DATA ON THE DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER, MARYLAND, VIRGINIA AND THE DISTRICT OF COLUMBIA, 1985

U.S. GEOLOGICAL SURVEY
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CONVERSION FACTORS

For the convenience of readers who prefer inch-pound units rather than the metric units used in this report, the following conversion factors may be used:

Multiply metric unit	By	To obtain inch-pound unit
meter (m)	3.33	foot (ft)
square meter (m^2)	11.11	square foot (ft^2)
centimeter (cm)	0.39	inch (in)
square centimeter (cm^2)	0.16	square inch (in^2)
kilometer (km)	0.62	mile (mi)
kilometer (km)	0.54	nautical mile (nm)

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°F = 9/5\ (°C) + 32$$

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ABSTRACT

This report summarizes data on the distribution and abundance of submersed aquatic vegetation collected in the tidal Potomac River during 1985. Plant species were identified and dry weight determined for selected sites. Information on competition between *Hydrilla verticillata* and other species was collected. Water-quality characteristics measured include temperature, specific conductance, dissolved oxygen, pH, and transparency as indicated by Secchi depth. A map was made of the distribution of submersed aquatic vegetation based on transect samples and a complete shoreline survey.

INTRODUCTION

A 1978-81 survey of submersed aquatic vegetation in the tidal Potomac River and Estuary showed that the tidal river was nearly devoid of submersed aquatic plants (Pascal and others, 1982; Haramis and Carter, 1983; Carter and others, 1983, 1985). In 1983, numerous species of submersed aquatic plants returned to the tidal river after an absence of decades, giving scientists reason to believe that environmental conditions and water quality had improved. In 1983, we began a new study of distribution and abundance of submersed aquatic vegetation concentrating on the tidal Potomac River. The data collected in 1983 and 1984 were summarized in Carter and others (1985) and Rybicki and others (1985). The objectives of this 1985 data collection study were:

1) to collect and identify all species of submersed aquatic plants found in the tidal river and larger tributaties;
2) to use both shoreline surveys and sampled transects to determine the distribution and abundance of the submersed aquatic vegetation;
3) to collect data comparable to that collected in the 1978-81 survey and in 1983-84 in order to quantify changes in biomass, species composition and water quality among the three periods;
4) to monitor the spread of *Hydrilla verticillata* in the tidal river.
5) to collect data on competition between *Hydrilla* and other submersed aquatic macrophytes.

This open-file report presents the data collected during 1985.

Acknowledgments

This work was partially supported by the U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. We thank all our colleagues in the National Park Service and the Government of the District of Columbia for their assistance. We also appreciate the assistance of the U.S. Geological Survey District Office in Towson, Maryland who helped us with the field work.

DESCRIPTION OF STUDY AREA

The tidal Potomac River extends from Chain Bridge to Quantico, Virginia (fig. 1). It contains fresh water except during periods of drought or extremely low river discharge. The fresh tidal river experiences tides of about 1 m. The U.S. Army Corps of Engineers maintains a minimum depth of 7.3 m in the main navigation channel up to Washington D.C. The channel is flanked on one or both sides by wide shallow flats or shoals suitable for the growth of submersed aquatic plants.

METHODS

A shoreline survey for submersed aquatic vegetation in the tidal river and tributaries was conducted in September and October of 1985. This survey was done by boat, at low tide, using rakes to gather samples and to check whether vegetation was rooted or floating. The proportion of each species in vegetated areas was estimated and referenced to 1-km grids shown on U.S. Geological Survey 7½ minute topographic maps with bathymetry added. These data were supplied to the U.S. Army Corps of Engineers for use in their Potomac River digital data base. The distribution information was transferred to a small-scale map for publication in this report.

In addition to the shoreline survey, 62 transects were sampled. The original tidal river transects (figs. 1 and 2) from the 1978-81 survey were resampled in June and September 1985 using previously reported methods (Paschal and others, 1982) which are summarized here for the reader's convenience. The original transects were supplemented by eight new transects to provide more complete coverage (fig. 1). Transects were sampled perpendicular to the shoreline. Most transects had sampling stations at 5 m, 15 m, and then at 15-m intervals from shore. These transects were terminated at five stations (60 m) from shore when no vegetation was present or at two stations (30 m) beyond the last vegetated station. Where water depth exceeded 2.0 m at 60 m of linear distance, the fixed interval sampling was not used and instead samples were taken at four stations along the transect corresponding with the depths 0.5-m, 1.0-m, 1.5-m, and 2.0-m.

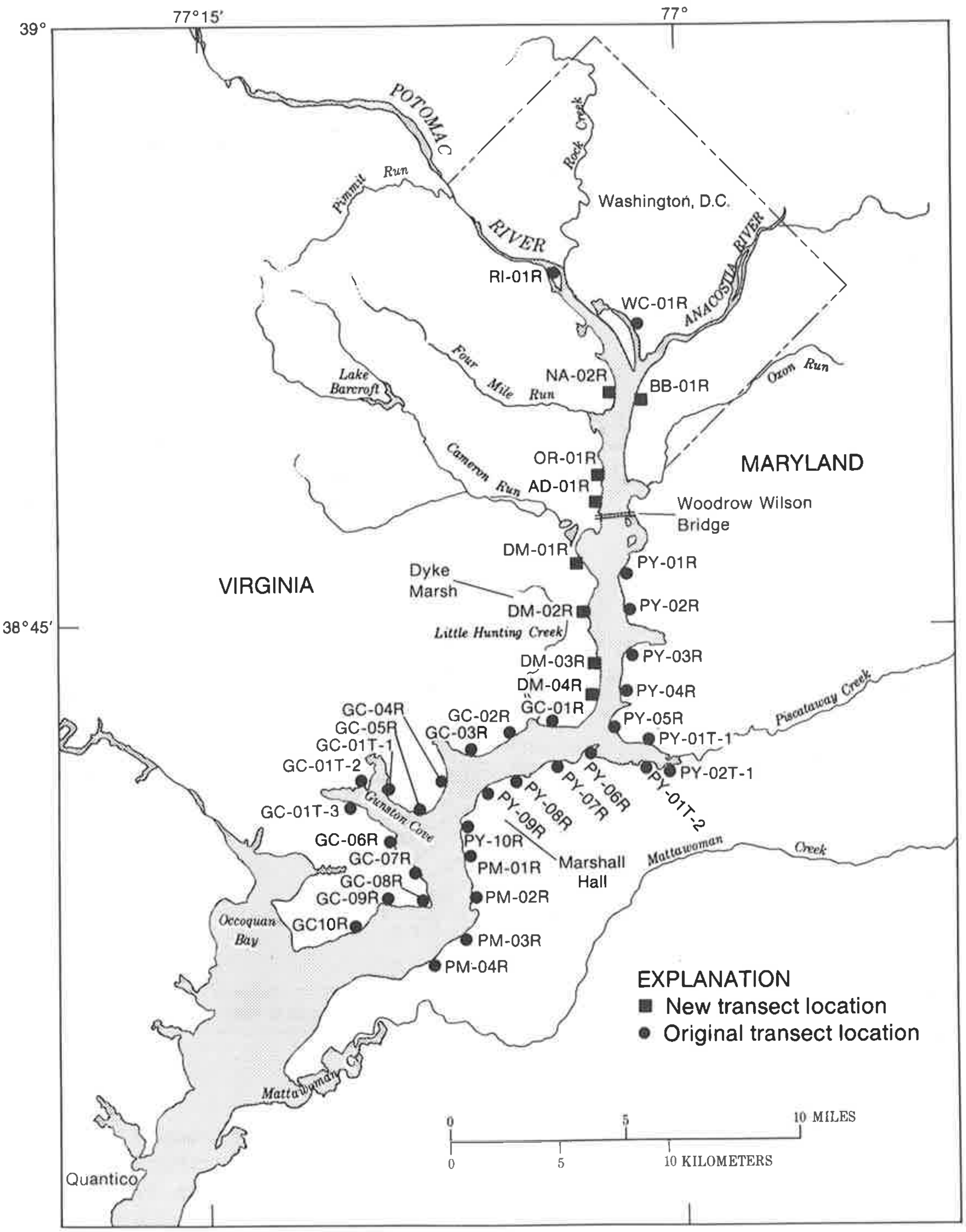

Figure 1: Location of vegetatior sampling transects in the tidal Potomac River above Mattawoman Creek. Codes for transects give location and tributary or river-mile for each location. RI is Roosevelt Island, NA is National Airport, OR is Oronoco Bay, AD is Alexandria Dock, DM is Dyke Marsh, GC is Gunston Cove, BB is Bolling Air Force Base, PY is Piscataway Creek, PM is Pomonkey Creek.

