Submersed macrophytes and water quality for four sites in Delta Marsh

Jodine Zirk[1] and L. Gordon Goldsborough[2]
[1]Environmental Science Program, University of Manitoba
[2]University Field Station (Delta Marsh), University of Manitoba
Winnipeg, Manitoba R3T 2N2

Introduction

The channels and bays of Delta Marsh contain conspicuous communities of submersed vascular plants (primarily *Ceratophyllum demersum*, *Myriophyllum sibiricum*, and *Potamogeton* spp.) that provide colonizable surface area for epiphytic algae, and habitat and food for invertebrates and fish. Despite numerous studies of the terrestrial and marsh vegetation of Delta Marsh (e.g., Shay and Shay 1986, Thompson and Shay 1989, van der Valk 1994), there are few data on the quantitative abundance of submersed plants (e.g., Anderson 1978, Garrod 1980). Therefore, their contribution to total marsh primary production is unclear.

Sampling of submersed plants was undertaken at four sites in Delta Marsh during mid- to late-summer in 1996 to provide basic information on their biomass. The sites differed with respect to water depth and chemistry, aspects of which were characterized.

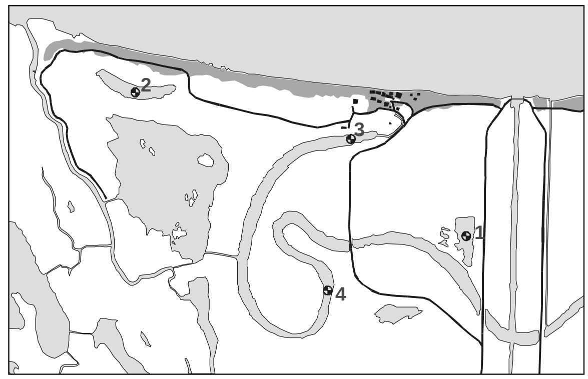

Figure 1. Location of four sites near the field station where submersed macrophytes were sampled in 1996.

Materials and Methods

Water and plant samples were taken at four sites in the west unit of Delta Marsh (Fig. 1) on five occasions (about every two weeks) between 24 June and 19 August 1996. Site 1 was in "Saline Pond", a borrow pit by the west dike of the Assiniboine River Diversion (UTM Zone 14: 544,581 m Easting 5,558,475 m Northing). Site 2 was in Crescent Pond (UTM Zone 14: 542,625 m Easting 5,559,270 m Northing). Site 3 was in the Blind Channel near the Portage Country Club dock (UTM Zone 14: 543,854 m Easting 5,559,015 m Northing). Finally, site 4 was in the Blind Channel by the Fisherman's Shack (UTM Zone 14: 543,718 m Easting 5,558,048 m Northing). All coordinates were determined using post-corrected point data collected with a Trimble Geo Explorer II GPS receiver.

Samples were collected in the middle of each water body except at sites in Blind Channel, where the water was too deep in the channel center to permit collection of submersed plants. Consequently, all samples were taken closer to shore. Surface mid-day water temperature (°C), and water depth (cm; n = 3) were measured at each site. Three water samples were collected just below the surface; one sample was taken for analysis of pH, conductivity (mS/cm), titratable alkalinity (mg/L), ammonia-N (µg/L), and soluble reactive phosphorus (SRP; µg/L) in the analytical lab at the Field Station using standard methods (Stainton *et al.* 1977; APHA 1992). The remaining two samples were shipped on ice to Winnipeg within twelve hours of collection. One sample was submitted to Norwest Labs for analysis of nitrate+nitrite-N (mg/L), total Kjeldahl nitrogen (TKN; mg/L), and total phosphorus (mg/L) using standard methods (APHA 1992). The other sample was analyzed for turbidity (NTU) using a Hach 2100 Turbidimeter.

A sample of the above-ground biomass of submersed macrophytes at each site was delimited by lowering a plastic cylinder (0.47 m diameter) into the water column. All macrophytes were cut at the sediment surface using clippers, then they were retrieved using a small rake and a mesh sieve. The samples were returned to the lab and sorted by species, making sure to remove all foreign material (litter, macrofauna, etc.). They were then dried to a constant weight at 104°C, usually 24 hours, and weighed. Biomass was expressed relative to wetland bottom area (g/m^2).

