DES PLAINES RIVER LONG-TERM MONITORING PROGRAM: VEGETATION ANALYSES AND HABITAT CHARACTERIZATION

Toxicants
Chemical
Analyses
Macrophytes
Heavy metals
Pesticide
PCB
heavy metals
dieldrin
DDT
Upper Illinois Waterway

PHASE II REPORT

by

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DISCLAIMER

This report was prepared for Commonwealth Edison Company. The findings, conclusions, recommendations, and views expressed are those of the researchers and should not be considered as the official position of Commonwealth Edison Company.

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DES PLAINES RIVER LONG-TERM MONITORING PROGRAM: VEGETATION ANALYSES AND HABITAT CHARACTERIZATION

INTRODUCTION

Macrophytes are an integral part of aquatic systems. They modify and diversify habitat and fuel secondary production. Macrophytes produce oxygen, cycle nutrients, stabilize sediments, provide cover for fishes, and provide food and substrate for macroinvertebrates and microorganisms (Richardson 1921, Bennett 1971, Raschke 1978, Wright et al. 1981, Wiley and Gorden 1984, Barko et al. 1986). Macrophytes also modify flow velocities and patterns, altering amount and location of sediment deposition, light penetration, and other environmental characteristics (Hynes 1970, Westlake 1973).

Aquatic macrophytes concentrate various toxic substances from the water column and sediments and the amounts concentrated are determined largely by availability of those substances in the environment, morphology of the plant species, and prevailing edaphic factors (Gerloff and Fishbeck 1973, Cowgill 1974, Mayes et al. 1977, Mudroch and Capobianco 1979, Schierup and Larsen 1981, Campbell et al. 1985, Everard and Denny 1985). Because macrophytes often accumulate, and sometimes translocate, large amounts of toxic materials and survive, investigators have proposed that they may (1) be useful as indicator species for certain pollutants and (2) provide a pathway for movement of toxic materials between ecosystem components (Welsh and Denny 1976, McIntosh et al. 1978, Aulio 1980, Franzin and McFarlane 1980, Campbell et al. 1985).

Aquatic habitat quality, except in systems that are phytoplankton or detritus based, is governed largely by the presence and characteristics of macrophytes. Thus, to assess habitat quality and the potential for a productive fishery, macrophyte populations must be examined.

STUDY SITE DESCRIPTION

Submersed and floating aquatic plants once flourished in the Illinois River Valley. Since the early 1960's, submersed and all but one species of floating macrophytes have virtually disappeared from the Illinois River and its bottomland lakes. A 1978 survey indicated that occasionally conditions exist that allow limited growth of more tolerant submersed aquatic plants, including *Potamogeton* spp., *Vallisneria americana*, and *Ceratophyllum demersum* (Havera et al. 1980).

The study site, located in Will and Grundy counties, Illinois, includes the Des Plaines River from Brandon Road Lock and Dam (river mile 286) to the confluence of the Des Plaines and

Kankakee rivers (river mile 273), and Grant Creek, a tributary of the Des Plaines River, which enters near river mile 274 (Fig. 1). A number of industries, such as Mobile Oil, AMOCO, Olin Matheson, Commonwealth Edison, and Rexall Chemical, are located along this reach. Treated effluents from the Metropolitan Sanitary District of Greater Chicago released into the Sanitary and Ship Canal ultimately enter the Des Plaines River 4 miles upstream of the study reach. Toxic substances have been identified in the North Branch of the Chicago River and in the sediments of the Des Plaines River using chemical analyses and clam gill bioassays (IEPA 1984, Blodgett et al. 1984).

OBJECTIVES

The purpose of the Des Plaines River Long-Term Monitoring Program is to determine habitat quality in the study site, including characterizing the present status of aquatic macrophyte and macroinvertebrate communities and assessing factors that may limit aquatic life, including habitat characteristics, sediment toxicity, and boat traffic.

Status of aquatic macrophyte and macroinvertebrate communities were characterized during Phase I (1985). Because no previous macrophyte studies had been conducted in this reach, these data provide a bench mark for comparison with future surveys of vegetation and habitat.

Phase II (1986) of the monitoring program consisted of two components: (1) resurvey of macrophyte populations in the study reach and (2) preliminary chemical analyses of macrophyte tissue to identify toxic substances being concentrated by resident macrophytes. In this report, data collected during Phase II on the extent of submersed and emersed macrophyte beds will be compared with Phase I macrophyte data. Results of chemical analyses of macrophyte tissue will be discussed along with chemical analyses of Des Plaines River sediments completed by the Illinois Environmental Protection Agency (IEPA) and Commonwealth Edison Company.

MATERIALS AND METHODS

A survey of the aquatic vegetation was completed 20 August 1986; areas of the study reach were examined for the presence of vegetation and species composition was recorded when possible. Specimens of macrophytes not found previously were collected, identified (Fassett 1940, Muenscher 1944, Beal 1977), and archived in the Illinois Natural History Survey (INHS) herbarium.

Low-altitude aerial photographs of the study reach (Aero-Metric Engineering Co.) were taken 3 August 1986 to document the location and extent of plant beds. Photointerpretation and ground-truth

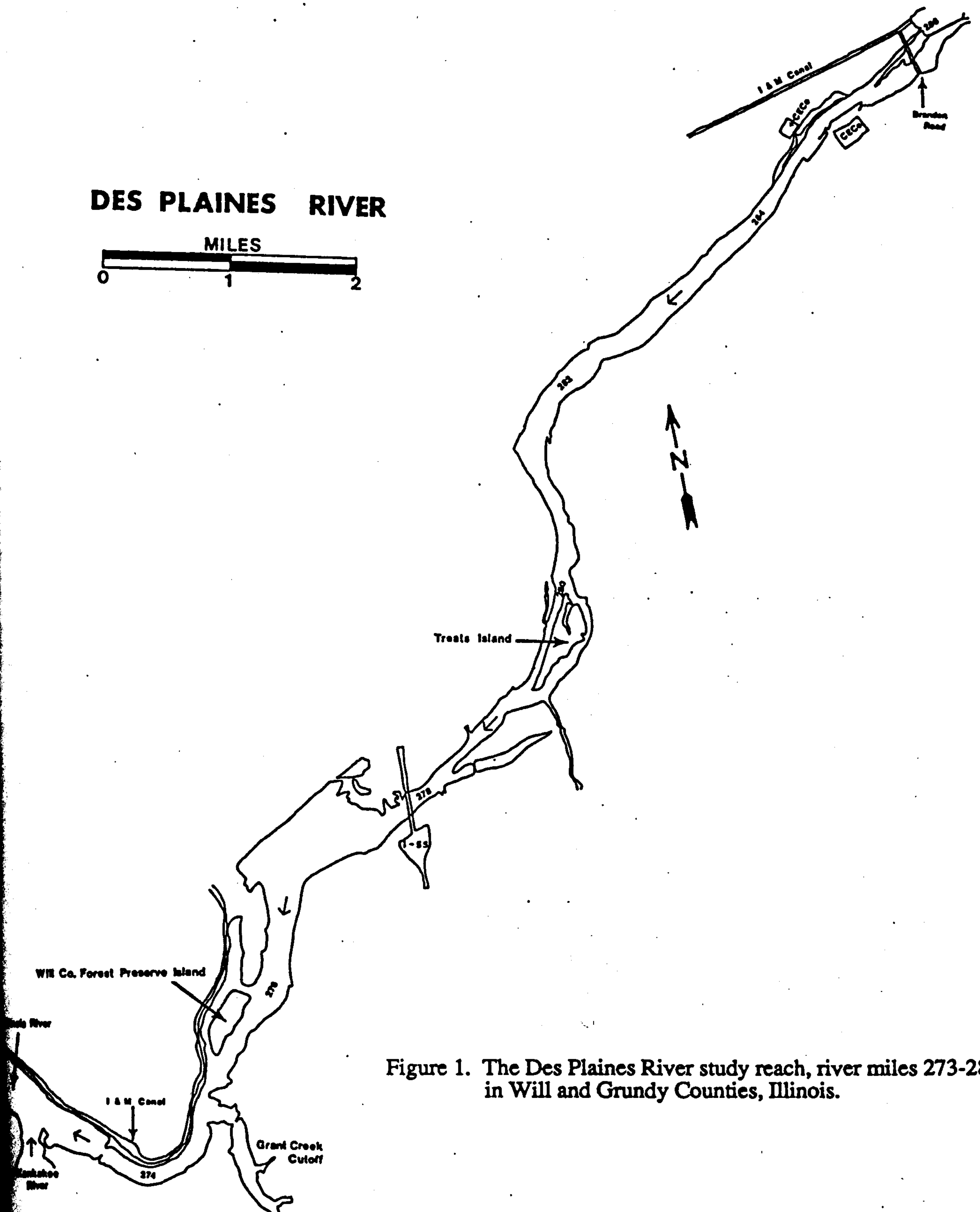

Figure 1. The Des Plaines River study reach, river miles 273-286, in Will and Grundy Counties, Illinois.

survey data were recorded on base maps of the study reach, digitized, and entered into the Geographic Information System (ARC/INFO) at INHS; coverage of vegetation beds and habitat classes were then calculated using INFO.

