

## BRYOPHYTES OF ST. MARTIN ISLAND, DELTA COUNTY, MICHIGAN

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### ABSTRACT

The first bryological survey of St. Martin Island, Delta County, Michigan was conducted in 2013 and 2014; it is only the second bryological survey of any island in the Grand Traverse Islands archipelago in northwestern Lake Michigan. The island has an area of 523 ha, is located 15 km south of the tip of the Garden Peninsula, and is underlain by Niagara dolomite, which outcrops as cliffs, particularly on the west coast. The predominant vegetation type is hardwood and mixed conifer-hardwood forests, and there is a small ephemeral pond and hardwood swamp in the northern part of the island. A total of 105 species of bryophytes (81 mosses and 24 liverworts) were recorded from St. Martin Island. Its bryophyte diversity is comparable to that of nearby Summer Island. Thirty species of mosses and ten species of liverworts represent new records for Delta County.

KEYWORDS: St. Martin Island, Delta County, Michigan, Lake Michigan islands, bryophytes

### INTRODUCTION

St. Martin Island (45°30' N, 86°46' W) has an area of 523 ha and is situated in northwestern Lake Michigan in Delta County, Michigan. It is part of the Grand Traverse Islands archipelago (Judziewicz 2001, Judziewicz et al. 2016) and is located approximately midway between the southern tip of the Garden Peninsula (in Michigan) to the north, and the northern tip of the Door Peninsula (Wisconsin) to the south. Underlain by Niagara dolomite that outcrops as cliffs up to 25 meters tall on the western coast, the majority of the island is dominated by second-growth forests (Figure 1) of sugar maple (*Acer saccharum* Marshall), beech (*Fagus grandifolia* Ehrh.), yellow birch (*Betula alleghaniensis* Britton), and red oak (*Quercus rubra* L.), with white cedar (*Thuja occidentalis* L.) and balsam-fir (*Abies balsamea* (L.) Mill.) more frequent near the coasts, especially on cliffs. There is a small four-hectare ephemeral pond and adjacent hardwood swamp (centered at 45°30'12" N, 86°45'43" W), which

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FIGURE 1. Mixed hardwood–conifer forest on the trans-island trail a short distance north of the center of the island, July 16, 2013. The persons on the trail are US Fish & Wildlife Service Biologist Sadie O’Dell, Karsten Crouse, and Virginia Freire. Photo by Emmet J. Judziewicz.

is dominated by green ash (*Fraxinus pennsylvanica* Marshall), present near the lighthouse in the northeastern part of the island that has a very diverse bryophyte flora. A recent, more detailed discussion of the island’s geography, plant communities, and vascular flora can be found in Judziewicz et al. (2016). Except for a few small inholdings, since 2015 St. Martin Island is now part of the Green Bay National Wildlife Refuge and is administered by the U.S. Fish & Wildlife Service.

#### MATERIALS AND METHODS

A total of five days of fieldwork were conducted on July 16–17, 2013 (by Freire alone) and on August 18–20, 2014 (by Freire and Route); Judziewicz also participated in this field work during both visits, collecting vascular plants, and a few bryophytes.

Areas collected included the southern part of the steep west coast bluffs; the entire main trans-island trail from the old fishing village in the south to the lighthouse in the north; secondary trails running east and west from this main trail; smaller interior outcrops in the south, east of the village; bare, horizontal dolomite bedrock fronting Lake Michigan; and the wetlands surrounding the ephemeral pond/wetland in the northeast a short distance inland from the lighthouse. The specimens collected are deposited in the Robert W. Freckmann Herbarium (UWSP) at the University of Wisconsin-Stevens Point in Stevens Point, Wisconsin. Most specimens were identified using Crum (1991, 2004) and, in a few instances, Flora of North America Editorial Committee (2007, 2014).

## RESULTS

A total of 233 bryophyte specimens were collected, and they represent 81 species of mosses and 24 species of liverworts, for a total of 105 bryophyte species, which are listed below. Each entry consists of the name of the species and the collection number. If the species is new to Delta County, Michigan (according to the Consortium of North American Bryophyte Herbaria, 2020), it is noted in the entry.

