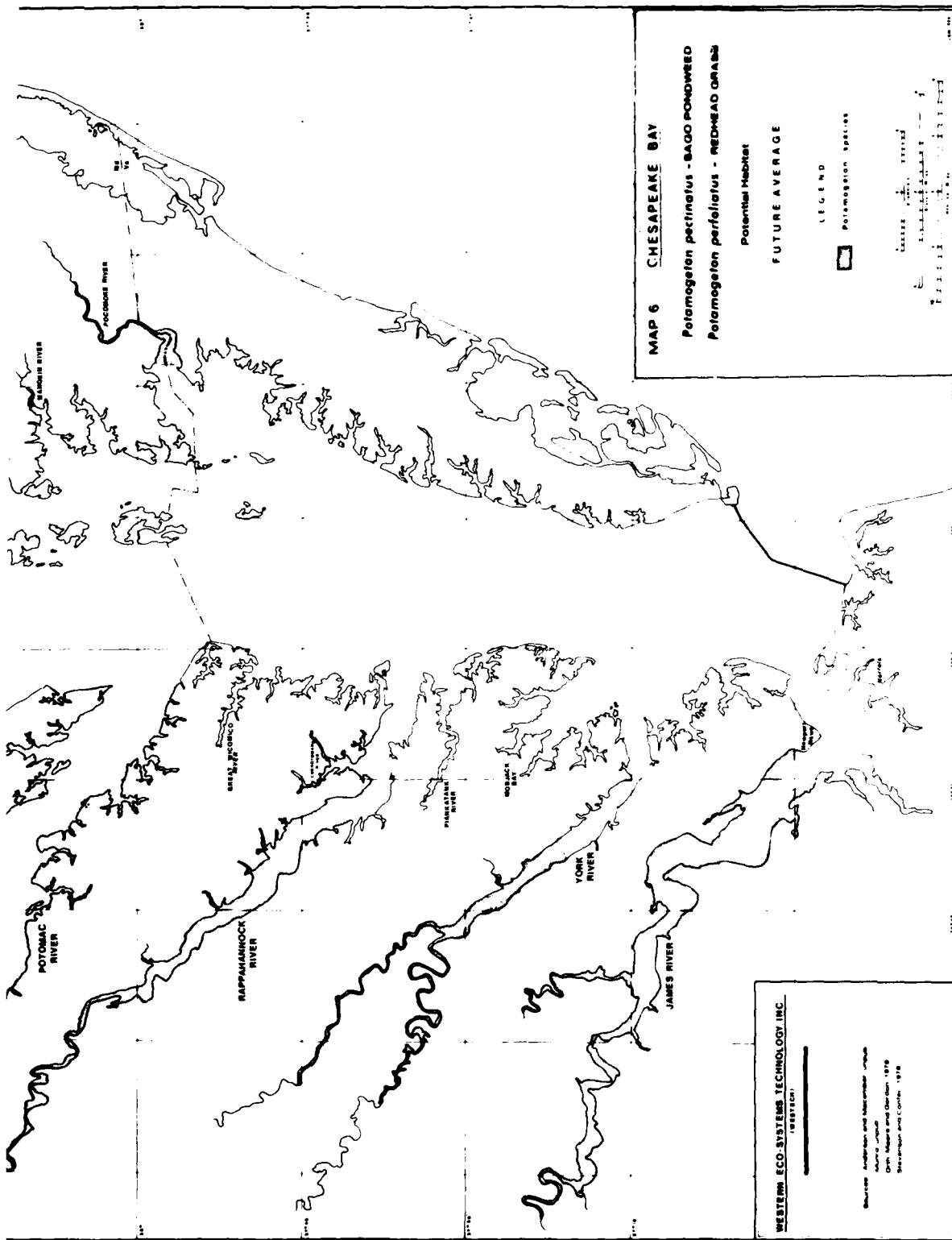
WESTERN GEO-TECHNOLOGY, INC.

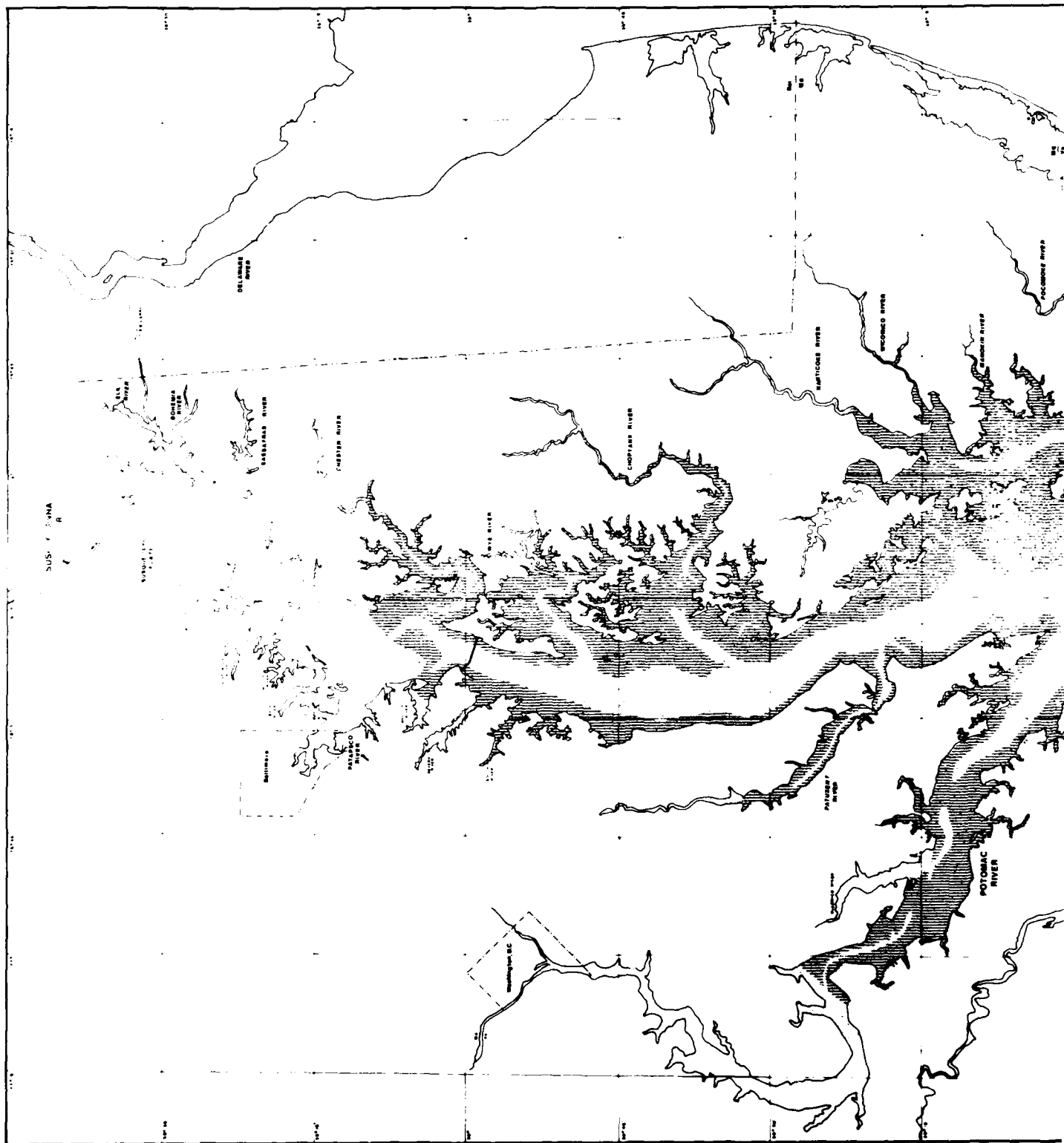
(1987-1988)

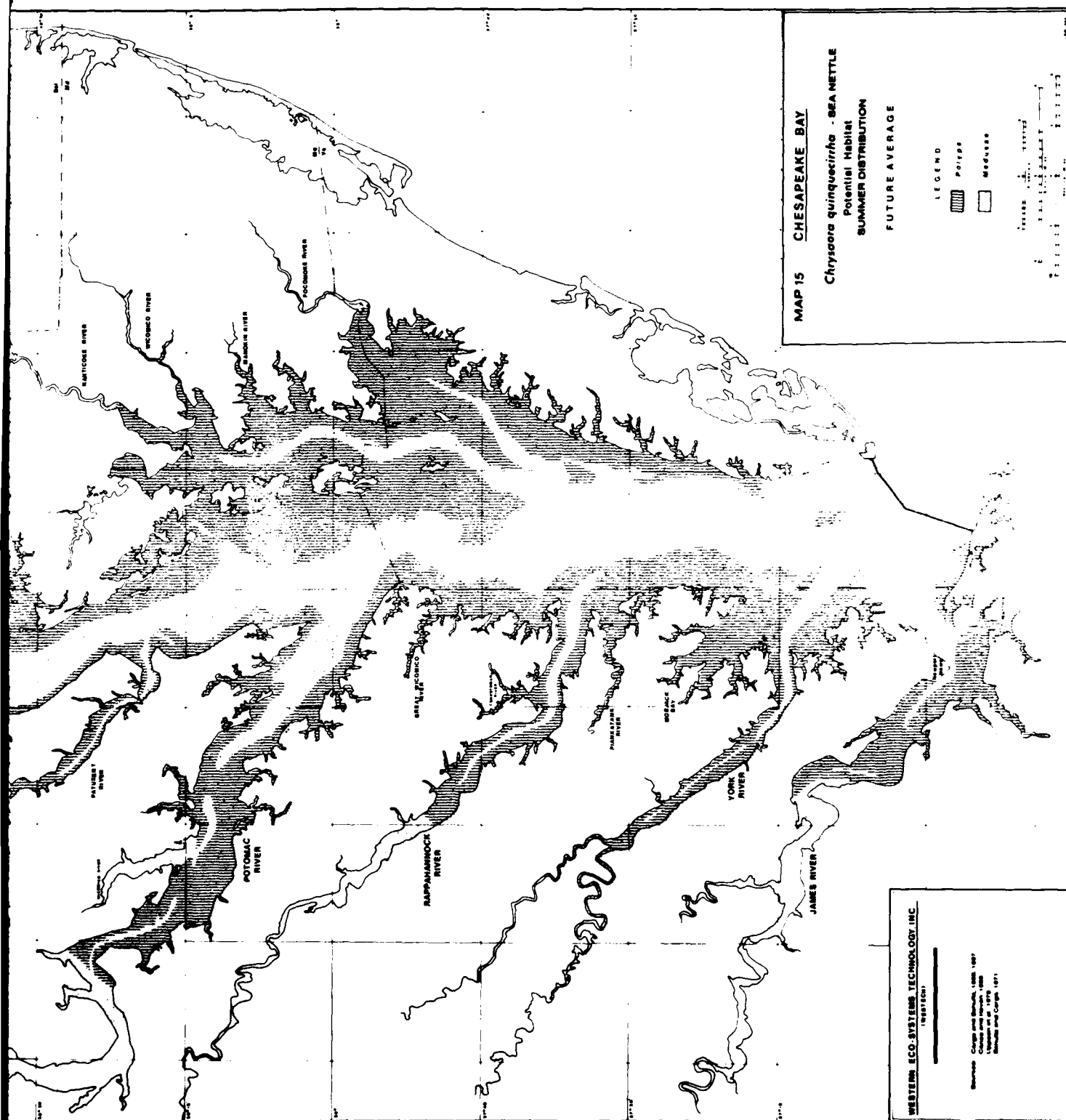
Revised: 1987 and 1988, 1989
Maple and Oak, 1974
Oak and Maple, 1975









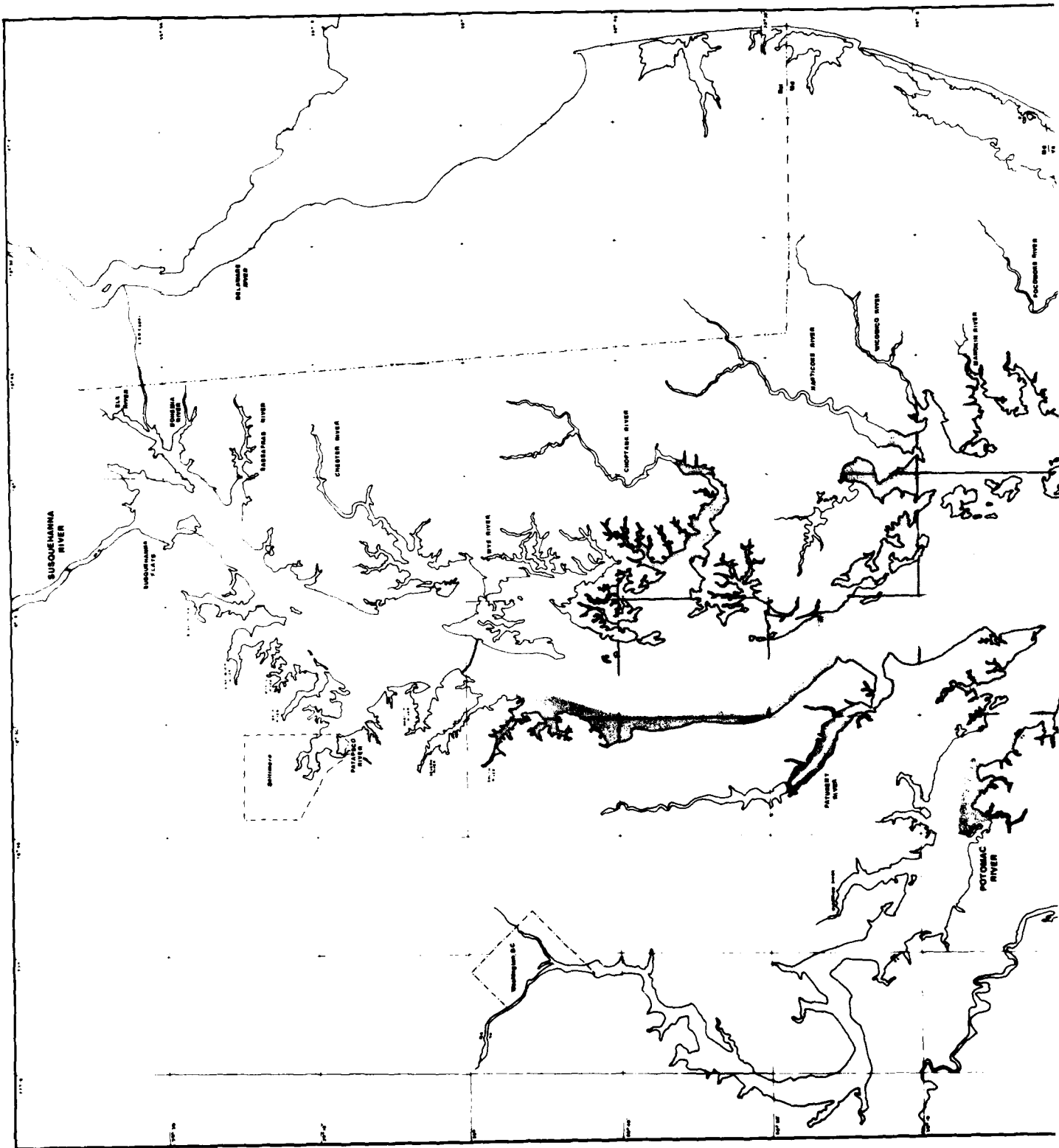


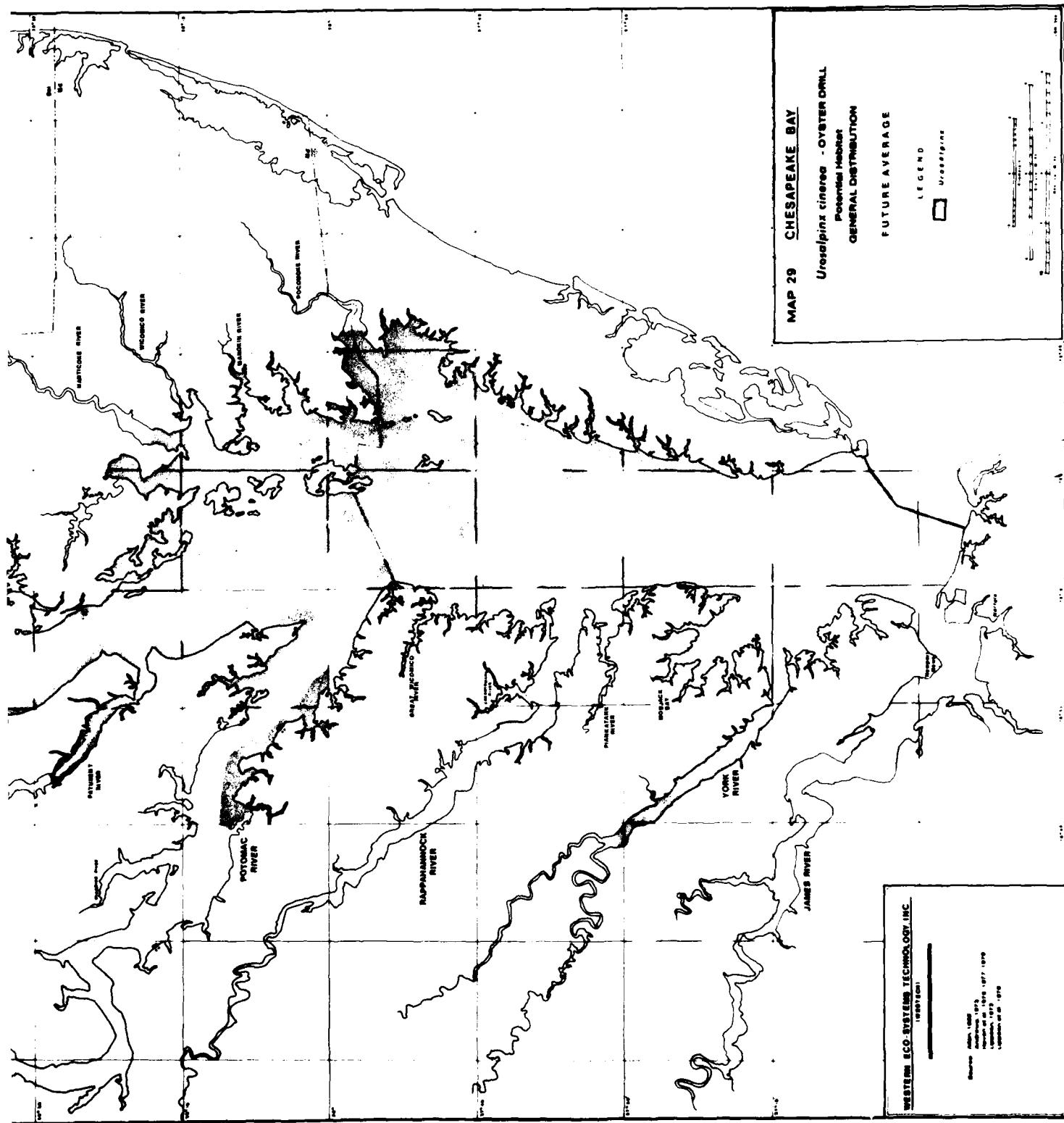
WESTERN ECO-SYSTEMS TECHNOLOGY, INC.

(1981/82)

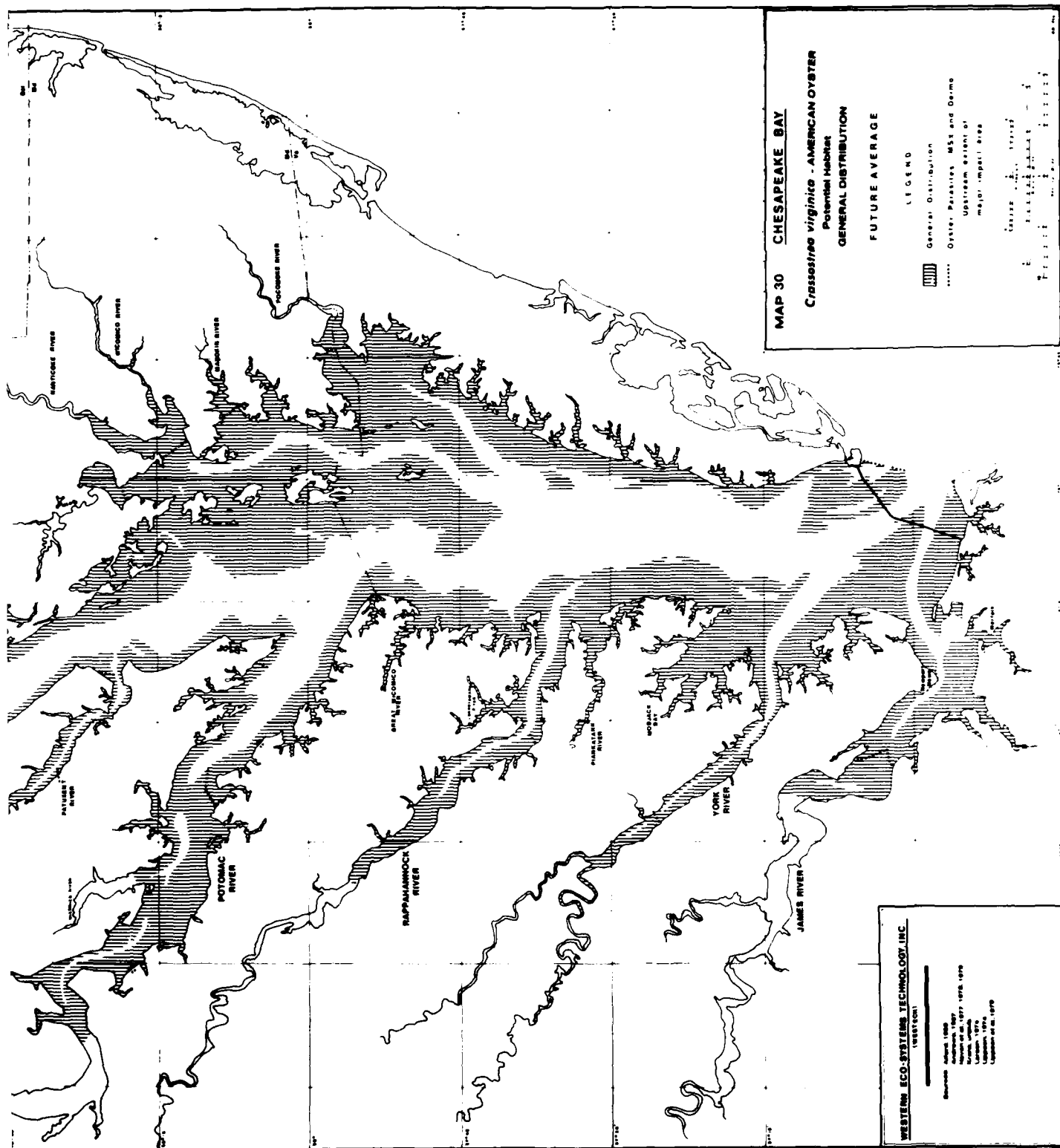
Source: Corps and Bureau, 1980, 1981
 Corps and Bureau, 1980
 Update as of 1979
 Benthic and Corals