Results and Discussion

The water depth at the sample sites was almost always less than one meter (Table 1). The water was alkaline, with pH generally ranging from 7.2 to 8.2, brackish (> 1,000 µS/cm conductivity; highest in Site 1: Saline Pond), and moderately clear (NTU < 3). Levels of inorganic nitrogen were low (NH_3-N undetectable, NO_3-N < 0.05 mg/L) so that dissolved organic nitrogen was the largest proportion of TKN. Similarly, inorganic phosphorus levels were lower than those for total phosphorus (< 100 µg/L and 150-200 µg/L, respectively).

Total macrophyte dry weight ranged from 1 g/m^2 (Site 4: 24 June) to 107 g/m^2 (Site 2: 24 June; Site 3: 19 August) (Table 1), on the low end of values reported in the 1970s for *P. pectinatus* at sites throughout the marsh (Anderson 1978). Mean dry weight (about 75 g/m^2) was highest at Sites 2 and 3 and lower (about 45 g/m^2) at the other sites. Six submersed macrophyte taxa were collected in our samples, including *Ceratophyllum demersum* (coontail; Sites 1,2,3,4), *Potamogeton spp.* (several pondweed species, mostly *P. pectinatus*; Sites 1,2,3,4), *Myriophyllum sibiricum* (formerly *M. exalbescens*; water milfoil; Sites 1,4), *Utricularia vulgaris* (bladderwort; Sites 1,3,4), *Drepanocladus spp.* (moss; Site 4), and *Sparganium* sp. (bur reed; Site 1) in descending order of abundance. *C. demersum* was the dominant species at three of the four sites. This differs from the results of a previous study in East Delta Marsh (Anderson and Jones 1976), where the most common submersed macrophyte was *P. pectinatus*, followed by *M. sibiricum*. Although we found *Potamogeton spp.* at each sample site, it was not numerically dominant. These results are similar to other data for submersed macrophytes in channels in the vicinity of the Field Station (e.g., Goldsborough and Hann 1996), where *C. demersum* appears to have largely displaced *M. sibiricum* since around 1994 (Goldsborough, unpublished observations). However, *Myriophyllum* has persisted in the Saline Pond (Site 1) so that species composition at that site was markedly different from

Table 1. Analyses of water and submersed macrophyte samples (mean and range in parentheses) collected at each of the four sampling sites at biweekly intervals from 24 June to 19 August 1996.

Parameter	Site 1 "Saline Pond"	Site 2 Crescent Pond	Site 3 Blind Channel PCC	Site 4 Blind Channel FS
Temperature (°C)	20 (17-21)	21 (18-23)	20 (15-23)	20 (16-23)
Water depth (cm)	63 (53-72)	85 (79-93)	87 (78-99)	95 (80-113)
Turbidity (NTU)	1.6 (0.9-2.1)	1.3 (0.8-2.0)	1.8 (1.1-2.9)	2.8 (1.8-3.9)
pH	8.1 (7.9-8.6)	7.4 (7.2-7.7)	7.8 (7.4-8.2)	7.9 (7.7-8.1)
Alkalinity (mg/L)	354 (277-386)	277 (251-304)	282 (271-294)	301 (277-321)
Conductivity (µS/cm)	2,106 (1,949-2,240)	1,174 (1,084-1,299)	1,330 (1,222-1,545)	1,384 (1,299-1,478)
NH_3-N (µg/L)	<50 (-)	<50 (-)	<50 (-)	<50 (-)
NO_3-N (mg/L)	0.03 (0.01-0.12)	0.04 (0.01-0.11)	0.03 (0.01-0.09)	0.04 (0.01-0.09)
TKN (mg/L)	1.81 (1.53-2.20)	1.93 (1.57-2.56)	1.48 (1.33-1.65)	1.53 (1.44-1.65)
SRP (µg/L)	<50 (-)	<50 (-)	97 (66-125)	70 (<50-105)
TP (µg/L)	160 (100-220)	158 (100-230)	182 (90-250)	202 (100-280)
Total macrophyte dry weight (g/m^2)	46 (2-92)	77 (59-107)	73 (12-107)	41 (1-73)

