

Birds of Wisconsin's Lake Beaches and Dunes

Surveys of Wisconsin birds of Great Lakes' beaches and dunes between 1970 and 1995 revealed a rich assemblage of species representative of several community types. A variety of edge species, and species attracted to open habitats and forest openings, use lake beach and dune communities for foraging and resting, and occasionally, nesting. Shorebirds, gulls, terns, and sometimes raptors, are the most visible avifauna frequenting our Great Lakes' coasts.

Descriptions of habitats and historical perspectives on habitat changes and changes in bird populations, notably the Piping Plover, are discussed.

by Summer W. Matteson

It is no secret that migrating raptors and shorebirds (Figure 1) are often best observed along Wisconsin's Great Lakes' coasts, and it is along Lakes Michigan and Superior that lake beach and dune communities are best represented, though these communities occur to a much lesser extent at sandy interior lakes (Curtis 1959). This paper, the thirteenth in the series "*Wisconsin Birding: The Habitat Way*," discusses breeding and migratory birds at these coastal communities.

Beaches and dunes covered in this paper refer to sand beaches and dunes, varying from open unvege-

tated beaches to vegetated dunes, open dune swales, and vegetated sand ridges, which succeed with stabilization to forest cover. For some of the more unfamiliar or obscure terms used, a few definitions are called for (from: Nelson and Nelson 1967, Monkhouse 1970, Tver 1979): 1) *barrier beach*—typically an offshore sand bar or sand ridge parallel to the mainland shore and separated from it by a lagoon that gradually becomes established as the ridge—barrier—is built up by storm waves. 2) *barrier spit*—elongated sandy point of land projecting into the lake (sea) from the mainland and across the mouth



Figure 1. Ruddy Turnstone, Wisconsin Point, Lake Superior. (Photo by Robbye Johnson)

of an estuary or head of a bay. 3) *baymouth bar*—a bank of sand, mud, or stones of varying sizes that extends across a bay, usually linking two mainland promontories to create a somewhat straight coastline. 4) *cusped foreland*—an island's broadly triangular, low sand promontory formed from the convergence of two opposing sand bars or ridges created by opposing longshore currents. 5) *longshore current*—inshore current that moves essentially parallel to the shore and which is usually generated by waves breaking at an angle to the shoreline. 6) *tombolo*—a sandbar connecting an island with the mainland. 7) "*true*" *sand spit*—long, fairly narrow sandy point of land or shoal that extends from shore into the lake (sea).

Among the best examples of beach and dune communities are those at:

Kohler-Andrae State Park, Point Beach State Forest, Whitefish Dunes State Park, Long Island and Chequamegon Point, Wisconsin Point, and Outer Island in the Apostle Islands. Nesting typically occurs less often at these coastal sites than inland, but management of them as feeding and resting grounds may be just as important as management of nesting habitat in the long-term considerations of bird survival.

METHODS

Information on lake beach and dune geology, botany, history, and avian studies was compiled from a variety of sources and cited accordingly in the text. Gleason and Cronquist (1991) was the final authority on plant nomenclature used throughout the paper.

Wisconsin Department of Natural Resources' (DNR) Natural Areas' standardized, single-visit breeding bird surveys, as well as additional surveys/visits to document breeding birds, were conducted during 1970–1995 by volunteers, state and federal agency personnel, and myself, at 24 sites on Lakes Michigan and Superior. (A July visit to Wisconsin Point in 1996 produced additional data.) Data from 132 (standardized and other) surveys at 10 representative sites were compiled for Table 1. A total of 78 single-visit breeding bird surveys in lake beach/dune habitats was used to determine species abundance in Table 2; for this table only those surveys were included where observers recorded habitat associations.

During June and early July 1989–1991, I described the vegetation of 7 lake beach and dune habitat types (strand, foredune, heath-like backdune, backdune grassland/savanna, open dune swale/wetland, forested dune ridge and swale, tombolo/sand ridge) within $50 \times 100\text{m}$ transects at 9 sites, with each transect separated from other transects by at least 100m. In each of 4 height classes (0–1m, 1–3m, 3–6m, and >6m), I made ocular estimates (James and Shugart 1970) of percent cover of open ground (including driftwood), vegetation, residual plant material, and water. Birds observed during these surveys are pooled with data from single-visit surveys in Table 2. In field notes, I also made cover estimates of vegetation types and heights during my single-visit breeding bird surveys.