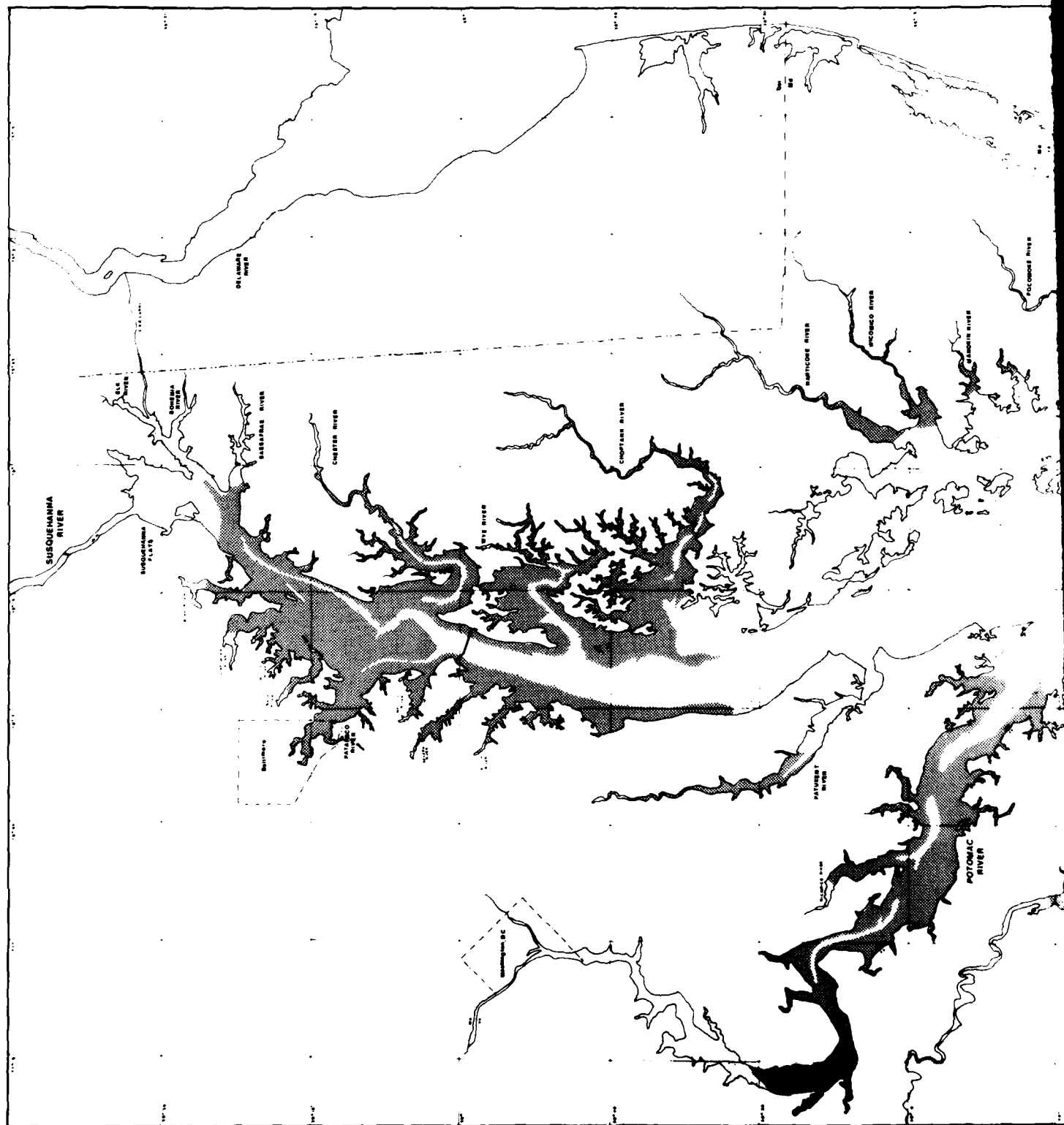


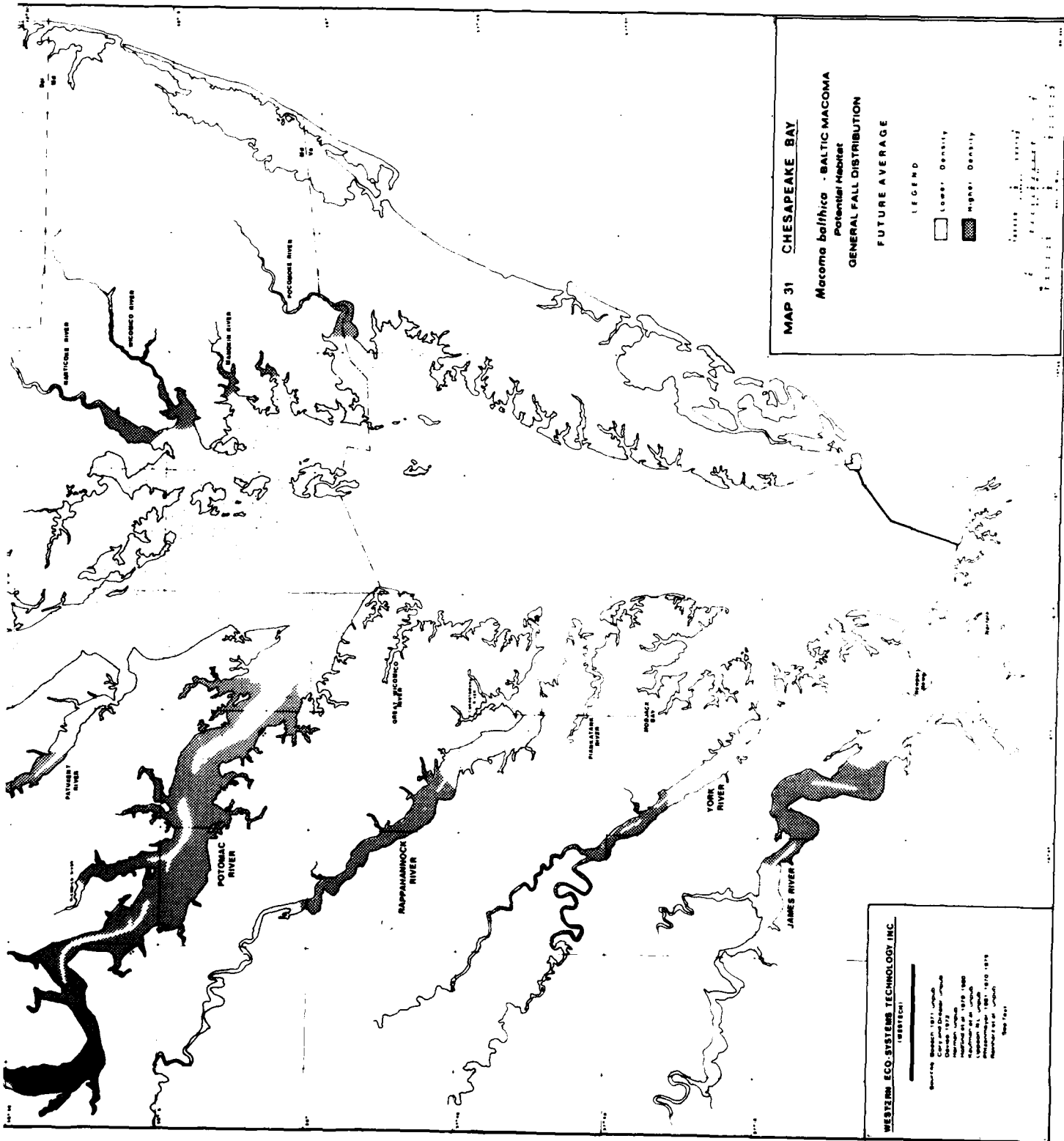


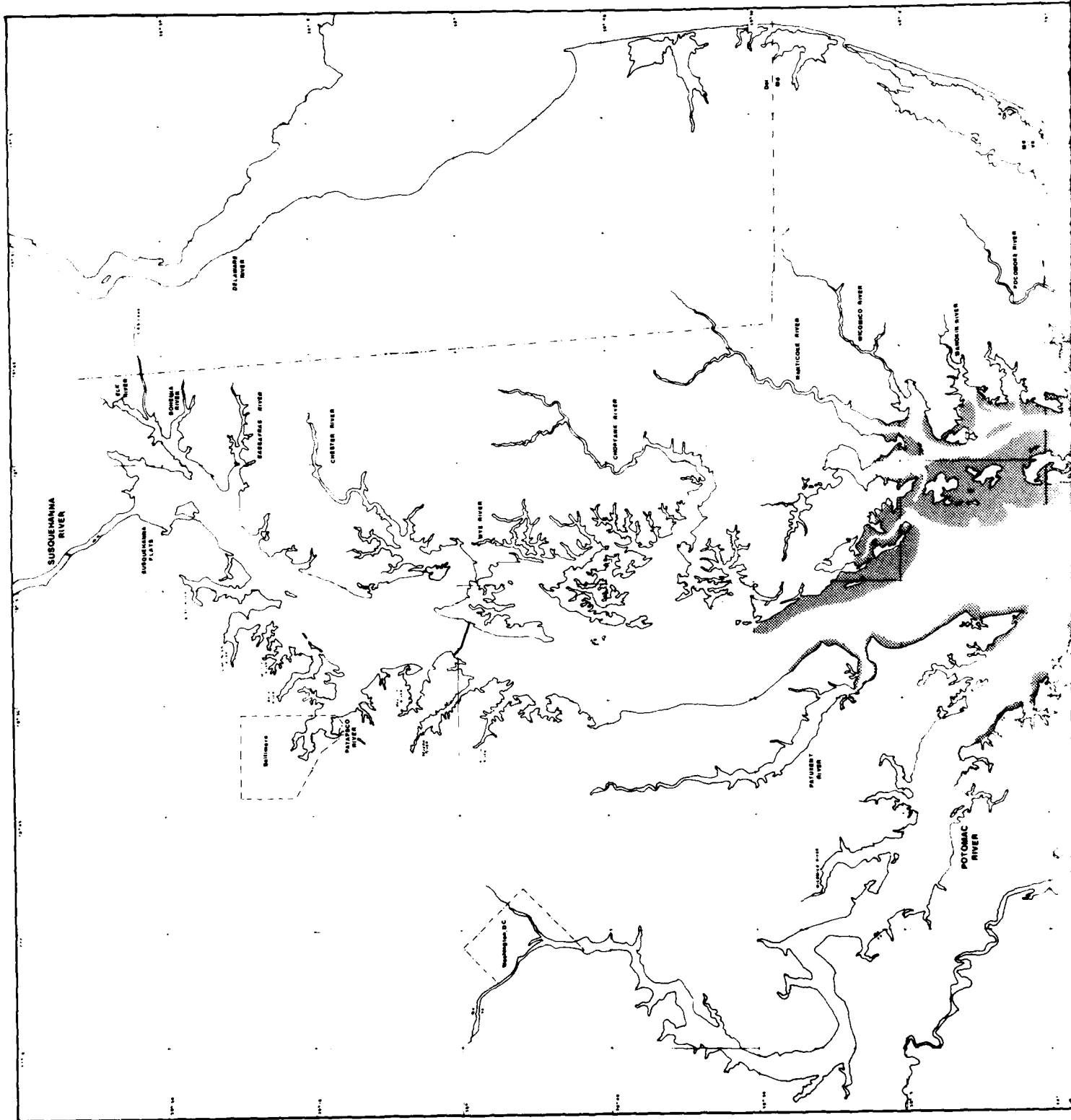


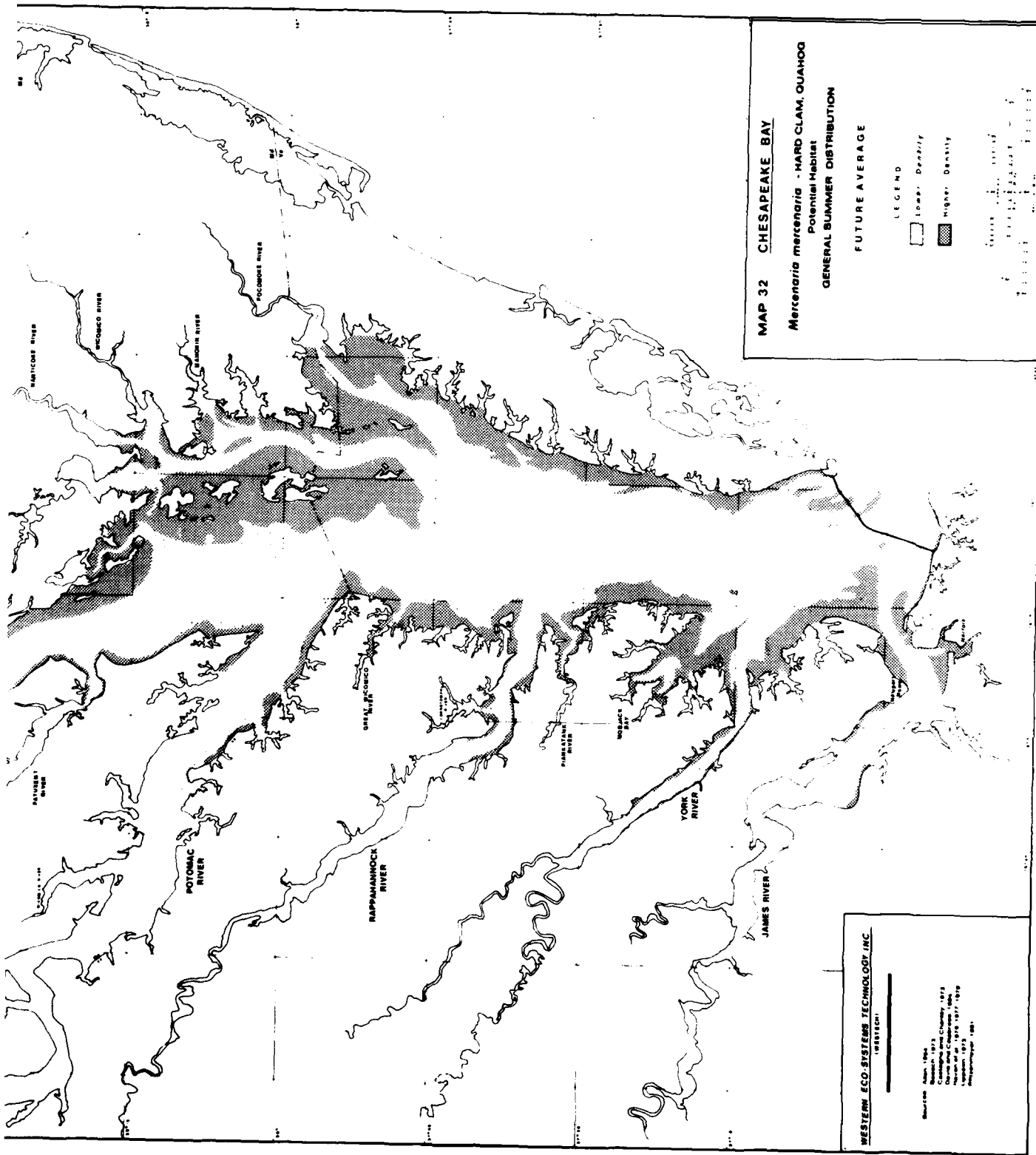


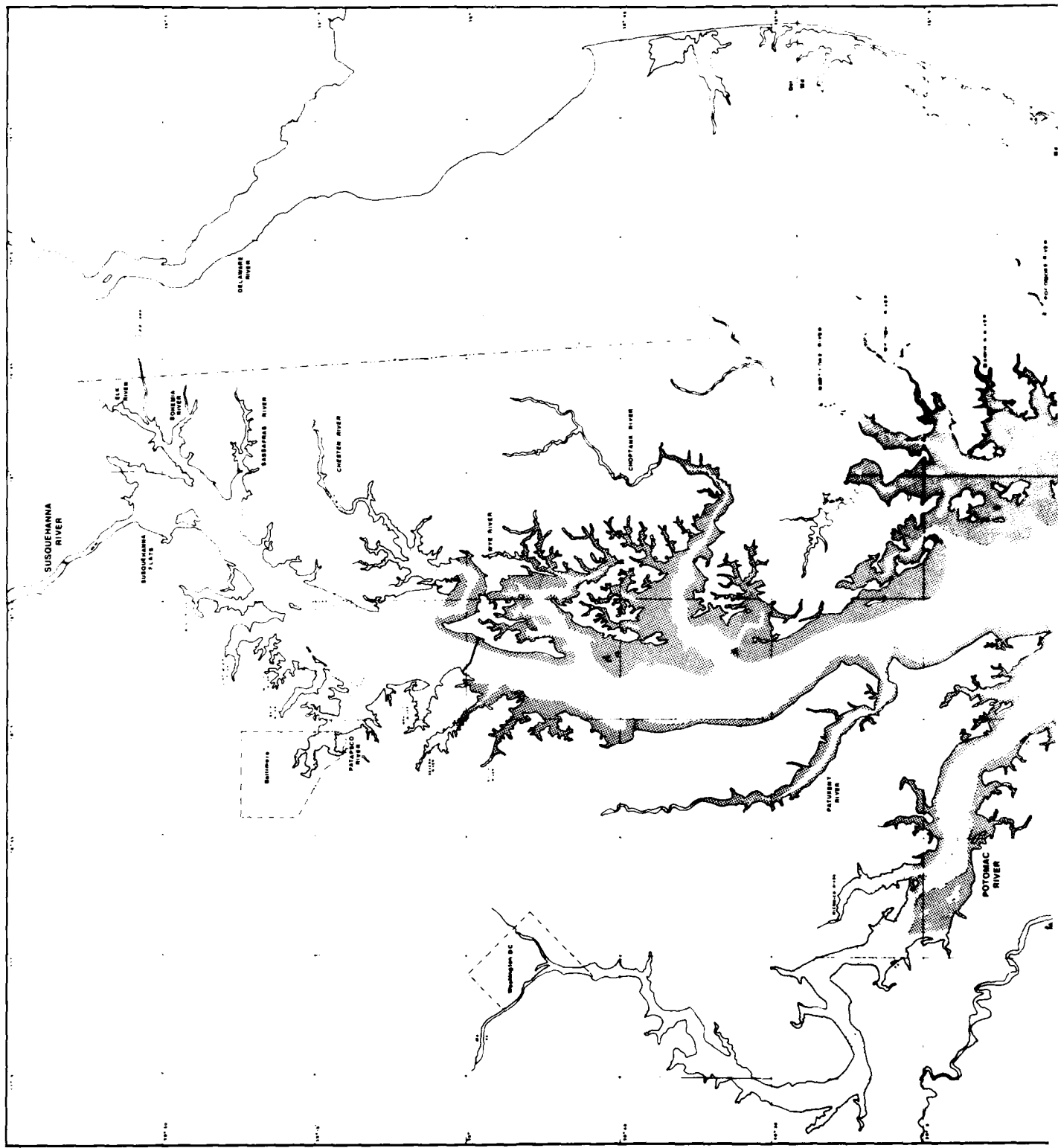


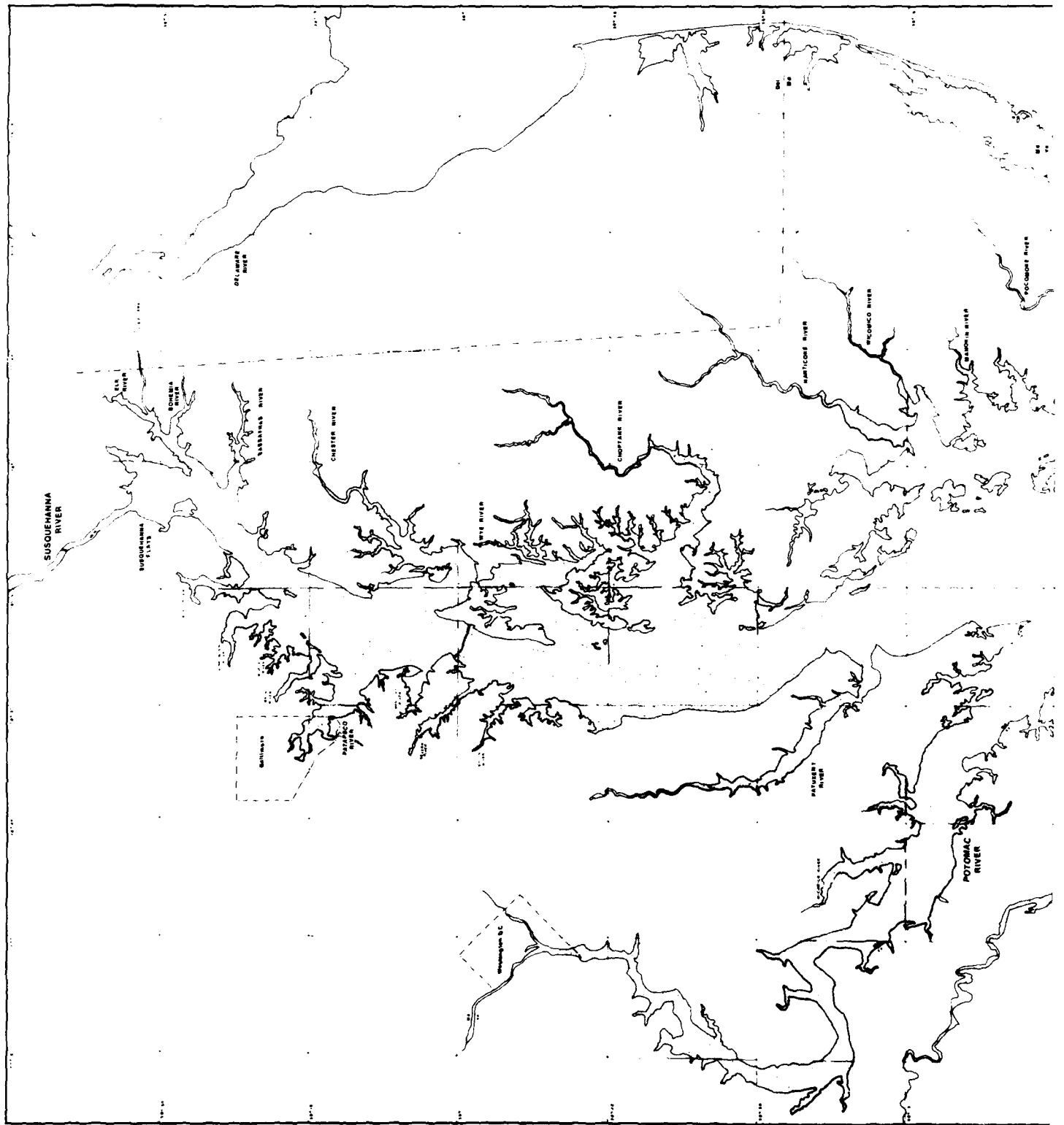


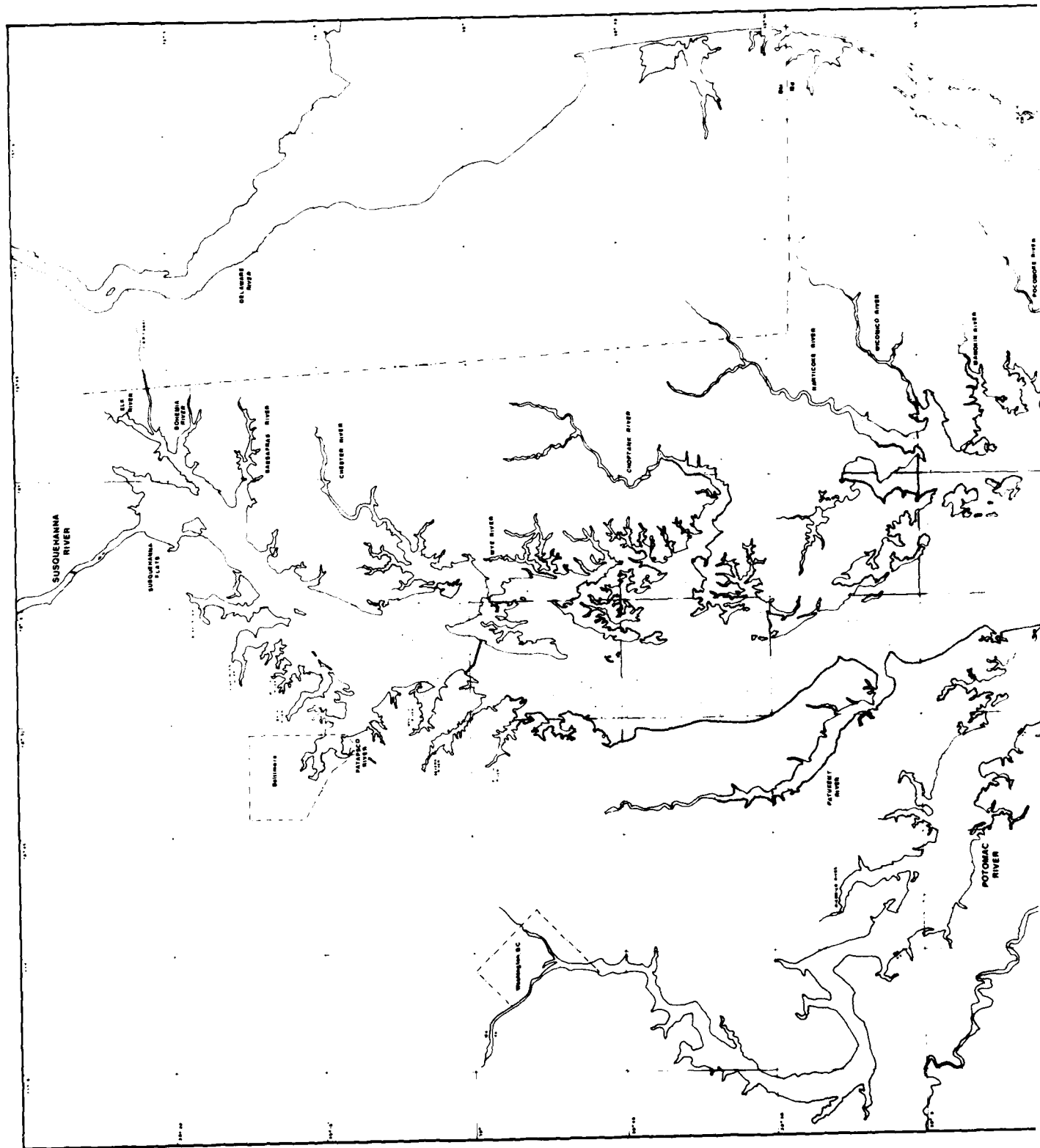


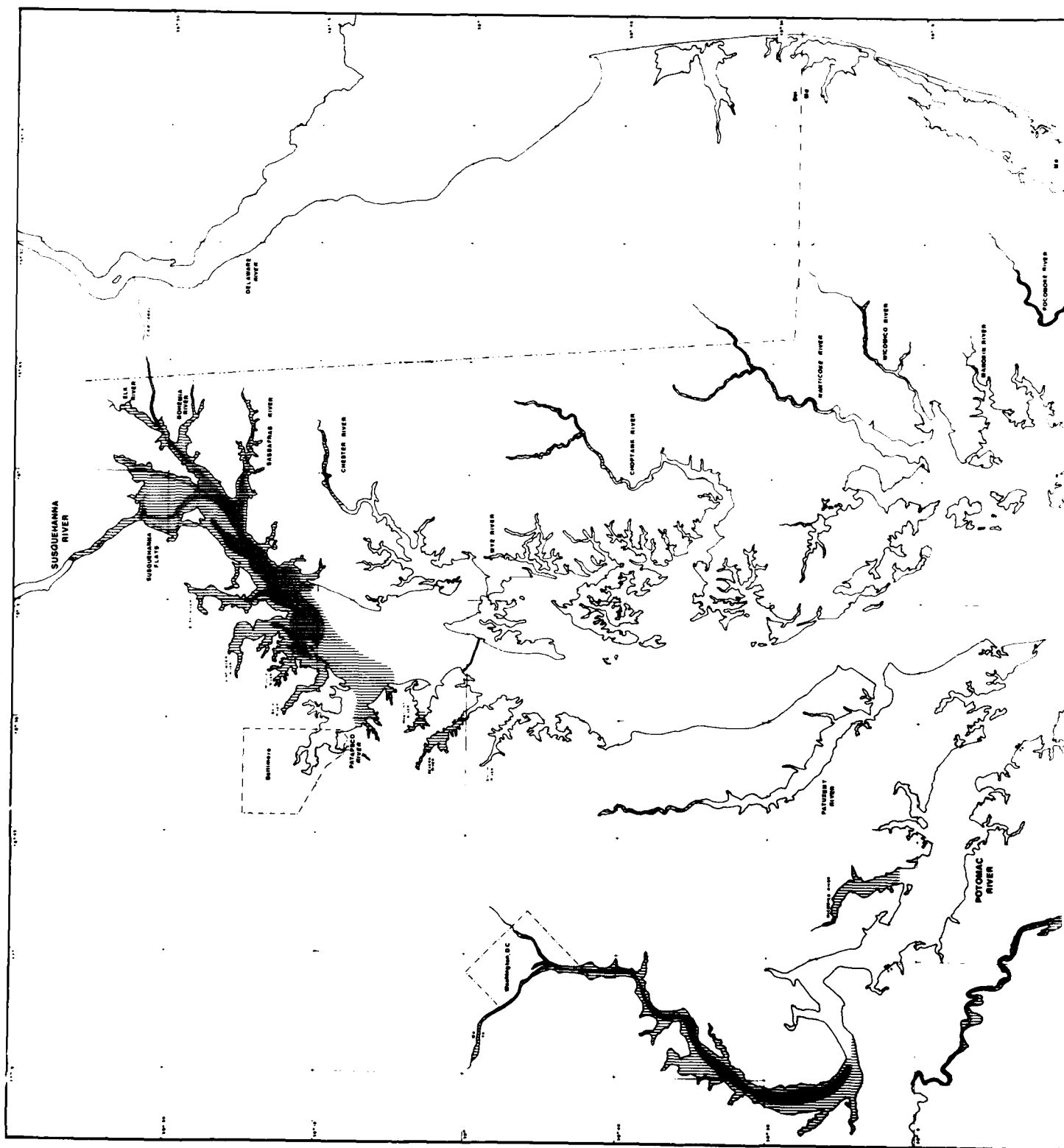


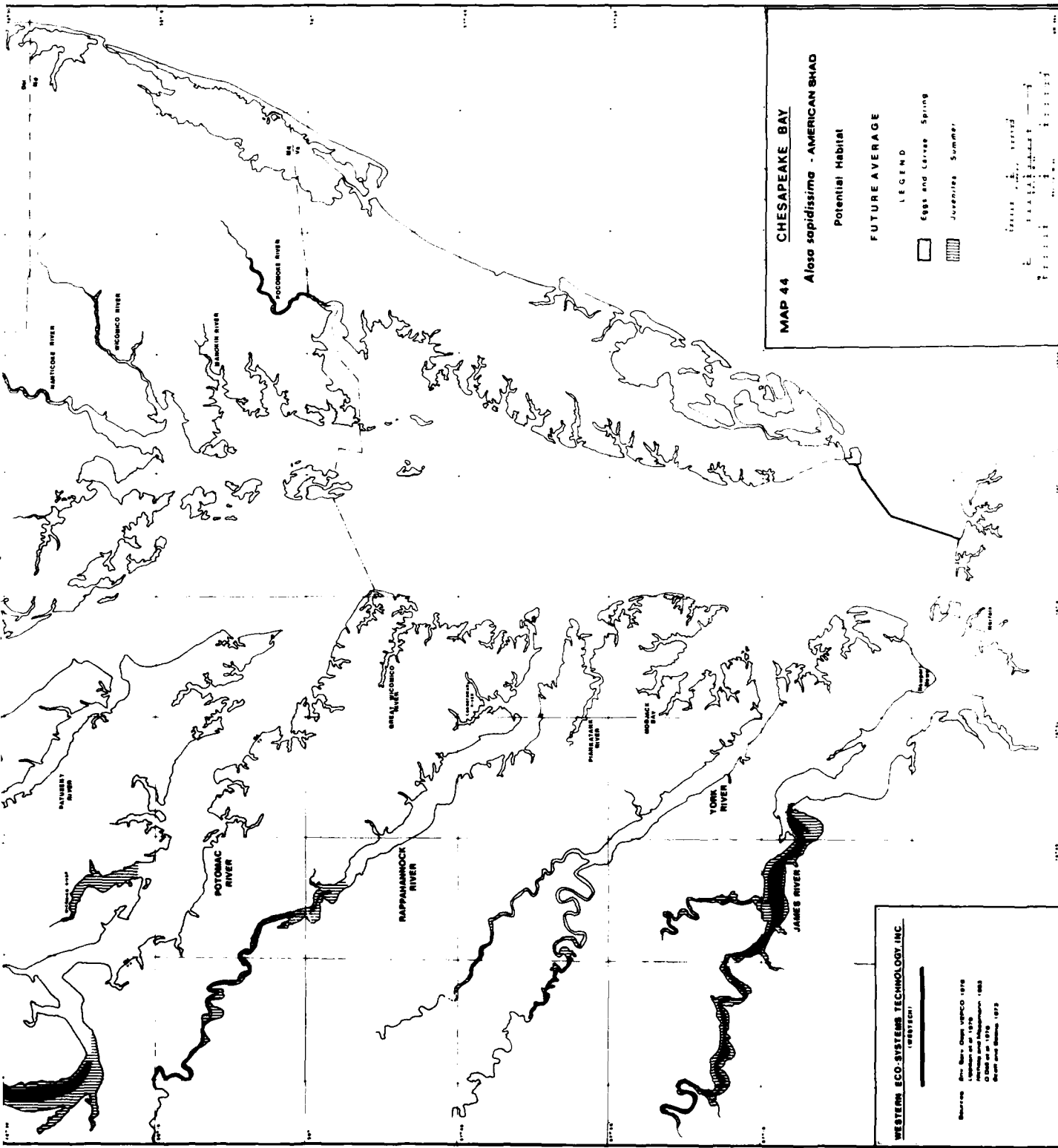


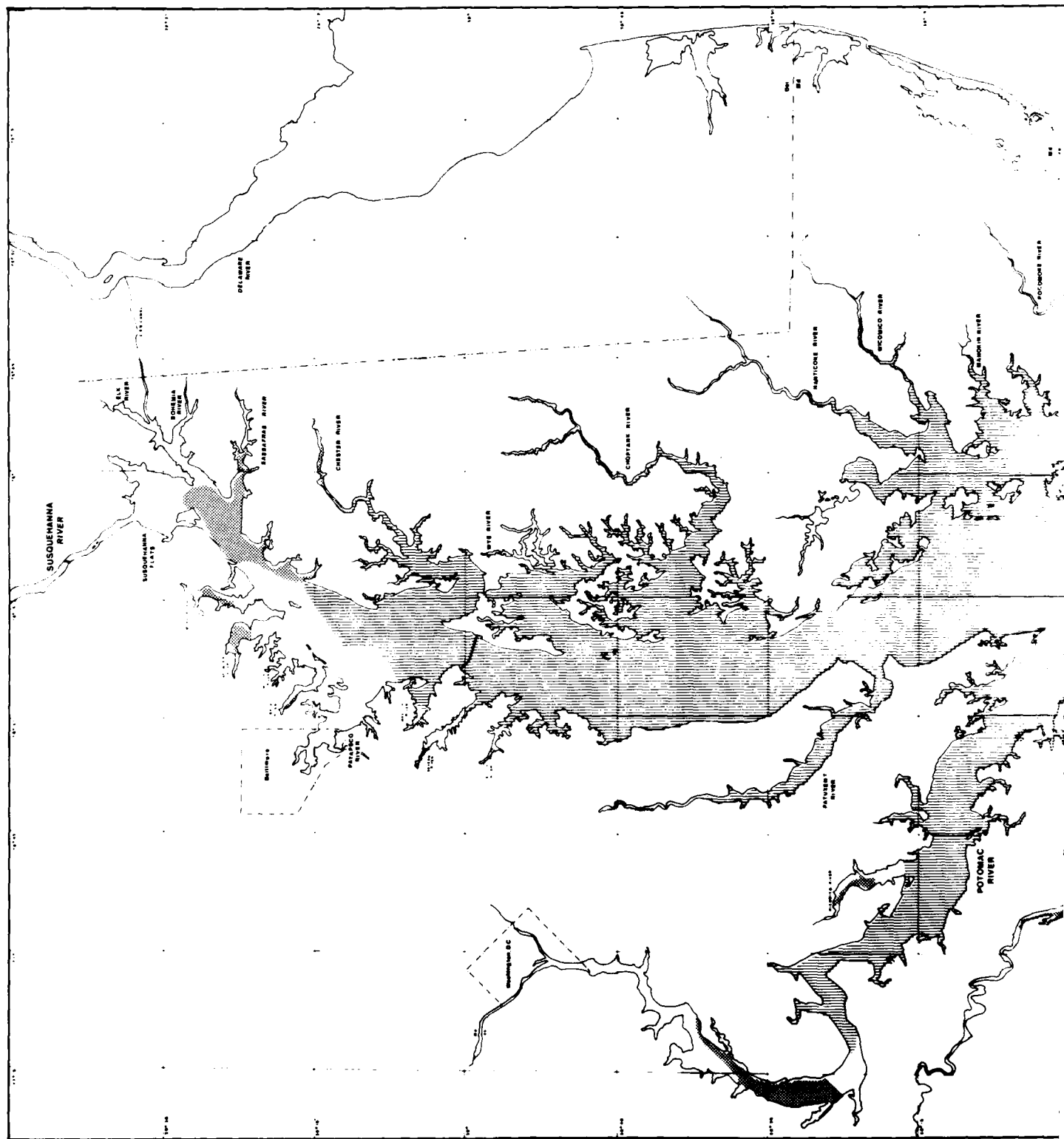


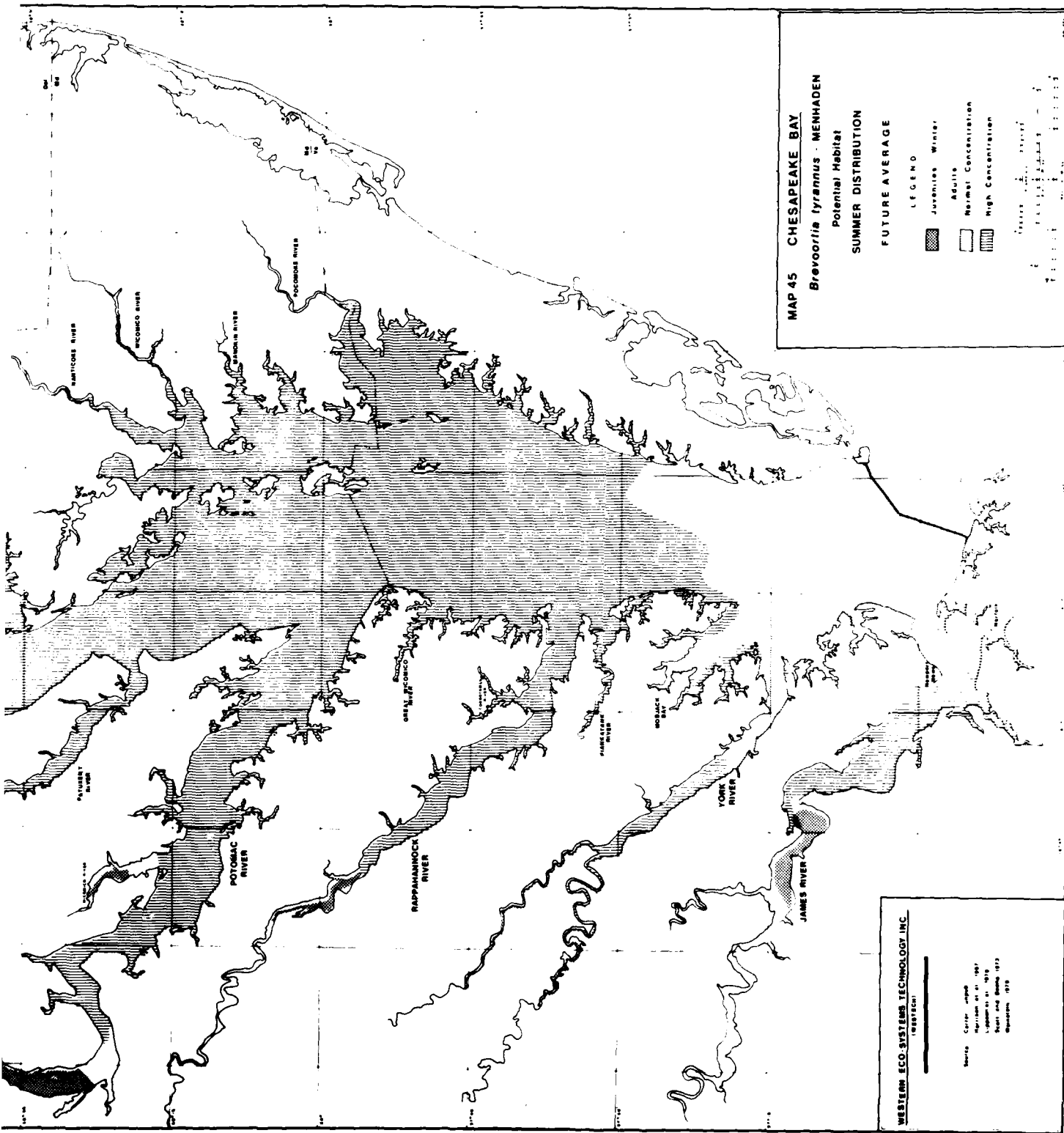


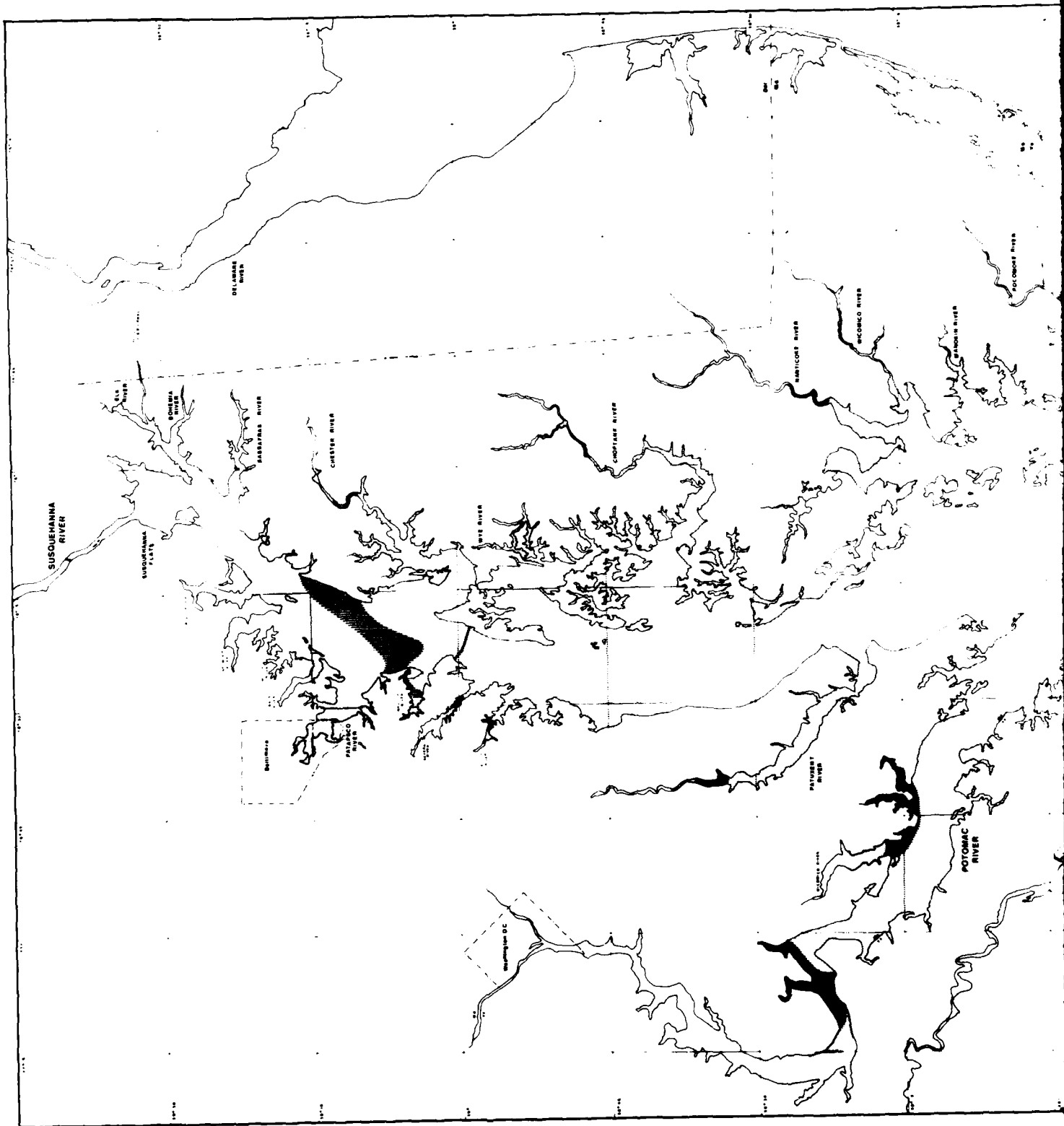


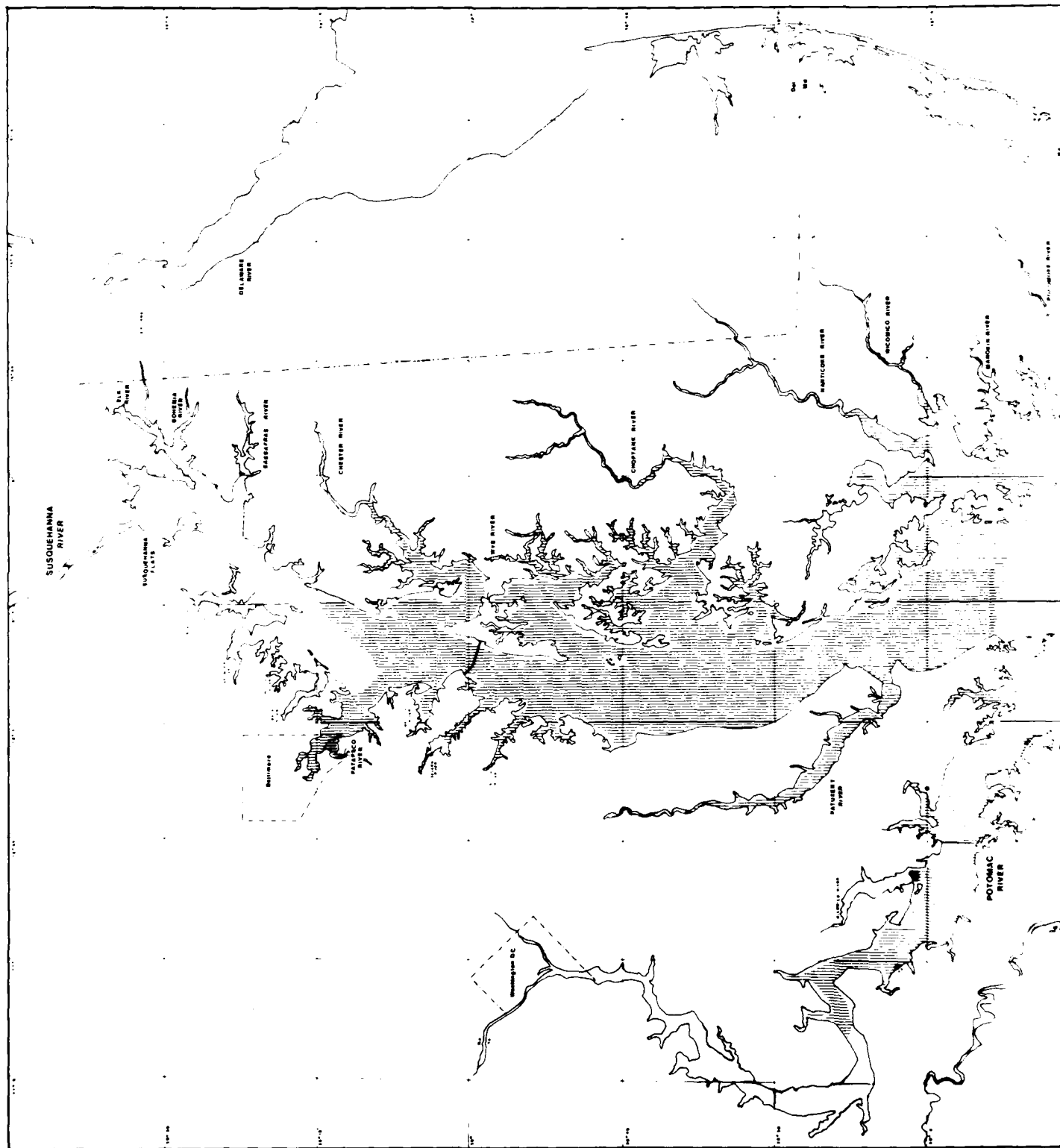


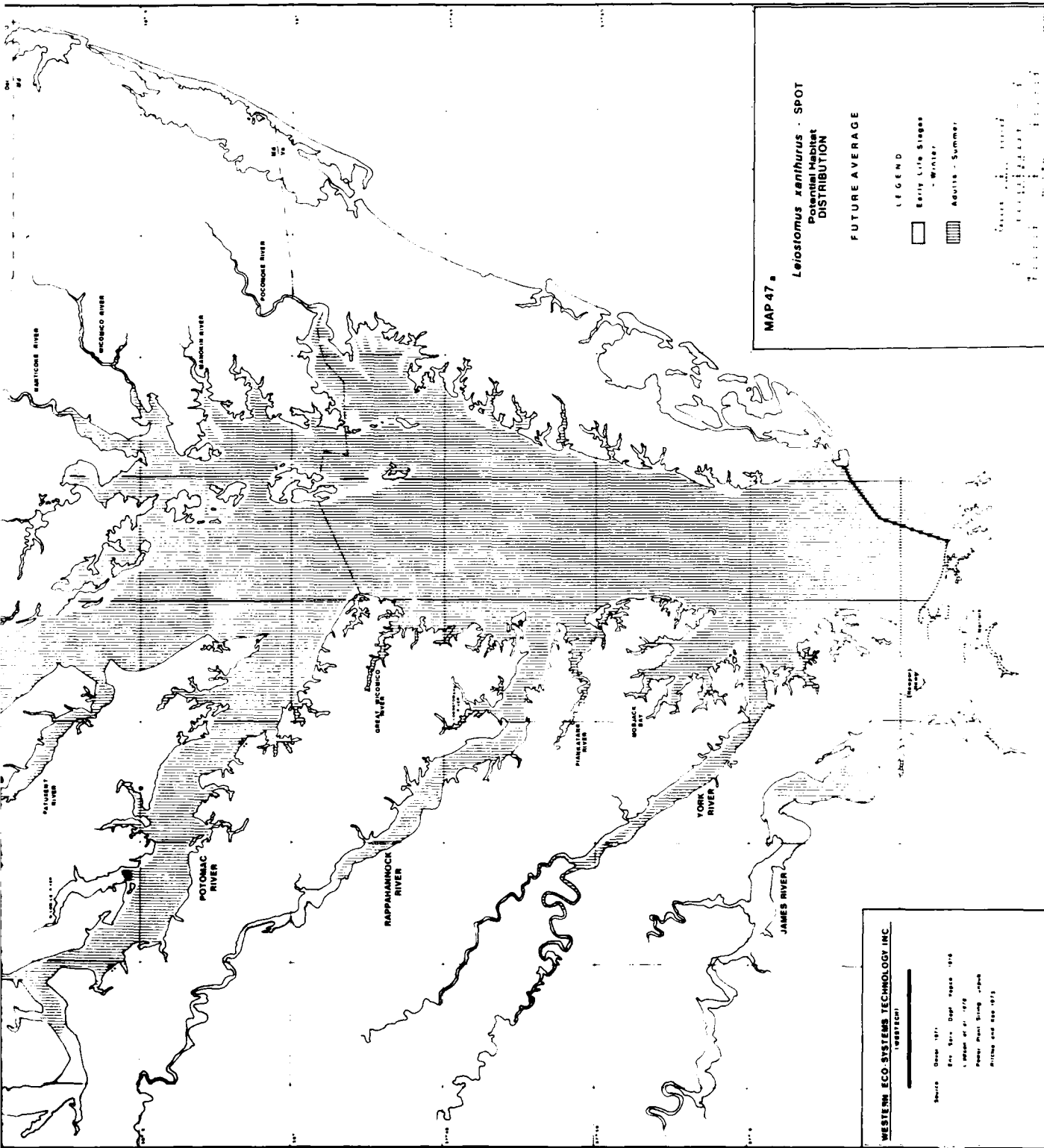