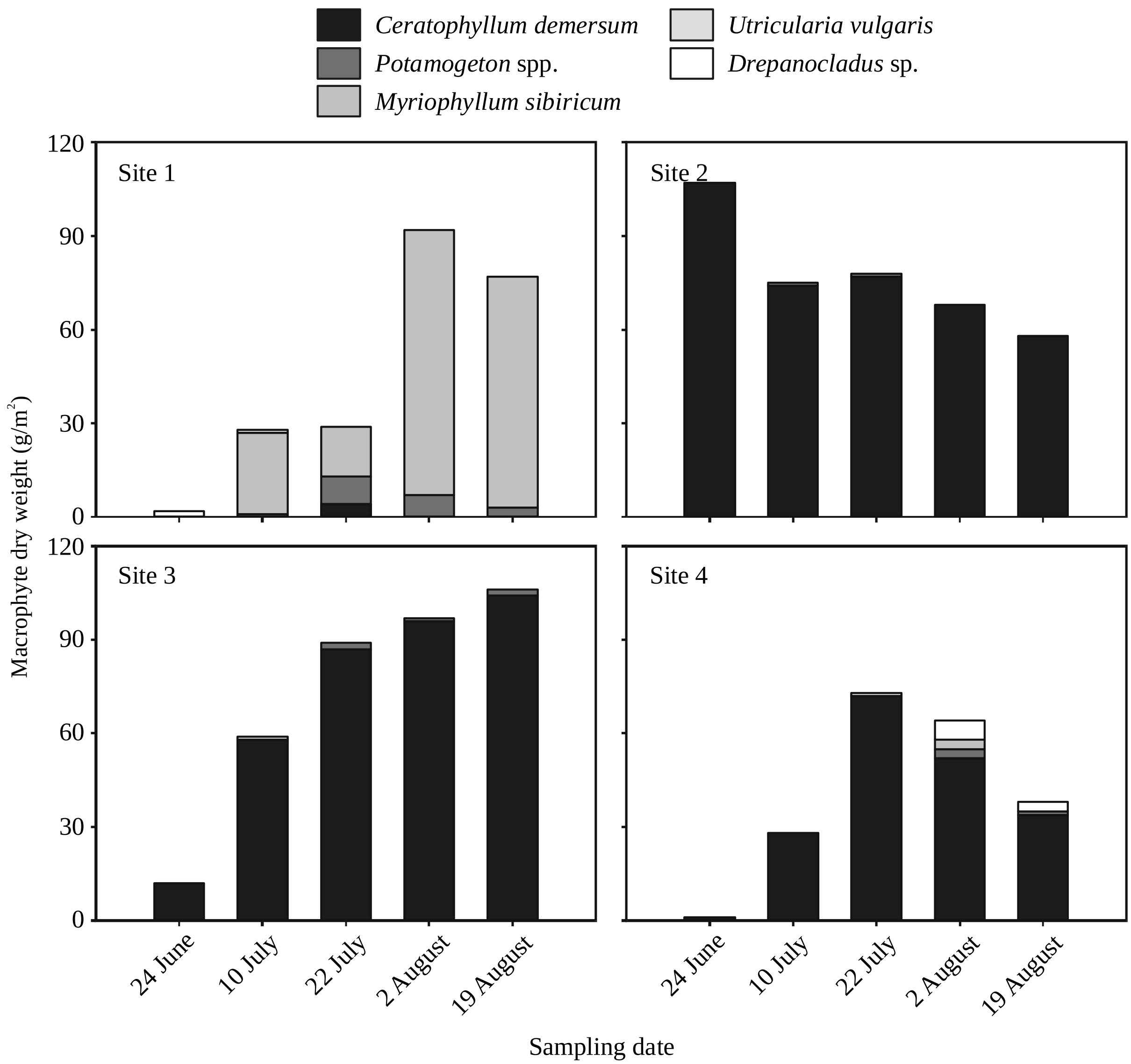

Figure 2. Above-ground dry weight (g/m^2) of the major submersed macrophyte taxa in samples collected at the four sites sampled in 1996.

the other three sites. The only environmental variable we measured that distinguishes Site 1 from the other sites is salinity, which was consistently much higher in the former site.

Clearly, results of this survey provide only preliminary characterization of the submersed macrophytes in the channels near the field station. More intensive sampling, both spatially and temporally, should be undertaken. These limited data indicate, however, that above-ground biomass of submersed macrophytes in the west marsh (45-75 g/m^2) is similar to that of planktonic and benthic algae (McDougal *et al.* 1997) but much lower than that of emergent macrophytes (200-2,000 g/m^2; Thompson and Shay 1989, Goldsborough, unpublished data).

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