During the survey, specimens from the 10 most abundant aquatic macrophyte species were collected for chemical analyses. Whole plants were collected, thoroughly rinsed to remove sediments and attached organisms, placed in plastic bags, and put on ice. Macrophyte samples were returned to the INHS chemistry laboratory, pulverized in a Spex #8000-11 Miller/Mill, and freeze dried in a Virtis 10-100 Unitrap freeze-dryer for later analysis.

Chemical Analyses

Total Cation Analysis:

Dried macrophyte samples were digested with nitric and perchloric acids by heating in a Kontes Kjeldahl rotary digestion apparatus. Digested samples were then analyzed for cation content using a Jarrell-Ash Model 975 Atomcomp (inductively coupled argon plasma) spectrometer.

Mercury Analysis:

Dried samples were digested using sulfuric acid, nitric acid, and potassium permanganate, then heated in a water bath for 2 hours. Samples were cooled and analyzed using cold-vapor atomic absorption spectroscopy (Fisher Model HG-3 mercury analyzer).

Pesticide and PCB Extraction:

Macrophyte tissue was digested using potassium hydroxide and ethanol, then separated using methylene chloride and hydrochloric acid. Samples were boiled and fractionated using hexone or acetone. Eluates were then boiled under a Snyder column for gas chromatograph analysis.

RESULTS

Macrophyte Taxa

Two new macrophyte species were found in the Grant Creek area during the Phase II survey, *Nymphaea tuberosa* Paine (white water lily) and *Lythrum salicaria* L. (purple loosestrife) (Table 1). *N. tuberosa* is a floating-leaved macrophyte and *L. salicaria* is an emersed exotic macrophyte. *Nelumbo lutea*, present in Grant Creek last year, was not located during the 1986 field

Table 1. Vascular plant taxa in the Des Plaines River in 1986. Macrophyte growth forms are rooted (R), submersed (S), emersed (E), aquatic (A), terrestrial (T), floating (F), and floating-leaved (FL).

Scientific name	Common name	Macrophyte growth form
Calamagrostis	Reed bentgrass	R T
Ceratophyllum demersum L.	Coontail	F A
Dianthera americana L.	Water willow	R E A
Eleocharis acicularis (L.) R. & S.*	Needle rush or slender spikerush	R E A
Elodea canadensis (Michx.) Planchon.*	American elodea or waterweed	R S A
Gramineae	Grass family	R T
Lythrum salicaria L.+	Purple loosestrife	R E A
Myriophyllum sp.*	Water milfoil	R S A
Nelumbo lutea (Willd.) Pers.	American lotus	R FL A
Nymphaea tuberosa Paine+	White water lily	R FL A
Phragmites communis Trin.	Reed grass	R E A
Polygonum sp.	Smartweed	R T
Potamogeton crispus L.*	Curlyleaf pondweed	R S A
Potamogeton pectinatus L.*	Sago pondweed	R S A
Potamogeton zosteriformis Fernald.*	Flatstem pondweed	R S A
Potamogeton sp. (floating-leaved)*	Floating-leaved pondweed	R FL A
Sagittaria latifolia L.*	Common arrowhead	R E A
Scirpus fluviatilis (Torr.) Gray	River bulrush	R E A
Scirpus validus Vahl.	Soft-stem bulrush	R E A
Typha angustifolia L.*	Narrowleaf cattail	R E A
Typha latifolia L.	Common cattail	R E A
Vallisneria americana (Michx.)*	Eelgrass	R S A

*Analyzed for heavy metals, PCBs, and pesticides.
+ New taxa identified in 1986.

investigations. It has not been removed from the species list, however, because it may have been present but not sighted.

Aquatic Vegetation in the Des Plaines River (river mile 273-286)

Over 46 ha of the study reach contained aquatic vegetation (Table 2, Fig. 2). The areas most heavily vegetated were located near river miles 273.5, 277.5, 279.5, and 285.5. A mix of submersed species accounted for 70% of the total vegetated area (32 ha); these species were dominant just below Brandon Dam, at the mouth of the Du Page River, and at the confluence of the Des Plaines and Kankakee rivers. *Sagittaria latifolia* , an emersed species, occupied 10 ha (25% of the total vegetated area) and was the dominant species in areas encompassed by river miles 279-284 (Table 2).

Submersed and floating-leaved macrophytes covered 33.9 ha of the study reach (Tables 2 and 3). A large portion of the submersed macrophyte population was comprised of *Potamogeton* spp. and

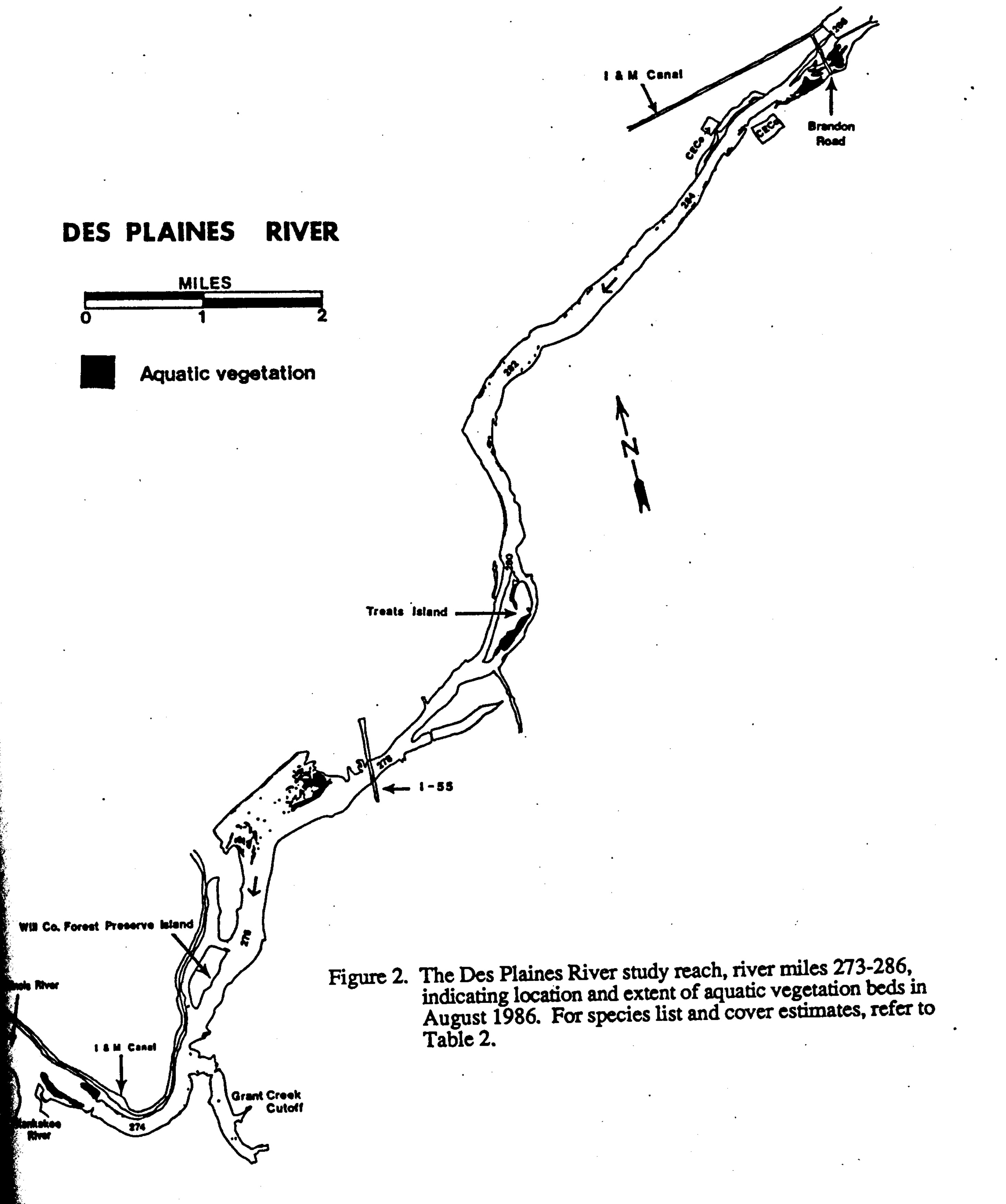

Figure 2. The Des Plaines River study reach, river miles 273-286, indicating location and extent of aquatic vegetation beds in August 1986. For species list and cover estimates, refer to Table 2.

Myriophyllum sp. Emersed vegetation covered over 12 ha of the study reach; *Sagittaria latifolia* and *Typha* spp. were the most abundant (Tables 2 and 3).