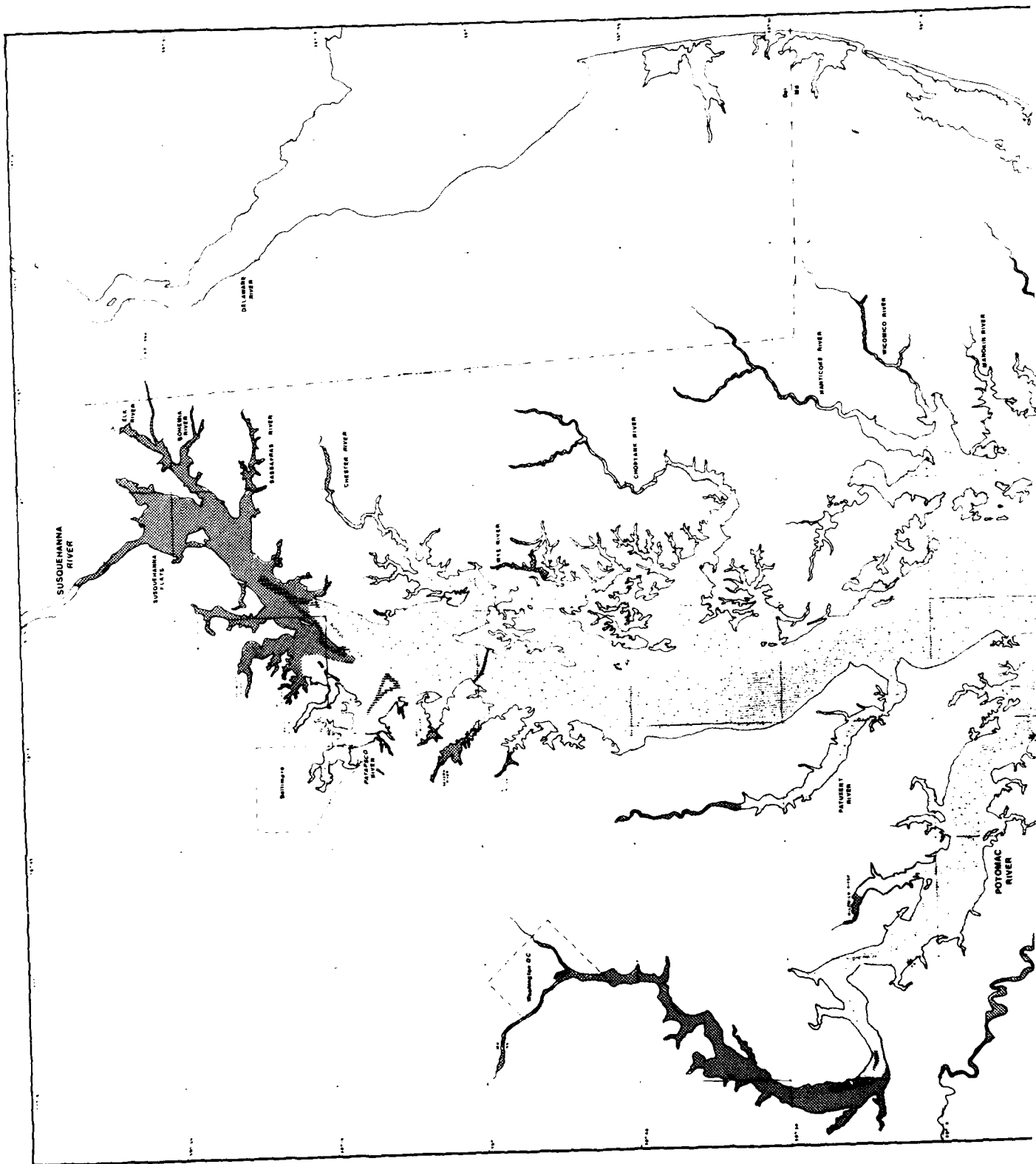


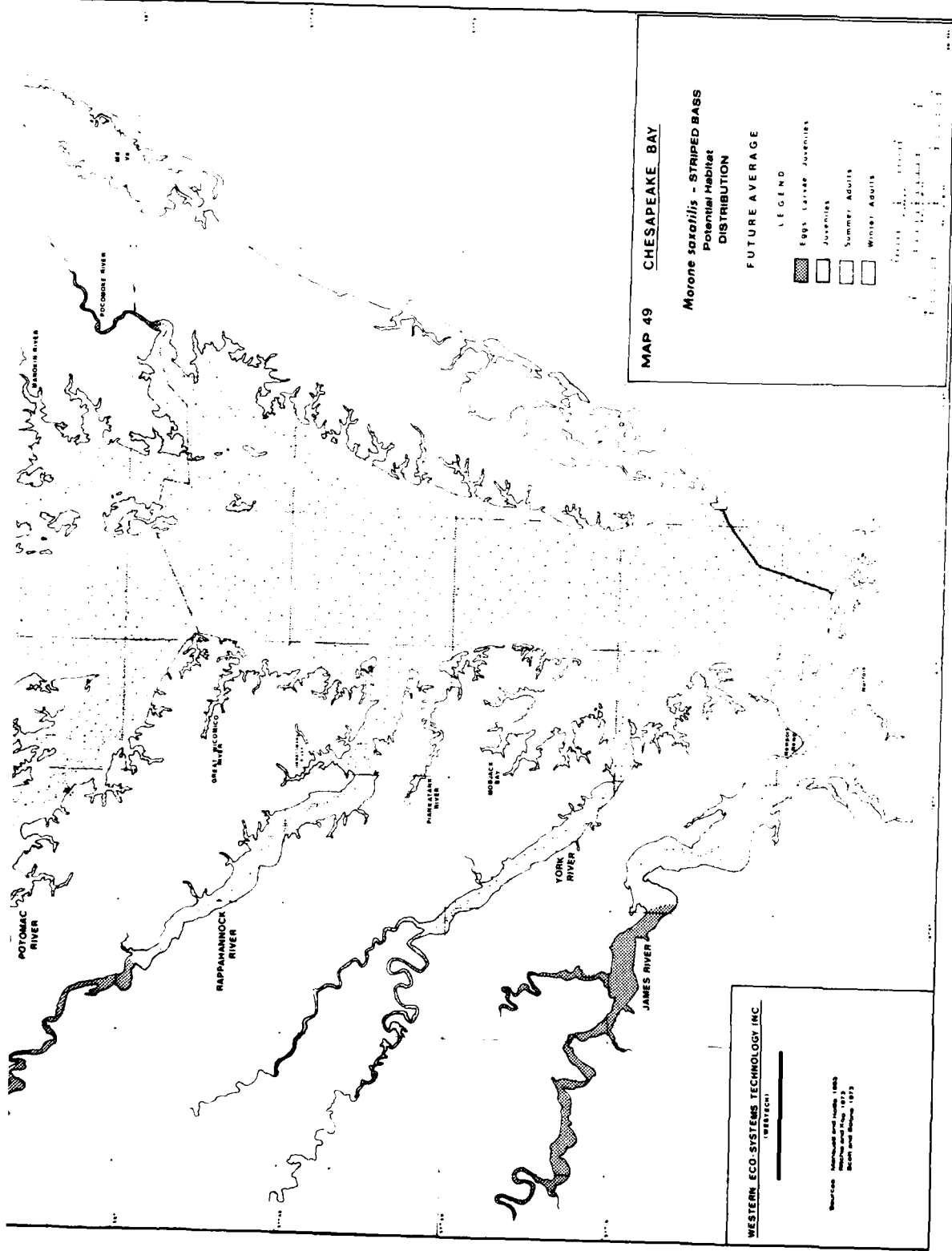












MAP 49 CHESAPEAKE BAY

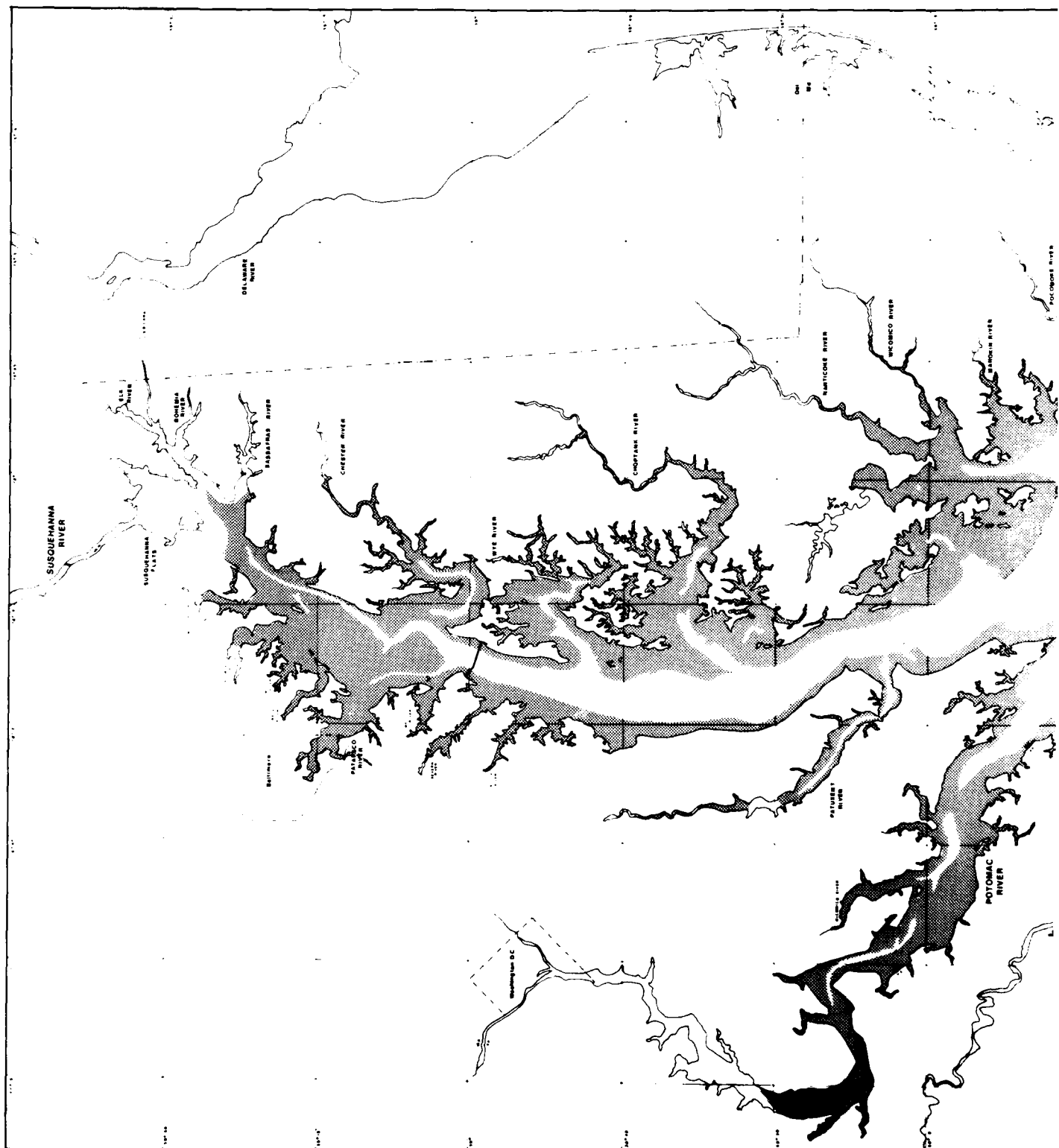
Morone saxatilis - STRIPED BASS
Potential Habitat
DISTRIBUTION

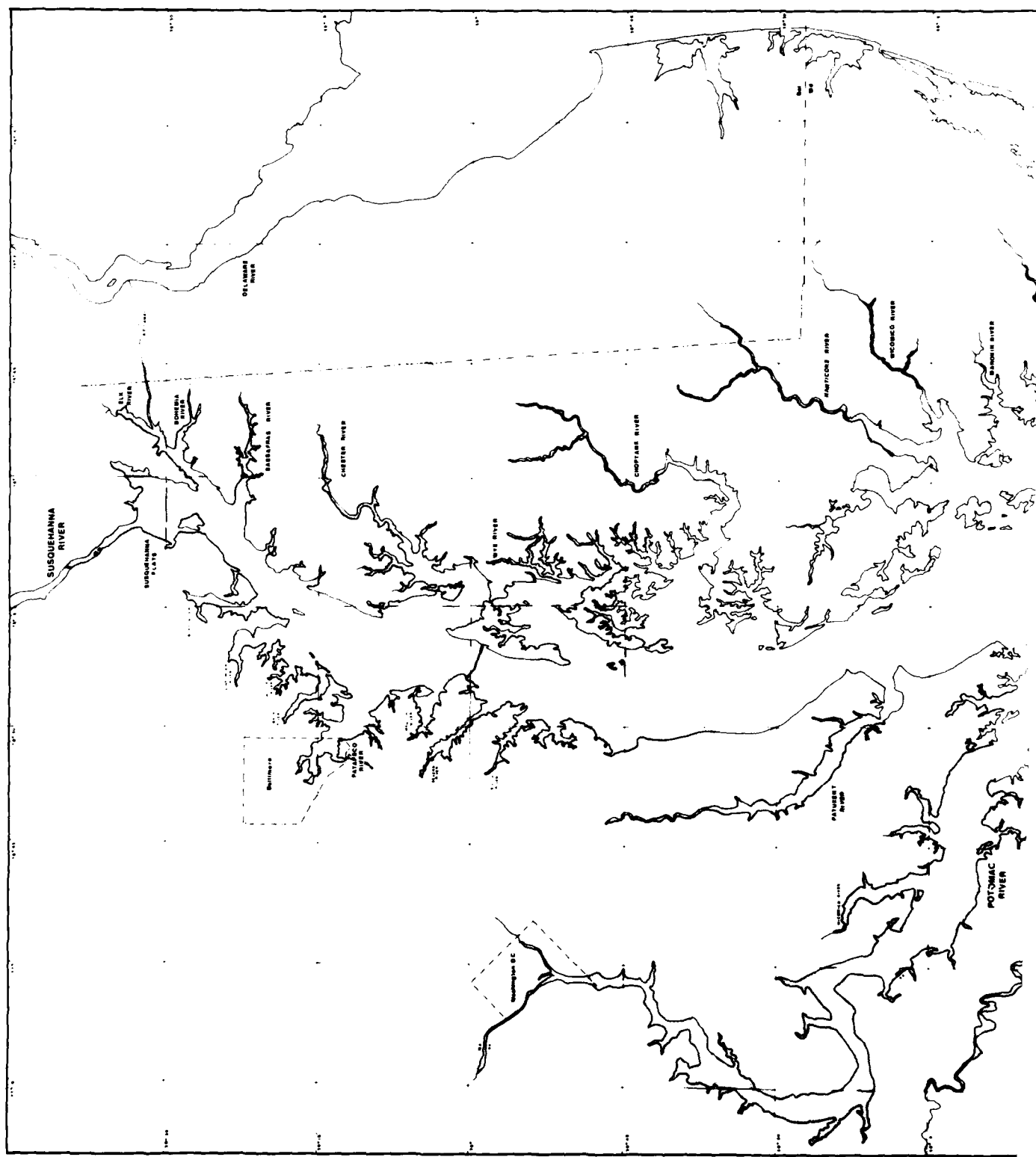
FUTURE AVERAGE

- LEGEND
- Eggs/Larvae/Juveniles
 - Juveniles
 - Summer Adults
 - Winter Adults

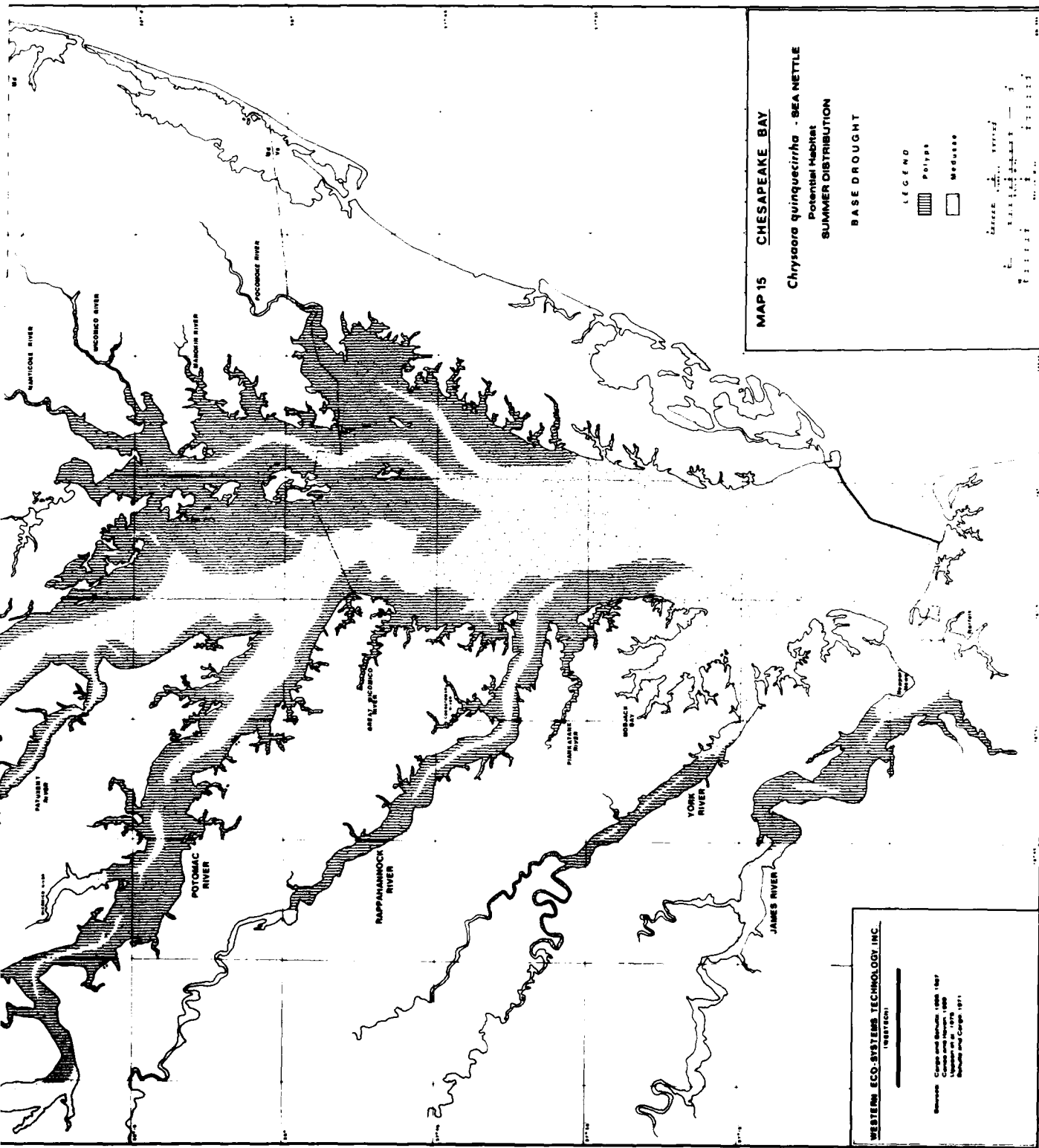
WESTERN ECO-SYSTEMS TECHNOLOGY INC.
(WESTECH)

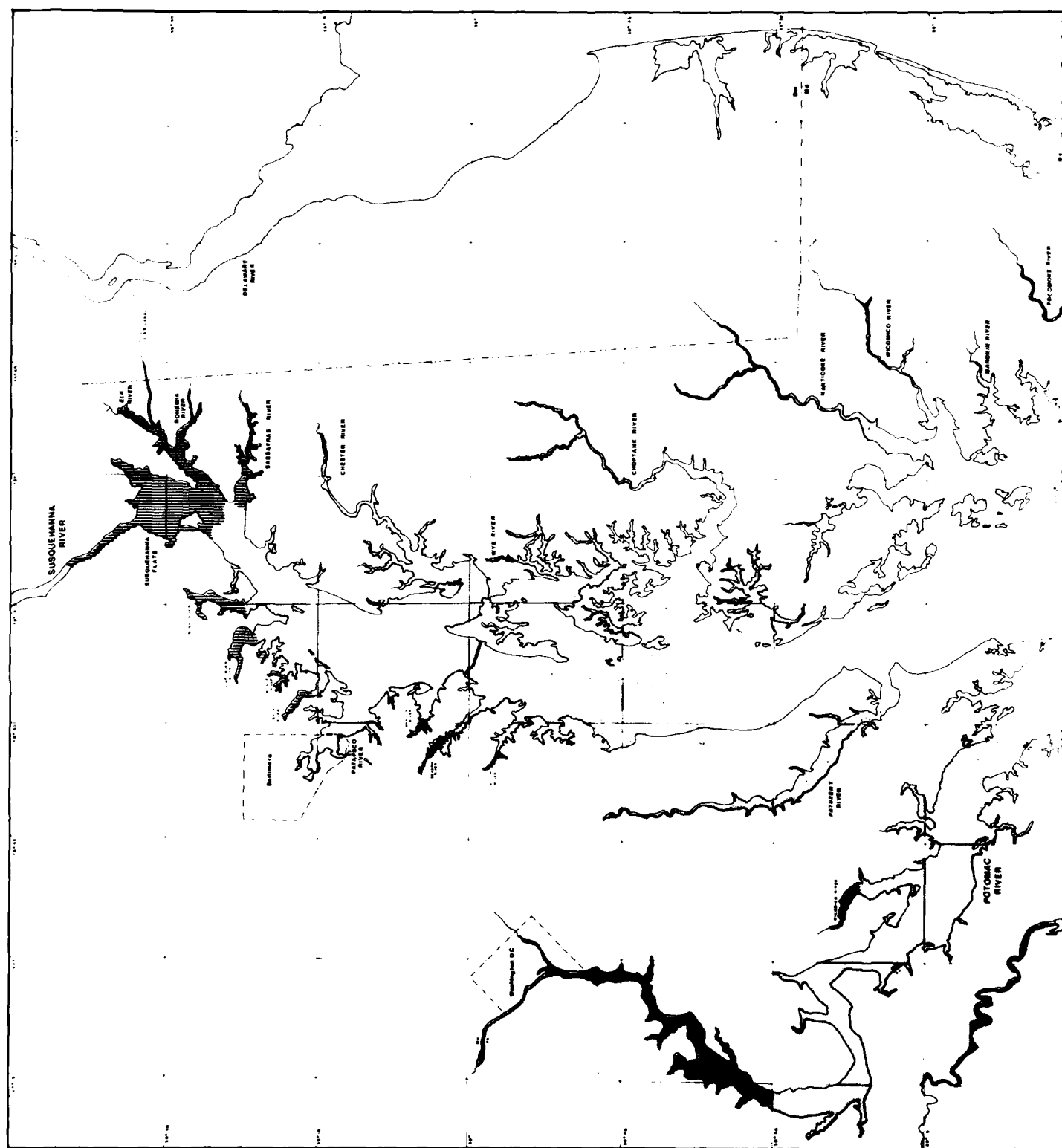
Source: Maryland and Virginia
Department of Natural Resources
Biology and Fisheries, 1973