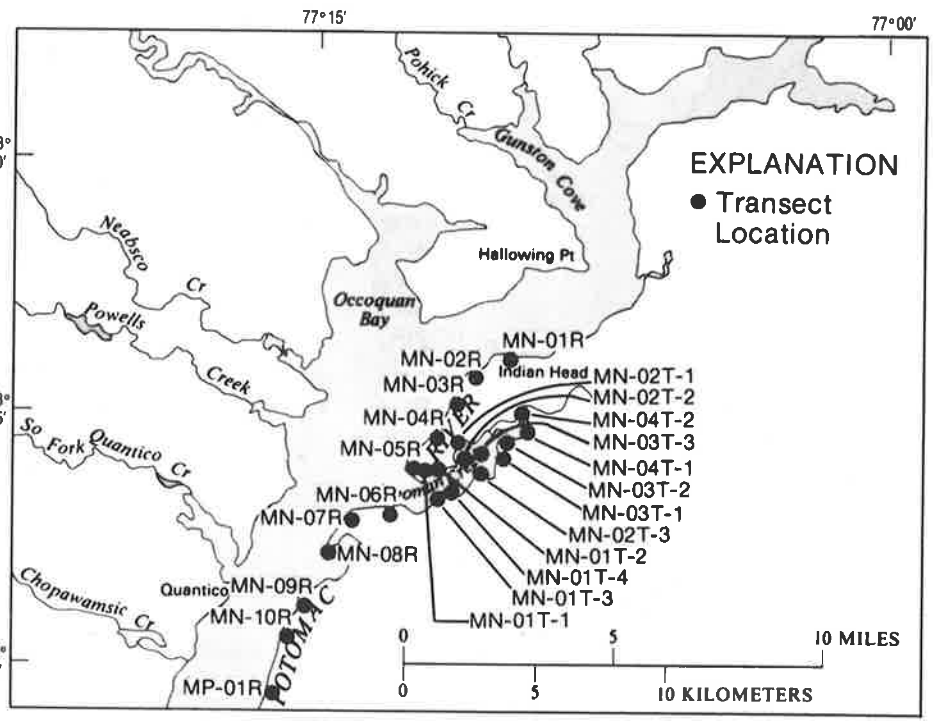

Figure 2: Location of vegetation sampling transects, Mattawoman Creek. Codes for transects give location and tributary or river-mile for each location. MN is Mattawoman Creek.

Codes for the transects in figures 1 and 2 provide information on location and the river- or tributary-mile for each location. For example, in MN-01T-2, MN is Mattawoman Creek, 01T is one nmi (nautical mile) up the tributary from the mouth, -2 is the second transect; in PY-06R, PY is Piscataway Creek, 06R is the sixth transect on the edge of the main river.

All stations were sampled three times using modified oyster tongs with blades welded across the teeth to facilitate biting into the sediment to collect rooted plants. The area sampled with each grab sample was about 930 cm^2. All species were identified. Taxonomic nomenclature is according to Hotchkiss (1950, 1967), Radford and others (1964), Wood (1967) and Godfrey and Wooten (1979). A species list for the tidal Potomac River in 1985 is shown in table A-1 (in appendix), and species found at each vegetated transect in spring and fall 1985 are shown in table A-2 (in appendix).

Samples were placed in plastic mesh bags and hung on lines to air dry. They were then dried in ovens at 110^{o} C, and dry weight in grams (g) per grab sample and biomass in grams per meter squared (g/m^2) of each species were determined. By fall, in many areas, the plants formed a tangled mass completely filling the water column; a grab area of 930 cm^2 results in a sample from a significantly larger area. For this reason, station dry weight (total dry weight of three grabs) greater than 100 g can not be directly related to area and therefore was not calculated.

In the fall, due to the tremendous increase in biomass, sampling methods were altered as follows to minimize time and labor:

1) at transect DM-1R, DM-2R, and DM-3R, stations were only sampled twice and the biomass and species composition of the third sample was calculated using the average for each species in the first two grab samples. In these areas, Hydrilla uniformly covered the entire bottom area and filled the water column near shore. Therefore, we assumed the variability between grab samples was minimal.

2) At all transects, subsamples of plant material for the species in each grab sample were dried. If a sample was larger than a predetermined mass, it was divided visually into approximately equal samples. The number of subsamples was recorded; all but one subsample was discarded and the dry weight of the subsample retained was multiplied by the number of subsamples in the grab sample.

Total dry weights and biomass at each transect during each sampling period are shown in table A-3 (in appendix). Relative occurrence of vegetated transects, stations, and grabs (grouped by 1978-81 study areas and salinity zones) are shown in table A-4 (in appendix). Biomass in g/m^2 of each species at each station (total biomass of three grabs) during each sampling period are shown in tables A-5 through A-14 (in appendix). Data from biomass samples taken by hand harvesting plants in 1-m^2 quadrats at several locations are presented in table A-15 (in appendix). Based on the shoreline surveys and the 62 transects sampled, in 1985, a map was made of the percent cover of Hydrilla in vegetated areas (fig. B-1, in appendix). Species composition was very similar in these vegetated areas, proportions of each species were variable.

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Water transparency measurements were made using a Secchi disk (tables C-1, in appendix). Specific conductivity, pH, dissolved oxygen, and temperature were measured with a Hydrolab 4041[1] (table C-2, in appendix).

Three 9-m^2 competition grids were established over existing plant beds at DM-4R. The grids were divided into nine 1-m^2 quadrats and the total cover and percent of each species in relation to the total number of plants in each square was estimated and recorded in spring and fall (table D-1 to D-3, in appendix). In addition, three 9-m^2 grids were cleared and planted in June with Hydrilla and Vallisneria. Four of the nine 1-m^2 quadrats were randomly selected to plant Hydrilla and 4 selected to plant Vallisneria. One quadrat was not planted. Ten sprigs of Hydrilla, 2 to 10 cm tall, and 30 sprigs of Vallisneria were planted in a quadrat. Percent of each species in relation to the total number of plants after four months was recorded (table D-4, in appendix). The Hydrilla and Vallisneria were hand-harvested from one grid and their biomass in each quadrat was measured (table D-5, in appendix).

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[1]Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

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Appendix B. Distribution map, 1985.

Table A-1.--List of submersed aquatic plants found in the tidal Potomac River, 1985

Taxonomy follows Hotchkiss (1950, 1967) unless otherwise noted

Family	Species	Common name
Characeae (muskgrass family)	Nitella flexilis (L.) Ag.[1]	Muskgrass
Najadaceae (pondweed family)	Potamogeton pectinatus L. Zannichellia palustris L. Najas quadalupensis (Spreng.) Morong Najas minor All	Sago pondweed Horned pondweed Southern naiad
Hydrocharitaceae (frogbit family)	Vallisneria americana Michx. Hydrilla verticillata (L.f.) Caspary.[3]	Wildcelery Hydrilla
Ceratophyllaceae (coontail family)	Ceratophyllum demersum L.	Coontail
Haloragidaceae (watermilfoil family)	Myriophyllum spicatum L.	Eurasian watermilfoil
Pontedariaceae (pickerelweed family)	Heteranthera dubia (Jacquin) MacM.[2]	Water-stargrass

[1]Keyed from Wood (1967).