To facilitate analysis of results, the 13-mile study reach was divided into segments. Segments of similar length were delimited without separating heavily vegetated areas. Cover and community composition are discussed for each segment (Figs. 3-10, Tables 2-5). Artificial water boundary lines were drawn on selected segment maps to permit percent cover calculations in heavily vegetated areas.

Vegetation Analyses by River Segment

Segment 1, near Brandon Road Lock and Dam (river mile 284.5-286), was the second most heavily vegetated segment. Of the area within the water boundary lines, 32.8% was vegetated (Table 4). Submersed macrophytes covered 10 ha (97% of the vegetated area) and emersed macrophytes covered 0.3 ha (Tables 4 and 5). The area upstream of Commonwealth Edison's power plant units contained primarily submersed vegetation and the area downstream contained primarily emersed vegetation (Fig. 3).

Segments 2 and 3 (river mile 280-284.5) were sparsely vegetated; of 161 ha, only 3.4 ha (1.7%) were vegetated, primarily with *Sagittaria latifolia* and *Typha* spp. (Figs. 4 and 5, Tables 3-5). Segment 4, Treats Island (river mile 278.2-280), contained *Sagittaria latifolia* and *Typha* spp. as well, but at considerably higher densities (Fig. 6, Table 2). There were 6.9 ha of *S. latifolia* and 1.5

Table 4. Total surface areas and vegetated areas (ha) for study reach segments in 1986. Number in parentheses is surface area within water boundary lines (see Figs. 3-10). Segment 8 does not include the area downstream of river mile 273.

Study reach segment	Surface area of water	Vegetated area			Percentage of surface area vegetated	
		Submersed	Emersed	Total		
1	66 (31)	10.29	0.32	10.61	16.1	(32.8)
2	88	0.04	0.78	0.82	0.9	
3	78	-	1.95	1.95	2.5	
4	71 (23)	-	8.45	8.45	11.9	(36.7)
5	165 (141)	14.62	0.25	14.87	9.0	(10.5)
6	110	0.16	0.07	0.23	0.2	
7	73 (26)	0.24	0.36	0.60	0.8	~~(1.5)~~ (2.3)
8	42 (39)	8.55	0.17	8.72	20.8	(22.2)
		33.9	12.35	46.25		