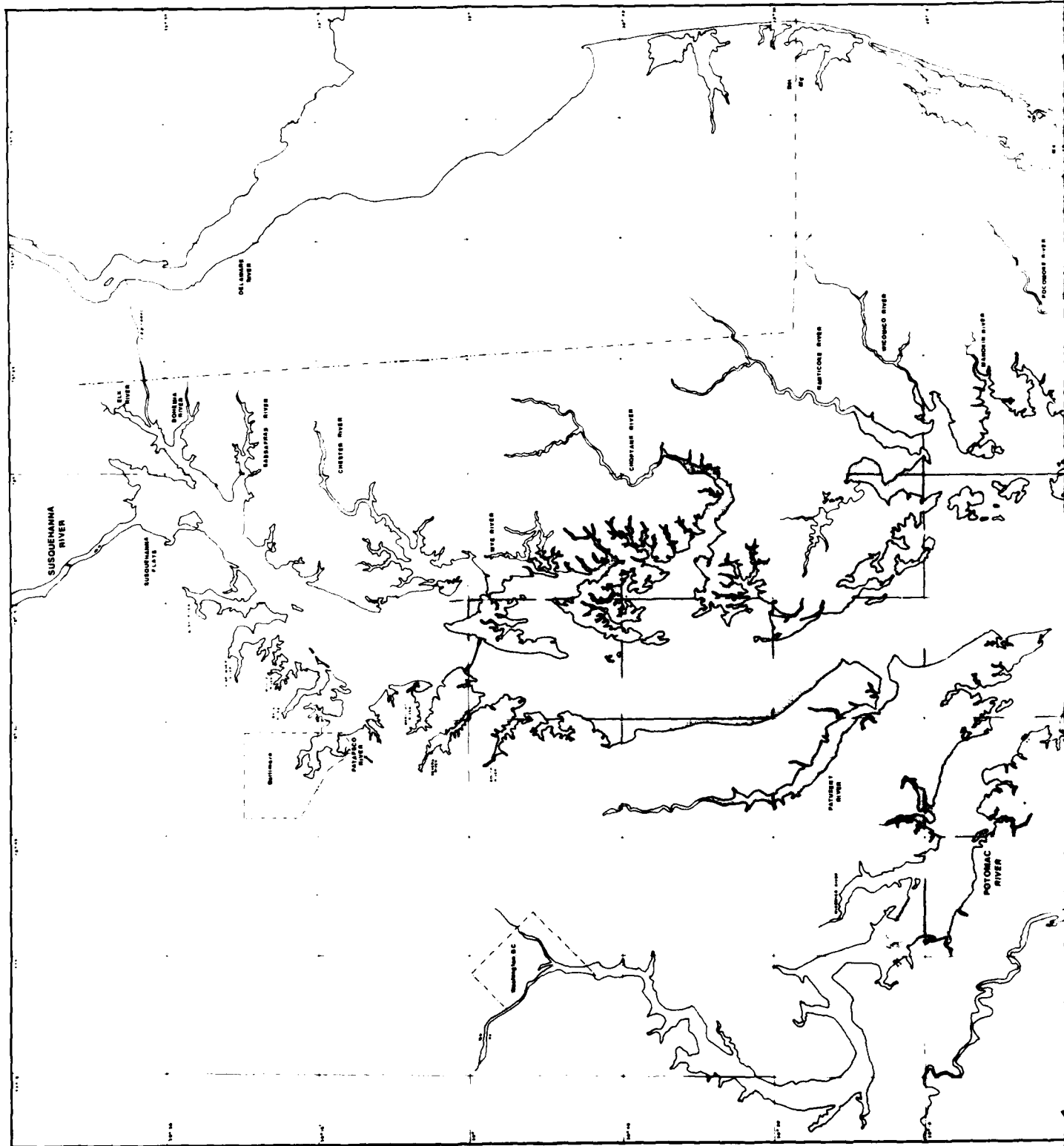


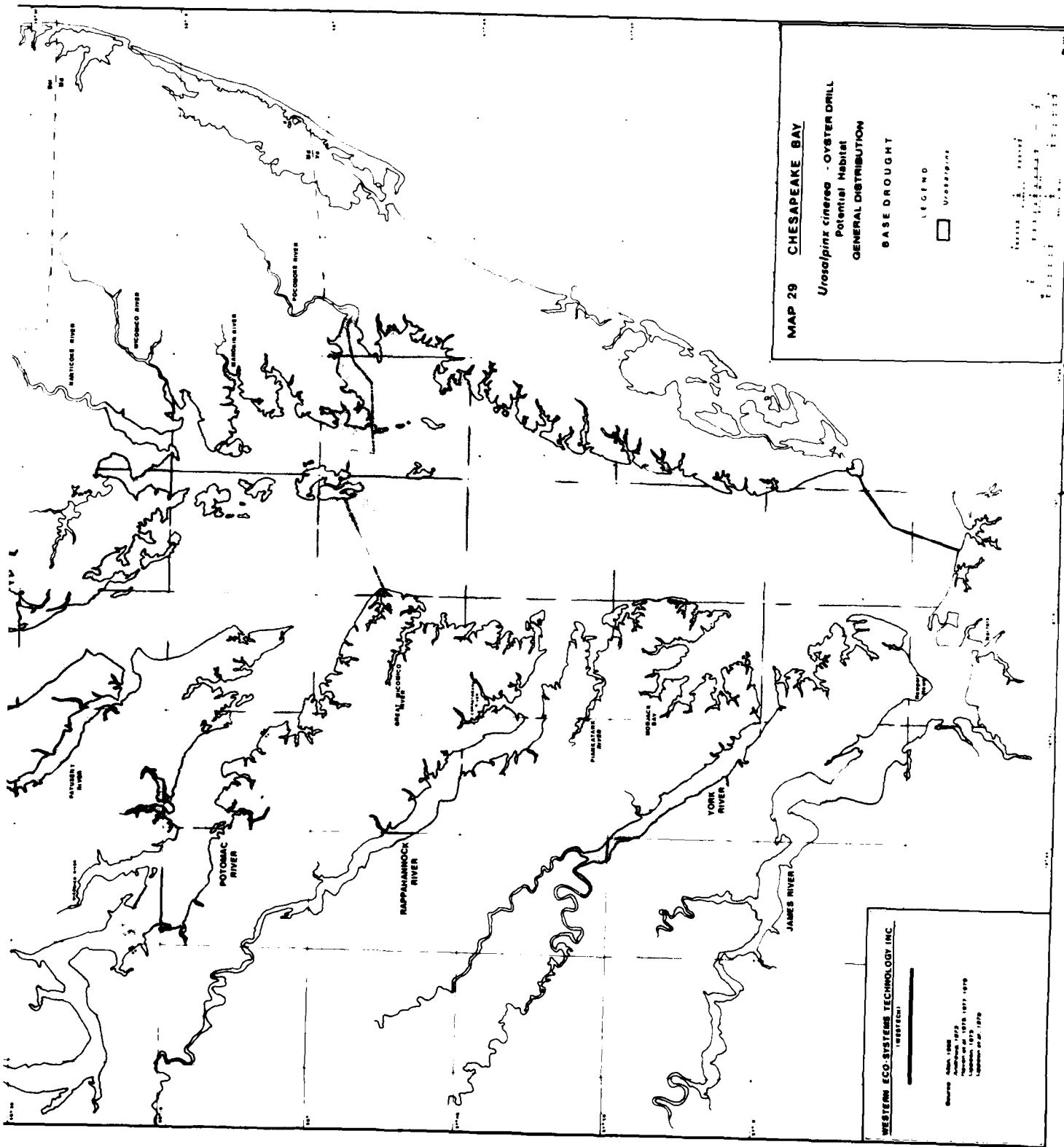


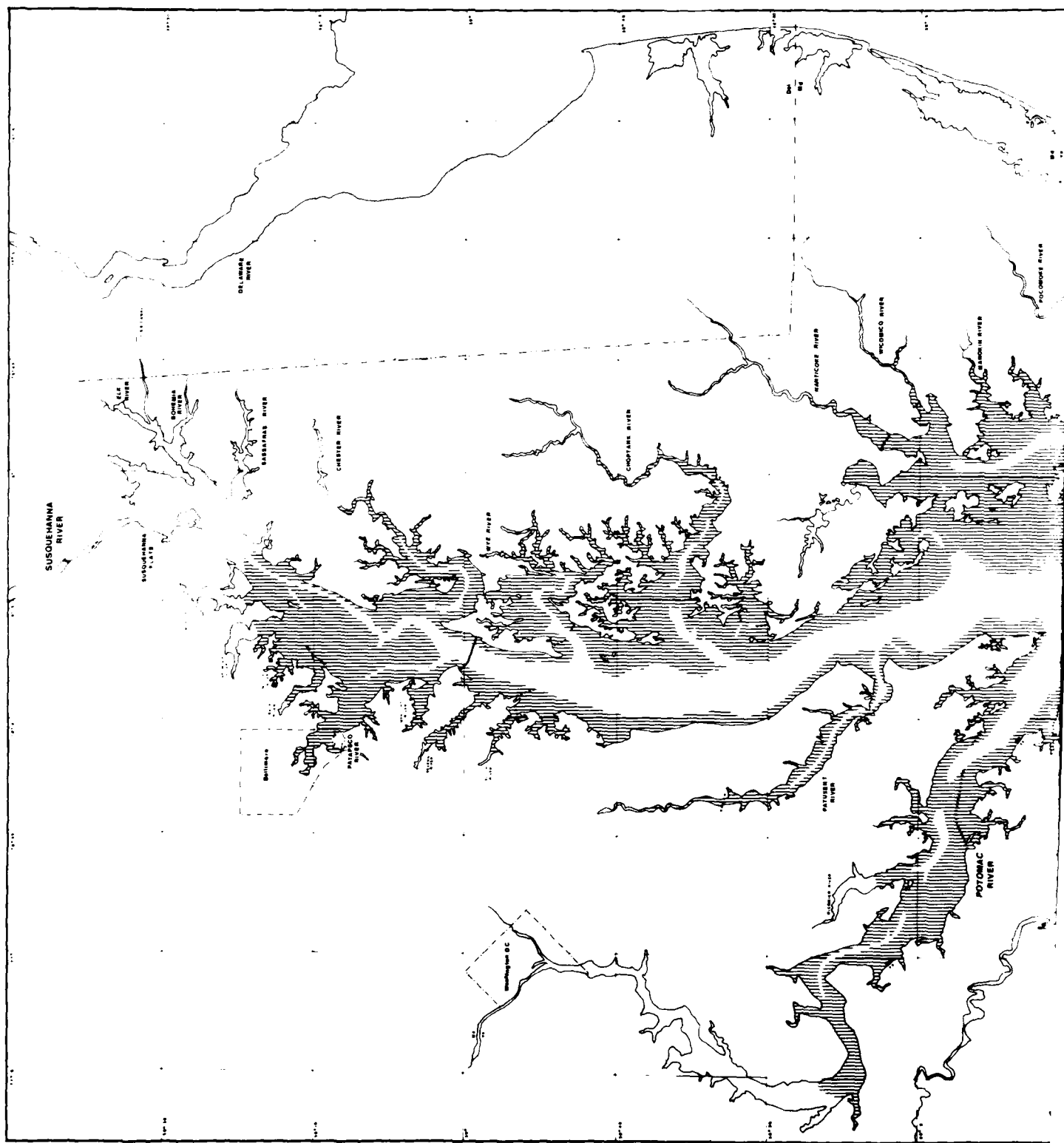


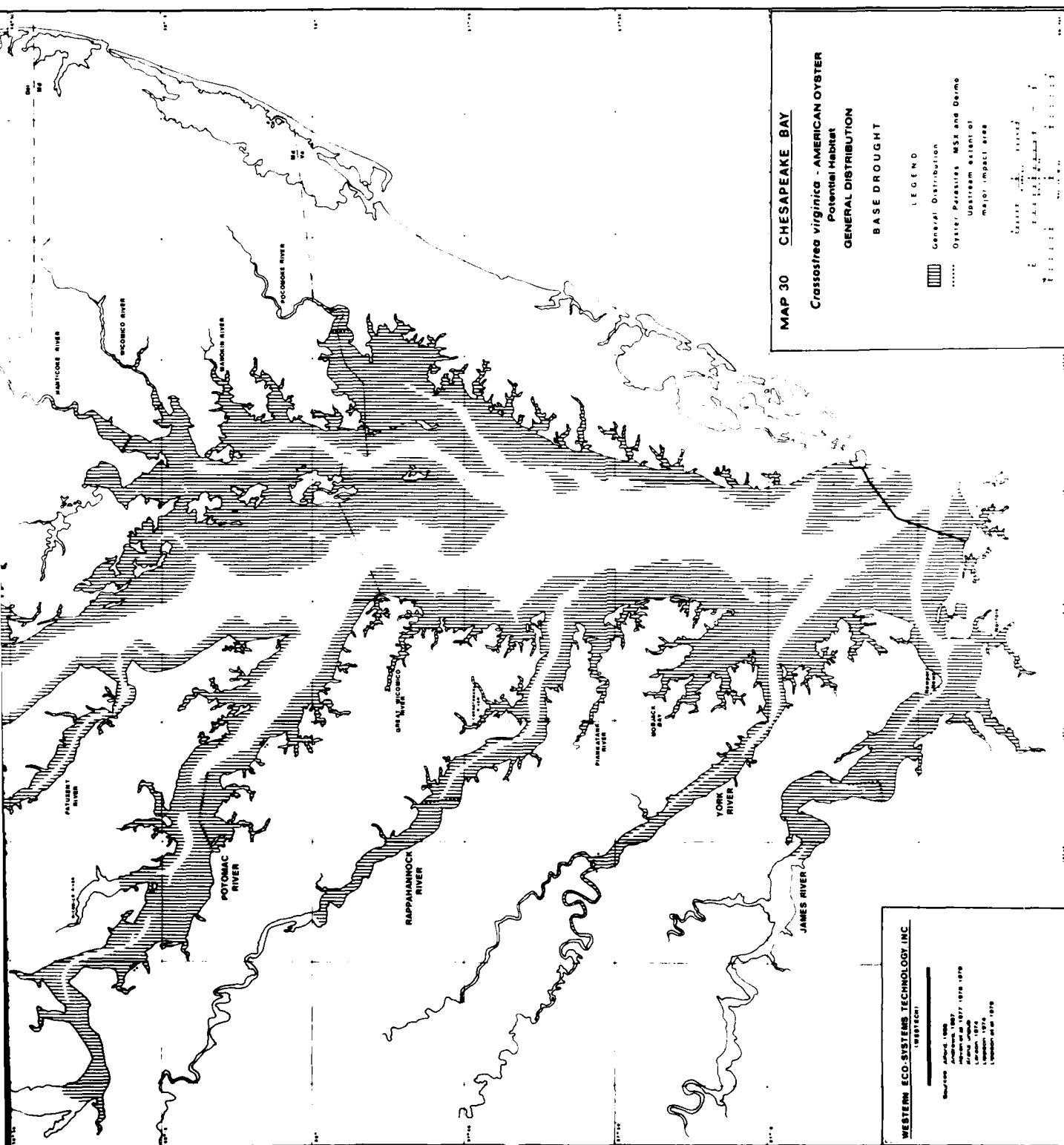


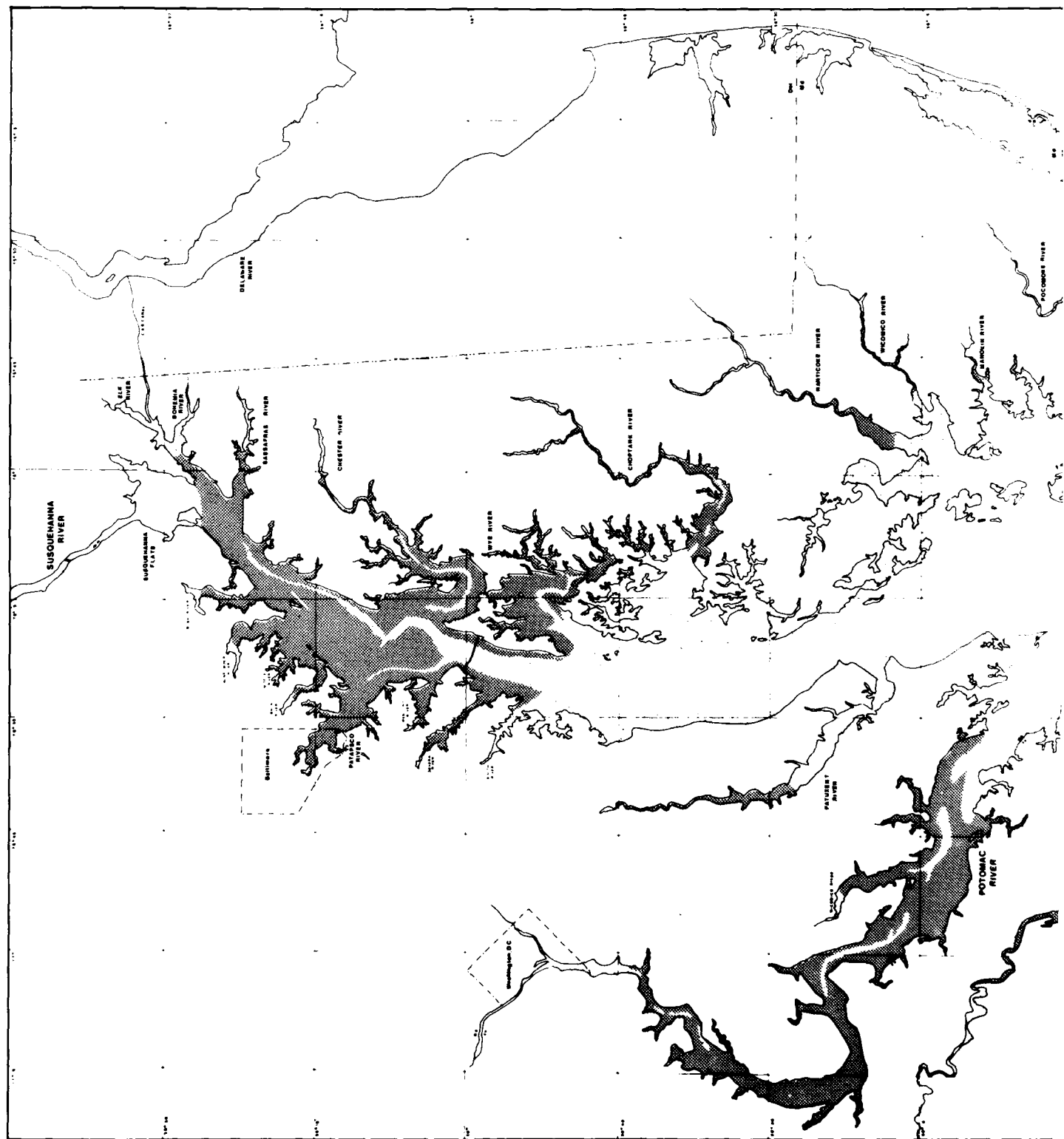


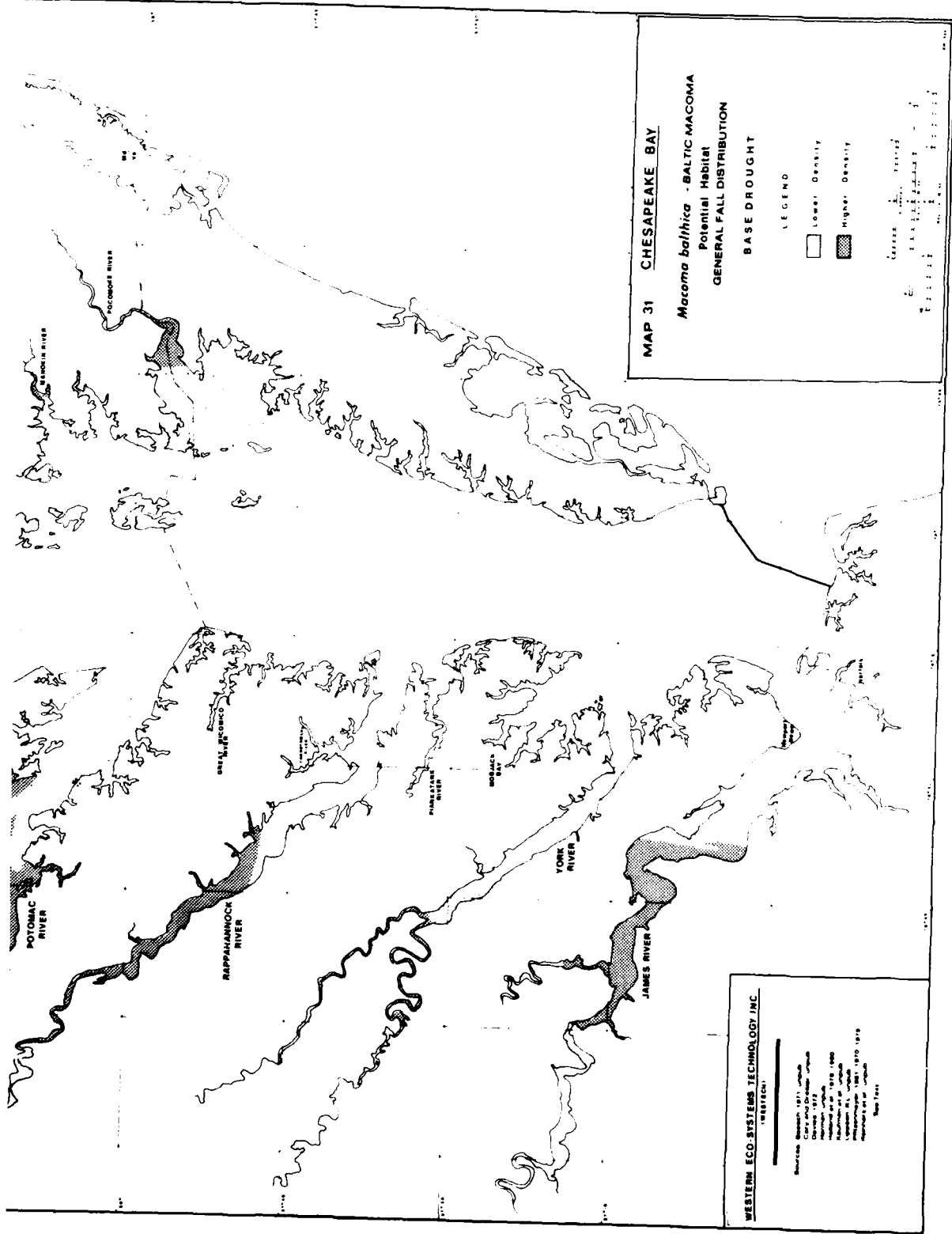


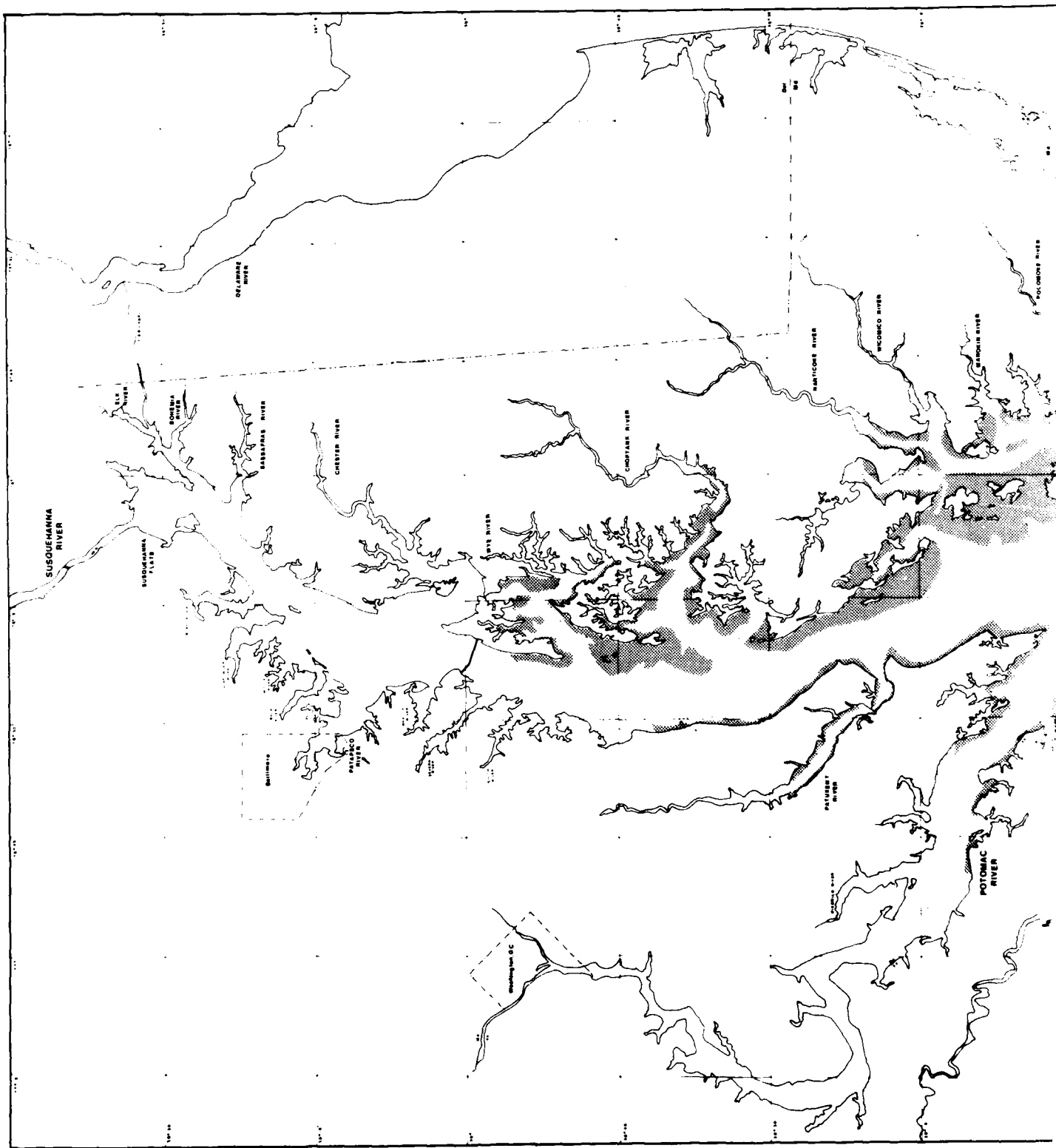


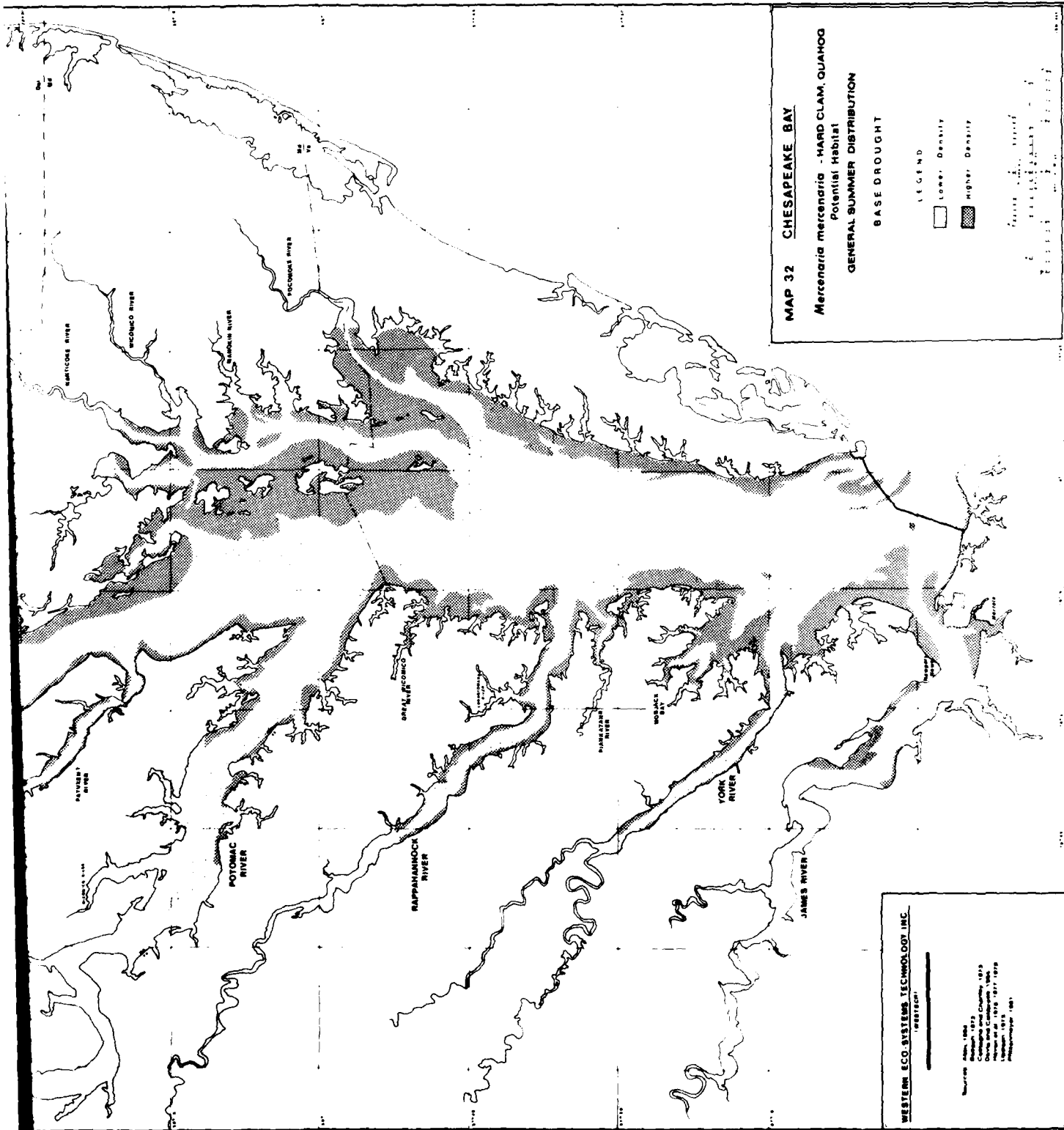




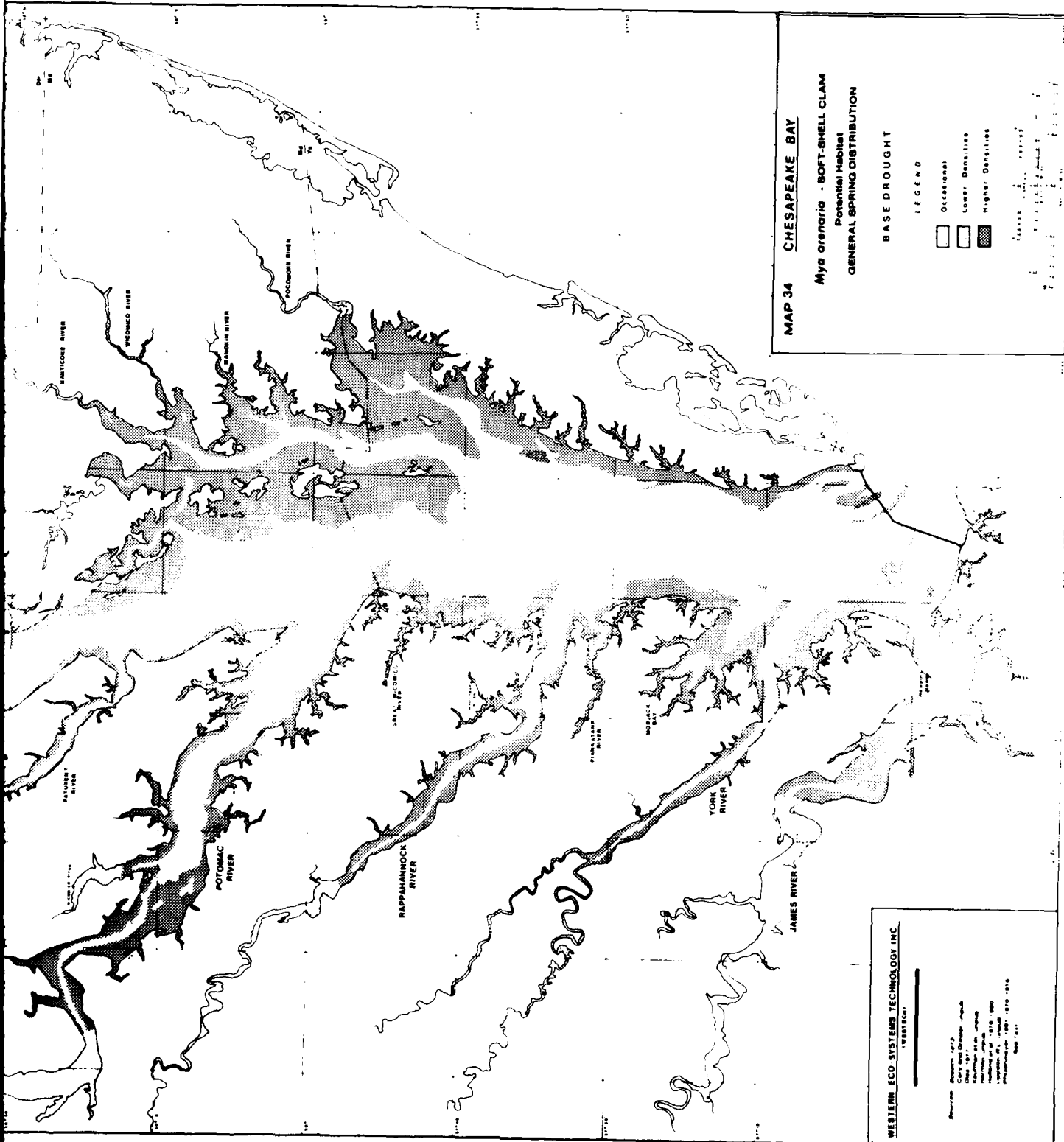








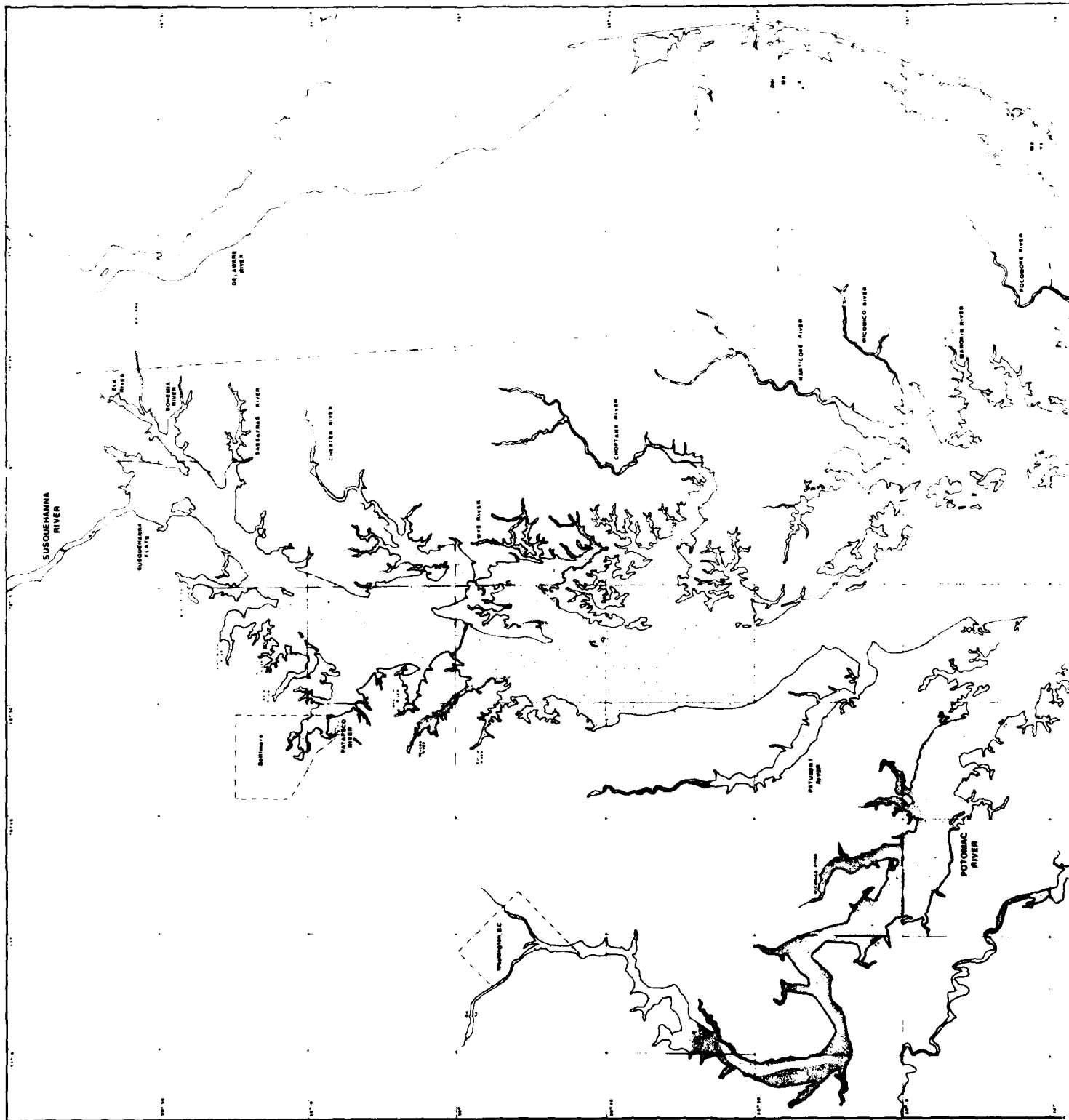


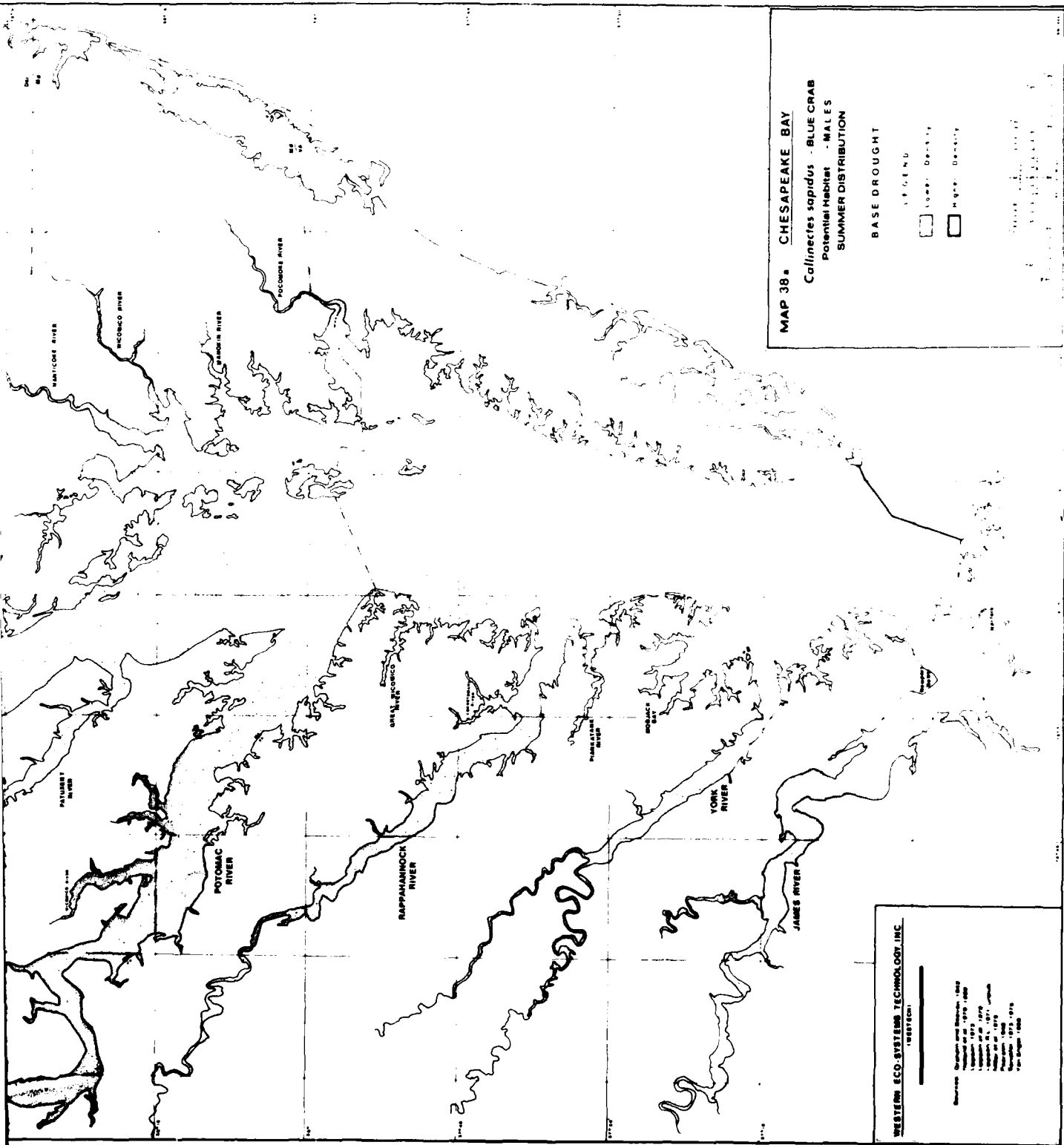


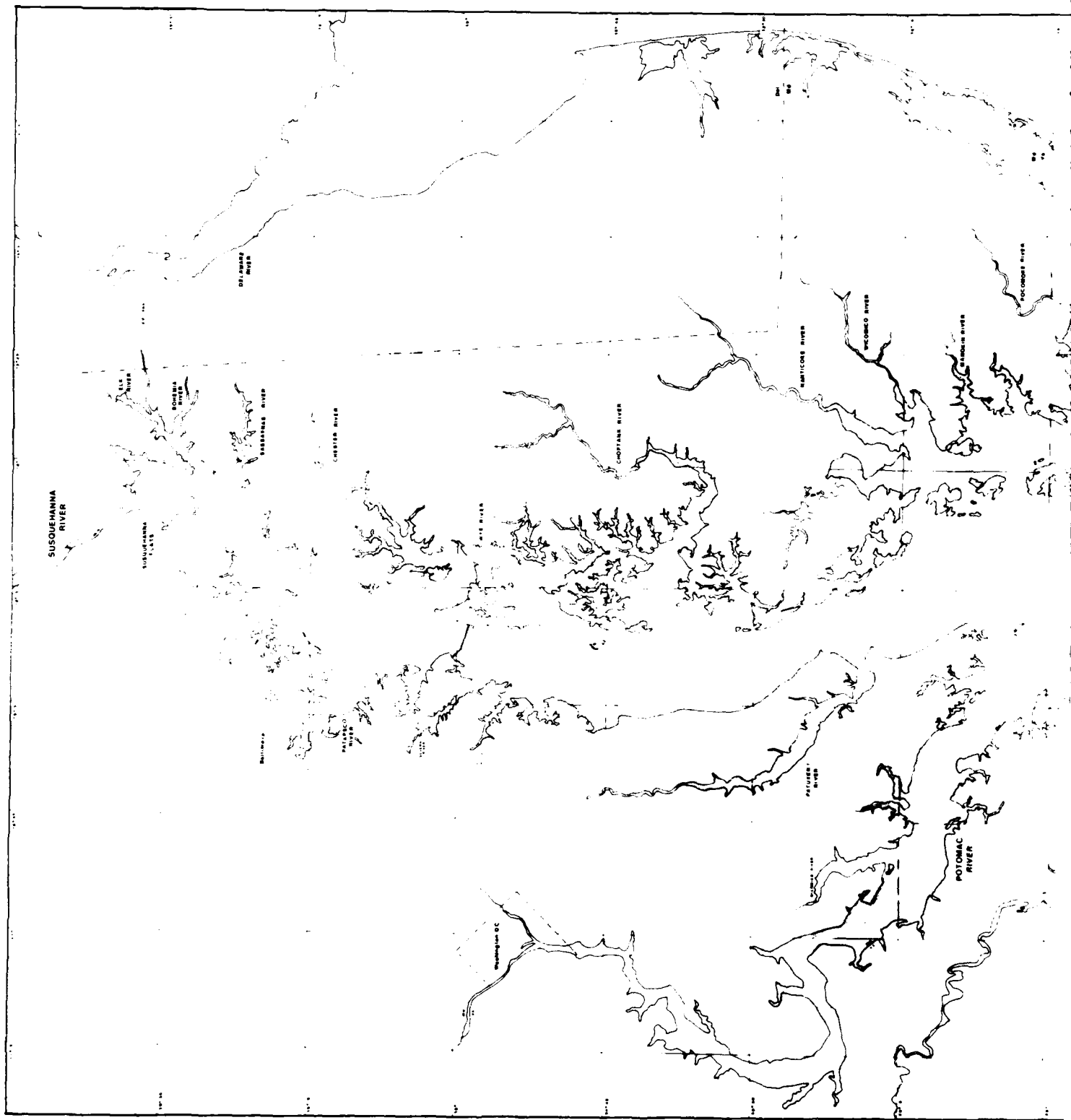
MAP 34 CHESAPEAKE BAY
Mya arenaria - SOFT-SHELL CLAM
 Potential Habitat
 GENERAL SPRING DISTRIBUTION