Site descriptions were based on several sources in addition to my observations. These sources were as fol-

lows: Bureau of Endangered Resources' (BER) Natural Areas' files (all sites), William Tans' notes and unpublished DNR reports on the flora of the Outer Island Sand Spit and Whitefish Dunes, Reed (1959) on Point Beach State Forest flora, Judziewicz and Koch (1971) on Outer Island and Long Island sand-scapes, and Bratley (1971), Koch *et al.* (1979), and Eric Epstein (pers. comm. and *in litt.*) on Wisconsin Point flora. These sites (with the exception of Outer Island Sand Spit), as well as several beach/dune birds, also received mention in *Wisconsin's Favorite Bird Haunts, Revised Edition* (Tessen 1976) and *Wisconsin's Favorite Bird Haunts: Supplement Edition* (Tessen 1979). These latter two publications include maps.

ORIGIN AND MAINTENANCE OF BEACHES/DUNES

About 20,000–35,000 years ago, the ancestral Great Lakes drained into an area north of the present St. Lawrence River. Southern portions of these receding lakes exposed broad lake plains—former lake bottoms with lacustrine soils, primarily sands, as well as coarser, clastic sediments (The Nature Conservancy 1994, Albert 1995), and also iron-rich red clay along the south shore of Lake Superior. Accompanying development of this drainage and the retreat of massive glacial ice sheets was a tilting of the Great Lakes basin (Martin 1965).

The scouring of bedrock sandstones and shales and other sedimentary rock by glacial action, the filling of scoured and dammed basins with water, and the rebound of

Table 1. Maximum number of birds detected at 10 lake beach and dune sites on Lakes Michigan and Superior, Wisconsin, during 28 May–4 July, 1970–1995. Includes observations for adjacent lake and wetland habitats, and forested ridges and swales. PB = Point Beach State Forest, KD = Kohler Dunes State Natural Area, LI = Long Island, WP = Wisconsin Point, OI = Outer Island Sand Spit, JHR = Jackson Harbor Ridges, WD = Whitefish Dunes State Park, MI = Madeline Island, SB = Seagull Bar, SI = Stockton Island. Years and numbers of visits given in Table 4. + = Species present but number not documented during observation period.

Species	PB	KD	LI	WP	OI	JHR	WD	MI	SB	SI
Common Loon			3	1	2			1		
White Pelican			24							
Double-crested Cormorant			7	2	30	28			2	
American Bittern				1				1		
Least Bittern									1	
Great Blue Heron	2		3	10	+	3			3	1
Green Heron	2	1		+						
Black-crowned Night-Heron									12	
Mute Swan				3						
Brant			3							
Canada Goose	5	4	14		+	1				
Wood Duck				7						
Green-winged Teal			6							
Black Duck	1			1						
American Coot				1					1	
Mallard	2	2	53	16		7		2	5	
Blue-winged Teal			3	8		2			4	
Northern Shoveler				1						
Gadwall			3							
American Wigeon			1	2						
Canvasback				4						
Redhead			1							
Greater Scaup				1						
Lesser Scaup			1	5						
White-winged Scoter										
Common Goldeneye						1				
Hooded Merganser				1						
Common Merganser			24		+					
Red-breasted Merganser			8	1	12	9		2		1
Turkey Vulture	1		1		4					
Osprey			1							
Bald Eagle			4	2	2					
Northern Harrier			2	1	+			1		2
Sharp-shinned Hawk					+	1				
Cooper's Hawk		1			+					
Red-shouldered Hawk	1									
Broad-winged Hawk					4	1	2			
Red-tailed Hawk					1					
American Kestrel	1				+					
Merlin	1		1	2	2				1	
Ring-necked Pheasant				1						
Ruffed Grouse	2					2				
Wild Turkey	1									
Virginia Rail			1	2						
Sora				2						
Black-bellied Plover	1		22		3				1	
Lesser Golden Plover			3		1					

(continued)