An asterisk (\*) preceding an entry indicates that the species is restricted on the island to the distinctive ephemeral pond and adjacent hardwood swamp habitat near the lighthouse; this habitat, dominated by green ash and a small fringing white cedar swamp, was the richest bryophyte habitat on St. Martin Island (Figures 2 and 3), with twenty-five species present here that are found nowhere else on the island.

Nomenclature, including familial dispositions, follows Flora North America Editorial Committee (2007, 2014) for mosses, and Stotler and Crandall-Stotler (2017) for liverworts. Collections numbers with the prefix “13” are those of Freire alone in 2013, and those with the prefix “14” are those of Freire and Route in 2014. The citation of these collection numbers should also include an “SM” (for St. Martin) prefix; for example, the single collection of *Abietinella abietina* below should be fully cited as “*Freire & Route SM14-108*.”

## MOSESSES

## AMBLYSTEGIACEAE

- Amblystegium serpens* (Hedw.) Schimp. 14-39, 14-46, 14-54A. New Delta County record.  
 \**Campyliadelphus chrysophyllus* (Brid.) R.S. Chopra. 13-37.  
 \**Campylium stellatum* (Hedw.) C.E.O. Jensen. 14-123.  
 \**Campylophyllum hispidulum* (Brid.) Hedenäs. 14-6A, 14-54B. New Delta County record.  
 \**Drepanocladus aduncus* (Hedw.) Warnst. var. *aduncus*. 14-43, also *Judziewicz & O'Dell s.n.* in 2013.  
 \**Hygroamblystegium varium* (Hedw.) Monk. subsp. *humile* (P. Beauv.) Vanderp. & Hedenäs. 13-38, 14-48.  
*Hygroamblystegium varium* (Hedw.) Monk. subsp. *varium*. 13-61, 14-70C.  
 \**Leptodictyum riparium* (Hedw.) Warnst. 13-40, 13-45, 14-42, 14-44, 14-50, 14-51. New Delta County record.  
*Platydictya subtilis* (Hedw.) H.A. Crum. 13-27B, 13-83B, 14-75A.  
*Pseudocampylium radicale* (P. Beauv.) Vanderp. & Hedenäs. 13-26A, 14-45.

## ANOMODONTACEAE

- Anomodon attenuatus* (Hedw.) Huebener (A). 13-39, 14-22, 14-63, 14-80, 14-86B.  
*Anomodon minor* (Hedw.) Lindb. 14-71, 14-90. New Delta County record.  
*Anomodon rostratus* (Hedw.) Schimp. 14-61B, 14-62B, 14-124A.

## BRACHYTHECIACEAE

- Brachythecium acutum* (Mitt.) Sull. 13-3, 13-20, 14-59. New Delta County record.  
*Brachythecium laetum* (Brid.) Schimp. 14-38, 14-72.  
*Brachythecium rutabulum* (Hedw.) Schimp. 14-1. New Delta County record.  
*Brachythecium salebrosum* F. Weber & D. Mohr. 13-68, 13-92A. New Delta County record.  
*Brachythecium turgidum* (Hartm.) Kindb. 14-73, 14-74, 14-77, 14-86C.  
*Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen. 13-90B. New Delta County record.



FIGURES 2 and 3. Ephemeral pond and green ash hardwood swamp near St. Martin Island lighthouse on July 17, 2013 and August 19, 2014, respectively. The pond, the swamp, and their forested margins have a rich bryoflora. Photos by Emmet J. Judziewicz.

*Sciuro-hypnum oedipodium* (Mitt.) Ignatov & Huttunen. 13-94, 14-76. New Delta County record.

*Sciuro-hypnum plumosum* (Mitt.) Ignatov & Huttunen. 14-12A. New Delta County record.

\**Tomentypnum nitens* (Hedw.) Loeske. 13-49.

#### BRYACEAE

*Ptychostomum creberrimum* (Taylor) J.R. Spence & H.P. Ramsay. 13-11A, 13-12A.

\**Ptychostomum pseudotriquetrum* (Taylor) J.R. Spence & H.P. Ramsay. 13-51.

*Rhodobryum ontariense* (Kindb.) Paris (Bryaceae). 14-41, 14-86A.

#### CALLIERGONACEAE

\**Warnstorfia fluitans* (Hedw.) Loeske. 13-31. New Delta County record.