[2]Keyed from Radford and others (1974).

[3]Keyed from Godfrey and Wooten (1979).

Table A-2.--Species of submersed aquatic plants found on vegetated transects in the tidal Potomac River, 1985

Transect	Species[1/] Spring	Fall
OR-1R	Hydr, P. pect, Zann	Heter, Hydr, Myrio, Najas m, Zann
AD-1R	Hydr	Cerat, Heter, Hydr, Myrio
DM-1R	Cerat, Hydr	Cerat, Heter, Hydr, Myrio
DM-2R	Hydr	Cerat, Heter, Hydr, Myrio, Vall
DM-3R	Cerat, Hydr, Myrio, Nitella	Cerat, Heter, Hydr, Myrio, Najas g
DM-4R	Cerat, Heter, Hydr, Myrio, Najas g, Nitella, P. pect, Vall, Zann	Cerat, Heter, Hydr, Myrio, Najas g, Najas m, Vall, Zann
GC-1R	Hydr, Myrio	Cerat, Heter, Hydr, Myrio, Vall
GC-2R	Cerat, Hydr, Myrio, Vall	Cerat, Heter, Hydr, Myrio, Vall
GC-3R	Myrio, Vall	Myrio, Vall
GC-4R	Cerat, Hydr, Myrio, Vall	Heter, Myrio
GC-5R		Myrio
GC-7R	Myrio	Myrio
WC-1R	Vall, Zann	Hydr, Vall
PY-1R	Hydr, Najas g	Cerat, Heter, Hydr, Myrio, Najas g, Najas m, Vall
PY-2R	Cerat, Heter, Hydr, Myrio, Najas g, Nitella, Vall	Cerat, Heter, Hydr, Myrio, Najas g, Vall
PY-3R	Hydr, Myrio, Najas g	Cerat, Heter, Hydr, Myrio, Najas g, Vall
PY-4R	Zann	Cerat, Heter, Hydr, Myrio, Vall
PY-5R		Heter, Myrio, Vall
PY-6R	Cerat, Myrio, Vall	Cerat, Heter, Hydr, Myrio, Vall
PY-7R	Cerat, Heter, Hydr, Myrio, Nitella, Vall, Zann	Cerat, Heter, Hydr, Myrio, Najas g, Najas m, Vall
PY-8R	Cerat, Heter, Hydr, Myrio, Najas g, Vall, Zann	Cerat, Heter, Hydr, Myrio, Najas g, Najas m, Vall

Table A-2.--Species of submersed aquatic plants found on vegetated transects in the tidal Potomac River, 1985--continued

Transect	Species[1/] Spring	Fall
PY-9R	Heter, Myrio	Heter, Hydr, Myrio
PY-10R	Cerat, Hydr, Najas g, Myrio	
PY-1T-2	Cerat, Myrio	Cerat, Hydr, Myrio
PY-2T-1	Cerat, Hydr, Myrio	Cerat, Hydr, Myrio
MN-10R	Vall	Vall
MN-4T-2	Vall	Cerat, Myrio, Vall

[1/] Cerat = Ceratophyllum demersum, Heter = Heteranthera dubia, Hydr = Hydrilla verticillata, Myrio = Myriophyllum spicatum, Najas g = Najas guadalupensis, Najas m = Najas minor, Nitella = Nitella flexilis, P. pect = Potamogeton pectinatus, Vall = Vallisneria americana, Zann = Zannichellia palustris

Table A-3.--Total sampled dry weight and biomass of all species of submersed aquatic vegetation in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Spring 1985			Fall 1985		
	Vegetated stations	Dry weight	Biomass	Vegetated stations	Dry weight	Biomass
OR-1R	6	10	6	7	138	71
AD-1R	4	36	32	4	100	90
DM-1R	11	44	14	14	3238	a
DM-2R	2	Tr	Tr	6	1663	a
DM-3R	6	128	76	12	1622	a
DM-4R	11	39	13	16	423	a
GC-1R	12	66	20	15	350	a
GC-2R	3	7	8	3	92	110
GC-3R	3	8	10	3	22	26
GC-4R	2	13	70	1	79	283
GC-5R	0	0	0	3	21	25
GC-7R	1	Tr	Tr	3	5	6
WC-1R	3	17	20	2	258	a
PY-1R	3	Tr	Tr	7	104	53
PY-2R	11	391	127	11	1849	a
PY-3R	3	Tr	Tr	4	261	234
PY-4R	2	Tr	Tr	2	38	68
PY-5R	0	0	0	3	41	49
PY-6R	4	3	3	3	130	155
PY-7R	4	12	11	11	1071	a
PY-8R	16	157	35	17	1562	a
PY-9R	2	1	18	2	43	77
PY-10R	5	12	9	0	0	0
PY-1T-2	1	1	4	4	Tr	Tr
PY-2T-1	3	19	34	3	552	a
MN-10R	2	8	14	1	96	344
MN-4T-2	0	0	0	1	8	29

Table A-4.--Relative occurrence of vegetated transects, stations, and grabs for the tidal Potomac River, 1985

Relative occurrence as number vegetated/total number

Study areas	Sampling unit	1985 Spring	1985 Fall
Roosevelt Island to Wilson Bridge	Transects	3/6	3/6
	Stations	13/32	12/33
	Grabs	33/96	24/99
Dyke Marsh	Transects	4/4	4/4
	Stations	29/38	48/55
	Grabs	56/114	127/165
Gunston Cove	Transects	5/13	6/13
	Stations	19/71	24/79
	Grabs	32/213	38/237
Piscataway Creek	Transects	11/13	11/13
	Stations	54/95	65/101
	Grabs	116/285	167/303
Pomonkey Creek	Transects	0/4	0/4
	Stations	0/20	0/20
	Grabs	0/60	0/60
Mattawoman Creek	Transects	2/22	2/22
	Stations	7/112	3/111
	Grabs	15/336	7/333

Table A-5.--Dry weight and biomass of <u>Vallisneria americana</u> in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring Dry weight	Spring Biomass	Fall Dry weight	Fall Biomass
DM-2R	20	0	0	Tr	a
DM-4R	15	17	63	44	157
	30	Tr	Tr	8	28
	45	1	4	Tr	Tr
	60	Tr	Tr	Tr	a
	75	0	0	Tr	Tr
	150	0	0	Tr	Tr
GC-1R	5	0	0	Tr	Tr
GC-2R	15	0	0	Tr	Tr
	45	Tr	Tr	0	0
GC-4R	30	13	46	0	0
WC-1R	5	6	22	101	a
	15	11	40	156	a
	30	Tr	Tr	0	0
PY-1R	30	0	0	11	40
	60	0	0	Tr	Tr
PY-2R	5	0	0	Tr	a
	45	26	92	66	a
	60	1	2	Tr	a
	75	Tr	Tr	Tr	a
	90	0	0	Tr	a
	135	0	0	Tr	a
PY-3R	15	0	0	Tr	Tr
	30	0	0	Tr	Tr
	45	0	0	Tr	Tr
PY-4R	15	0	0	3	9
PY-5R	5	0	0	2	8

Table A-5.--Dry weight and biomass of *Vallisneria americana* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-6R	5	0	0	29	103
	15	0	0	4	13
	30	0	0	Tr	Tr
	45	Tr	Tr	0	0
	60	Tr	Tr	0	0
PY-7R	5	0	0	Tr	Tr
	15	0	0	Tr	a
	30	0	0	Tr	a
	60	0	0	2	a
	75	1	5	28	a
	90	0	0	55	a
	120	0	0	Tr	Tr
PY-8R	30	1	3	0	0
	180	0	0	Tr	Tr
	210	0	0	39	139
MN-10R	15	2	8	88	315
	30	4	13	0	0
	45	4	13	8	29
	60	3	10	0	0
	75	1	3	0	0
MN-4T-2	5	2	7	6	27
	15	6	21	0	0