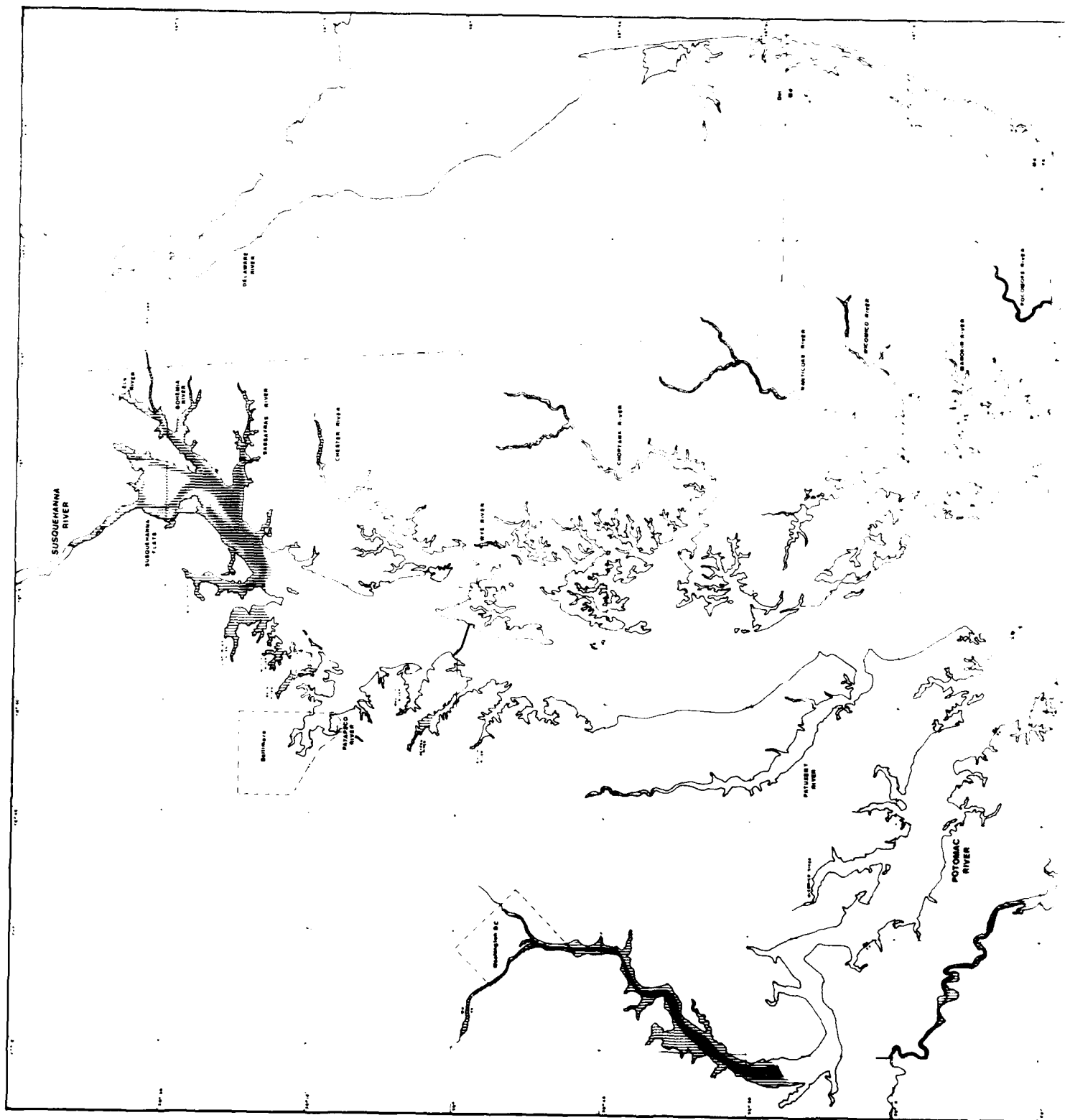
BASE DROUGHT
 LEGEND
 Occasional
 Lower Densities
 Higher Densities

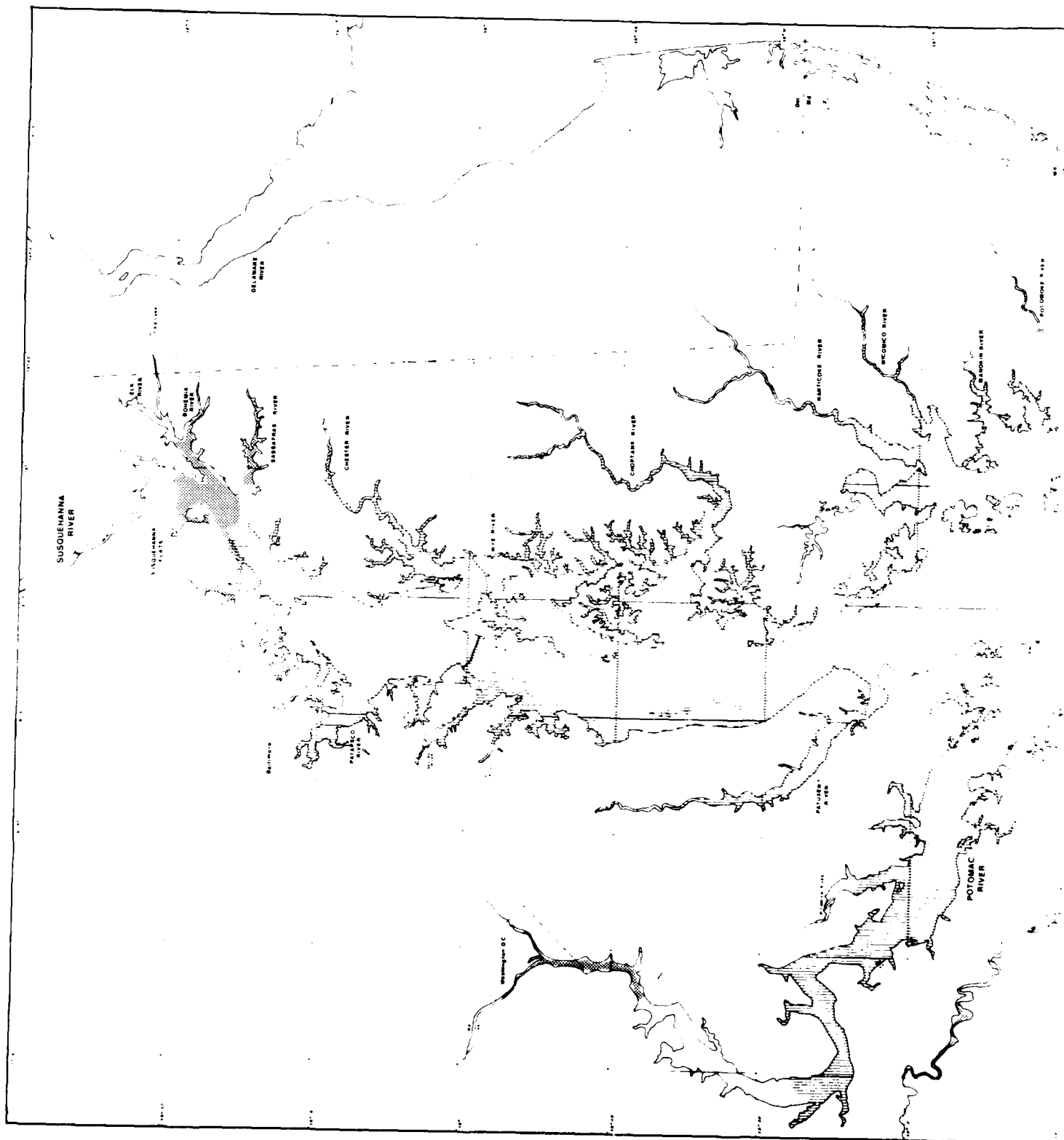
WESTERN ECO-SYSTEMS TECHNOLOGY INC.
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 REGIONAL
 CORP AND DESIGN GROUP
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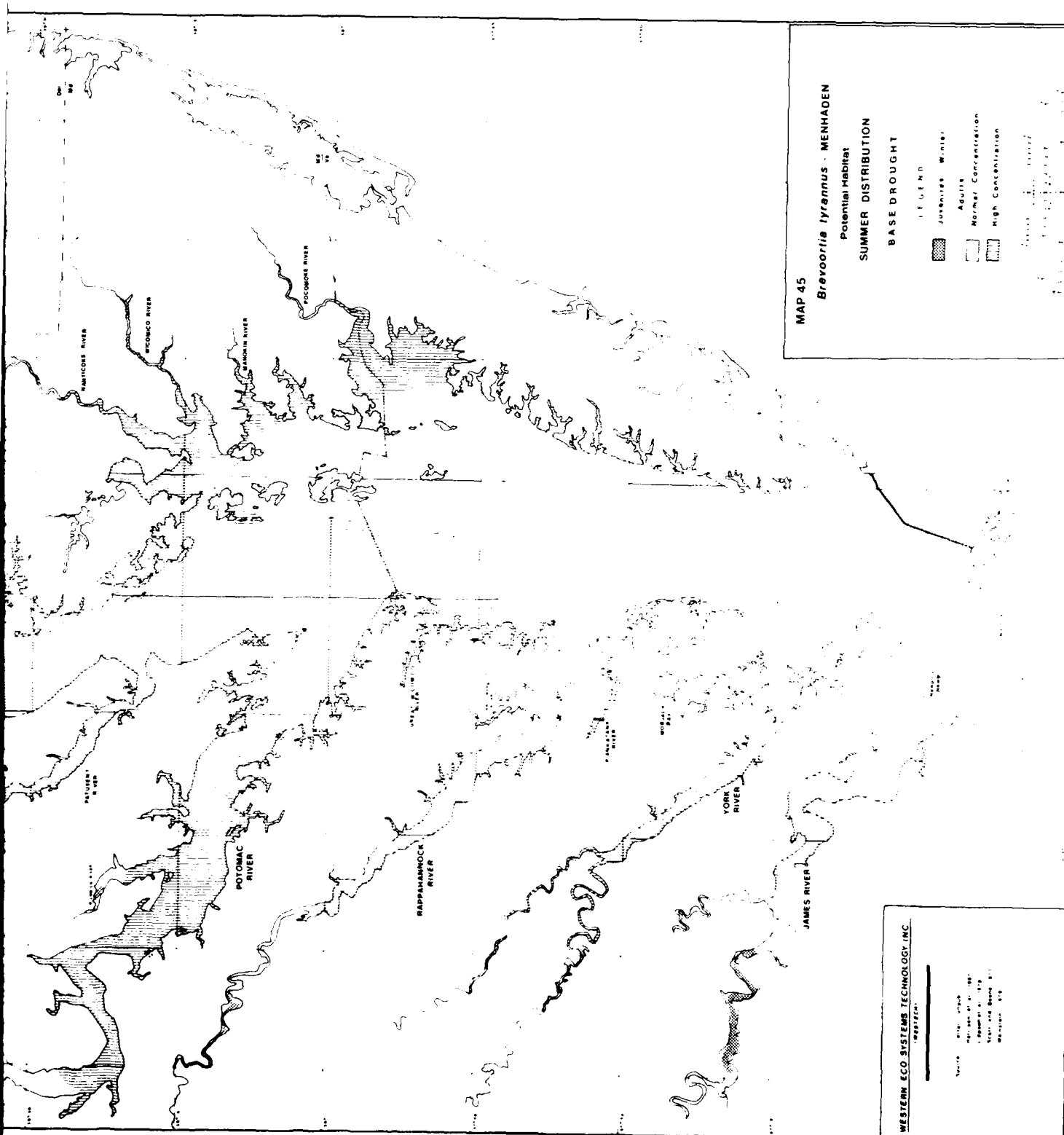












MAP 45
Brevoortia tyrannus - MENHADEN
 Potential Habitat
 SUMMER DISTRIBUTION

BASE DROUGHT

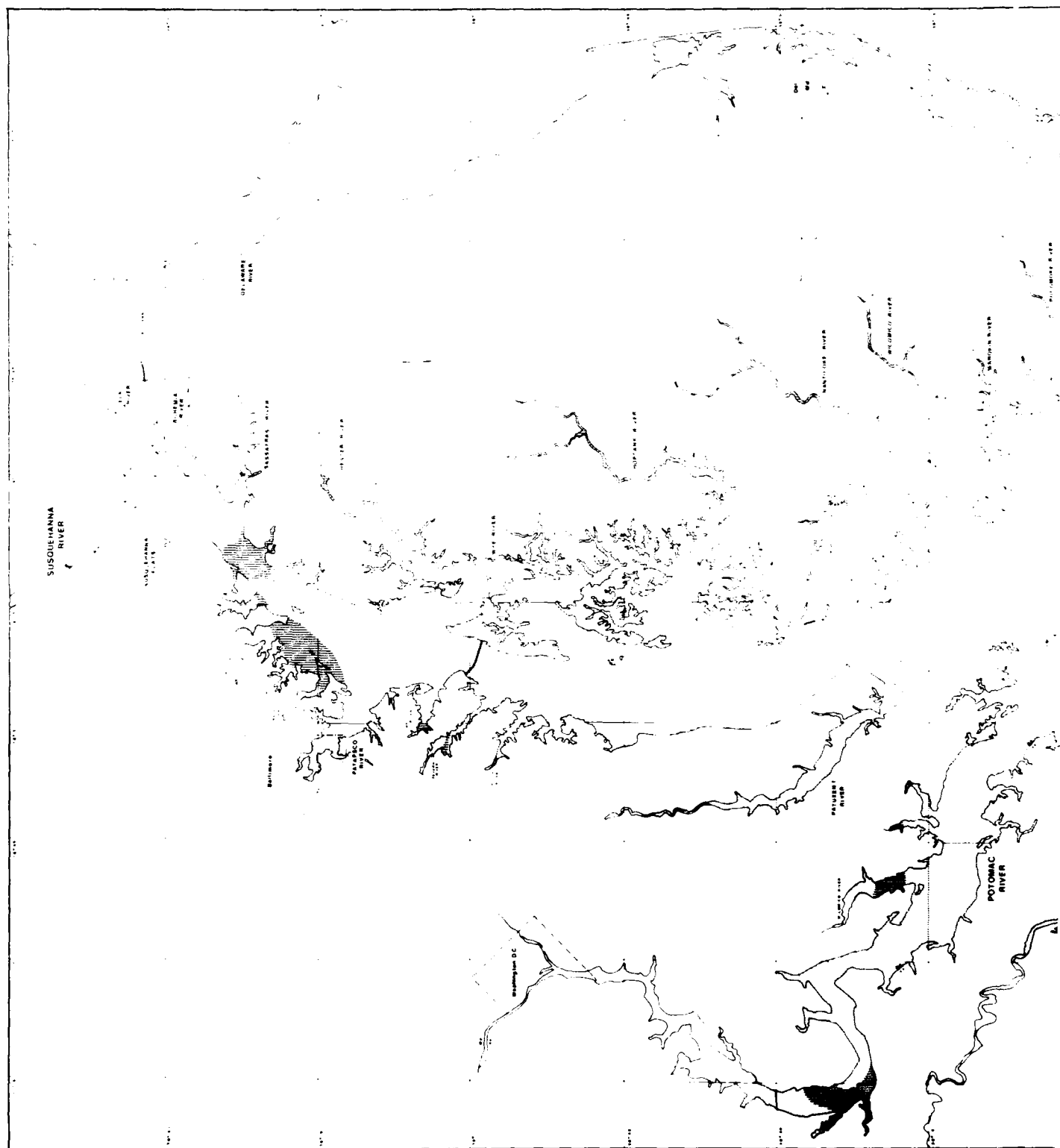
LEGEND

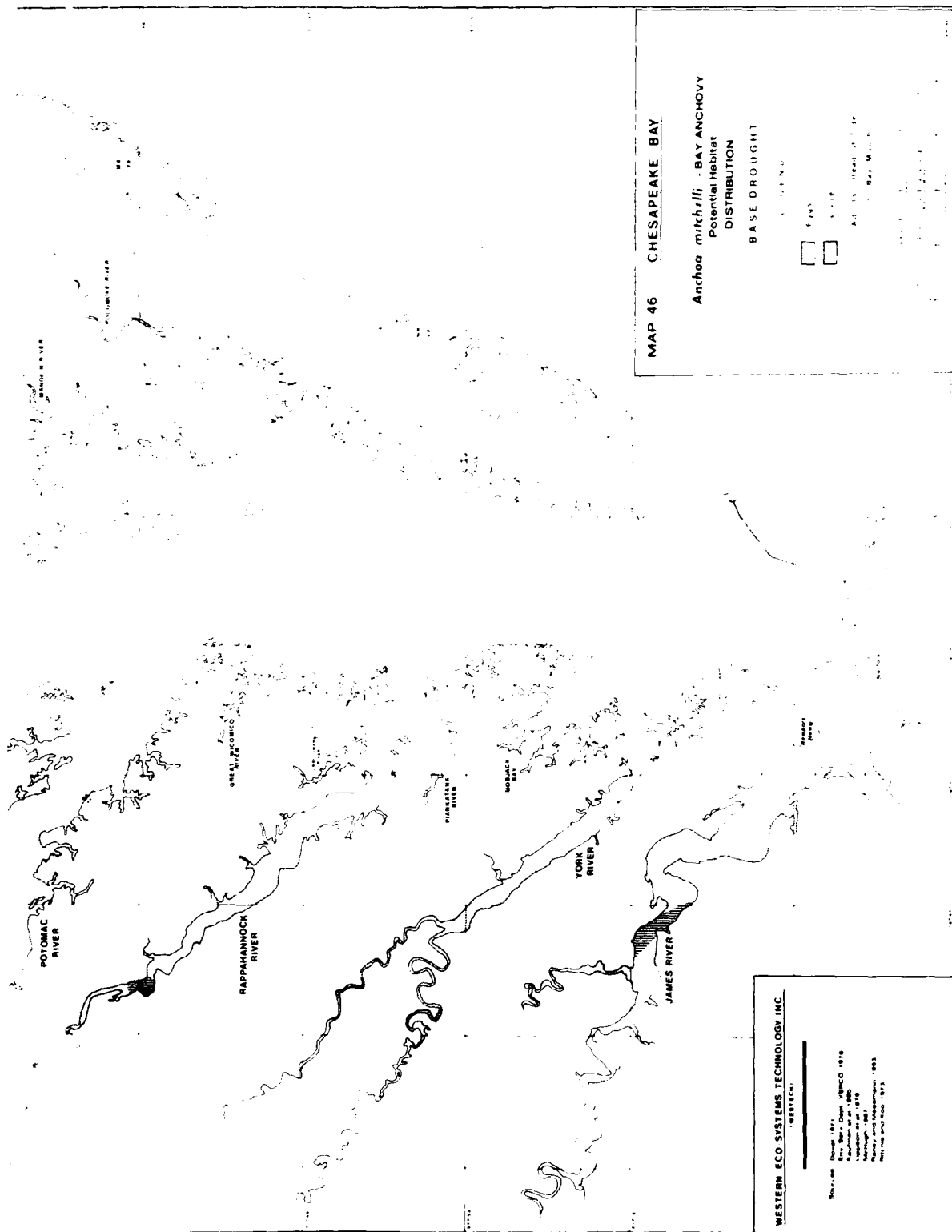
	Juveniles	Winter
	Adults	Normal Concentration
		High Concentration

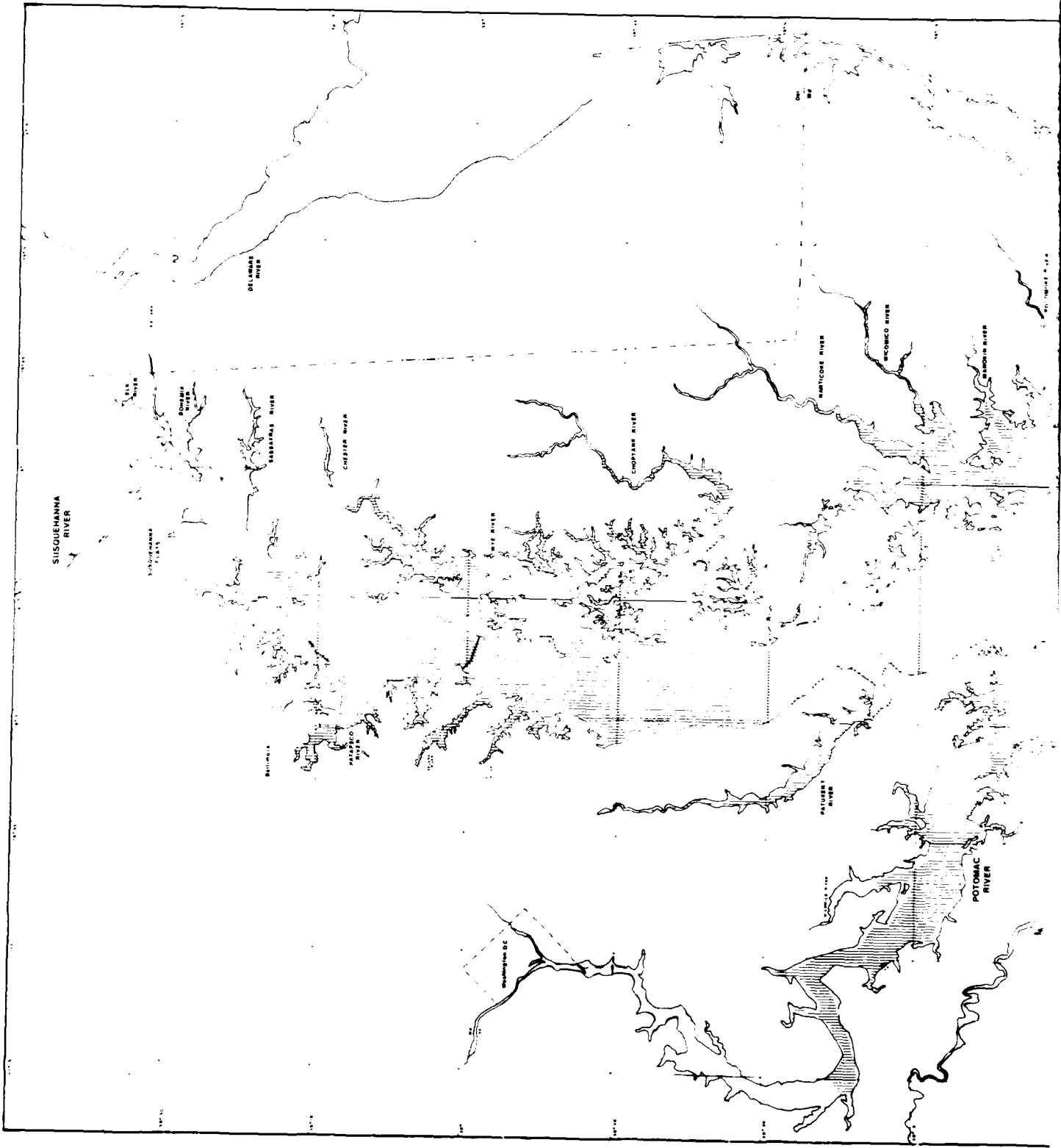
Scale: 0 10 20 Miles
 0 10 20 Kilometers

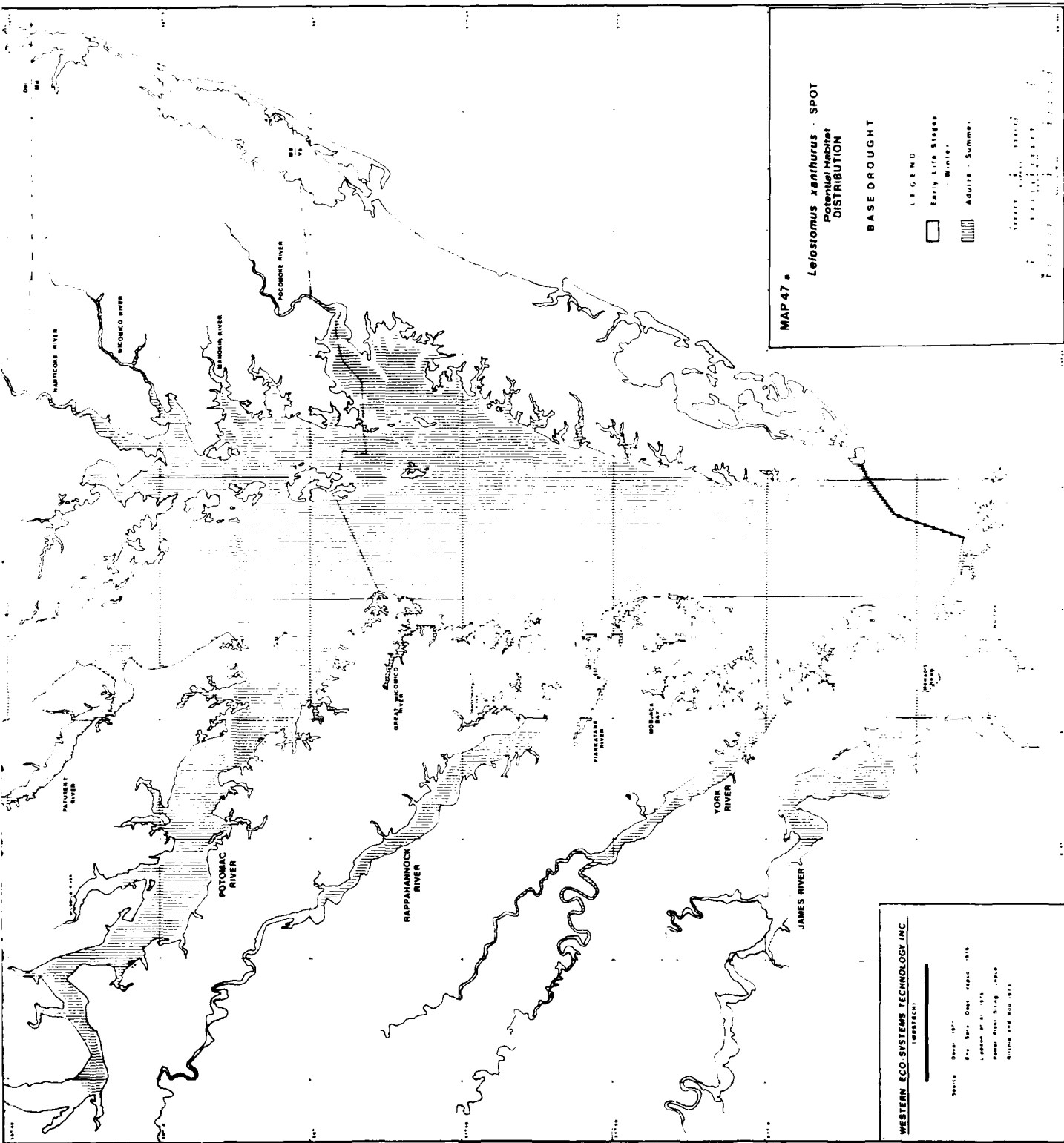
WESTERN ECO SYSTEMS TECHNOLOGY INC.
 1989-1990

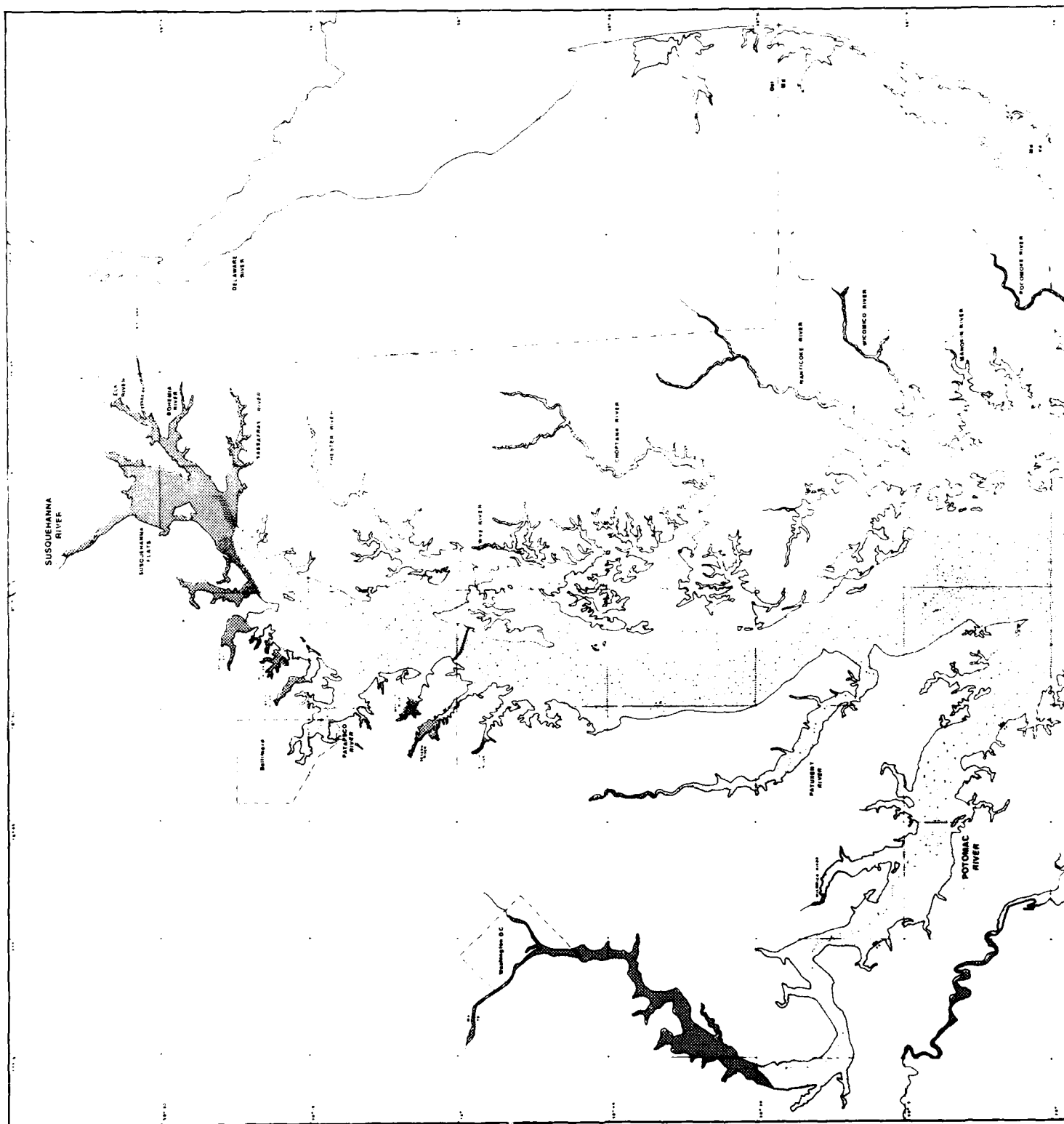
Map 45: 1989-1990
 Map 46: 1991-1992
 Map 47: 1993-1994
 Map 48: 1995-1996
 Map 49: 1997-1998
 Map 50: 1999-2000