#### CLIMACIACEAE

\**Climacium dendroides* (Hedw.) F. Weber & D. Mohr. 14-91.

#### DICRANACEAE

*Dicranella heteromalla* (Hedw.) Schimp. 14-70A.

*Dicranella varia* (Hedw.) Schimp. 14-9A. New Delta County record.

*Dicranum montanum* Hedw. 13-78, 13-80A.

*Dicranum polysetum* Sw. 14-26.

*Dicranum scoparium* Hedw. 14-20, 14-90A, 14-91, 14-93.

\**Leucobryum glaucum* (Hedw.) Ångstr. 14-102. New Delta County record.

#### DITRICHACEAE

*Ceratodon purpureus* (Hedw.) Brid. 13-58, 14-27.

#### ENTODONTACEAE

*Entodon seductrix* (Hedw.) Müll. Hal. 14-87. New Delta County record.

#### FISSIDENTACEAE

\**Fissidens adiantoides* Hedw. 14-113.

*Fissidens dubius* P. Beauv. 14-61A.

\**Fissidens osmundioides* Hedw. 14-114A.

\**Fissidens taxifolius* Hedw. 14-119. New Delta County record.

#### FONTINALACEAE

\**Fontinalis novae-angliae* Sull. 14-93B.

#### FUNARIACEAE

\**Funaria hygrometrica* Hedw. 13-73, 14-120.

#### HELODIACEAE

*Elodium blandowii* (F. Weber & P. Mohr) Eckel. 13-19. New Delta County record.

#### HYLOCOMIACEAE

*Hylocomiastrum pyrenaicum* (Spruce) M. Fleisch. 14-10. New Delta County record.

*Pleurozium schreberi* (Willd.) Mitt. 13-4B, 14-106.

*Rhytidiadelphus squarrosus* (Hedw.) Warnst. 13-34B.

*Rhytidiadelphus triquetrus* (Hedw.) Warnst. 13-14, 13-34, 13-67.

#### HYPNACEAE

*Herzogiella striatella* (Brid.) Z. Iwats. 14-3. New Delta County record.

*Herzogiella turfacea* (Lindb.) Z. Iwats. 13-95, 14-5, 14-92B.

*Homomallium adnatum* (Hedw.) Broth. 14-60, 14-78A, 14-83. New Delta County record.

\**Hypnum cupressiforme* Hedw. 14-115. New Delta County record.

*Hypnum fauriei* Cardot. 13-39. New Delta County record.

*Hypnum lindbergii* Mitt. 14-49.

\**Hypnum pratense* W.D.J. Koch ex Spruce. 13-46.

*Platygyrium repens* (Brid.) Schimp. 13-79, 14-122.

*Pylaisia polyantha* (Hedw.) Schimp. 14-37B.

*Pylaisia selwynii* Kindb. 13-34A. New Delta County record.

## MNIACEAE

- Mnium spinulosum* Bruch & Schimp. 13-59, 14-12B, 14-28, 14-95, 14-96, 14-97, 14-107, 14-118.  
*Mnium thomsonii* Schimp. 13-82.  
*Plagiomnium ciliare* (Müll. Hal.) T.J. Kop. 14-17, 14-88.  
*Plagiomnium cuspidatum* (Hedw.) T.J. Kop. 13-24, 13-26B, 13-29, 13-39, 13-87, 14-4A, 14-34A, 14-36.  
*Plagiomnium medium* (Bruch & Schimp.) T.J. Kop. Judziewicz s.n. in 2013, 14-1.  
*Plagiomnium rostratum* (Schrad.) T.J. Kop. 13-86.  
 \**Rhizomnium punctatum* (Hedw.) T.J. Kop. 14-93A, 14-114B. New Delta County record.

## NECKERACEAE

- Neckera pennata* Hedw. 13-27A, 13-76A, 13-83C, 14-93, 14-98.

## ORTHOTRICHACEAE

- Orthotrichum pumilum* Sw. 14-37A. New Delta County record.  
*Orthotrichum speciosum* Nees. 13-75. New Delta County record.

## PLAGIOTHECIACEAE

- \**Plagiothecium cavifolium* (Brid.) Z. Iwats. 14-52.  
*Plagiothecium denticulatum* (Hedw.) Schimp. 14-21.  
*Plagiothecium laetum* Schimp. 14-16.