Table A-6.--Dry weight and biomass of Myriophyllum spicatum in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
OR-1R	5	0	0	7	25
	45	0	0	Tr	Tr
	90	0	0	7	25
AD-1R	30	0	0	Tr	Tr
	45	0	0	4	14
DM-1R	5	0	0	Tr	a
	105	0	0	Tr	a
	135	0	0	Tr	a
	150	0	0	Tr	a
DM-2R	15	0	0	Tr	a
	20	0	0	Tr	a
DM-3R	15	17	61	0	0
	30	0	0	Tr	a
	45	Tr	Tr	25	a
	60	0	0	12	a
	75	0	0	Tr	Tr
	90	0	0	Tr	Tr
	135	0	0	Tr	Tr
	180	0	0	7	26
DM-4R	5	0	0	Tr	Tr
	15	Tr	Tr	2	6
	30	0	0	Tr	Tr
	45	Tr	Tr	2	6
	60	9	33	6	a
	75	Tr	Tr	2	8
	90	Tr	Tr	Tr	Tr
	105	3	12	Tr	Tr
	120	Tr	Tr	2	5
	135	0	0	Tr	Tr
	150	0	0	2	4
	165	0	0	Tr	Tr
	195	0	0	2	7
	225	0	0	17	61
	240	0	0	Tr	Tr

Table A-6.--Dry weight and biomass of Myriophyllum spicatum in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
GC-1R	5	2	6	13	47
	30	0	0	44	158
	45	0	0	4	a
	60	4	14	46	165
	75	1	5	5	18
	90	10	35	12	45
	105	6	21	2	8
	120	10	35	20	73
	135	5	19	36	131
	150	4	13	31	111
	165	14	52	8	29
	180	2	6	0	0
	195	5	16	0	0
	210	3	12	0	0
GC-2R	5	0	0	3	10
	15	Tr	Tr	54	196
	30	7	25	9	77
GC-3R	5	Tr	Tr	2	8
	30	2	6	4	14
	60	6	21	16	59
GC-4R	15	Tr	Tr	49	176
GC-5R	5	0	0	19	68
	15	0	0	Tr	Tr
	45	0	0	2	8
GC-7R	5	0	0	1	5
	30	0	0	Tr	Tr
	60	Tr	Tr	4	15
PY-1R	30	0	0	22	80
	45	0	0	Tr	Tr
	60	0	0	9	33
	75	0	0	11	39

Table A-6.--Dry weight and biomass of *Myriophyllum spicatum* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-2R	5	0	0	8	a
	15	32	116	21	a
	30	33	120	6	a
	45	Tr	Tr	5	a
	60	24	87	17	a
	75	3	9	56	a
	90	19	67	63	a
	105	71	253	Tr	a
	120	4	13	24	87
	135	Tr	Tr	59	a
	150	7	23	35	a
	165	23	82	0	0
PY-3R	5	0	0	5	18
	15	Tr	Tr	6	21
	30	0	0	86	310
	45	0	0	3	10
	60	Tr	Tr	0	0
PY-4R	15	0	0	Tr	Tr
	30	0	0	13	48
PY-5R	60	0	0	8	29
PY-6R	15	0	0	Tr	Tr
	30	Tr	Tr	0	0
	45	1	4	0	0
	60	2	6	0	0
PY-7R	5	0	0	Tr	Tr
	15	Tr	Tr	15	a
	30	6	21	27	a
	45	5	17	34	a
	60	0	0	14	a
	75	Tr	Tr	34	a
	90	0	0	79	a
	120	0	0	Tr	Tr
	135	0	0	3	9

Table A-6.--Dry weight and biomass of *Myriophyllum spicatum* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-8R	15	Tr	Tr	0	0
	30	0	0	3	a
	45	10	36	Tr	a
	60	Tr	Tr	28	a
	75	19	70	7	a
	90	7	26	13	48
	105	12	41	10	a
	120	5	19	47	a
	135	Tr	Tr	35	a
	150	4	13	77	278
	165	3	10	34	a
	180	5	19	8	29
	195	18	66	Tr	Tr
	210	36	130	Tr	Tr
	225	4	15	0	0
	240	9	33	0	0
	255	Tr	Tr	0	0
PY-9R	5	Tr	Tr	0	0
	30	0	0	27	97
PY-10R	30	7	25	0	0
	45	Tr	Tr	0	0
	60	5	18	0	0
	75	Tr	Tr	0	0
PY-1T-2	5	0	0	Tr	Tr
	15	0	0	Tr	Tr
	60	1	4	0	0
PY-2T-1	5	Tr	Tr	22	81
	15	0	0	2	a
	45	0	0	282	a
	60	15	53	0	0
MN-4T-2	5	0	0	Tr	Tr

Table A-7.--Dry weight and biomass of *Zannichellia palustris* in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
OR-1R	15	2	6	0	0
	30	Tr	Tr	0	0
	60	0	0	Tr	Tr
DM-4R	5	Tr	Tr	Tr	Tr
	15	1	5	Tr	Tr
	30	2	8	0	0
	45	Tr	Tr	0	0
WC-1R	5	Tr	Tr	0	0
PY-4R	15	Tr	Tr	0	0
	30	Tr	Tr	0	0
PY-7R	15	1	4	0	0
PY-8R	15	4	13	0	0
	30	Tr	Tr	0	0
	45	Tr	Tr	0	0
	60	Tr	Tr	0	0

Table A-8.--Dry weight and biomass of *Hydrilla verticillata* in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
OR-1R	5	Tr	Tr	0	0
	15	0	0	3	12
	30	0	0	Tr	Tr
	45	0	0	Tr	Tr
	60	2	8	Tr	Tr
	75	Tr	Tr	Tr	Tr
AD-1R	5	17	62	0	0
	15	17	62	17	62
	30	2	6	55	198
	45	Tr	Tr	6	23
DM-1R	5	Tr	Tr	203	a
	15	15	52	216	a
	30	29	103	293	a
	45	Tr	Tr	225	a
	60	0	0	133	a
	75	Tr	Tr	285	a
	90	0	0	123	a
	105	Tr	Tr	289	a
	120	Tr	Tr	495	a
	135	Tr	Tr	298	a
	150	Tr	Tr	238	a
	165	Tr	Tr	61	220
	180	0	0	30	108
	195	0	0	176	a
DM-2R	5	22	80	419	a
	8	0	0	374	a
	15	37	134	398	a
	20	0	0	113	a
	25	0	0	199	a
	30	0	0	28	101

Table A-8.--Dry weight and biomass of *Hydrilla verticillata* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring Dry weight	Spring Biomass	Fall Dry weight	Fall Biomass
DM-3R	5	12	43	179	a
	15	27	97	364	a
	30	38	136	213	a
	45	1	4	314	a
	60	Tr	Tr	264	a
	75	Tr	Tr	51	184
	90	0	0	2	7
	105	0	0	Tr	Tr
	135	0	0	Tr	Tr
	150	0	0	1	4
	165	0	0	Tr	Tr
DM-4R	5	0	0	Tr	Tr
	15	0	0	Tr	Tr
	30	Tr	Tr	4	14
	45	0	0	16	59
	60	1	3	98	a
	75	Tr	Tr	17	59
	90	1	5	6	21
	105	Tr	Tr	17	62
	120	0	0	2	9
	135	0	0	Tr	Tr
	150	0	0	4	14
	165	0	0	11	39
	195	0	0	Tr	Tr
	225	0	0	Tr	Tr
GC-1R	5	0	0	Tr	Tr
	60	0	0	1	5
	90	0	0	6	22
	105	Tr	Tr	2	6
	135	0	0	Tr	Tr
	150	0	0	4	14
	165	0	0	1	4
	195	Tr	Tr	0	0