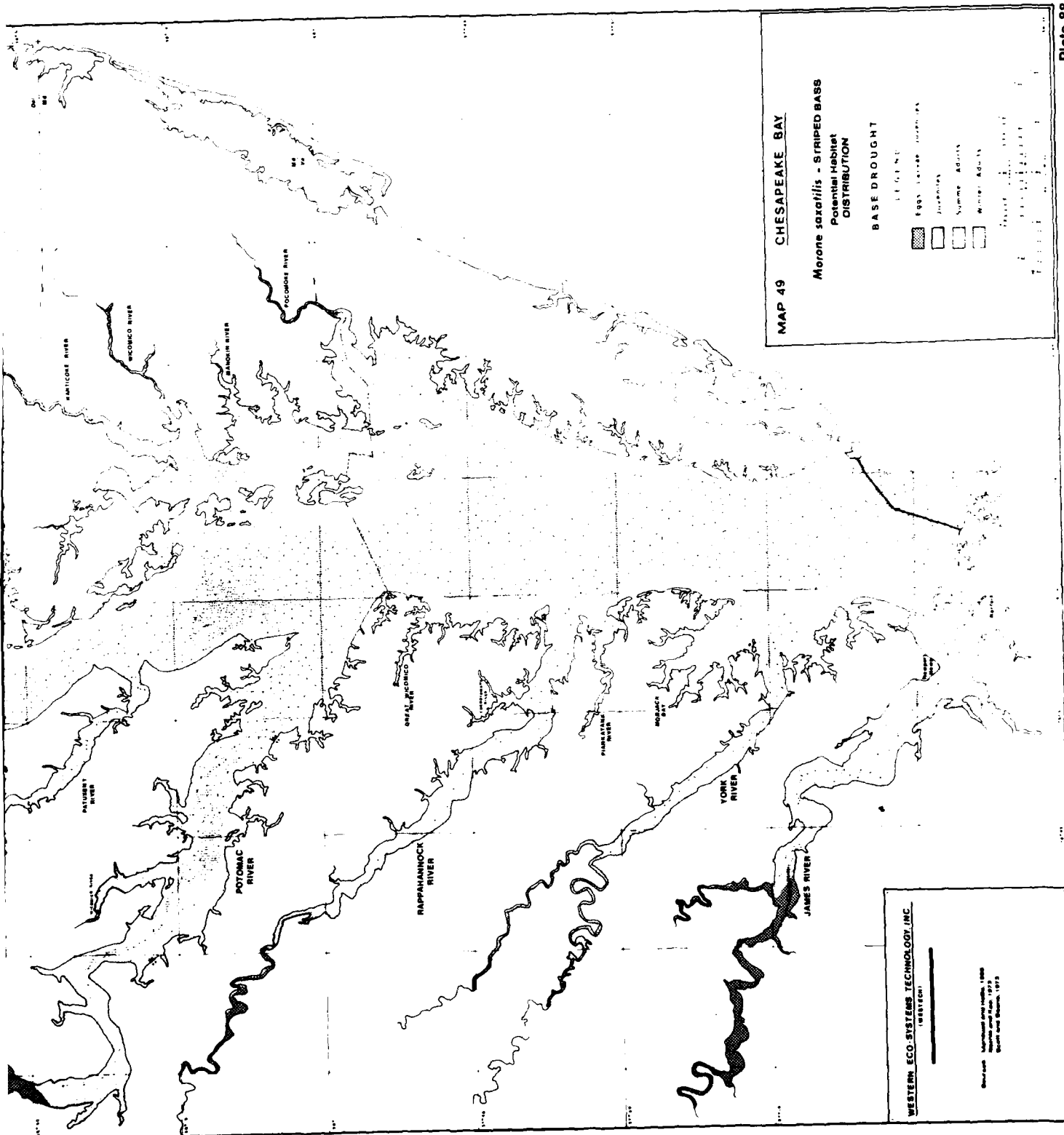












MAP 49 CHESAPEAKE BAY

Morone saxatilis - STRIPED BASS
Potential Habitat
DISTRIBUTION

BASE DROUGHT

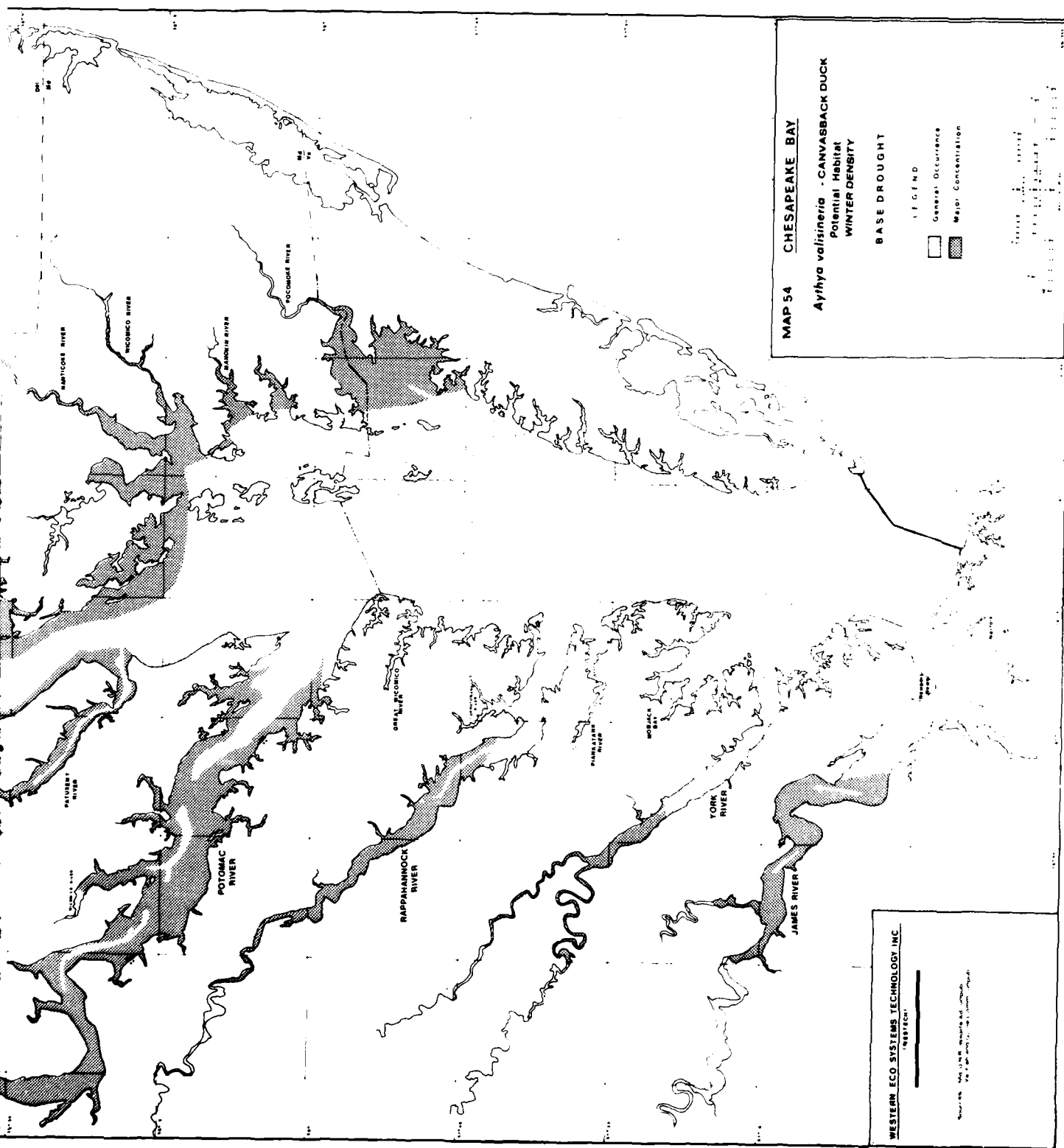
LEGEND

- Eggs (dark stippled)
- Juveniles (light stippled)
- Summer Adults (white)
- Winter Adults (white with horizontal lines)

WESTERN ECO-SYSTEMS TECHNOLOGY INC.
(WESTECH)

Developed: September 1988
Revised and Published: 1993
Scale: 1:50,000





MAP 54 CHESAPEAKE BAY

***Aythya valisineria* - CANVASBACK DUCK**

Potential Habitat

WINTER DENSITY

BASE DROUGHT

LEGEND

General Occurrence

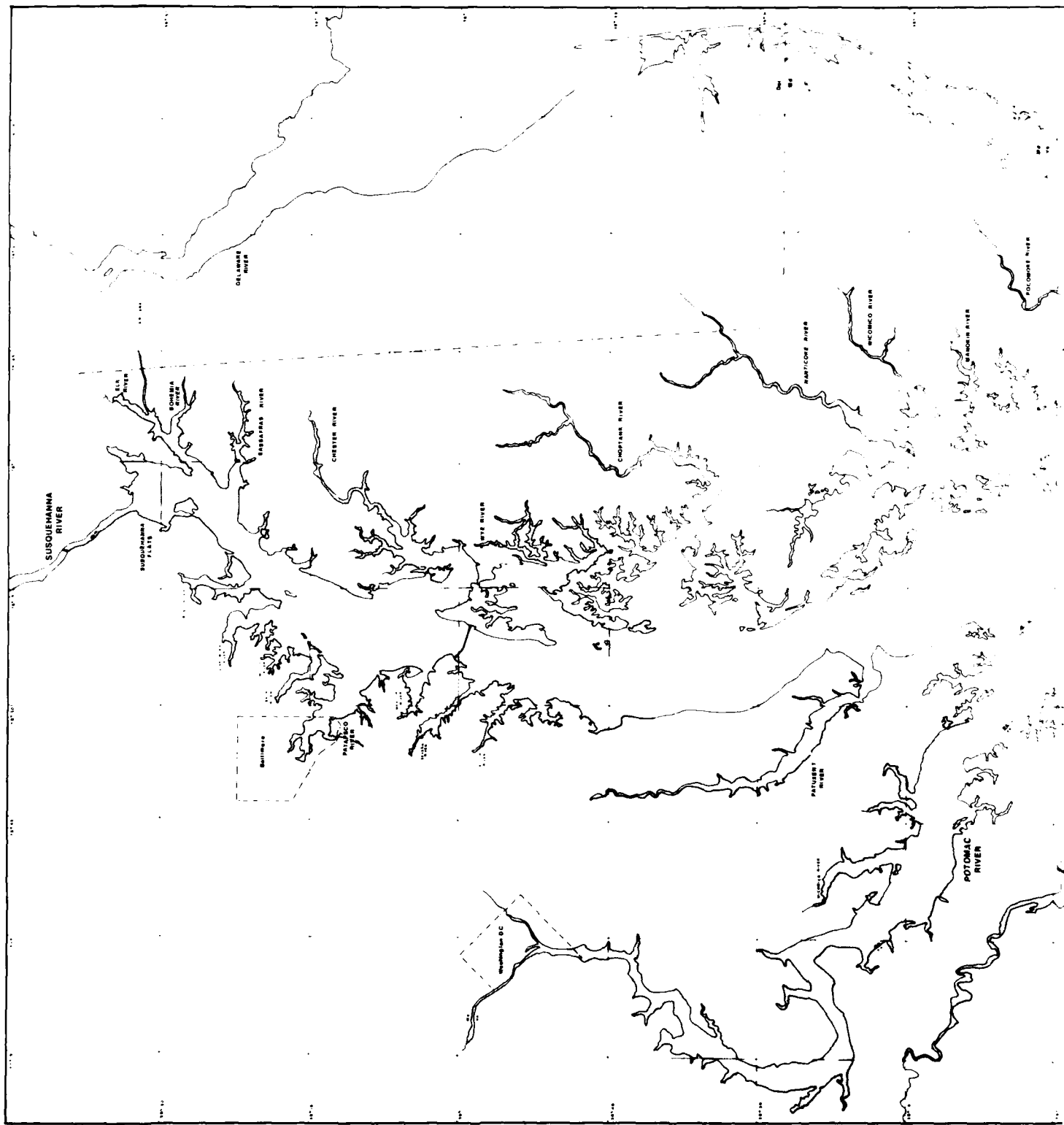
Major Concentration

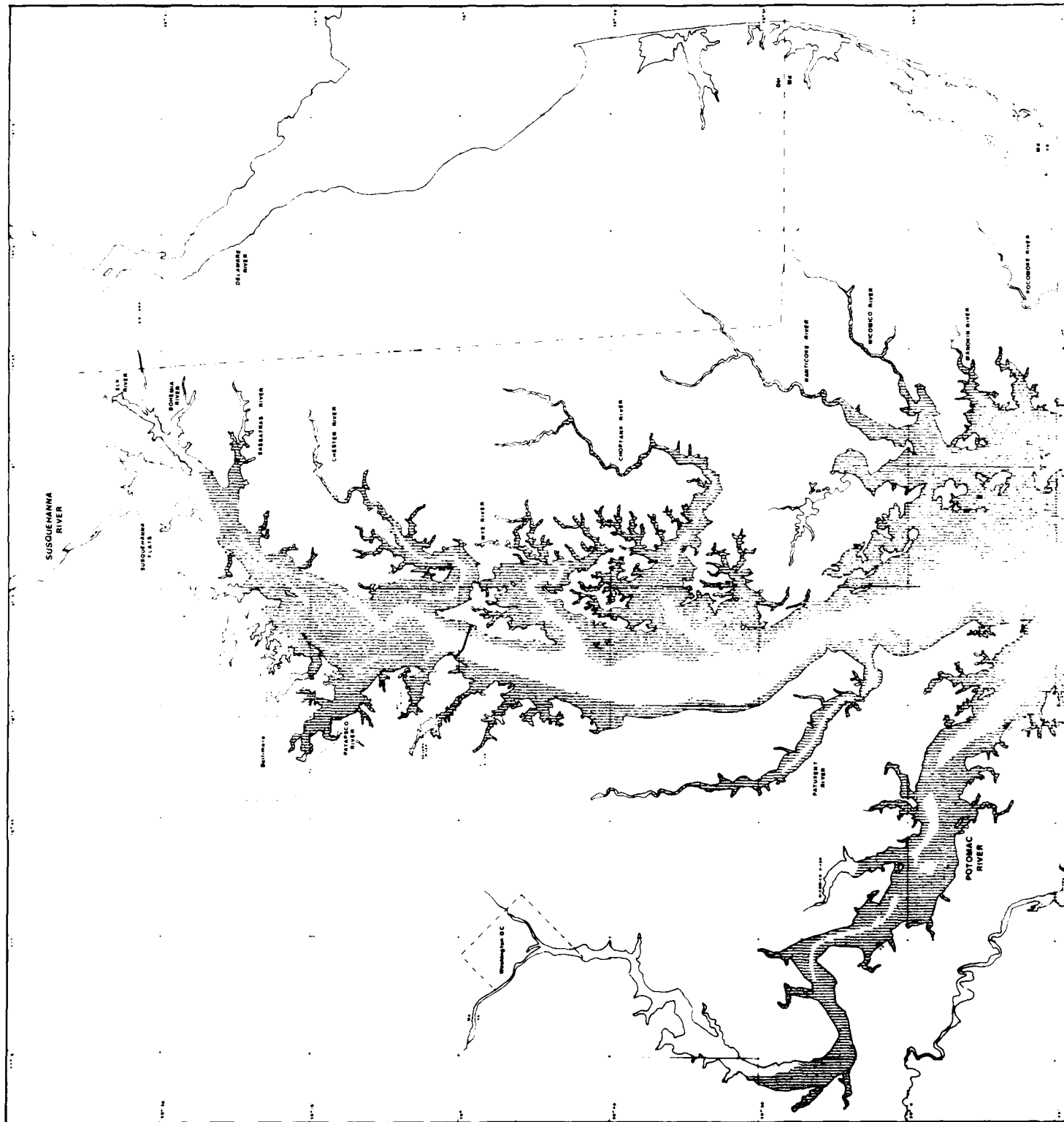
WESTERN ECO SYSTEMS TECHNOLOGY INC.

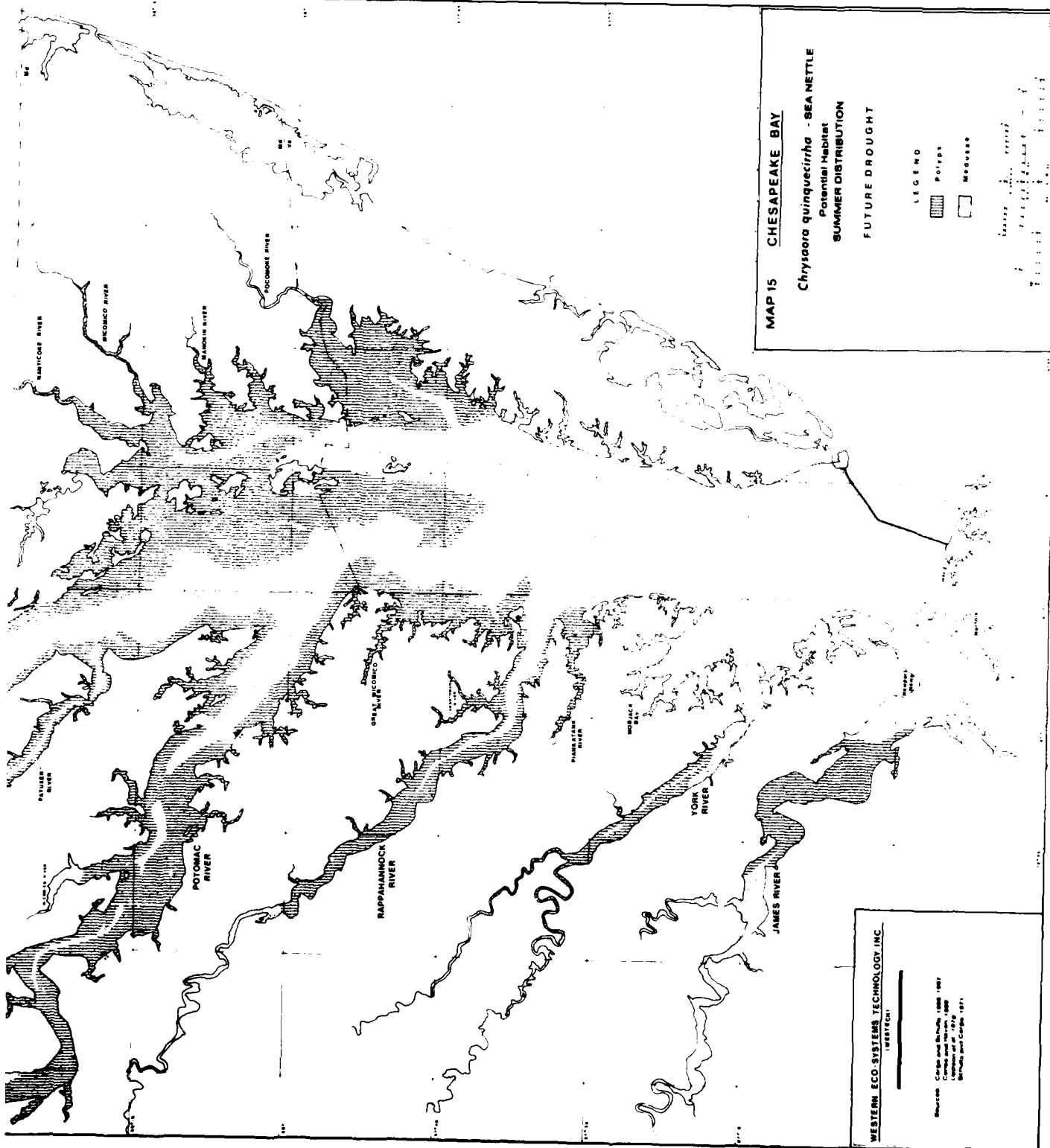
1987

Map 54: Canvasback Duck Potential Habitat

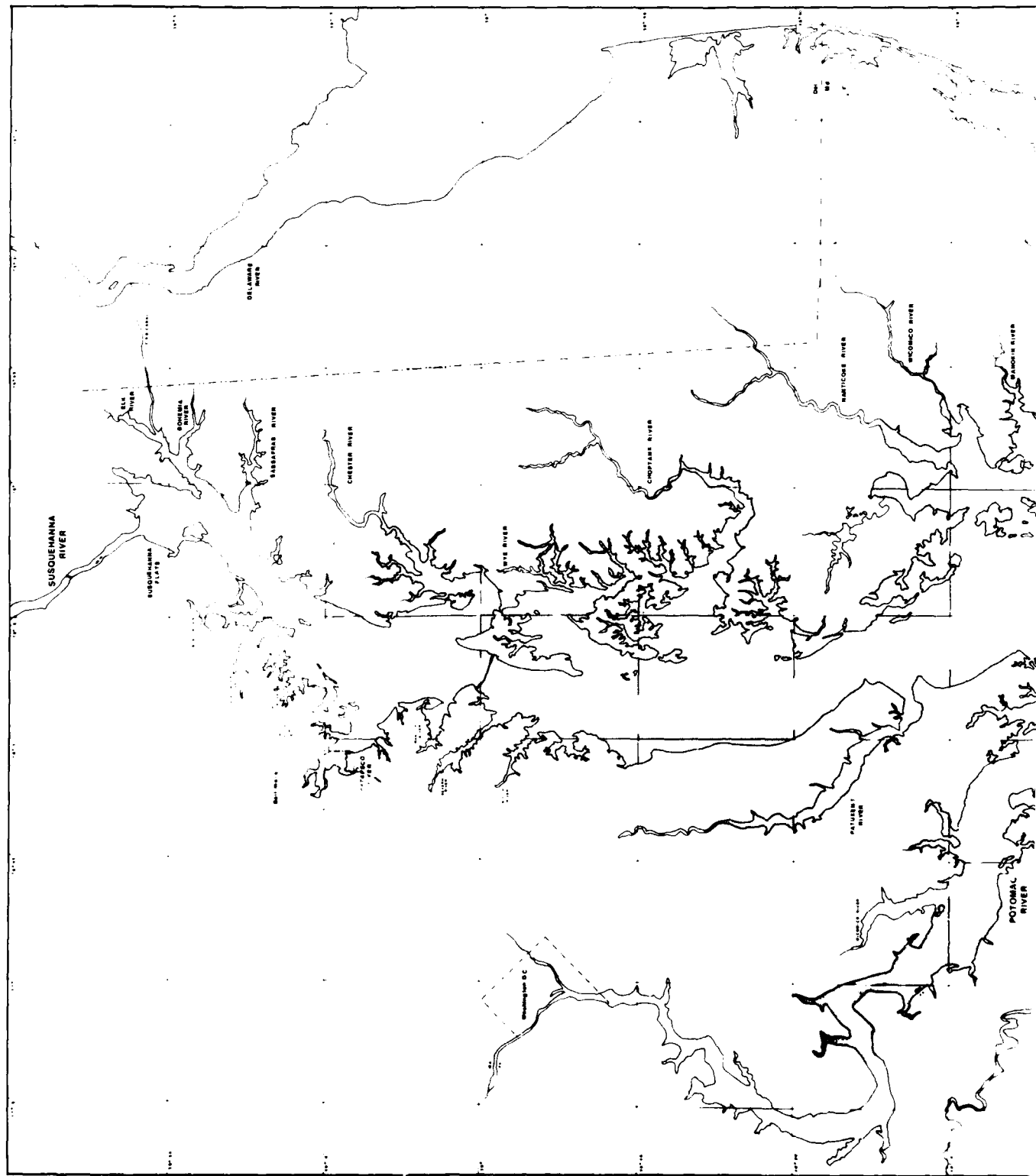
Map 54: Canvasback Duck Potential Habitat











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CHESAPEAKE BAY LOW FRESHWATER INFLOW STUDY PHASE II

BIOTA ASSESSMENT MAP..(U) WESTERN ECO-SYSTEMS

TECHNOLOGY INC BOTHELL WA G B MACKIERNAN ET AL. MAY 82

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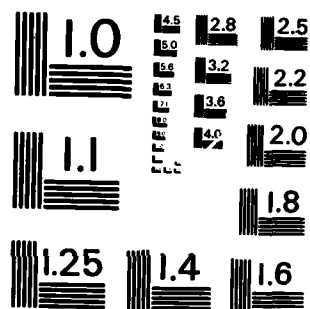
F/G 8/8

NL

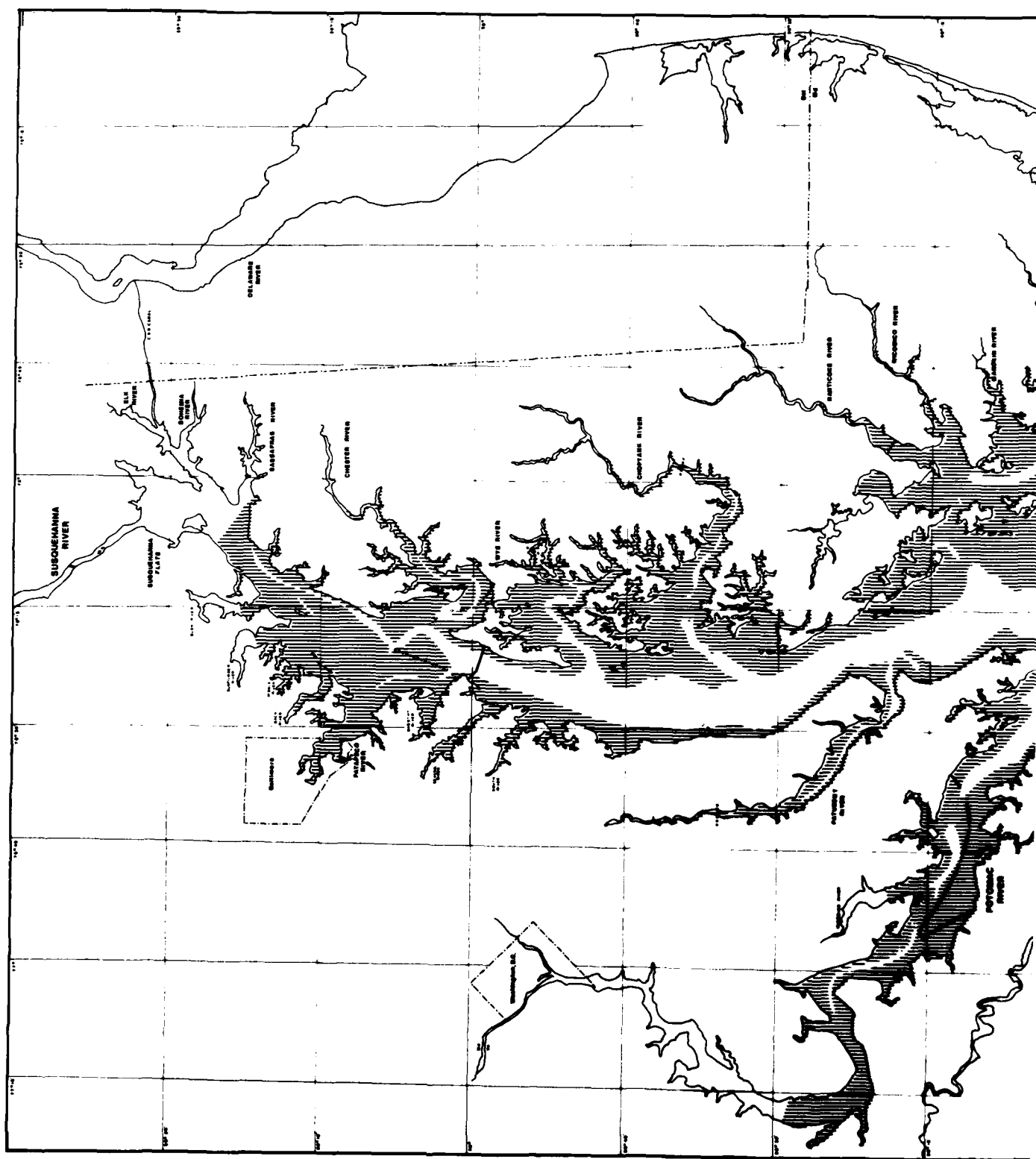
UNCLASSIFIED

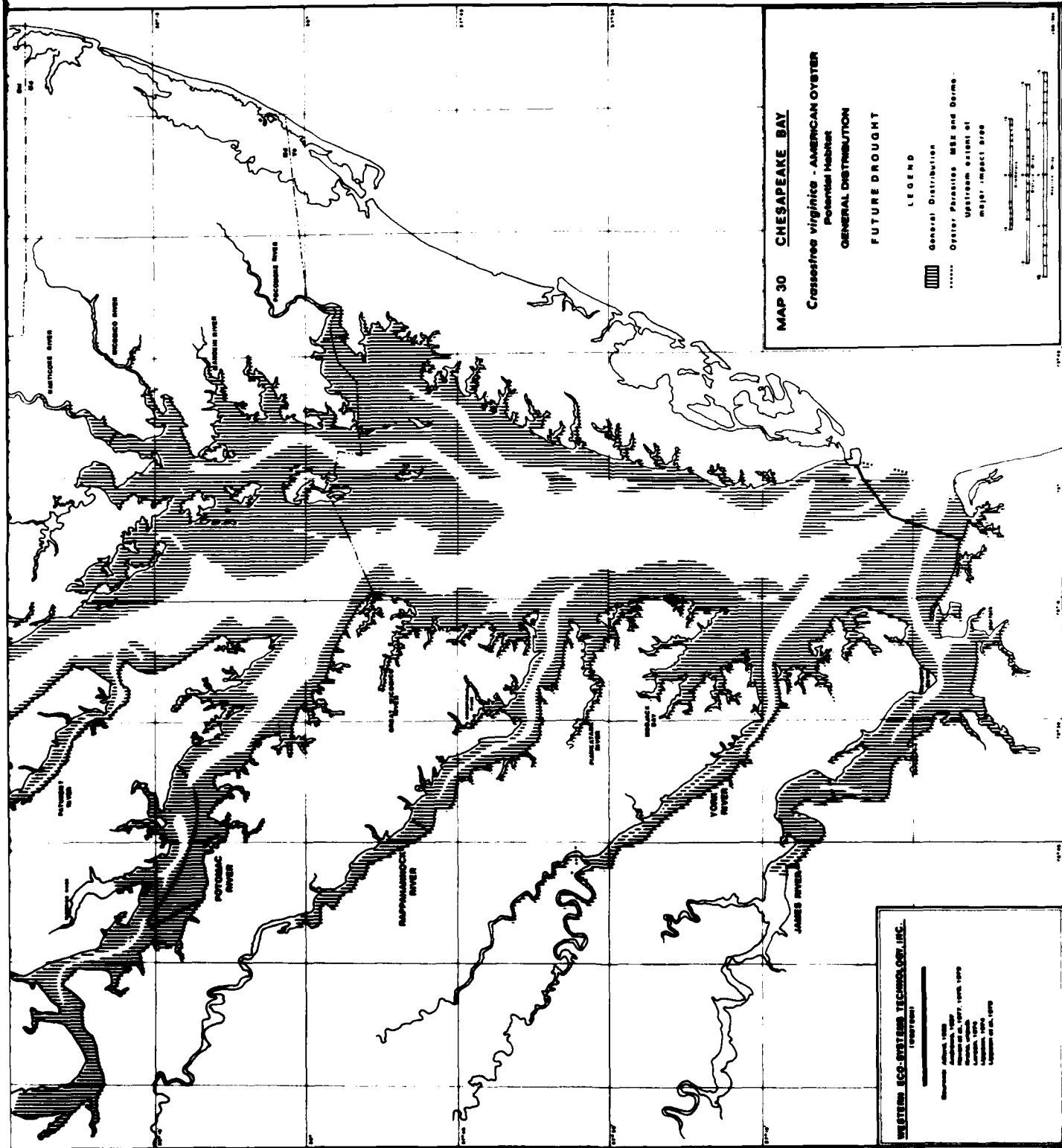
2/2

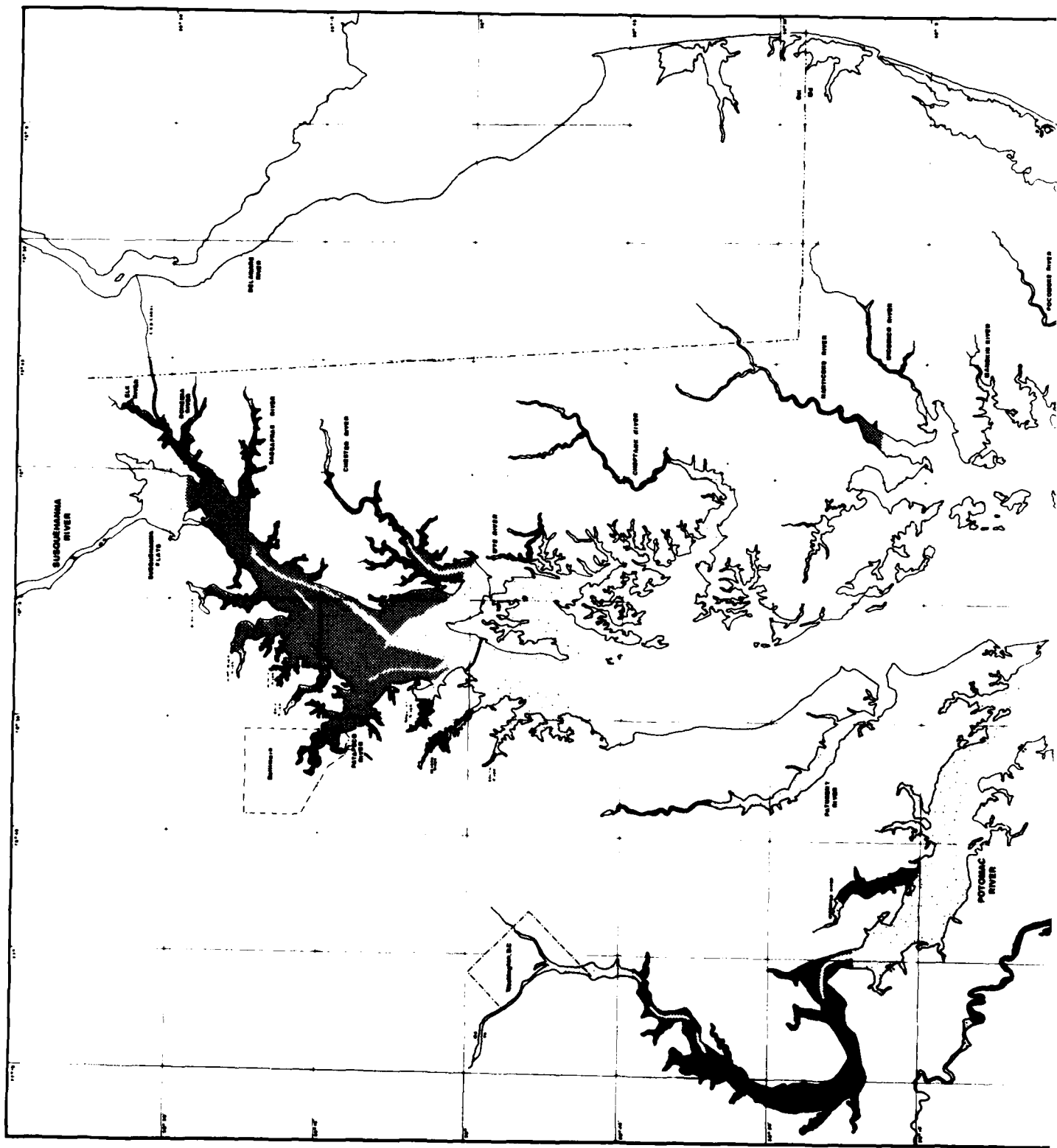
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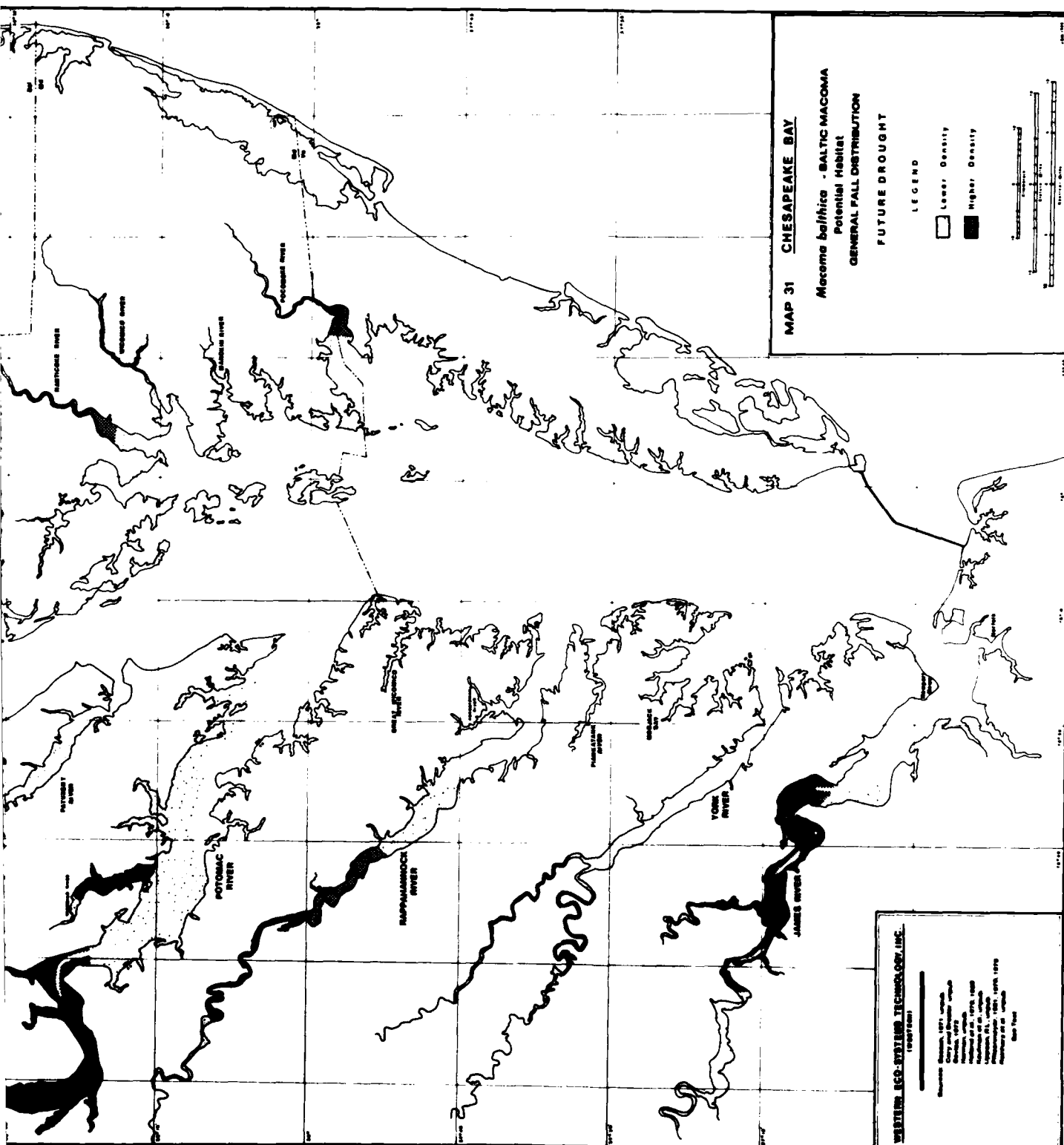