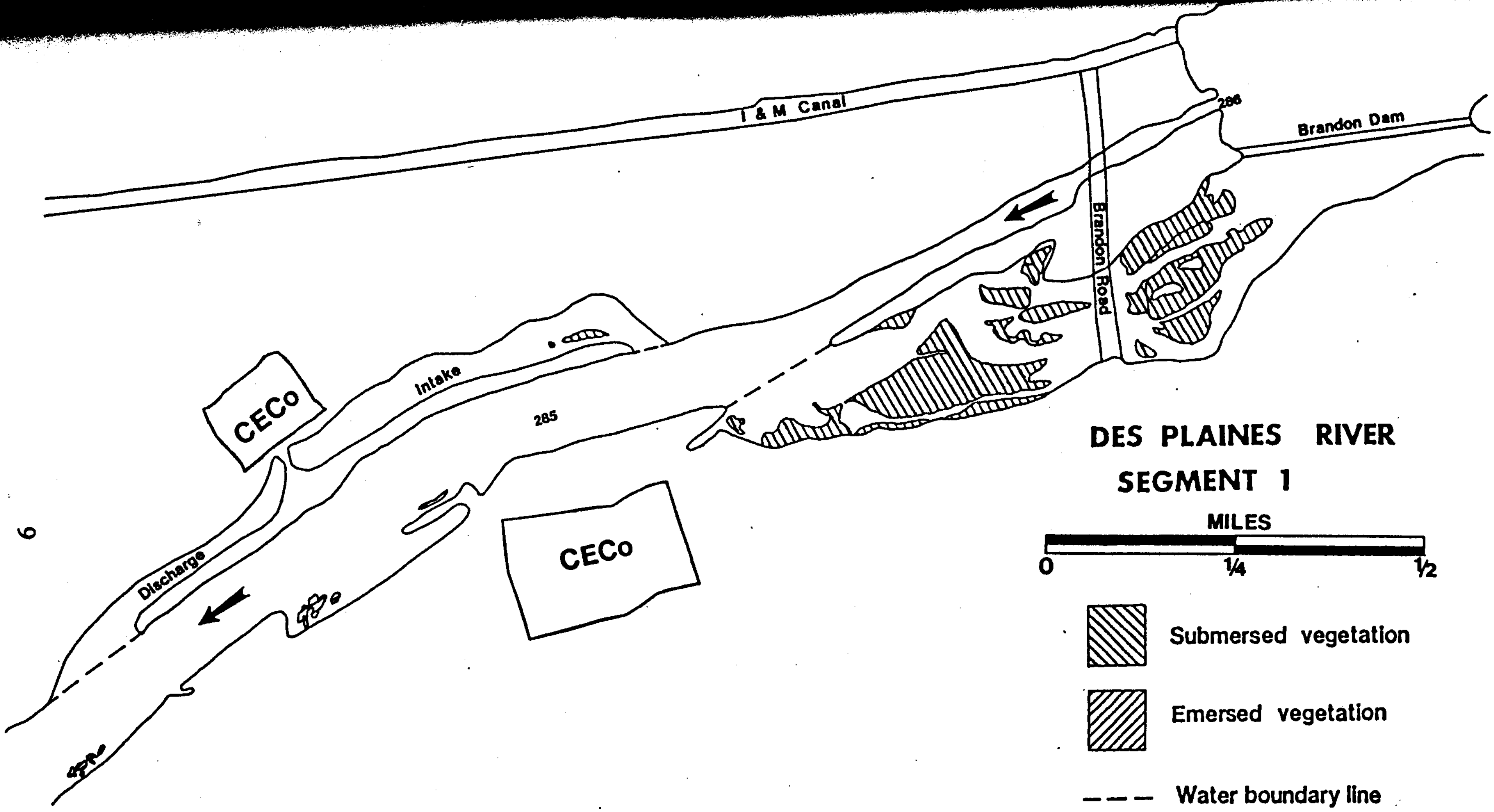

Figure 3. Segment 1 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

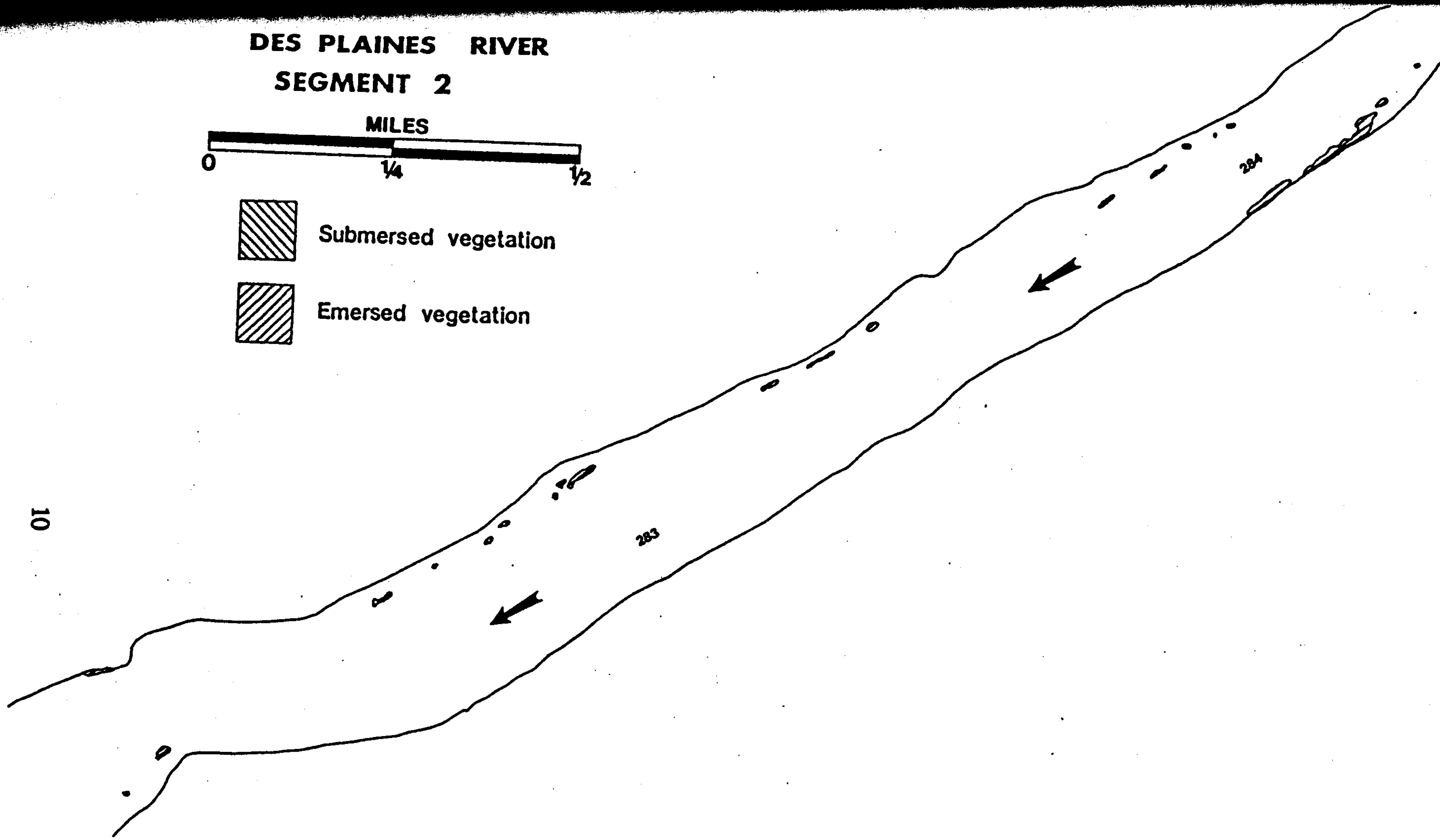

Figure 4. Segment 2 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

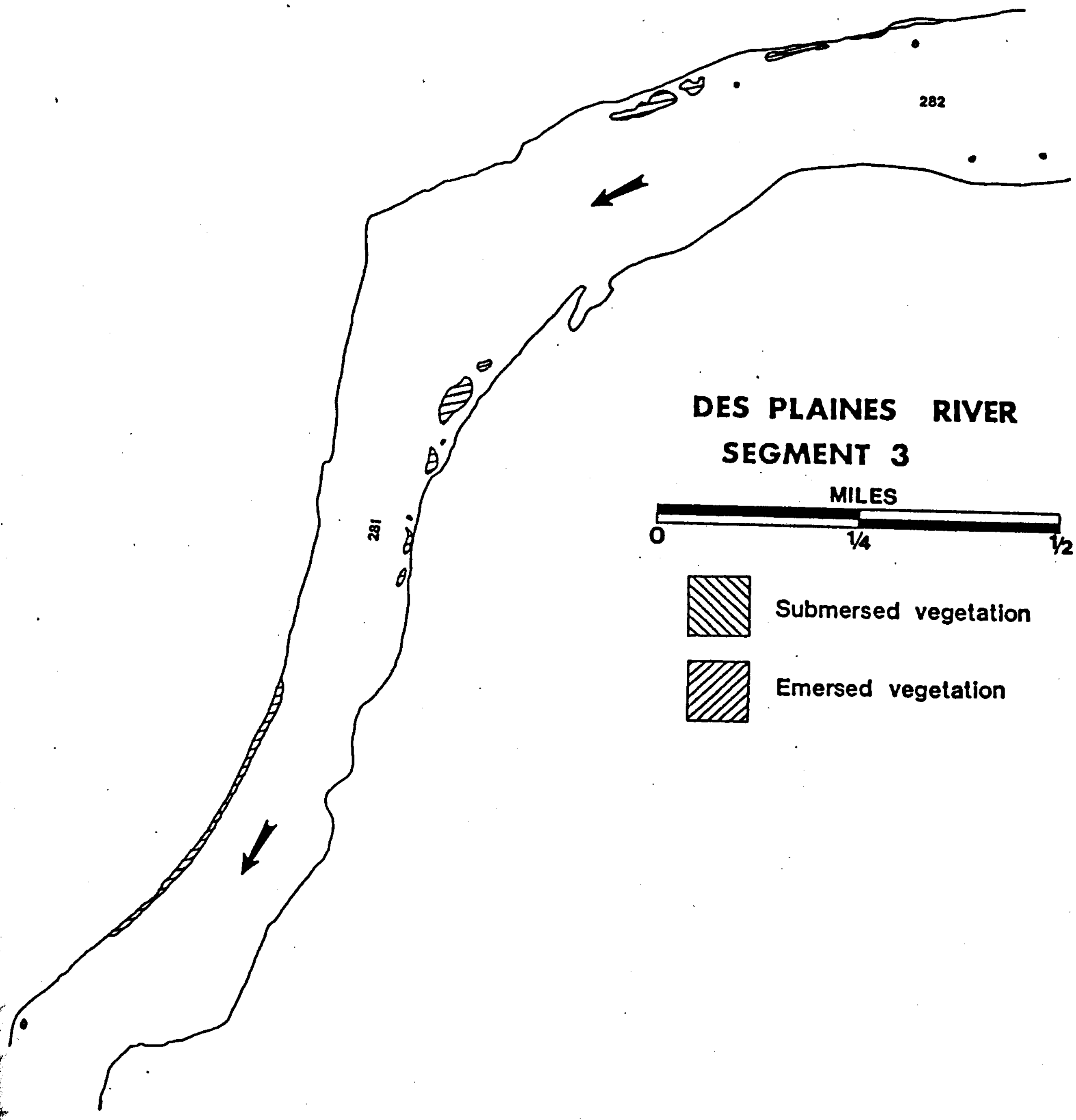

Figure 5. Segment 3 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

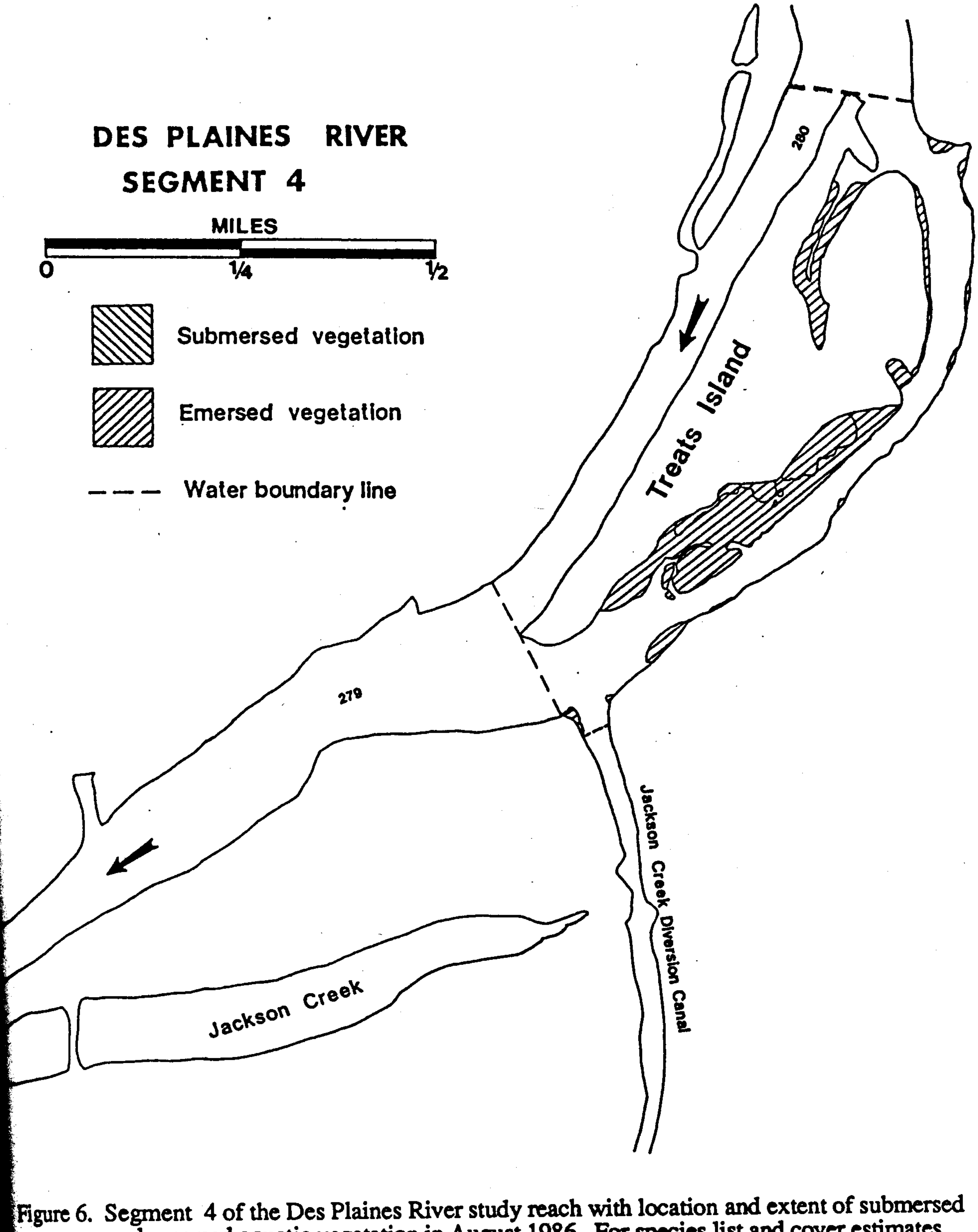

Figure 6. Segment 4 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

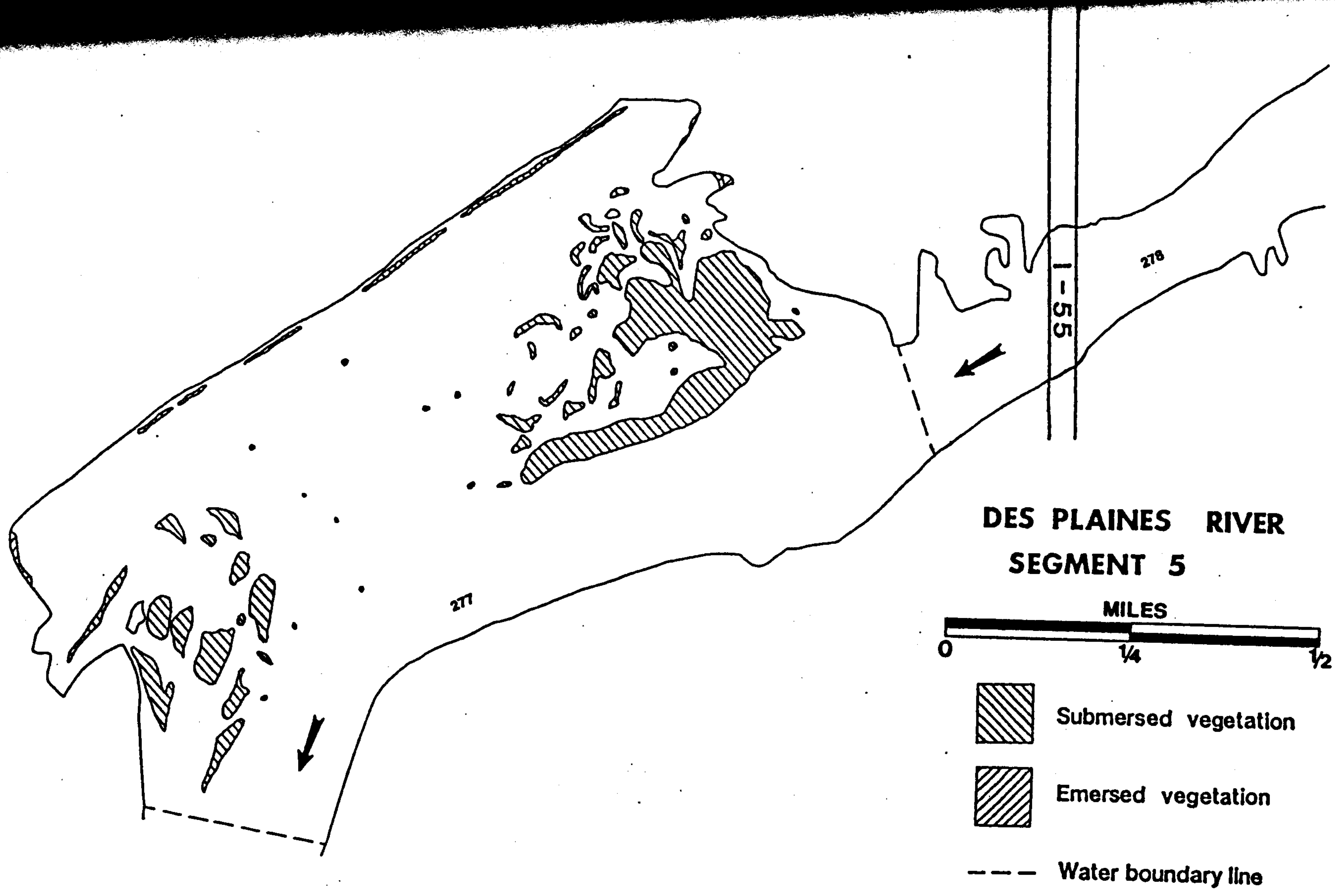

Figure 7. Segment 5 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

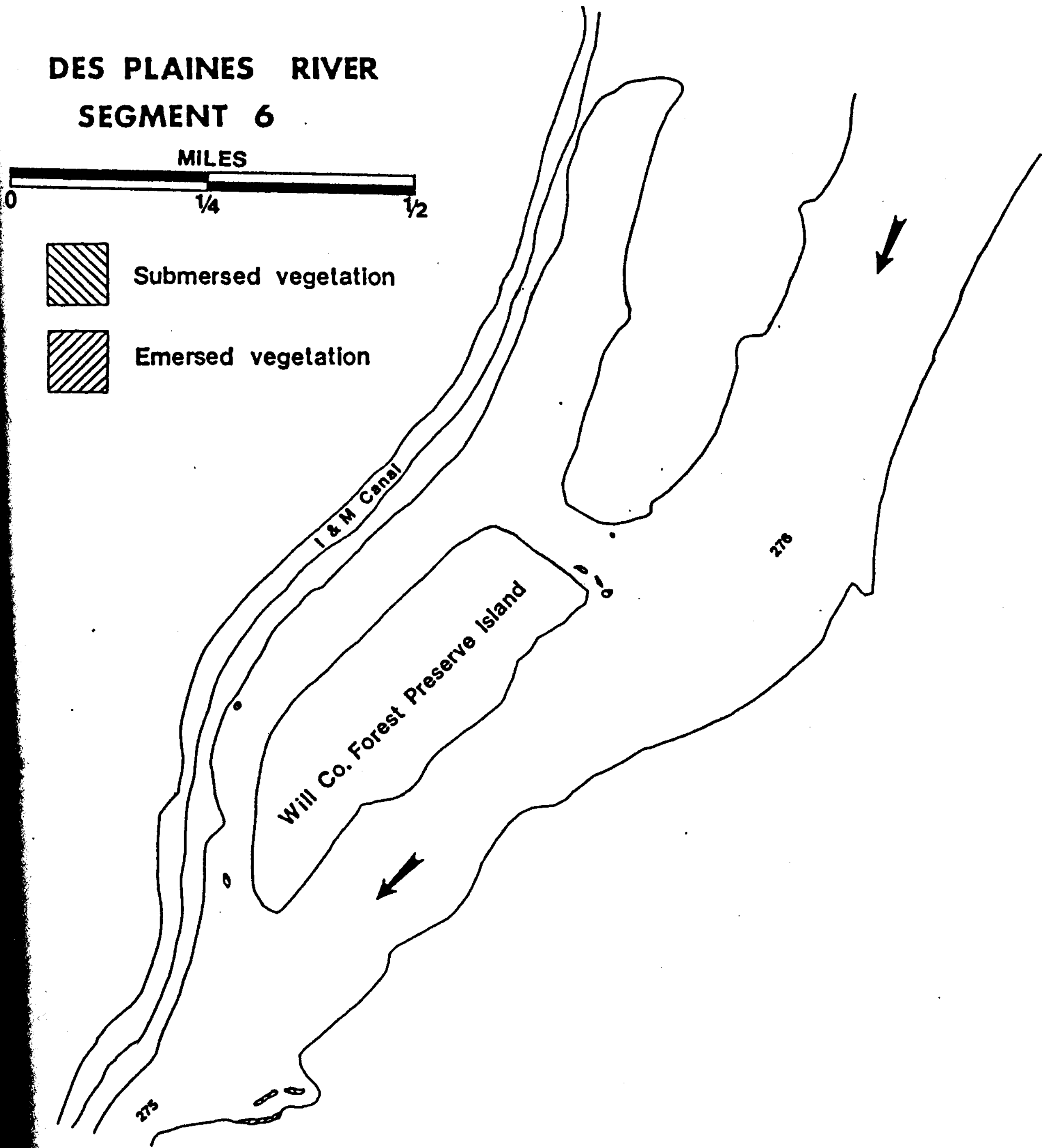

Figure 8. Segment 6 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

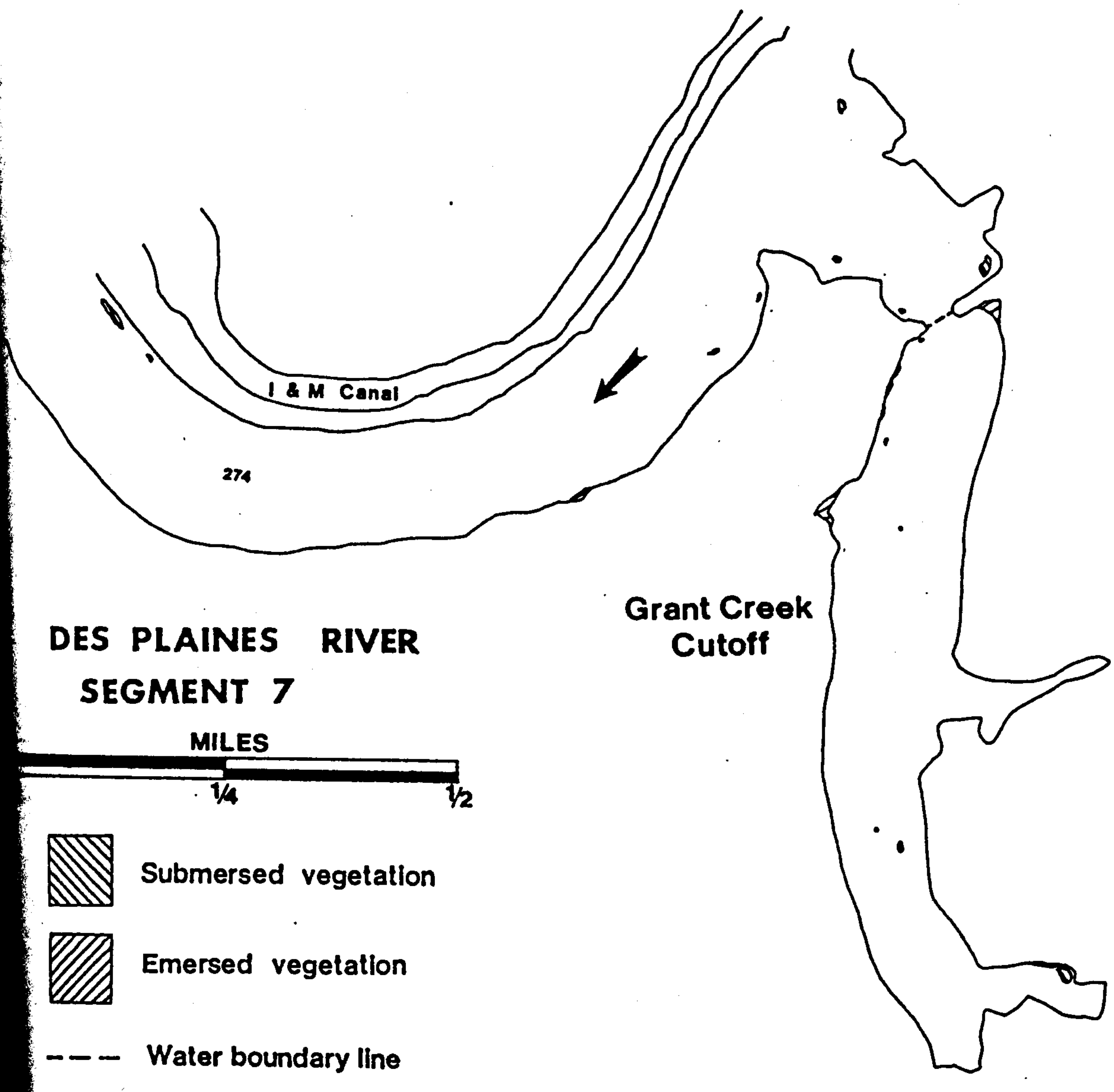

Figure 9. Segment 7 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

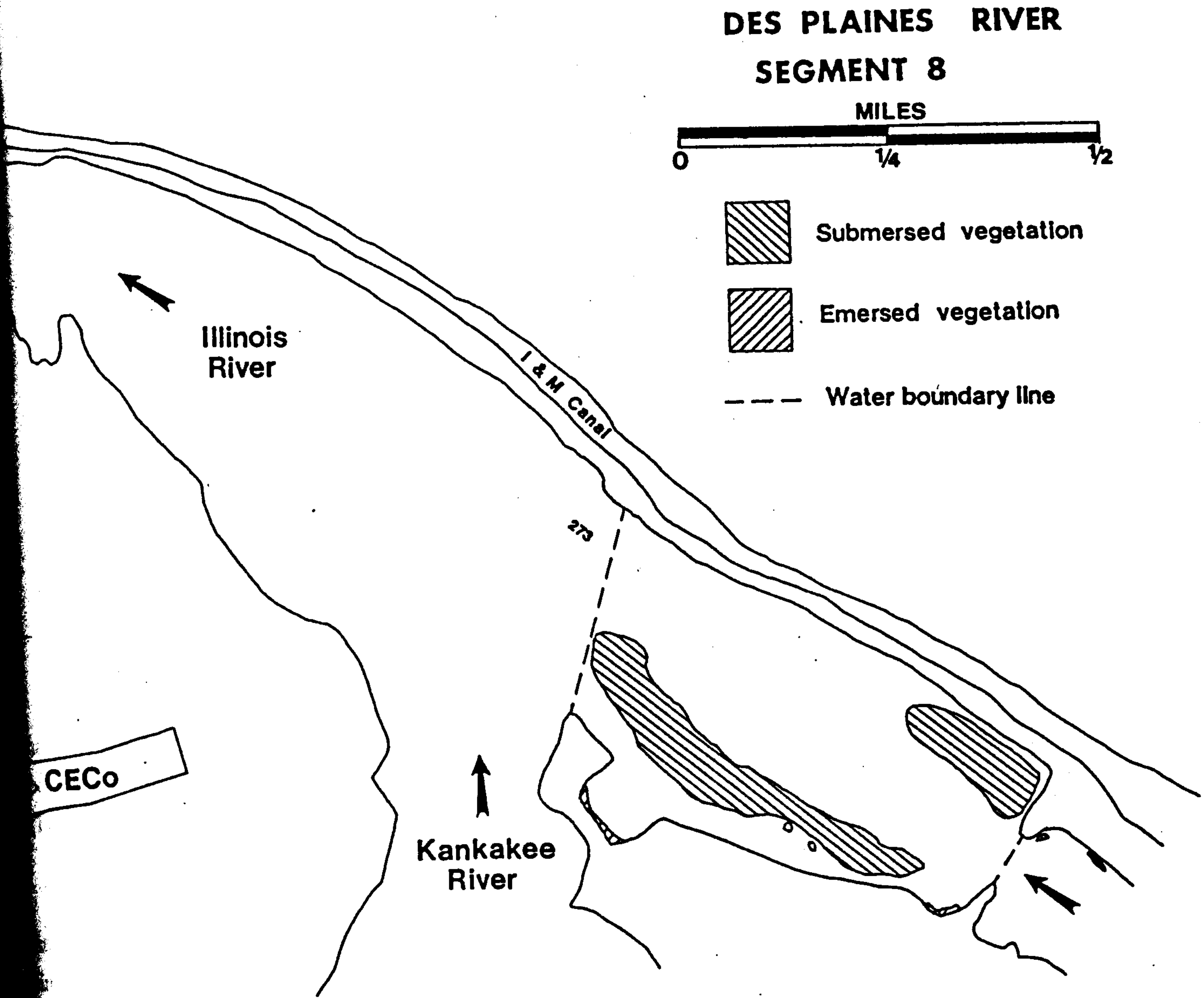

Figure 10. Segment 8 of the Des Plaines River study reach with location and extent of submersed and emersed aquatic vegetation in August 1986. For species list and cover estimates refer to Table 2.