Table A-8.--Dry weight and biomass of Hydrilla verticillata in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
GC-2R	5	0	0	Tr	Tr
	15	Tr	Tr	16	57
	30	Tr	Tr	Tr	Tr
GC-4R	15	Tr	Tr	0	0
WC-1R	5	0	0	1	a
PY-1R	15	0	0	Tr	Tr
	30	Tr	Tr	7	24
	45	0	0	Tr	Tr
	60	Tr	Tr	14	49
	75	0	0	Tr	Tr
	105	0	0	Tr	Tr
	120	0	0	Tr	Tr
PY-2R	5	0	0	120	a
	15	Tr	Tr	33	a
	30	Tr	Tr	116	a
	45	0	0	25	a
	60	Tr	Tr	6	a
	75	0	0	23	a
	90	0	0	81	a
	105	0	0	117	a
	120	0	0	1	5
	135	Tr	Tr	2	a
	150	0	0	Tr	a
	165	Tr	Tr	0	0
PY-3R	5	0	0	32	116
	15	0	0	25	89
	30	0	0	6	22
	45	0	0	63	227
	90	Tr	Tr	0	0
PY-4R	15	0	0	2	6
PY-6R	5	0	0	Tr	Tr
	15	0	0	3	12

Table A-8.--Dry weight and biomass of *Hydrilla verticillata* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-7R	5	0	0	7	26
	15	Tr	Tr	65	a
	30	Tr	Tr	107	a
	45	Tr	Tr	81	a
	60	0	0	66	a
	75	0	0	101	a
	90	0	0	Tr	a
	105	0	0	5	16
	120	0	0	Tr	Tr
	135	0	0	9	34
	150	0	0	Tr	Tr
PY-8R	5	0	0	Tr	Tr
	15	0	0	13	45
	30	0	0	86	a
	45	Tr	Tr	125	a
	60	Tr	Tr	100	a
	75	Tr	Tr	125	a
	90	6	23	63	227
	105	2	5	92	a
	120	4	15	66	a
	135	Tr	Tr	74	a
	150	0	0	82	297
	165	Tr	Tr	130	a
	180	Tr	Tr	53	192
	195	0	0	3	10
	210	Tr	Tr	Tr	Tr
	240	Tr	Tr	0	0
PY-9R	30	0	0	Tr	Tr
PY-10R	60	Tr	Tr	0	0
PY-1T-2	60	0	0	Tr	Tr
PY-2T-1	5	2	9	54	196
	15	0	0	95	a
	45	Tr	Tr	14	a
	60	2	6	0	0

Table A-9.--Dry weight and biomass of _Potamogeton pectinatus_ in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
OR-1R	5	1	5	0	0
	15	Tr	Tr	0	0
	30	Tr	Tr	0	0
	45	Tr	Tr	0	0
	60	5	20	0	0
DM-4R	45	Tr	Tr	0	0

Table A-10.--Dry weight and biomass of *Najas minor* in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from space	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
OR-1R	30	0	0	1	4
DM-4R	15	0	0	Tr	Tr
	75	0	0	Tr	Tr
PY-1R	60	0	0	Tr	Tr
PY-7R	45	0	0	Tr	a
	60	0	0	Tr	a
	90	0	0	Tr	a
	120	0	0	Tr	Tr
	135	0	0	Tr	Tr
PY-8R	30	0	0	Tr	a
	45	0	0	Tr	a

Table A-11.--Dry weight and biomass of Najas guadalupensis in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring Dry weight	Spring Biomass	Fall Dry weight	Fall Biomass
DM-3R	45	0	0	Tr	a
	60	0	0	Tr	a
DM-4R	5	0	0	Tr	Tr
	45	0	0	Tr	Tr
	60	0	0	1	a
	75	0	0	Tr	Tr
	90	Tr	Tr	12	44
	105	0	0	Tr	Tr
	120	0	0	Tr	Tr
	150	0	0	Tr	Tr
PY-1R	15	0	0	Tr	Tr
	30	Tr	Tr	Tr	Tr
	45	Tr	Tr	Tr	Tr
	60	Tr	Tr	Tr	Tr
	75	0	0	1	5
	105	0	0	Tr	Tr
	120	0	0	2	8
PY-2R	15	Tr	Tr	0	0
	30	Tr	Tr	3	a
	45	Tr	Tr	Tr	a
	105	Tr	Tr	9	a
	135	Tr	Tr	0	0
PY-3R	5	0	0	Tr	Tr
	15	Tr	Tr	0	0
	45	0	0	3	9
PY-7R	15	0	0	26	a
	30	0	0	Tr	a
	45	0	0	18	a

Table A-11.--Dry weight and biomass of Najas guadalupensis in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-8R	45	0	0	Tr	Tr
	90	Tr	Tr	6	23
	105	Tr	Tr	0	0
	120	0	0	Tr	a
	135	Tr	Tr	0	0
	150	0	0	1	5
	165	0	0	Tr	a
	180	0	0	Tr	Tr
PY-10R	60	Tr	Tr	0	0

Table A-12.--Dry weight and biomass of Nitella flexilis in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
DM-3R	60	Tr	Tr	0	0
DM-4R	45	Tr	Tr	0	0
	60	Tr	Tr	0	0
	135	Tr	Tr	0	0
PY-2R	15	Tr	Tr	0	0
PY-7R	30	Tr	Tr	0	0

Table A-13.--Dry weight and biomass of *Heteranthera dubia* in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

		Spring		Fall	
Transect	Distance from shore	Dry weight	Biomass	Dry weight	Biomass
OR-1R	75	0	0	54	195
	90	0	0	66	239
AD-1R	30	0	0	11	40
	45	0	0	Tr	Tr
DM-1R	105	0	0	11	a
	195	0	0	Tr	a
DM-2R	15	0	0	108	a
	20	0	0	5	a
DM-3R	15	0	0	15	a
	75	0	0	47	169
	105	0	0	76	275
DM-4R	15	0	0	Tr	Tr
	45	0	0	22	78
	60	3	9	Tr	a
	75	Tr	Tr	9	33
	105	0	0	Tr	Tr
	150	0	0	1	5
	225	0	0	15	55
	240	0	0	Tr	Tr
	255	0	0	4	15
GC-1R	45	0	0	111	a
	165	0	0	Tr	Tr
GC-2R	5	0	0	Tr	Tr
	30	0	0	Tr	Tr
GC-4R	15	0	0	30	107
PY-1R	45	0	0	24	88
	75	0	0	Tr	Tr

Table A-13.--Dry weight and biomass of *Heteranthera dubia* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less than 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-2R	5	0	0	10	a
	15	Tr	Tr	6	a
	30	Tr	Tr	53	a
	45	1	3	46	a
	60	Tr	Tr	197	a
	75	45	160	34	a
	90	0	0	22	a
	105	Tr	Tr	3	11
	120	0	0	49	178
	135	Tr	Tr	18	a
	150	1	3	124	a
	165	Tr	Tr	0	0
PY-3R	5	0	0	2	8
	30	0	0	Tr	Tr
PY-4R	15	0	0	18	67
PY-5R	45	0	0	4	13
	60	0	0	27	96
PY-6R	5	0	0	35	125
	15	0	0	34	121
	30	0	0	22	79
PY-7R	5	0	0	Tr	Tr
	30	0	0	Tr	a
	45	0	0	33	a
	75	Tr	Tr	0	0
	105	0	0	68	245
	120	0	0	50	181
	135	0	0	Tr	Tr
	150	0	0	34	121

Table A-13.--Dry weight and biomass of *Heteranthera dubia* in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-8R	30	0	0	39	a
	45	0	0	24	a
	90	0	0	1	5
	165	0	0	5	a
	195	8	27	0	0
PY-9R	15	1	5	0	0
	45	0	0	16	59