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A





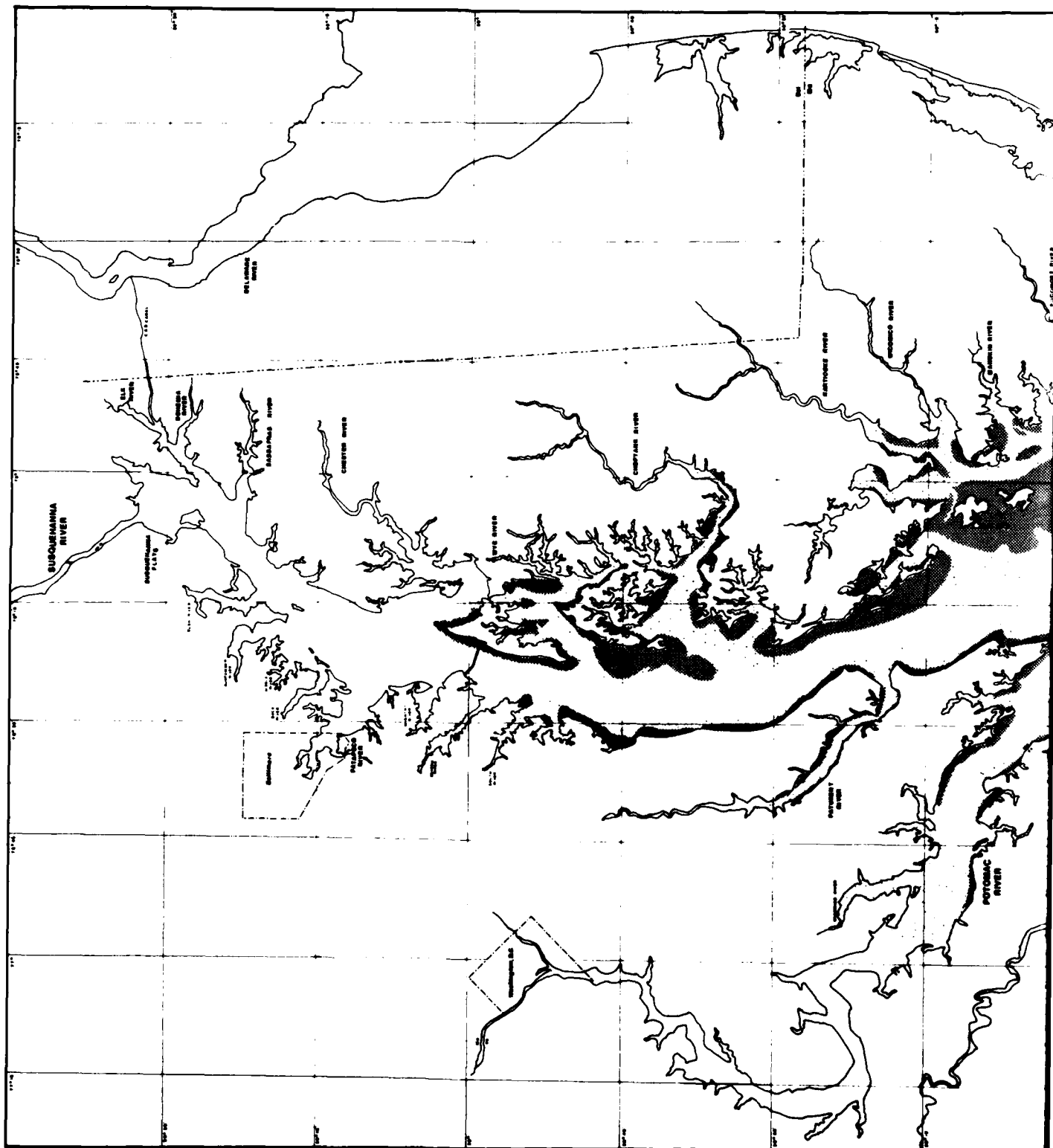


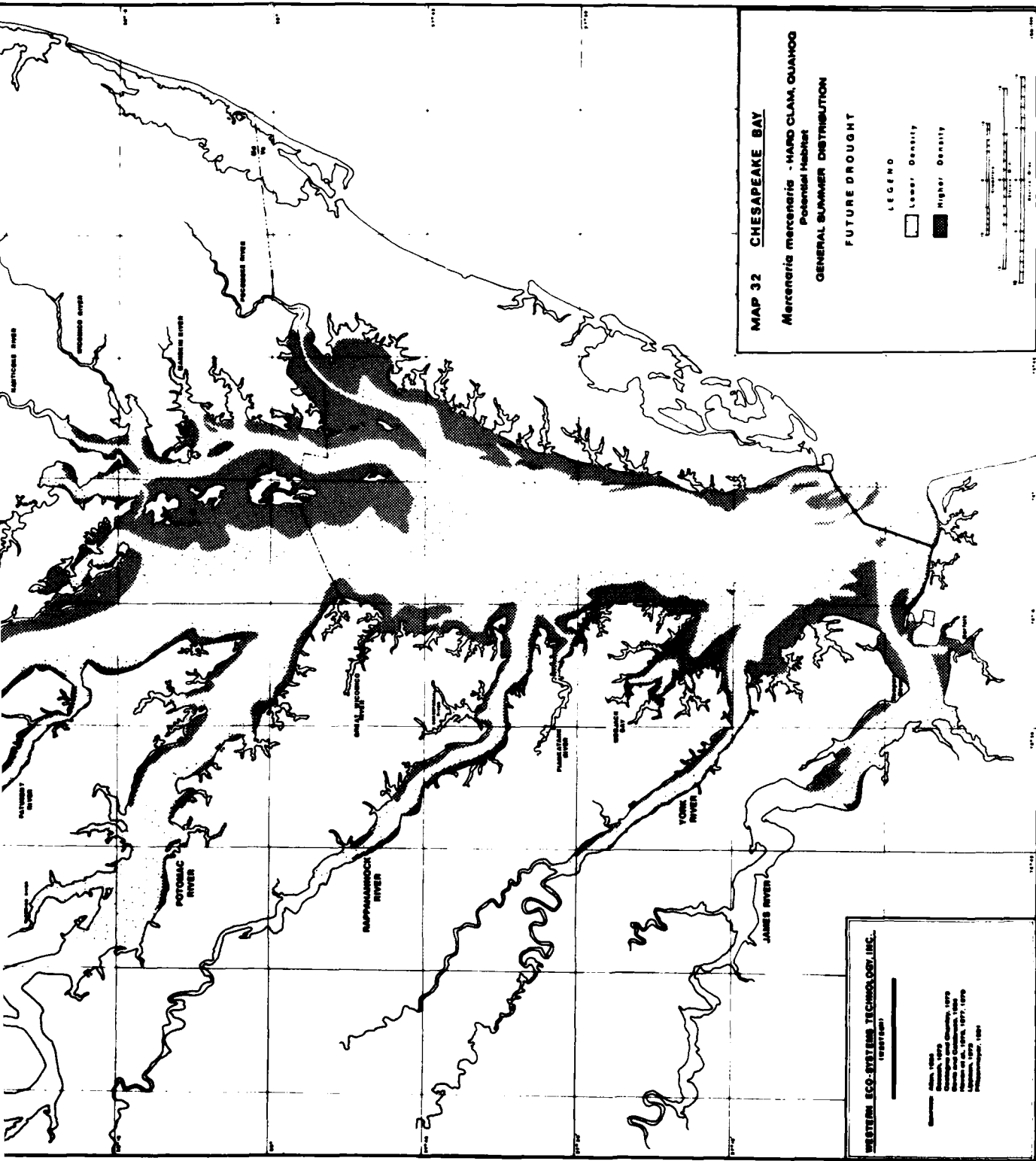


WESTERN GEO-TECHNICAL TECHNOLOGY, INC.
(1987-1988)

Project: Macoma balthica - Baltic Macoma
Potential Habitat
General Fall Distribution
Future Drought
Map 31

Map 31





MAP 32 CHESAPEAKE BAY

Mercenaria mercenaria - HARD CLAM QUAHOG
Potential Habitat

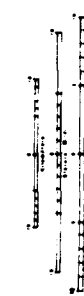
GENERAL SUMMER DISTRIBUTION

FUTURE DROUGHT

LEGEND

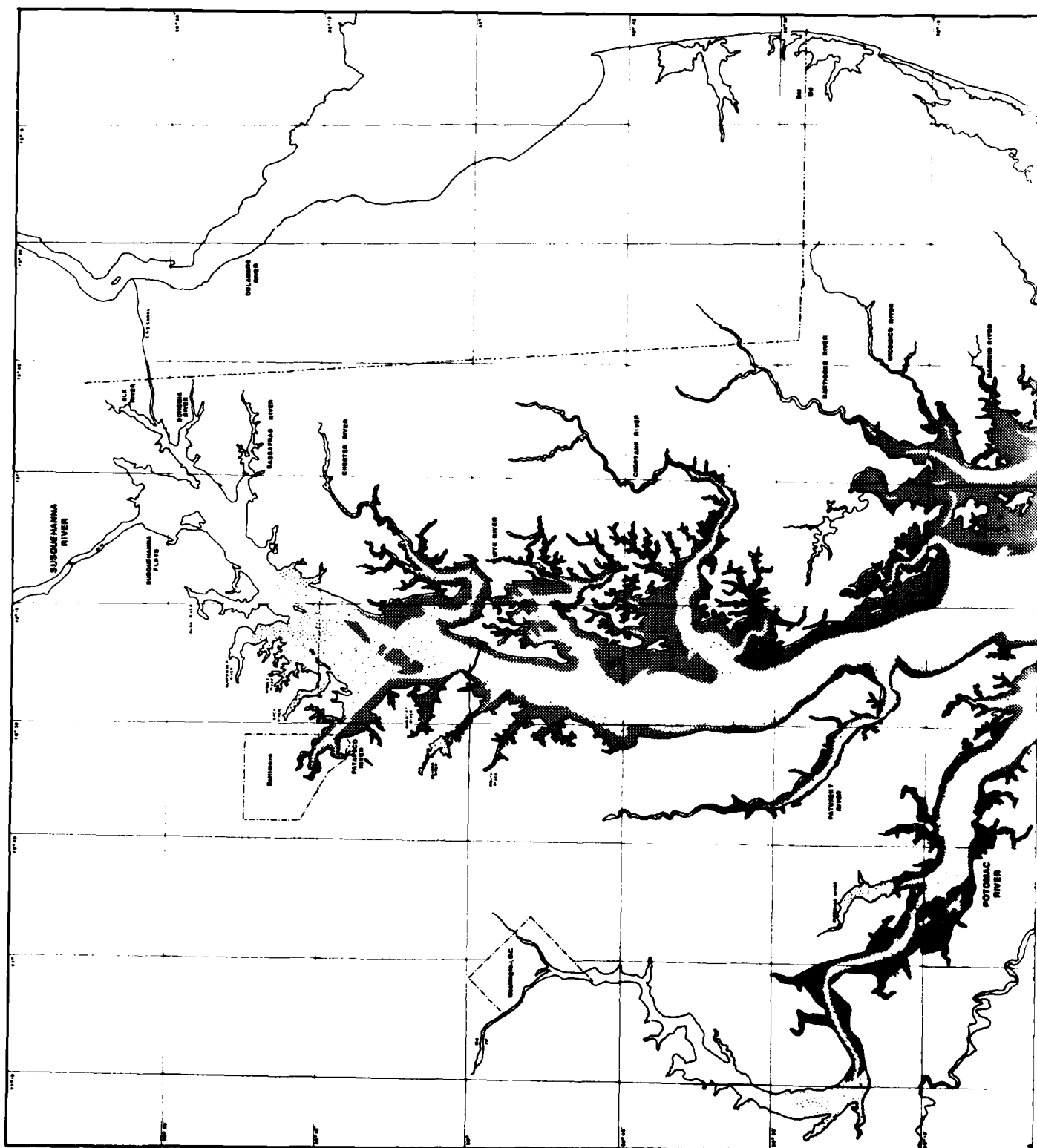
Lower Density

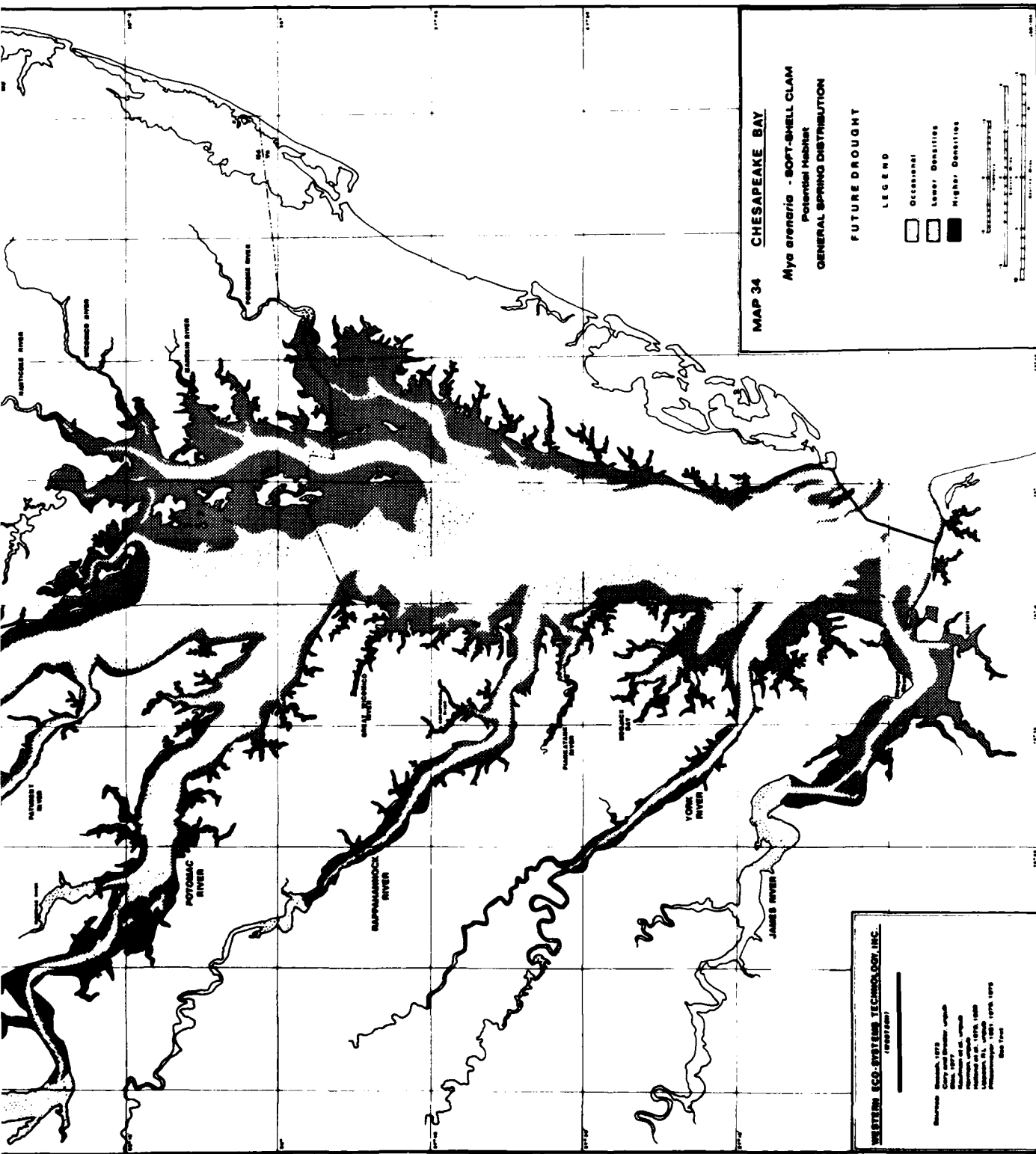
Higher Density

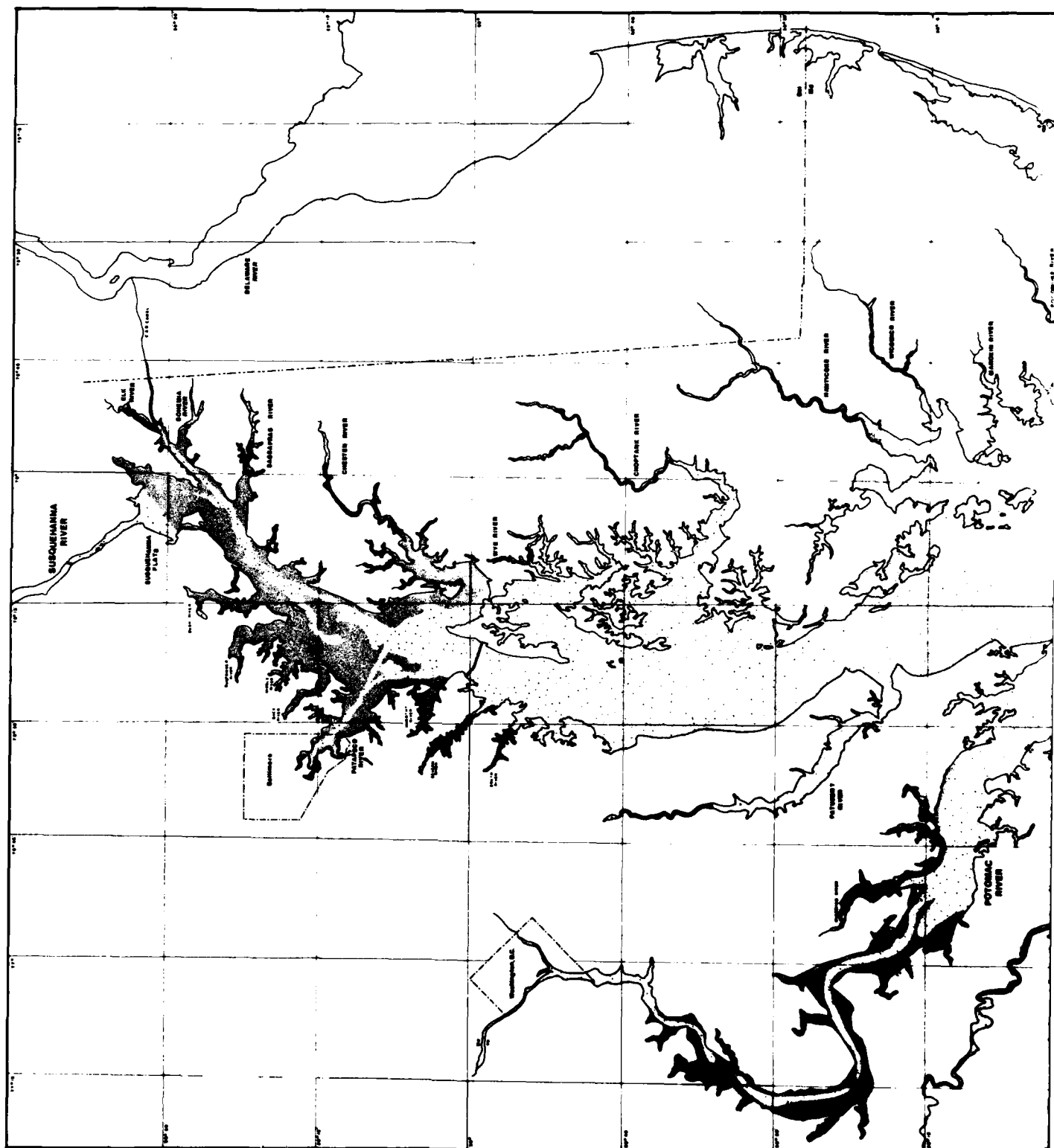


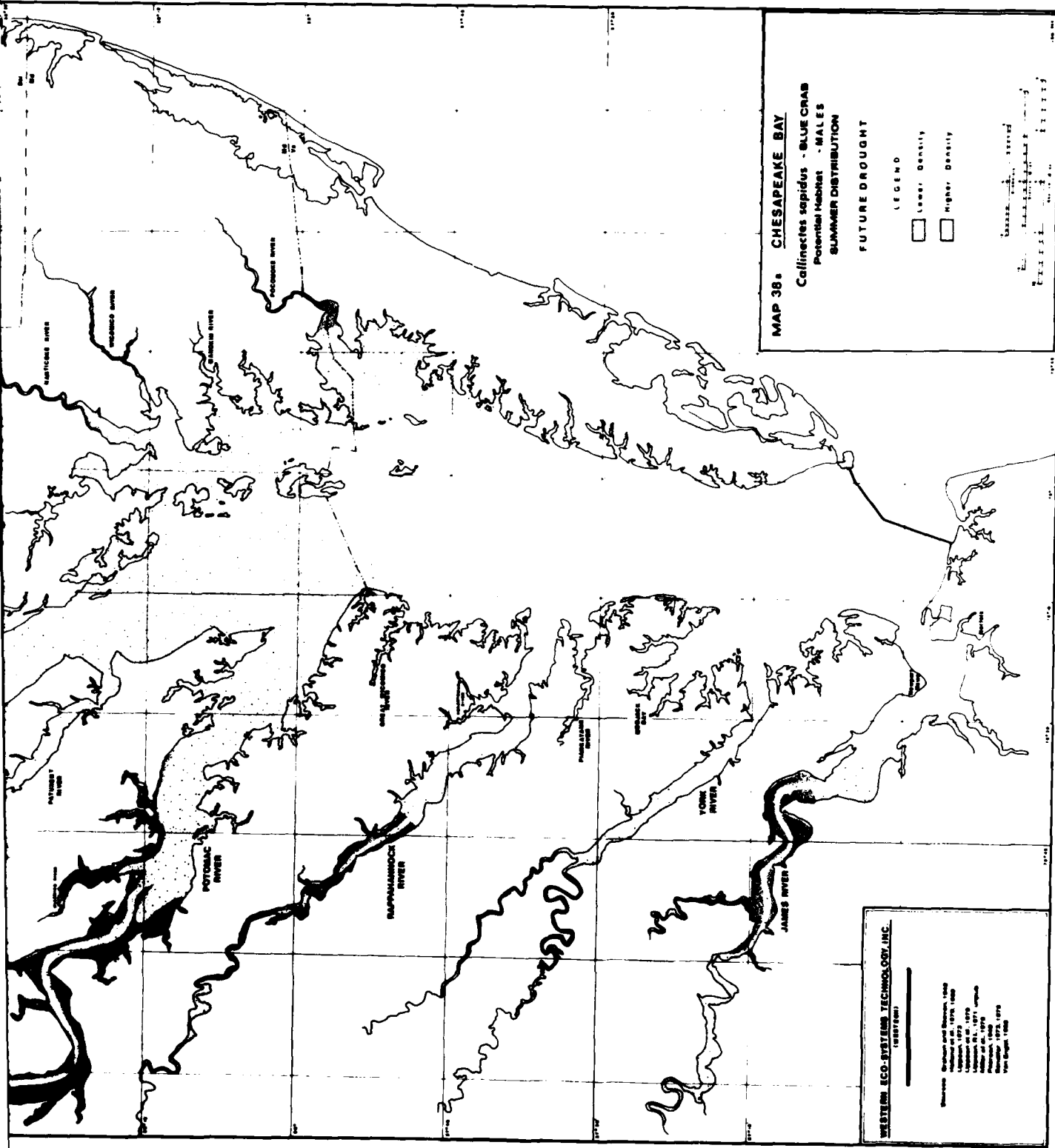
WESTERN ECO-SYSTEMS TECHNOLOGY, INC.
(CONTINUED)

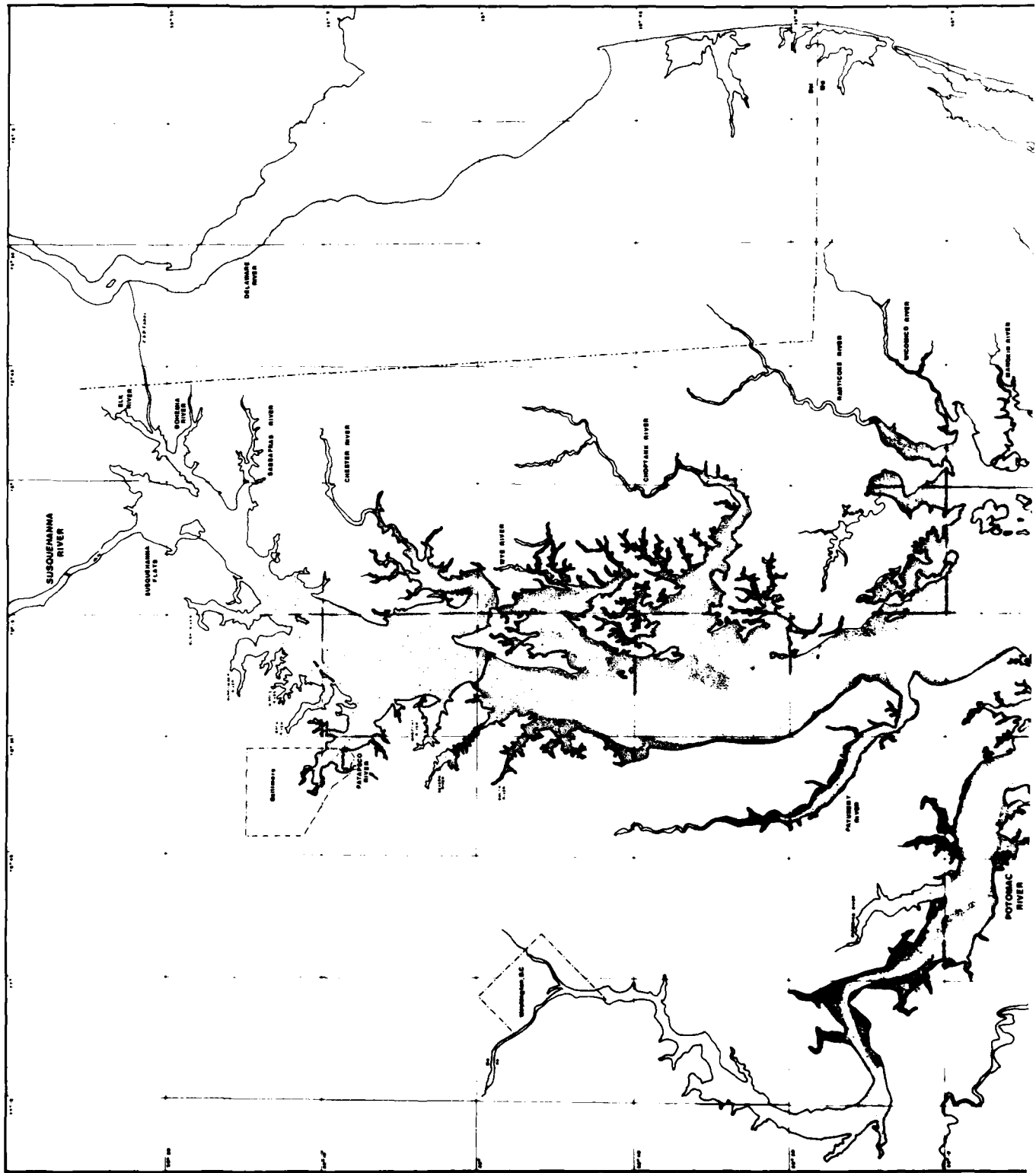
Map 32
Scale: 1:50,000
Data: 1980
Map Date: 1980
Map Title: Chesapeake Bay
Map Number: 32