Table 5. Coverage (expressed as percentage of total vegetated area of that segment) of macrophyte species present in each study reach segment in 1986. Macrophyte growth forms are submersed (S), emersed (E), floating-leaved (FL), and floating (F).

Macrophyte species	Macrophyte growth form	Study reach segments							
		1	2	3	4	5	6	7	8
Ceratophyllum demersum	F	-	-	-	-	-	-	2	-
Myriophyllum sp.	S	8	2	-	-	-	9	-	-
Potamogeton pectinatus	S	-	2	-	-	-	9	-	-
Potamogeton crispus	S	2	-	-	-	-	-	3	-
Potamogeton zosteriformis	S	-	-	-	-	-	13	-	-
Potamogeton sp.	FL	2	-	-	-	-	-	-	-
Potamogeton spp. mix	S/FL	3	-	-	-	-	-	-	-
Submersed species mix	S/FL	82	-	-	-	98	39	15	98
Nymphaea tuberosa	FL	-	-	-	-	-	-	20	-
Lythrum salicaria	E	-	-	-	-	-	-	3	-
Phragmites communis	E	-	-	3	1	-	-	-	-
Sagittaria latifolia	E	3	96	92	81	1	30	7	1
Typha spp.	E	-	-	5	18	1	-	43	1
Emersed species mix	E	-	-	-	-	-	-	7	-
Total		100	100	100	100	100	100	100	100

ha of *Typha* spp. in the side channel at Treats Island (Table 2). Of 23 ha of water within the water boundary lines, 36.7% was vegetated, making it the most heavily vegetated part of the study reach (Table 4).

Segment 5, at the mouth of the Du Page River (river mile 276.5-278.2), contained about 14.9 ha of vegetation, which is equivalent to 9% of the surface area within the artificial water boundary lines. Submersed macrophytes dominated, covering 14.6 ha (Fig. 7, Tables 2-4).

Segments 6 and 7, including Will County Forest Preserve Island and Grant Creek (river mile 273.5-276.5), had little vegetation. Of 183 ha, only 1 ha contained vegetation, consisting primarily of *Typha* spp., *Sagittaria latifolia, Nymphaea tuberosa,* and a submersed species mix (Figs. 8 and 9, Tables 2-4).

Segment 8, the confluence of the rivers (river mile 273-273.5), was the third most heavily vegetated area in the study reach; 8.7 of 39 ha (22%) within the water boundary lines were vegetated, primarily with a mix of submersed vegetation (Fig. 10, Tables 2-4).