Table A-14.--Dry weight and biomass of Ceratophyllum demersum in the tidal Potomac River, 1985

Dry weight in grams; biomass in grams per square meter; Tr, trace (less that 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
AD-1R	30	0	0	6	32
	45	0	0	1	5
DM-1R	15	0	0	1	a
	30	0	0	Tr	a
	45	0	0	Tr	a
	60	0	0	1	a
	105	0	0	15	a
	120	0	0	99	a
	150	0	0	30	a
	165	0	0	Tr	Tr
	180	Tr	Tr	0	0
	195	0	0	16	a
DM-2R	15	0	0	3	a
	20	0	0	15	a
	25	0	0	1	a
DM-3R	5	21	76	10	a
	15	12	43	2	a
	30	Tr	Tr	3	a
	45	0	0	Tr	a
	60	0	0	37	a
DM-4R	5	0	0	Tr	Tr
	15	0	0	Tr	Tr
	45	0	0	9	34
	60	1	4	Tr	a
	75	0	0	71	254
	90	0	0	Tr	Tr
	105	0	0	2	9
	135	0	0	Tr	Tr
	150	0	0	14	50
	165	0	0	1	5
GC-1R	5	0	0	Tr	Tr
	30	0	0	4	16
	60	0	0	Tr	Tr
	75	0	0	Tr	Tr
	105	0	0	Tr	Tr
	165	0	0	Tr	Tr

Table A-14.--Dry weight and biomass of Ceratophyllum demersum in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less that 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
GC-2R	15	Tr	Tr	3	9
	30	Tr	Tr	7	24
GC-4R	15	Tr	Tr	0	0
PY-1R	30	0	0	Tr	Tr
	60	0	0	Tr	Tr
	75	0	0	3	9
PY-2R	5	0	0	3	a
	15	15	53	60	a
	30	3	10	15	a
	45	Tr	Tr	73	a
	60	13	48	19	a
	75	3	10	31	a
	90	2	8	3	a
	105	2	9	9	a
	120	0	0	Tr	Tr
	135	0	0	21	a
	150	0	0	157	a
PY-3R	5	0	0	Tr	Tr
	30	0	0	27	96
	45	0	0	3	11
PY-4R	15	0	0	2	8
PY-6R	5	0	0	Tr	Tr
	15	0	0	3	10
	75	Tr	Tr	0	0
PY-7R	5	0	0	5	18
	15	0	0	Tr	a
	30	Tr	Tr	Tr	a
	45	Tr	Tr	Tr	a
	60	0	0	23	a
	75	Tr	Tr	72	a
	90	0	0	2	a
	105	0	0	2	7
	120	0	0	2	7
	135	0	0	4	13

Table A-14.--Dry weight and biomass of Ceratophyllum demersum in the tidal Potomac River, 1985--continued

Dry weight in grams; biomass in grams per square meter; Tr, trace (less that 1 gram); a, no biomass calculated--see text (p. 5)

Transect	Distance from shore	Spring		Fall	
		Dry weight	Biomass	Dry weight	Biomass
PY-8R	5	0	0	Tr	Tr
	15	0	0	Tr	Tr
	30	0	0	Tr	a
	45	Tr	Tr	35	a
	60	0	0	3	a
	75	0	0	Tr	a
	90	0	0	10	37
	105	0	0	16	a
	120	0	0	61	a
	135	0	0	Tr	a
	150	0	0	18	64
	165	0	0	12	a
	180	0	0	18	63
	195	Tr	Tr	0	0
	210	0	0	Tr	Tr
PY-10R	15	Tr	Tr	0	0
	60	Tr	Tr	0	0
PY-1T-2	45	0	0	Tr	Tr
	60	Tr	Tr	0	0
PY-2T-1	5	Tr	Tr	22	78
	15	0	0	9	a
	45	0	0	52	a
	60	Tr	Tr	0	0
MN-4T-2	5	0	0	2	7

Table A-15.--Biomass of vegetation in sample quadrats, September 24 - October 4, 1985
[Biomass in grams per meter square]

Species composition	Nearest transect location	Total biomass
Ceratophyllum	PY-1T-2	152
Heteranthera	PY-2R	92
Hydrilla	DM-1.5R	255
Myriophyllum	PY-1T-2	82
Vallisneria	PY-1R	228
Mixed[1]	PY-1T-2	205
Mixed[1]	DM-4R	81
Mixed[1]	DM-4R	72

[1]Mixed = varying amounts of Ceratophyllum, Heteranthera, Hydrilla, Myriophyllum, Najas guadalupensis and Vallisneria

Appendix B. Distribution map, 1985.

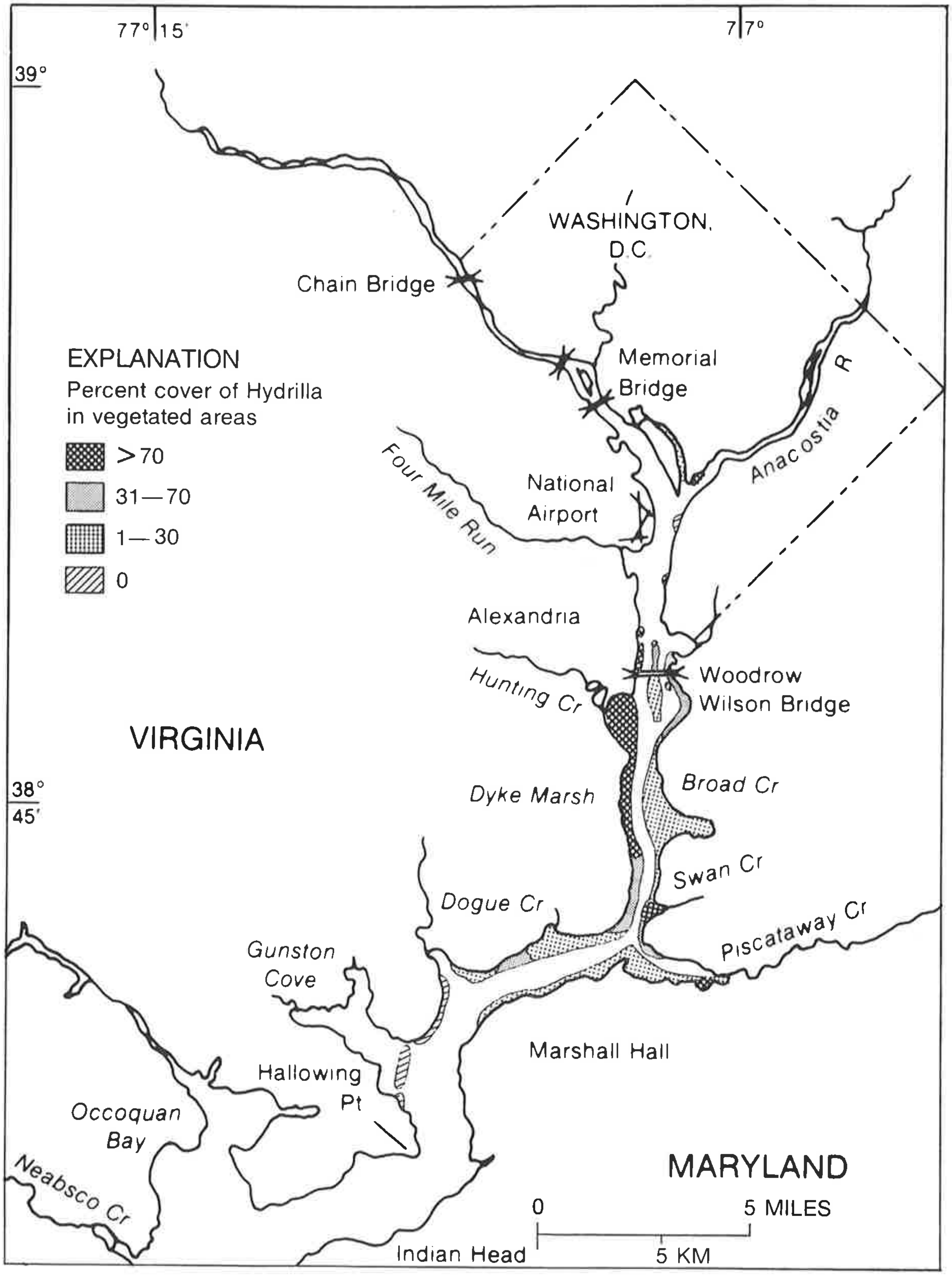

Figure B-1: Percent cover of Hydrilla in vegetated areas, fall 1985.