## POLYTRICHACEAE

- Atrichum angustatum* (Brid.) Bruch & Schimp. 13-65, 13-67, 14-31, 14-35A, 14-69B. New Delta County record.  
*Atrichum tenellum* (Rohling) Sull. 14-29. New Delta County record.  
*Polytrichastrum ohioense* (Renauld & Cardot) G.L. Sm. 13-97, 14-84.  
*Polytrichum juniperinum* Hedw. 14-30, 14-35B.

## POTTIACEAE

- Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr. 13-12B, 13-13B, 13-26C.  
*Tortella tortuosa* (Hedw.) Limpr. 13-13A, 13-23, 14-7, 14-57B, 14-81, 14-94.  
*Tortula mucronifolia* Schrad. Schwäger. 13-s.n. New Delta County record.  
*Weissia controversa* Hedw. 13-6A, 14-109B, 14-112B. New Delta County record.

## SEMATOPHYLLACEAE

- Sematophyllum subpinnatum* (Brid.) E. Britton. 14-70D. New Delta County record.

## TETRAPHIDACEAE

- Tetraphis pellucida* Hedw. 13-12.

## THUIDIACEAE

- \**Abietinella abietina* (Hedw.) M. Fleisch. 14-108.  
*Thuidium delicatulum* (Hedw.) Schimp. 13-10, 13-11B, 13-21, 13-22, 13-69, 14-25.  
*Thuidium recognitum* (Hedw.) Lindb. 13-8.

## LIVERWORTS

## ADELANTHACEAE

- \**Syzygiella autumnalis* (DC.) K. Feldberg, Váňa, Hentschel & Heinrichs. 14-117.

## BLEPHAROSTOMATACEAE

- Blepharostoma trichophyllum* (L.) Dumort. 13-80B, 14-67C.

## CEPHALOZIACEAE

- Cephalozia bicuspidata* (L.) Dumort. 13-35B, 13-55B, 13-60A. New Delta County record.  
*Fuscocephaloziopsis catenulata* (Huebner) Váňa & L.Söderstr. 14-67B. New Delta County record.  
*Fuscocephaloziopsis connivens* (Dicks.) Váňa & L.Söderstr. 13-14, 13-47C. New Delta County record.  
*Fuscocephaloziopsis lunulifolia* (Dumort.) Váňa & L.Söderstr. 13-47D. New Delta County record.

*Fuscocephaloziopsis pleniceps* (Austin) Vána & L.Söderstr. var. *caroliniana* (R. M. Schust.) Vána & L.Söderstr. 13-52A, 13-60C. New Delta County record.

CEPHALOZIELLACEAE

*Cephaloziella divaricata* (Sm.) Schiffn. 14-68B. New Delta County record.  
*Cephaloziella rubella* (Nees) Warnst. 13-47B, 14-67E.

CONOCEPHALACEAE

*Conocephalum conicum* (L.) Dumort. 14-92.

FRULLANIACEAE

*Frullania eboracensis* Lehm. 13-27C, 13-56C, 14-11, 14-55.  
*Frullania inflata* Gottsche. 14-75B, 14-82. New Delta County record.

JUNGERMANNIACEAE

*Mesoptychia badensis* (Gottsche ex Rabenh.) Vána & L.Söderstr. 13-60B.

LEPIDOZIACEAE

\**Bazzania trilobata* (L.) Gray. 13-11, 14-103, 14-104. New Delta County record.

LOPHOCOLEACEAE

*Chiloscyphus pallescens* (Ehrh.) Dumort. 13-35A, 13-55A, 14-53.  
*Chiloscyphus polyanthos* (L.) Corda. 13-60D, 14-67A, 14-68A, 14-70B.  
*Lophocolea bidentata* (L.) Dumort. 14-67D. New Delta County record.  
*Lophocolea heterophylla* (Schrad.) Dumort. 13-47A, 13-52B, 13-56B, 13-81C, 14-2, 14-4B, 14-69A, 14-112A.  
\**Lophocolea minor* Nees. 13-43, 13-81B, 14-105B.

MARCHANTIACEAE

*Marchantia polymorpha* L. 13-33, 13-96, 14-85.