Habitat Classification

The study reach is classified as a Riverine System, which includes all wetlands and deepwater habitats within a channel except (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens and (2) habitats within water containing ocean-derived salts in excess of 0.5% (Table 6) (Cowardin et al. 1979).

Table 6. Classification of the Des Plaines River study reach (rivermile 273-286) according to Cowardin et al. (1979).

SYSTEM	Riverine			Palustrine
SUBSYSTEM	Upper Perennial,		Lower Perennial	
CLASS	Aquatic Bed		Emergent Wetland	Emergent Wetland
SUBCLASS	Rooted vascular	Floating vascular	Nonpersistent	Persistent

The study reach has water flowing throughout the year and substrates of rock, cobble, or gravel with occasional patches of sand and is classified in the Upper Perennial Subsystem. Side channel areas and some channel border areas, such as the mouth of the Du Page River, are in the Lower Perennial Subsystem, which includes areas of low water velocity, and sand and mud substrates.

Class, the next step in the hierarchy, is the highest taxonomic unit and describes the general appearance of habitat in terms of vegetative life form or physiography and composition of substrate. Nearly all vegetated areas of the study reach can be separated into two classes, Aquatic Bed and Emergent Wetland. Aquatic Bed includes plant communities that require surface water for optimum growth and reproduction (Cowardin et al. 1979). Most submersed vascular macrophytes in this reach belong to the subclass Rooted Vascular, which includes macrophytes with submersed and floating leaves. *Ceratophyllum demersum* is a non-rooted submersed macrophyte and is classified in the subclass Floating Vascular.

The Emergent Wetland Class includes persistent and nonpersistent subclasses. Most emersed macrophytes in the reach are nonpersistent because they fall to the substrate or water surface at the end of the growing season (Cowardin et al. 1979). *Phragmites communis* persists year-round and belongs in the Persistent Subclass, which is in the Palustrine System; therefore a small part of the study reach (about 0.11 ha of *P. communis*) is not in the Riverine System.

Habitats within the Des Plaines River may also be classified according to a system developed by the Upper Mississippi River Conservation Committee (Rasmussen 1979) for scientific study and fisheries management. Habitat classifications include main channel, main channel border, tail waters, side channels, river lakes and ponds, and sloughs. Classifications within the Des Plaines River study reach include main channel, main channel border, side channel, and slough.

The main channel includes that portion of the river through which large commercial craft can operate (Rasmussen 1979). Within the study reach, the main channel accounts for 35.4% of the water surface area and contained no macrophytic vegetation. Main channel border areas exist in the zone between the navigation channel and the main river bank, islands, or submerged definitions of the old main river (Rasmussen 1979). Main channel border habitats encompass 28.8% of the study reach and contained about 3.2 ha of emersed and 0.4 ha of submersed vegetation scattered through all segments except 4 and 5.

Side channels include all departures from the main channel and main channel border in which there is current during normal river stage (Rasmussen 1979). Side channels account for 34% of the study reach and contained 90% of the macrophytic vegetation. Sloughs are narrow branches or offshoots of the main water body and are characterized by no current at normal water stage; they may be former side channels that have been cut off from the river (Rasmussen 1979). Only 1.8% of the study reach is slough habitat and contained only 1% of the vegetation.

Chemical Analyses

Whole plants of 10 macrophyte species were collected and analyzed for 25 elements, 2 pesticides, and total PCBs. Substance amounts concentrated by the macrophytes varied greatly between species, sometimes by up to two orders of magnitude. Most elements and compounds were present in quantities ranging from just above to 10,000 times the detection limit (Table 7). For all species, arsenic, beryllium, molybdenum, antimony, selenium, and heptachlor epoxide were measured in quantities below or near the detection limit and will not be discussed.

DISCUSSION

A wide variety of submersed and emersed vegetation inhabited the study reach in 1986, as was true in 1985 (Tables 2, 3, 8, and 9). All aquatic macrophyte species present are typical of riverine systems in temperate climatic zones and serve important functions in their lotic environments (Clark et al. 1983, Sparks 1984, Donnermeyer and Smart 1985, Anderson et al. 1986). Although no quantitative ground truth data were collected during the August 1986 survey, it seemed that most

Table 7. Concentration of mineral nutrients, metals, PCB's, and dieldrin as measured in 10 macrophytes collected from the Des Plaines River study reach (river miles 273-286) in 1986. All concentrations are reported in ppm except Hg (ppb).

Macrophyte species	Al (3.72)	B (0.090)	Ba (0.020)	Ca (0.040)	Cd (0.070)	Co (0.130)	Cr (1.17)	Cu (0.270)
Eleocharis acicularis	13500	43.4	168	22800	14.4	12.4	73.6	60.8
Elodea canadensis	1640	34.2	45.0	12300	3.90	14.2	6.90	23.2
Myriophyllum sp.	6000	76.3	204	15200	6.25	7.65	35.9	33.6
Potamogeton crispus	3900	43.9	102	21700	5.20	3.55	28.7	32.4
Potamogeton pectinatus	3720	176	94.7	12800	3.65	9.50	27.0	23.1
Potamogeton zosteriformis	3140	32.0	67.1	15300	6.70	13.3	21.8	30.4
Potamogeton sp.	3340	35.1	113	17400	4.35	4.00	28.1	30.4
Vallisneria americana	8750	53.8	196	31600	11.5	8.65	63.1	60.0
Sagittaria latifolia	4560	46.7	122	18700	6.95	1.00	32.7	47.6
Typha spp.	575	22.9	15.6	10800	1.35	<DL	5.15	14.7

Macrophyte species	Fe (1.44)	Hg (5.00)	K (60.5)	Mg (0.100)	Mn (0.470)	Na (72.2)	Ni (0.630)	P (2.46)
Eleocharis acicularis	16100	347	14700	12500	4980	768	144	4580
Elodea canadensis	1870	33.8	40400	4050	2100	3610	84.9	9020
Myriophyllum sp.	10200	204	17700	5330	1360	7640	44.0	6080
Potamogeton crispus	6350	242	23500	4440	614	7710	40.8	7400
Potamogeton pectinatus	4200	138	17400	5570	1120	8840	100	5740
Potamogeton zosteriformis	2920	94.3	38300	4710	1660	11400	105	9100
Potamogeton sp.	7330	236	31000	4780	958	10600	52.0	8660
Vallisneria americana	16000	411	35900	14600	2190	14500	86.8	10400
Sagittaria latifolia	11300	276	57300	6990	1300	8500	44.1	12000
Typha spp.	1780	67.2	18800	2500	156	5770	7.55	3440

Macrophyte species	Pb (0.900)	Sn (1.55)	V (4.46)	Zn (0.000)	Total PCBs (0.0001)	Dieldrin (0.0001)
Eleocharis acicularis	18.8	20.0	28.0	508	21.7	0.100
Elodea canadensis	9.80	<DL	4.90	754	4.86	0.267
Myriophyllum sp.	29.3	2.80	18.0	262	3.02	<DL
Potamogeton crispus	9.40	9.00	9.80	268	1.25	<DL
Potamogeton pectinatus	14.3	<DL	10.4	244	0.908	<DL
Potamogeton zosteriformis	18.6	<DL	10.4	510	0.618	0.0165
Potamogeton sp.	17.0	6.55	8.45	206	2.11	<DL
Vallisneria americana	16.7	7.35	24.7	557	1.80	<DL
Sagittaria latifolia	20.2	3.90	15.4	298	1.064	<DL
Typha spp.	2.70	2.18	<DL	58.2	0.244	0.0016

Table 8. Coverage (ha) of macrophyte species present in study reach segments in 1985. Macrophyte growth forms are submersed (S), emersed (E), floating-leaved (FL), and floating (F).

Macrophyte species	Macrophyte growth form	Study reach segments 1	2	3	4	5	6	7	8	Total area
Ceratophyllum demersum	F	-	-	-	-	0.14	-	0.24	-	0.38
Eleocharis acicularis	S	1.01	-	-	-	-	-	-	-	1.01
Myriophyllum sp.	S	2.15	0.07	-	0.14	2.95	0.03	-	0.01	5.35
Nelumbo lutea	FL	-	-	-	-	-	-	0.47	-	0.47
Potamogeton pectinatus	S	0.97	0.01	-	-	4.48	0.02	-	0.26	5.74
Potamogeton crispus	S	4.79	-	-	-	0.41		-	5.52	10.72
Potamogeton zosteriformis	S	0.03	-	-	-	0.20	0.03	-	-	0.26
Potamogeton sp.	FL	3.17	0.02	-	-	0.21	0.02	-	0.08	3.50
Vallisneria americana	S	-	-	-	0.08	3.57	-	-	0.05	3.70
Dianthera americana	E	-	-	-	-	-	-	0.02	-	0.02
Phragmites communis	E	-	-	0.06	0.07	-	-	-	-	0.13
Sagittaria latifolia	E	0.83	1.82	1.78	7.10	0.08	0.10	0.09	0.08	11.88
Scirpus spp.	E	0.11	-	-	-	-	-	-	-	0.11
Typha spp.	E	0.08	-	0.30	1.67	0.72	-	0.15	0.11	3.03
Total		13.14	1.92	2.14	9.06	12.76	0.20	0.97	6.11	46.30

Table 9. Submersed and emersed macrophyte cover (ha) in 8 segments of the Des Plaines River study reach in 1985. Cover is expressed as a percentage of submersed and emersed plant populations. Floating-leaved and floating vegetation are included in the submersed macrophyte totals.