Appendix C. Water-quality data.

Table C-1.--Secchi depths in the tidal Potomac River, 1985

Nearest transect	Date	Secchi depth (centimeters)	Nearest transect	Date	Secchi depth (centimeters)
NA-2R	June 13	44	WC-1R	June 13	71
OR-1R	September 21	70	WC-1R	August 21	104
OR-1R	September 23	65	PY-1R	June 17	97
AD-1R	June 12	61	PY-1R	September 23	87
DM-1R	June 17	118	PY-1R	September 23	93
DM-3R	June 13	125	PY-1R	September 23	81
DM-3R	November 21	40	PY-1R	September 24	153
DM-4R	June 13	122	PY-2R	June 17	96
DM-4R	November 21	83[1]	PY-2R	September 10	125
DM-4R	November 21	94[1]	PY-3R	June 6	41
DM-4R	November 21	50	PY-3R	September 10	143
DM-4R	November 21	59	PY-4R	June 6	69
GC-1R	June 6	88	PY-4R	October 10	87
GC-1R	August 27	62	PY-4R	October 10	107
GC-1R	October 8	82	PY-5R	June 6	96
GC-1R	October 8	85	PY-6R	June 6	104
GC-1R	October 8	100	PY-6R	September 10	120
GC-2R	June 5	104	PY-6R	October 10	125
GC-2R	August 27	55	PY-8R	May 1	123
GC-2R	October 8	130	PY-8R	May 14	136
GC-3R	August 27	45	PY-8R	June 5	92
GC-3R	October 10	42	PY-8R	June 6	117
GC-4R	June 5	74	PY-8R	September 6	109
GC-4R	August 27	76	PY-8R	October 10	100
GC-4R	October 10	58	PY-9R	September 6	52
GC-5R	May 1	73	PY-9R	October 11	53
GC-5R	May 14	107	PY-10R	June 5	66
GC-5R	June 5	66	PY-1T-1	September 24	28
GC-5R	August 27	79	PY-1T-2	June 6	52
GC-5R	October 9	71	PY-2T-1	September 24	46
GC-6R	June 5	60	MN-2R	June 5	56
GC-6R	August 27	30	MN-3R	June 5	64
GC-7R	June 5	43	MN-4R	June 5	63
GC-7R	August 27	48	MN-5R	June 11	77
GC-8R	June 5	50	MN-6R	May 1	70
GC-8R	August 27	44	MN-6R	May 14	76
GC-9R	June 5	47	MN-6R	June 11	74
GC-9R	August 27	32	MN-7R	June 11	76
GC-10R	June 5	37	MN-8R	June 11	69
GC-10R	August 27	32	MN-9R	June 11	74
GC-1T-1	August 27	29	MN-10R	June 11	71
GC-1T-2	June 5	36	MN-1T-1	June 12	44
GC-1T-2	August 27	30	MN-1T-2	September 12	47
GC-1T-3	August 27	33	MN-1T-3	June 12	39

[1] measurement taken in the vegetation bed

Table C-1.--Secchi depths in the tidal Potomac River, 1985--continued

Nearest transect	Date	Secchi depth (centimeters)	Nearest transect	Date	Secchi depth (centimeters)
MN-2T-1	June 12	42	MN-3T-2	June 12	34
MN-2T-2	June 12	35	MN-3T-2	September 12	54
MN-2T-3	June 12	88	MN-3T-3	June 12	34
MN-3T-1	June 12	34	MN-4T-1	June 12	45

Table C-2--Secchi depth, conductivity, dissolved oxygen, pH and temperature in the tidal Potomac River, August-October, 1985

Secchi is Secchi depth in centimeters; Cond is specific conductance in micromhos; Temp is temperature in degrees Celsius; DO is dissolved oxygen in milligrams per liter; n.d. is no data available

Transect	Date	Secchi	Cond	pH	Temp	DO
RI-1R	August 28	113	334	8.0	26.2	8.1
NA-2R	August 28	77	387	8.6	26.7	10.6
OR-1R	September 4	79	378	8.6	26.7	6.8
AD-1R	September 4	111	406	7.3	26.8	6.0
DM-1R	September 4	201	475	7.1	27.2	4.0
DM-1.5R	October 21	40	n.d.	n.d.	13.0	n.d.
DM-3R	August 20	135	399	7.1	26.5	5.8
DM-4R	August 28	75	379	8.1	25.8	7.9
GC-5R	May 28	100	276	7.3	23.6	9.9
GC-5R	June 11	n.d.	249	7.6	25.3	7.8
GC-5R	June 25	65	261	8.8	26.4	9.9
GC-5R	July 9	54	304	8.8	26.5	7.1
GC-5R	August 6	57	355	8.9	26.7	10.9
GC-5R	August 20	52	407	8.4	27.1	7.6
GC-5R	September 3	75	439	8.7	27.6	10.1
GC-5R	September 17	68	627	8.9	23.2	8.9
WC-1R	August 28	137	377	8.0	26.6	8.1
BB-1R	September 4	87	392	7.7	26.6	7.1
PY-1R	June 11	n.d.	269	7.2	25.2	6.4
PY-1R	June 25	79	344	7.1	25.2	7.7
PY-1R	July 9	91	341	7.5	27.5	6.7
PY-1R	August 6	97	340	7.2	26.9	6.7
PY-1R	August 20	90	416	7.2	27.5	6.0
PY-1R	September 3	89	436	7.6	26.9	8.1
PY-1R	September 17	67	431	7.5	22.9	7.8
PY-1R	September 18	62	434	7.1	23.3	7.3
PY-7R	September 11	110	383	7.3	28.2	6.0
PY-8R	May 28	120	292	7.2	23.4	6.5
PY-8R	June 11	n.d.	240	7.2	25.3	5.3
PY-8R	June 25	78	286	7.2	25.9	8.7
PY-8R	July 9	73	284	7.8	26.7	6.7
PY-8R	August 6	61	340	8.9	26.5	11.9
PY-8R	August 20	70	360	7.4	27.1	6.4
PY-8R	August 20	70	360	7.2	27.2	5.9
PY-8R	September 3	83	414	7.5	26.8	7.7
PY-8R	September 11	104	380	7.3	28.1	6.0
PY-8R	September 17	70	437	8.3	22.8	9.6
PY-9R	September 11	84	387	7.9	27.9	8.0
PY-10R	September 11	66	409	8.5	27.6	8.6
PY-2T-1	September 11	75	510	7.7	27.1	5.5

Table C-2--Secchi depth, conductivity, dissolved oxygen, pH and temperature in the tidal Potomac River, August-October, 1985--continued

Secchi is Secchi depth in centimeters; Cond is specific conductance in micromhos; Temp is temperature in degrees Celsius; DO is dissolved oxygen in milligrams per liter; n.d. is no data available