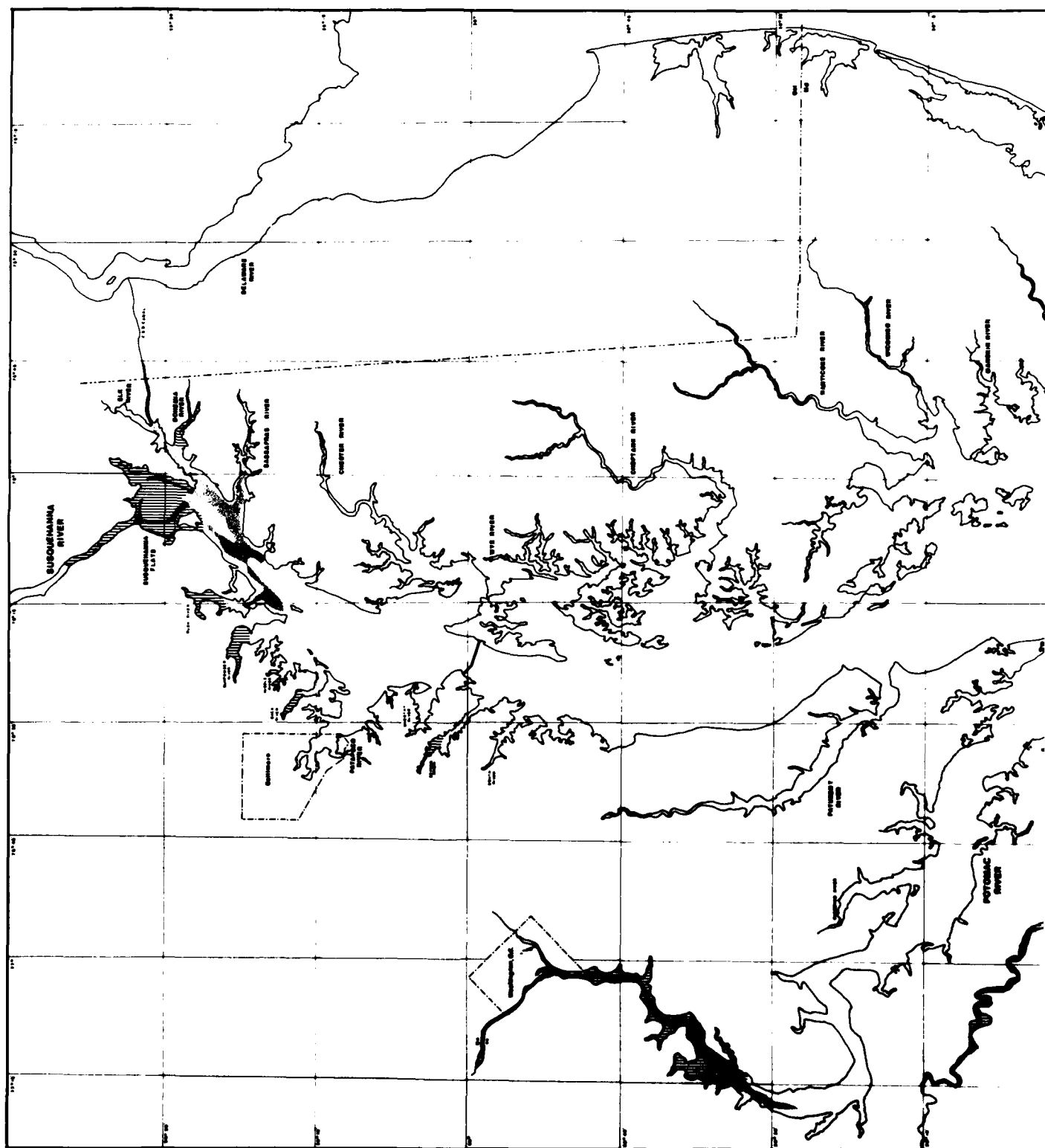


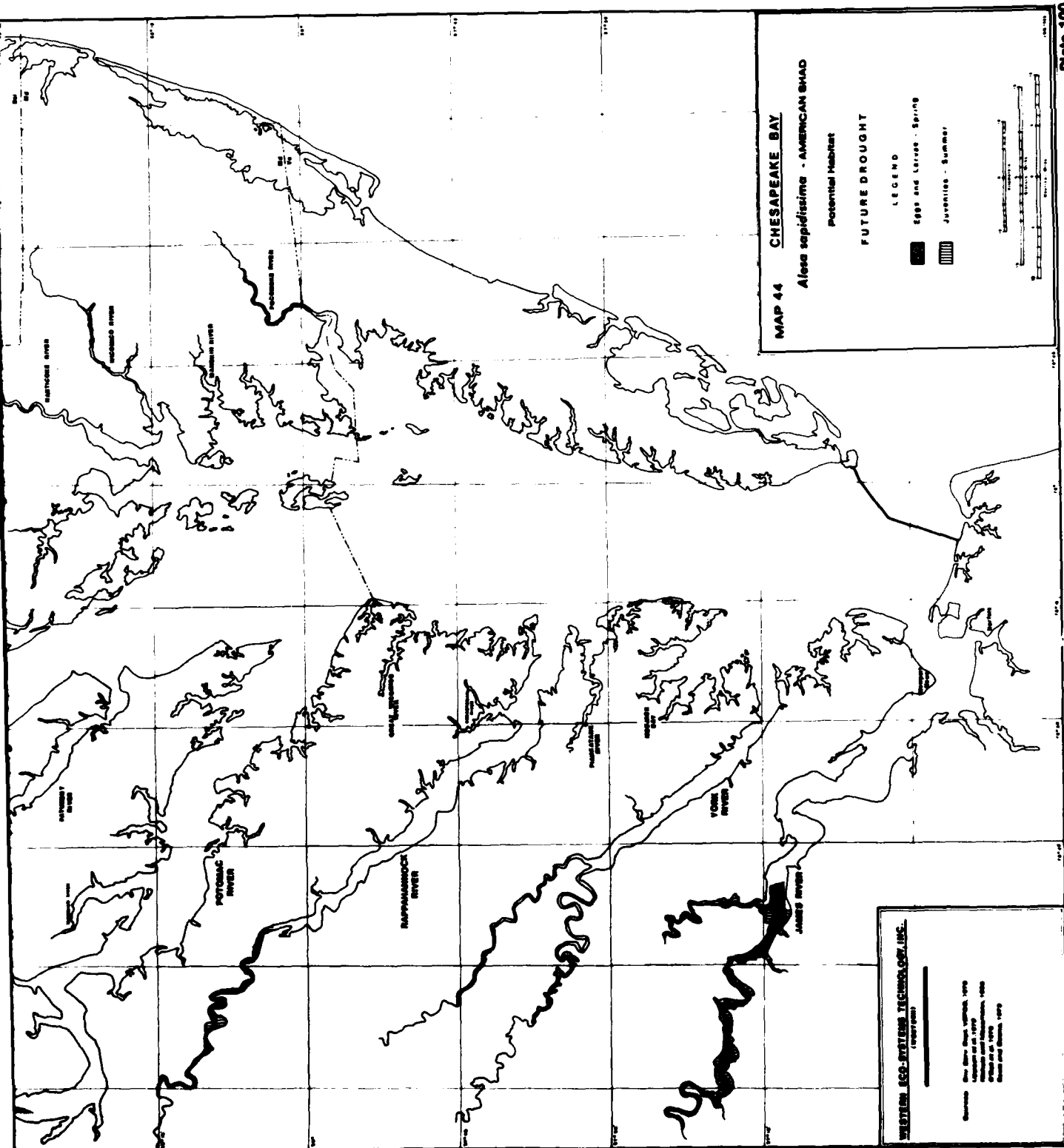






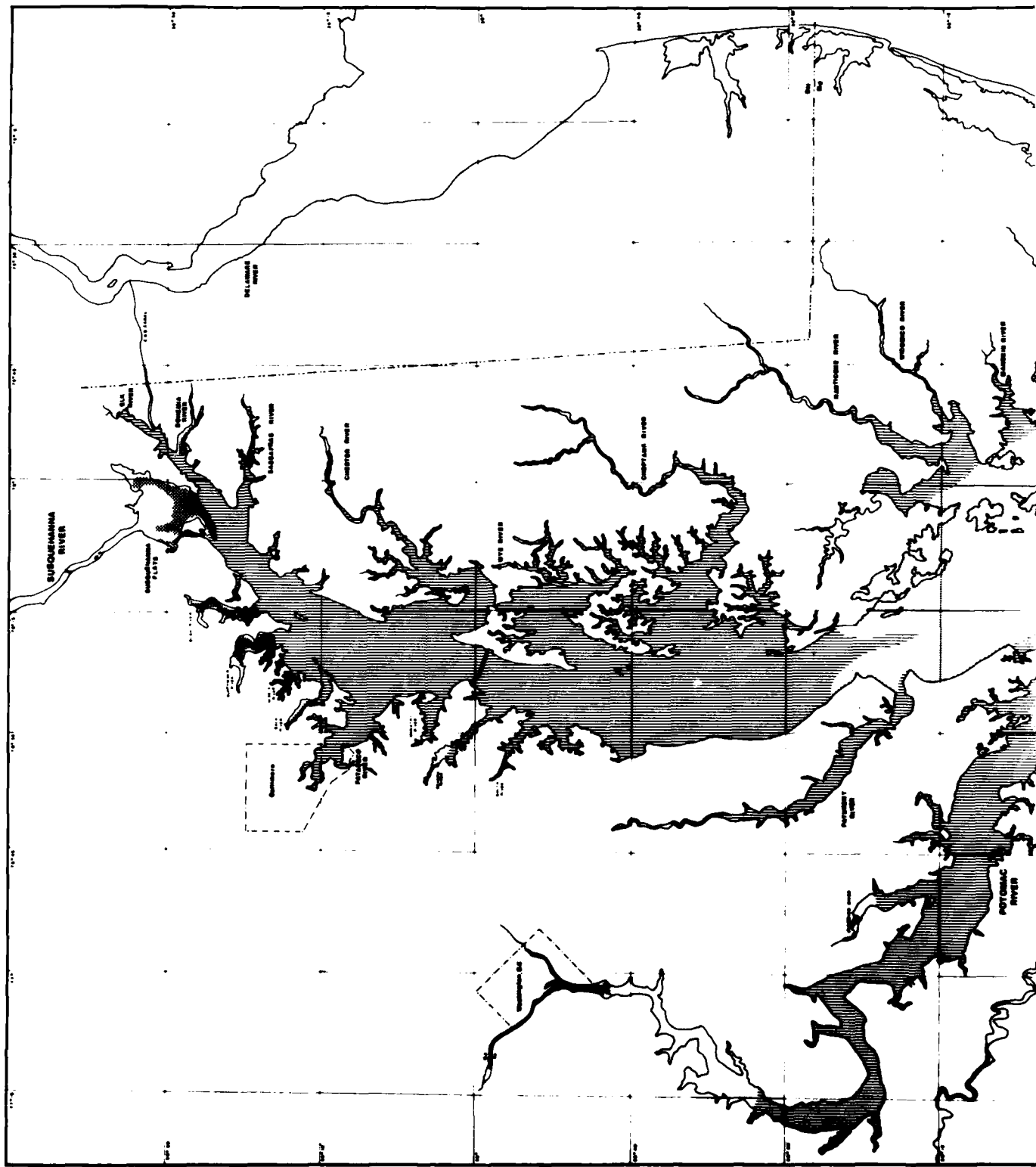


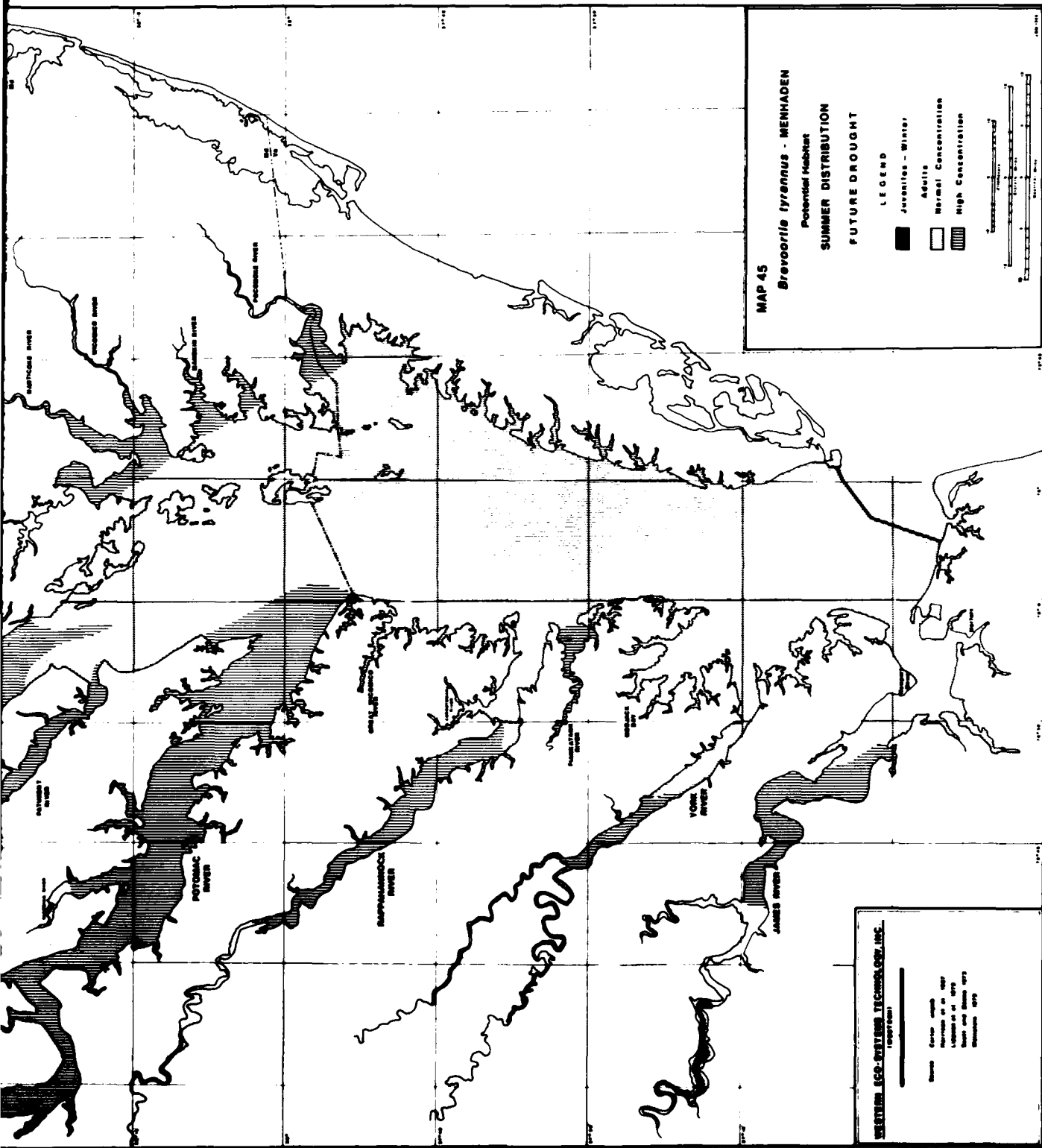


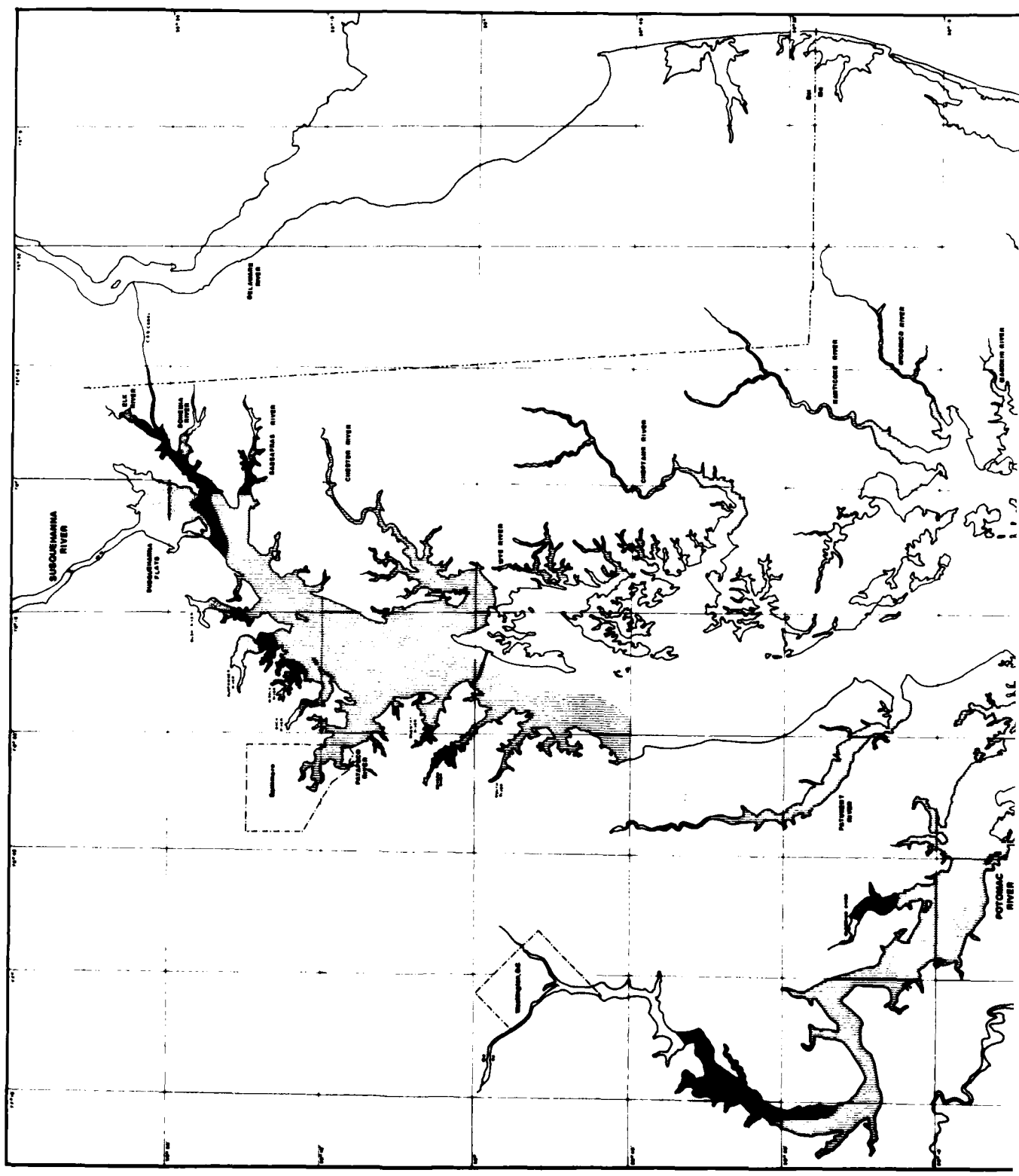


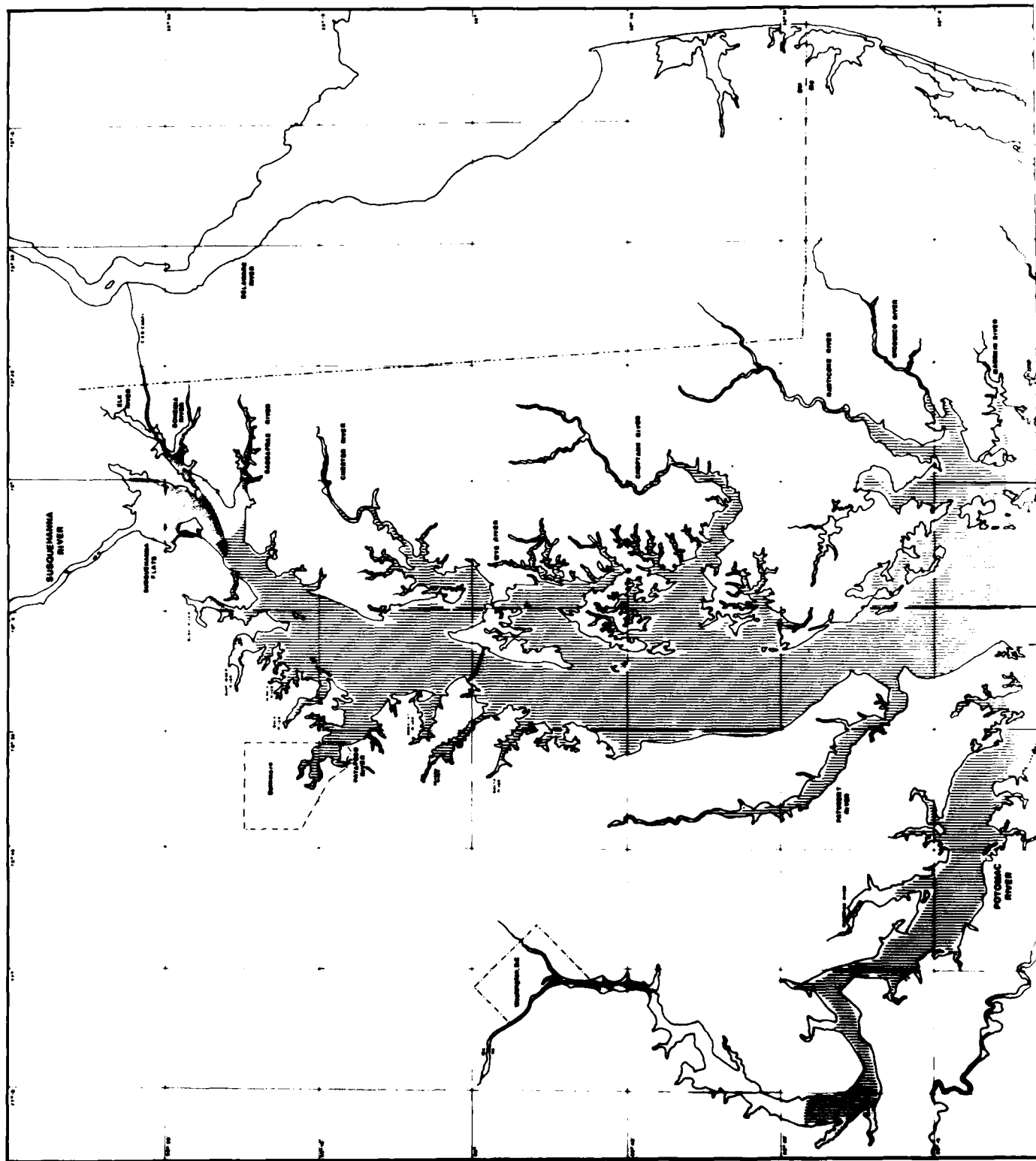
WESTERN ECO-SYSTEM TECHNOLOGY, INC.
 (1980-1981)

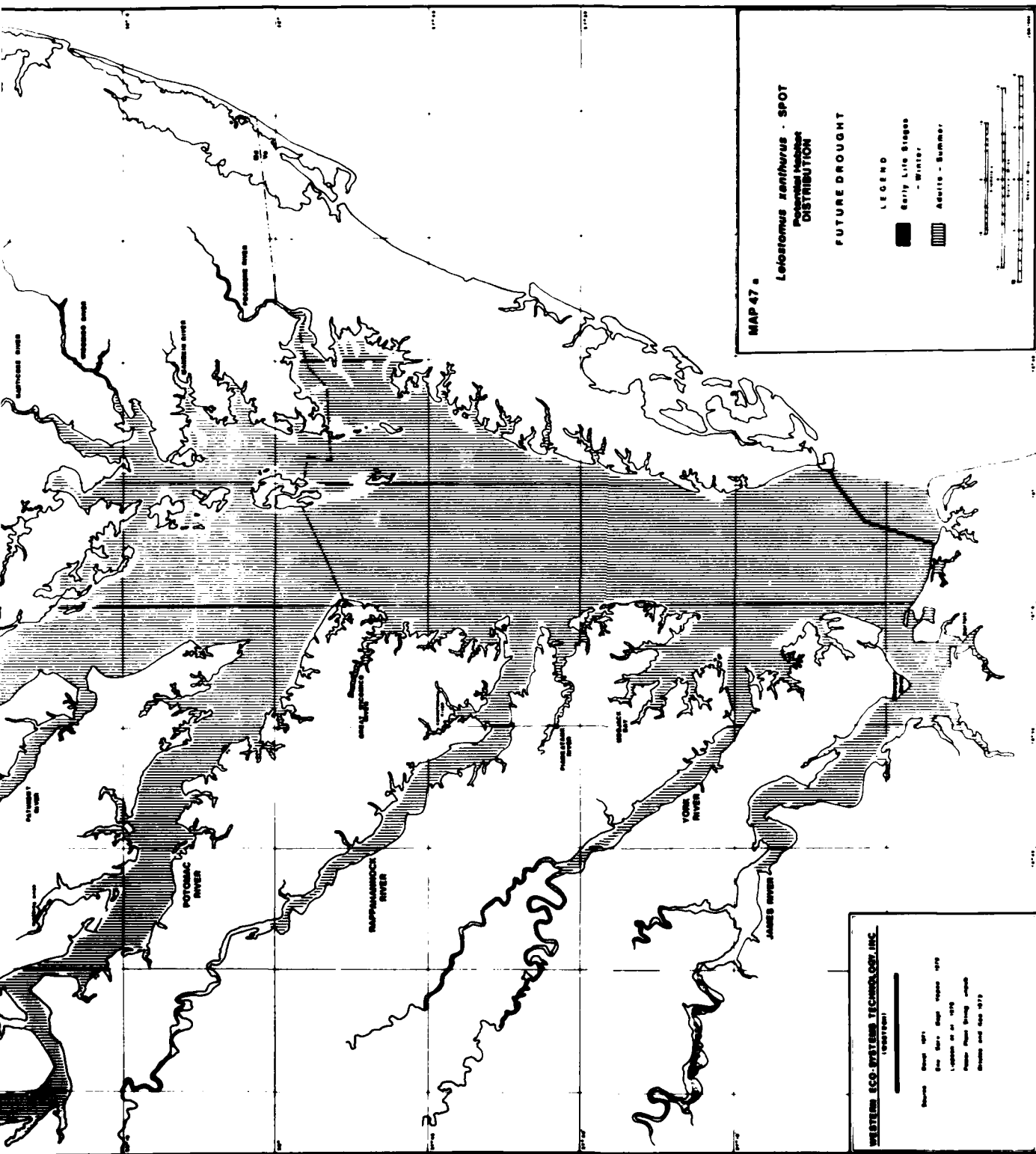
Prepared by: John R. Smith, 1980
 Revised by: J. R. Smith, 1981
 Revised by: J. R. Smith, 1982
 Revised by: J. R. Smith, 1983

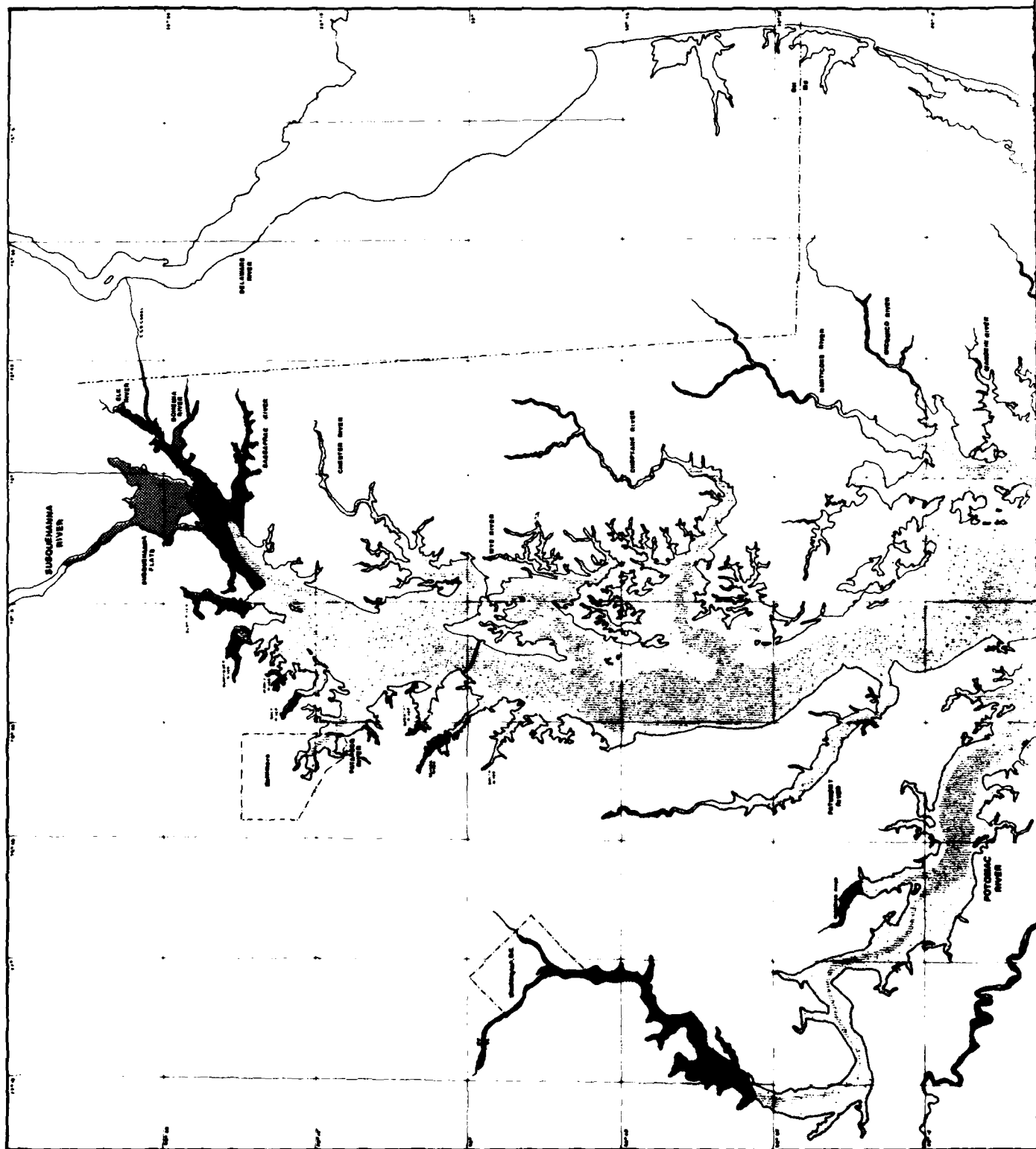


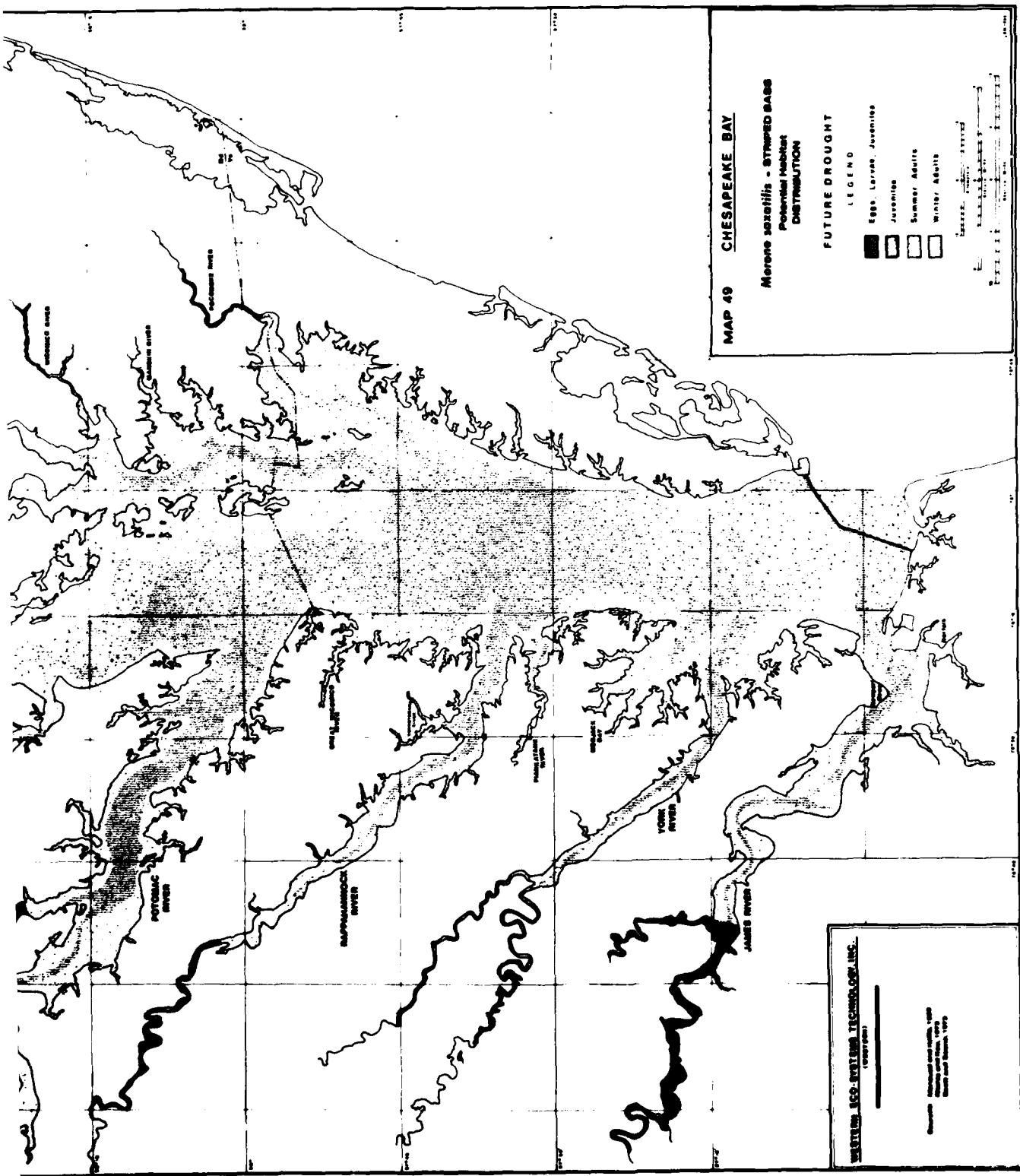


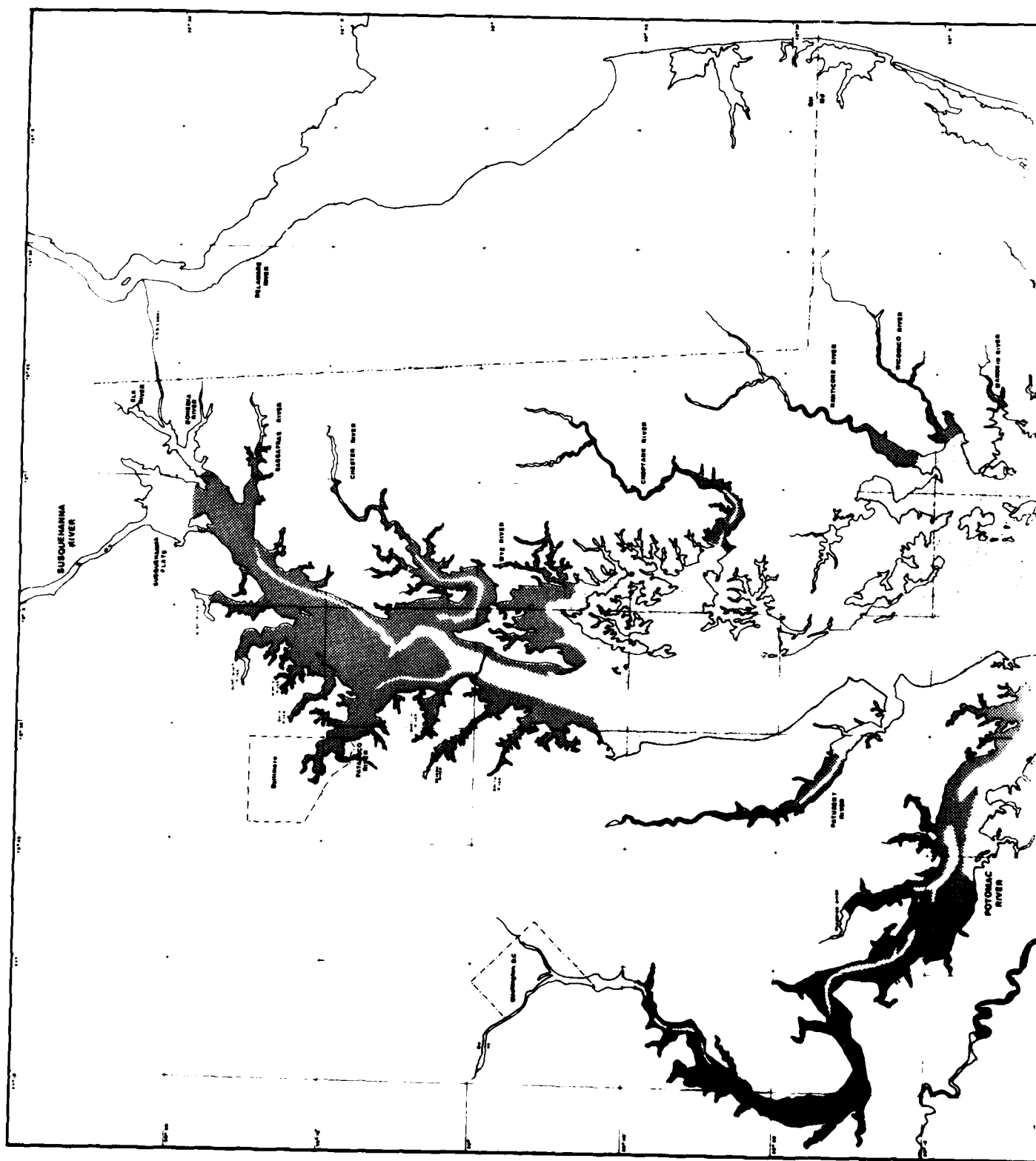












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