Study reach segments	Submersed cover (ha)	Emersed cover (ha)	Percentage of population Submersed	Emersed	Total
1	12.12	1.02	38.9	6.7	28.37
2	0.10	1.82	0.3	12.0	4.15
3	0.00	2.14	0.0	14.1	4.62
4	0.22	8.84	0.7	58.2	19.57
5	11.96	0.80	38.4	5.3	27.56
6	0.10	0.10	0.3	0.7	0.44
7	0.71	0.26	2.3	1.7	2.09
8	5.92	0.19	19.1	1.3	13.20
Total	31.13	15.17	100.0	100.0	100.00

species had approximately the same relative abundance as noted in Phase I. Four areas contained appreciable amounts of vegetation in both years: below Brandon Road Dam, the side channel at Treats Island, the mouth of the Du Page River, and the confluence of the Des Plaines and Kankakee rivers. In all of these areas, except the side channel at Treats Island, submersed vegetation dominated; at Treats Island, *Sagittaria* and *Typha* dominated.

As in 1985, the low-altitude color aerial photographs of the study area taken in August 1986 were clear and accurately indicated location and bed size of submersed and emersed vegetation. Differences between emersed vegetation types, and submersed and floating-leaved vegetation beds were clearly depicted. Information from the aerial photographs was especially important in 1986 because it provided quantitative estimates of the extent of vegetation beds. Unfortunately, it was not possible to distinguish submersed or floating-leaved species from photographs. Thus, areal estimates cannot be calculated for all species, making some comparisons with previous data difficult.

The total vegetated area estimate for the study reach was nearly identical for the 2 years. There were slight differences in the amount of cover of individual plants and within certain segments, but overall there was little change in the plant population. Some segments, such as 5, 7 and 8, showed increases in vegetative cover in 1986 and others, particularly Segment 1, showed a decrease.

Although these changes in vegetative cover may be real, it is also possible that, at least in part, the differences noted are due to changes in the method of data collection. During Phase I, an extensive quantitative ground truth survey was conducted which allowed for inclusion of some plant beds not apparent on the photographs and for species identification of nearly all plant beds present. Because no quantitative ground-truth data were collected during Phase II, it was not possible to note all plant beds not apparent on the photographs, nor to identify the species composition of all plant beds documented by the aerial photographs. Consequently, in the 1986 data several new categories were included that group species by growth form, such as submersed species mix and emersed species mix. Because these groups include all vegetation beds not identified to species, they include coverage that may otherwise have been added to individual species coverages within each segment. So although one may compare some species cover data from the 2 years (Tables 2 and 8), for other species that is not appropriate.

One trend apparent from Phase II data was that plant beds are being established where none were noted in the previous year. In 1985 few plants, if any ,were noted at the mouth and just downstream (left bank) of Grant Creek or in the area just upstream of the Joliet Yacht Club. However, both submersed and emersed vegetation have now become established in those areas.

Although macrophytes seemed to be spreading in selected parts of the study reach, at least one area, the slough at Will County Forest Preserve Island, remained conspicuously devoid of vegetation (Sparks et al. 1986). Neither aerial photographs nor a survey of the area revealed any sign of vegetation. The reasons for this lack of vegetation are remain unknown.

Another notable change was the apparent loss of *Nelumbo lutea*. Although *N. lutea* may not have totally dissappeared, it was not present in Grant Creek locations that it inhabited in 1985. To some extent, *Nymphaea tuberosa* has taken its place by inhabiting some of the areas once occupied by *N. lutea*. Some *N. tuberosa* may have been present in 1985 in the very shallow southern end of Grant creek, an area not passable by boat in 1985. In any case, *N. tuberosa* is spreading, and is now scattered throughout Grant Creek and nearly to the Des Plaines River. Although *N. tuberosa* has spread, Grant Creek still does not support the vegetative biomass that might be expected given its physical characteristics.

The Des Plaines River has been subjected to considerable pollution (IEPA 1984) and has notably toxic sediments (Blodgett et al. 1984). Recent chemical analyses of sediments in the study reach revealed high levels of metals, including cadmium, chromium, copper, lead, mercury, and zinc (IEPA 1984, Commonwealth Edison Co. 1986). Although there are no quality criteria for sediments such as those for water (USEPA 1976), substance levels in sediments from lotic environments throughout Illinois can be compared using the Illinois stream sediment classification system (Kelly and Hite 1984, IEPA 1984). Levels of the metals listed above ranked in the two highest categories of the sediment classification system, highly elevated and extreme.

Dieldrin, DDT, and PCBs were also found in measurable quantities in Des Plaines River sediments; PCBs in sediments near the Joliet Yacht Club were measured at levels up to 380 ppb (IEPA 1984). Levels of chromium, cadmium, iron, manganese, lead, zinc, mercury, and arsenic in Des Plaines River sediments were similar to levels in Waukegan Harbor sediments, which is considered severely polluted (Environmental Control Technology Corporation 1977, Mason & Hanger - Silas Mason Co., Inc. 1980).

In comparing literature values with those measured in macrophytes in the study reach, it was apparent that macrophytes in the Des Plaines River often contained high levels, especially of certain metals and PCBs. When substance levels were averaged from all plants collected, the values for aluminum, barium, boron, chromium, cobalt, nickel, tin, vanadium, and zinc were rarely exceeded by literature values (Cowgill 1974, Franzin and McFarlane 1980, Schierup and Larsen 1981). Measured levels of most other substances were comparable to values listed in the literature.

Because macrophytes are known to concentrate substances from the environment, it was not surprising to find high levels of some pollutants in tissues of resident macrophytes (Table 7). Interestingly, levels of cadmium, chromium, lead, mercury, zinc, and PCBs were correspondingly high in several macrophytes analyzed, indicating that sediments are probably an important source of toxic materials.

Certain macrophytes accumulated selected substances in larger amounts than others. Without specific information on toxic substance levels in the sediments inhabited by the macrophytes, it is impossible to determine if certain macrophyte species selectively concentrated substances or if substance concentrations in sediments varied between areas.

Recent studies suggest that macrophytes provide a pathway for movement of toxic substances from deeper sediments to the water column and top sediments (Welsh and Denny 1976, McIntosh et al. 1978, Campbell et al. 1985). This mobilization occurs when toxic substances are accumulated by roots and rhizomes and acropetally translocated to stems and leaves. During plant senescence, substances are leached into the aqueous environment in a form available for uptake by planktonic organisms or become available to benthic organisms in decomposing particulate matter. Exposure to and biomagnification of substances once buried then becomes possible. Thus, the process of uptake, translocation, and leaching, by increasing exposure of aquatic organisms to toxic substances, may be limiting aquatic life in the river and life dependent on river resources (e.g., waterfowl).

SUMMARY

1. As estimated through aerial photograph interpretation, aquatic macrophytes occupied over 46 ha in the Des Plaines River study reach (river mile 273-286) in August 1986; a coverage similar to that estimated in 1985.

2. The most heavily vegetated areas were below Brandon Road Dam (river mile 285.5), the side channel at Treats Island (river mile 279.5), the mouth of the Du Page River (river mile 277), and the confluence of the Des Plaines and Kankakee rivers (river mile 273.5). Submersed vegetation dominated in all but the side channel at Treats Island.

3. *Sagittaria latifolia* was the dominant emersed macrophyte. Adequate data are not available to determine the dominant submersed species for 1986.

4. The slough at Will County Forest Preserve Island remained devoid of vegetation.

5. The study reach is classified as a Riverine System except for the small area inhabited by *Phragmites communis*, which is classified in the Persistent Wetland Subclass of the Palustrine System.

6. According to the classification system of Rasmussen (1979), 35.4% of the study reach is main channel, 28.8% main channel border, 34% side channel, and 1.8% slough. Side channels contained 90% of the macrophytic vegetation.

7. Specimens of the 10 most abundant macrophyte species present in the study reach were subjected to chemical analyses. Results indicated that some macrophytes concentrated high levels of PCB's and heavy metals, including aluminum, cadmium, chromium, cobalt, and lead.

8. Analysis of sediment data available from several sources revealed correspondingly high levels of heavy metals and PCBs.

RECOMMENDATIONS FOR PHASE III

1. Continue monitoring studies of macrophyte populations in the lower Des Plaines River study reach so that several consecutive years of data will be available to assess population trends, including species composition and extent of vegetation beds.

2. To examine levels of toxic substances in the sediments, water column, and macrophytes in the lower Des Plaines and evaluate their effect on aquatic life within the study reach.

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