PORELLACEAE

*Porella platyphylla* (L.) Pfeiff. 13-83A, 14-23, 14-62, 14-78B, 14-79, 14-100.

PTILIDIACEAE

*Ptilidium pulcherrimum* (Weber) Vain. 13-53B, 13-64, 13-81A, 14-8, 14-57A, 14-58, 14-109A, 14-110.

RADULACEAE

*Radula complanata* (L.) Dumort. 13-56A, 13-76B, 13-77, 14-15, 14-99, 14-124B.

TRICHOCOLEACEAE

\**Trichocolea tomentella* (Ehrh.) Dumort. 14-105A. New Delta County record.

## DISCUSSION

St. Martin Island is only the second island in the Grand Traverse Islands (Michigan and Wisconsin) to be systematically surveyed for bryophytes. Summer Island, Michigan, located 10 km to the northeast of St. Martin Island, is the only other island in the archipelago with a comprehensive bryological survey, which was made on July 16–17, 1968 by Miller and Halbert (1971). They found 95 moss species (vs. 81 for St. Martin Island) and 35 liverwort species (vs. 24 for St. Martin Island) for a total of 130 bryophyte species (vs. 105 for St. Martin Island) on Summer Island, meaning that Summer Island has a bryophyte flora that is 19% greater than that of St. Martin Island (Table 1). However, Summer Island is larger (891 ha) than St. Martin Island (523 ha), and, based on a slope of approximately 0.3 in Great Lakes archipelago plant species-area curves (Judziewicz et al. 2001), Summer Island should have a flora that is 17% richer

TABLE 1. Comparison of bryophyte floras of islands and peninsulas of northwestern Lake Michigan. The regions are listed from north to south. Sources: Delta County, Michigan: Consortium of North American Bryophyte Herbaria (2020) plus new reports presented in this paper; Summer Island: Miller and Halbert (1971); Door County, Wisconsin (Rose, 2019).

Region	Area (ha)	Number of Moss species	Number of Liverwort species	Total
Delta County, Michigan	303,300	150	65	215
Summer Island, Delta Co., Michigan	891	95	35	130
St. Martin Island, Delta Co., Michigan	523	81	24	105
Door County, Wisconsin	124,800	250	37	287

than St. Martin Island. Thus, Summer Island and St. Martin Island have roughly equivalently rich bryofloras. St. Martin Island's 105 species of bryophytes represent 49% of the 215 species found in Delta County, Michigan (Consortium of North American Bryophyte Herbaria, 2020), and 36% of the 287 species found in adjacent Door County, Wisconsin (Rose, 2019), just to the south.

The west coast of Summer Island has well-developed alvar plant communities, featuring “moss-clogged springs flowing over dolomite pavement” (Miller and Halbert 1971). In this habitat, which is absent on St. Martin Island (both islands were visited by the third author during 1998 and 2013–2014 field work), Miller and Halbert noted the presence of the following, mostly calciphilic, species that are not known from St. Martin Island: *Aneura pinguis* (L.) Dumort., *Aulacomnium palustre* (Hedw.) Schwägr., *Calliergon giganteum* (Schimp.) Kindb., *Cratoneuron filicinum* (Hedw.) Spruce, *Ditrichum flexicaule* (Schwägr.) Hampe, *Drepanocladus polygamus* (Schimp.) Hedenäs, *D. sendtneri* (Schimp.) Warnst., *Hamatocaulis vernicosus* (Mitt.) Hedenäs, *Hylocomium splendens* (Hedw.) Schimp., *Lophozia porphyroleuca* (Nees) Schiffn., *Philonotis fontana* (Hedw.) Brid., *Preissia quadrata* (Scop.) Nees, *Scapania nemorea* (L.) Grolle, and *Sphagnum capillaceum* (Ehrh.) Hedw.; thus, a total of 14 species found only in this unique habitat. Subtracting these 14 species from the total of 130 found on Summer Island gives 116 species and Summer would have a bryophyte flora that is only 5% poorer than St. Martin Island's total of 105 species—again, factoring in island size.

Thirty species of mosses and ten species of liverworts represent new records for Delta County, and increase that county's bryoflora from 175 (Consortium of North American Bryophyte Herbaria, 2020) to 215 species.

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