Transect	Date	Secchi	Cond	pH	Temp	DO
PM-1R	September 11	51	433	9.3	27.8	11.8
PM-3R	September 11	80	435	8.3	27.8	7.6
PM-4R	September 11	82	456	8.3	27.9	7.8
MN-2R	September 16	68	1760	7.7	23.2	6.2
MN-3R	September 16	68	1900	7.6	23.1	5.9
MN-4R	September 12	64	1190	8.3	26.3	7.7
MN-6R	May 28	n.d.	264	8.2	22.5	9.2
MN-6R	June 11	n.d.	283	8.1	25.7	7.2
MN-6R	June 25	83	263	8.1	26.7	8.5
MN-6R	July 9	63	826	8.6	26.3	7.4
MN-6R	August 6	71	1617	8.6	26.3	8.9
MN-6R	August 20	53	310	8.5	26.7	9.8
MN-6R	September 3	83	1637	8.1	27.7	8.1
MN-6R	September 12	61	2600	7.7	26.5	6.5
MN-6R	September 17	62	4690	7.3	22.7	6.3
MN-7R	September 16	53	3390	7.6	22.9	6.3
MN-8R	September 16	54	4530	7.4	23.4	5.7
MN-9R	September 16	65	5220	7.5	23.5	6.3
MN-10R	September 16	69	n.d.	7.5	23.1	n.d.
MN-1T-1	September 12	48	1675	7.9	25.3	7.6
MN-1T-3	September 12	70	1690	5.4	24.7	7.2
MN-1T-4	September 12	49	1699	8.7	24.5	7.9
MN-2T-2	September 12	50	1740	8.7	25.0	9.1
MN-2T-3	September 12	50	1630	8.7	25.4	8.5
MN-3T-1	September 12	50	1577	8.7	25.1	8.0
MN-4T-2	September 12	64	1347	7.9	25.5	8.5

Appendix D. Competition data.

Table D-1.--Competition grid data, DM-4R, grid number 1, 1985

[Total cover: A is <10 percent, B is 10-40 percent, C is 40-70 percent, D is 70 to 100 percent, 0 is no vegetation. Percent by species: 1 is <10 percent, 2 is 10-40 percent, 3 is 40-70 percent, 4 is 70-100 percent, 0 is species absent]

Date	Cover Percent	Grid cell number 1	2	3	4	5	6	7	8	9
June 6	Total cover	B	D	C	D	D	D	B	C	D
	Percent by species									
	Cerat	0	0	0	0	0	1	0	0	0
	Hyd	0	0	3	0	1	2	0	3	0
	Myrio	0	0	0	1	1	0	0	0	0
	Nit	0	0	0	0	0	0	0	1	0
	Sago	1	1	3	1	1	1	1	0	1
	Vall	4	4	3	4	4	4	4	3	4
October 3	Total cover	D	D	D	D	D	D	D	D	D
	Percent by species									
	Cerat	0	0	0	0	0	0	0	1	0
	Hyd	1	0	2	1	1	1	2	0	1
	Myrio	2	1	0	1	1	1	0	1	0
	Vall	4	4	4	4	4	4	4	4	4

Cerat = *Ceratophyllum demersum*; Hydr = *Hydrilla verticillata*; Myrio = *Myriophyllum spicatum*; Nit = *Nitella flexilis*; Sago = *Potamogeton pectinatus*; Vall = *Vallisneria americana*; Zann = *Zannichellia palustris*

Table D-2.--Competition grid data, DM-4R, grid number 2, 1985

[Total cover: A is <10 percent, B is 10-40 percent, C is 40-70 percent, D is 70 to 100 percent, 0 is no vegetation. Percent by species: 1 is <10 percent, 2 is 10-40 percent, 3 is 40-70 percent, 4 is 70-100 percent, 0 is species absent]

		Grid cell number								
Date	Cover Percent	1	2	3	4	5	6	7	8	9
June 6	Total cover	D	D	D	D	D	C	A	A	A
	Percent by species									
	Cerat	0	0	1	0	0	1	0	0	0
	Hydr	0	0	0	0	0	1	0	0	0
	Myrio	0	0	0	0	0	0	4	0	0
	Sago	1	1	0	1	0	0	0	4	4
	Vall	4	4	4	4	4	4	3	0	0
October 3	Total cover	D	D	D	D	D	D	D	D	D
	Percent by species									
	Cerat	0	0	0	0	0	1	2	0	0
	Heter	0	0	0	0	0	0	1	2	1
	Hydr	1	1	1	2	3	3	2	4	4
	Myrio	2	1	0	2	0	1	3	0	0
	Vall	4	4	4	3	3	3	1	2	0

Cerat = Ceratophyllum demersum; Heter = Heteranthera dubia; Hydr = Hydrilla verticillata; Myrio = Myriophyllum spicatum; Sago = Potamogeton pectinatus; Vall = Vallisneria americana

Table D-3.--Competition grid data, DM-4R, grid number 3, 1985

[Total cover: A is <10 percent, B is 10-40 percent, C is 40-70 percent, D is 70 to 100 percent, 0 is no vegetation. Percent by species: 1 is <10 percent, 2 is 10-40 percent, 3 is 40-70 percent, 4 is 70-100 percent, 0 is species absent]

		Grid cell number								
Date	Cover Percent	1	2	3	4	5	6	7	8	9
June 6	Total cover	A	C	C	C	D	C	C	D	D
	Percent by species									
	Hydr	0	0	2	0	3	0	0	0	0
	Myrio	4	0	0	2	1	0	0	0	1
	Nit	3	0	1	2	2	1	0	1	2
	Sago	0	0	0	0	0	1	0	0	0
	Vall	0	0	0	0	0	0	0	1	0
	Zann	0	4	4	2	3	4	4	4	4
October 3	Total cover	D	D	D	D	D	D	D	D	D
	Percent by species									
	Heter	1	1	1	0	0	1	0	0	1
	Hydr	1	4	4	3	4	4	4	4	4
	Myrio	1	0	0	2	2	1	2	2	3
	Vall	1	0	0	0	0	0	2	1	1

Heter = *Heteranthera dubia*; Hydr = *Hydrilla verticillata*; Myrio = *Myriophyllum spicatum*; Nit = *Nitella flexilis*; Sago = *Potamogeton pectinatus*; Vall = *Vallisneria americana*; Zann = *Zannichellia palustris*

Table D-4.--Percent of each species in *Hydrilla* and *Vallisneria* competition grids, after four months, 1985

	Grid cell number								
	1	2	3	4	5	6	7	8	9
Grid 1:									
Original species planted	V	H	V	H	V	∅	V	H	H
Percent by species									
Hydrilla	40	85	0	70	10	20	15	95	80
Vallisneria	60	15	100	30	90	80	85	5	0
Myriophyllum	0	0	0	0	0	0	0	0	20
Grid 2:									
Original species planted	V	∅	H	H	V	V	H	H	V
Percent by species									
Hydrilla	30	n.d.	80	100	30	70	100	95	20
Vallisneria	70	n.d.	10	0	70	30	0	5	80
Sago	0	n.d.	10	0	0	0	0	0	0
Grid 3:									
Original species planted	H	H	V	V	∅	V	V	H	H
Percent by species									
Hydrilla	70	95	60	40	n.d.	10	40	90	40
Vallisneria	25	5	35	60	n.d.	80	60	10	40
Myriophyllum	5	0	5	0	n.d.	10	0	0	10
Ceratophyllum	0	0	0	0	n.d.	0	0	0	10

∅-This quadrat not planted

Table D-5.--Biomass of *Hydrilla* and *Vallisneria* in competition grid no. 1, October 3, 1985
[Biomass in grams per meter squared]

Original species planted in cell	Biomass *Vallisneria*	Biomass *Hydrilla*	Total Biomass	Cell number
Hydrilla	20	80	100	2
Hydrilla	18	62	80	4
Hydrilla	20	116	136	8
Hydrilla	8	97	105	9
Vallisneria	61	36	97	1
Vallisneria	82	18	100	3
Vallisneria	39	32	71	5
Vallisneria	39	18	57	7

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