Table 1. *Continued*

Species	PB	KD	LI	WP	OI	JHR	WD	MI	SB	SI
Semipalmated Plover			15	1	1				2	
Piping Plover			6	4						
Killdeer	4	3	14	19	2	2		1	8	1
Greater Yellowlegs			3		+					
Lesser Yellowlegs			14	2						
Solitary Sandpiper			1							
Willet			1	1						
Spotted Sandpiper	1		10	12	8	7		3	6	1
Upland Sandpiper			1							
Whimbrel			2							
Hudsonian Godwit			1							
Marbled Godwit			14							
Ruddy Turnstone	1		8		21				4	
Red Knot			3		1					
Sanderling	1		140	3	17				1	
Semipalmated Sandpiper			35	4	23				10	
Western Sandpiper			1							
Least Sandpiper			70	2	6				20	
White-rumped Sandpiper			2							
Baird's Sandpiper			1		17					
Pectoral Sandpiper			3							
Buff-breasted Sandpiper			1							
Dunlin	1		47		8				5	
Short-billed Dowitcher			9							
Common Snipe				1	+			3		
American Woodcock				2	1					
Wilson's Phalarope			4							
Franklin's Gull			1							
Bonaparte's Gull	100		33	45	22				1	
Ring-billed Gull	1,000	210	664	190	54	1	1,200		1,000	
Herring Gull	500		206	420	65	30	12		156	2
Caspian Tern	8		192	2		1			40	
Common Tern	2		105	104					15	
Forster's Tern									5	
Black Tern			55	41					20	
Mourning Dove	6	6		4	+	2	4		1	
Black-billed Cuckoo	1	2	1	4						
Yellow-billed Cuckoo				1						
Great Horned Owl						1				
Barred Owl	1				1					
Long-eared Owl			1							
Whip-poor-will							1			
Chimney Swift	2	6		1			1	1		2
Ruby-throated Hummingbird	1	2						1	2	
Belted Kingfisher	3		2		+			2		
Red-headed Woodpecker					1					
Red-bellied Woodpecker						1				
Yellow-bellied Sapsucker				1	+					
Downy Woodpecker	1	1		+	+					
Hairy Woodpecker	5				+	7	3	1		
Northern Flicker	1	1	2	4	+	3	1	1		
Pileated Woodpecker	2					1	1			
Olive-sided Flycatcher	1			1				2		
Eastern Wood-Pee-wee	7	3	1	1	1	1	8			

(continued)

Table 1. *Continued*

Species	PB	KD	LI	WP	OI	JHR	WD	MI	SB	SI
Yellow-bellied Flycatcher		1			1					
Alder Flycatcher	6		2	5	5			5		1
Willow Flycatcher		1				1			3	
Least Flycatcher	3		1	12	2				1	2
Eastern Phoebe			1	1	+	1				
Great Crested Flycatcher	11	2		3	+	7				
Western Kingbird					1					
Eastern Kingbird	6	6	4	8	2	6		4	7	
Horned Lark			1		2				1	
Purple Martin	2	6		2		1	2		2	
Tree Swallow	6	12	7	544	3	3	6	14	12	6
Northern Rough-winged Swallow	5	1	2	8	+			1	3	
Bank Swallow	12	10	10		+	2			125	
Cliff Swallow	4		5	34		4	5		10	
Barn Swallow	4	7	10	6	2	2			1	
Blue Jay	54	3	13	1	2	21	7			
American Crow	15	6	7	8	2	10	26	2	1	1
Common Raven			5	1	1	1		1		
Black-capped Chickadee	19	8	3	3	11	11	10	3		
Tufted Titmouse	1									
Red-breasted Nuthatch	10		1	3	1	3	1			
White-breasted Nuthatch	2			1	2		6	2		
Brown Creeper	2				+	1				
House Wren	5	5		1			4			
Winter Wren	1	1			1	1				1
Sedge Wren	3				15			1		1
Marsh Wren									15	
Golden-crowned Kinglet			1		+	11				1
Ruby-crowned Kinglet					+					
Blue-gray Gnatcatcher	1									
Eastern Bluebird	2	4	1		5	1	3			1
Veery	16	1	2	5	+		8	5		
Gray-cheeked Thrush					+					
Swainson's Thrush					+					
Hermit Thrush	1				1		4			
Wood Thrush	1				1	1	4			
American Robin	9	9	3	32	1	6	10	1		1
Gray Catbird	7	4	1	6	+	1		3	2	
Northern Mockingbird					2					
Brown Thrasher		2	1	1	+					2
American Pipit					1					
Cedar Waxwing	19	9	40	17	3	48	13	+	5	
European Starling	1	3	1	10	+	6	2		38	
Solitary Vireo	3			+	+				+	
Yellow-throated Vireo	2						3		1	
Warbling Vireo		1		7			4	1	3	
Red-eyed Vireo	18	5	2	7	2	1	11	6		1
Tennessee Warbler				1	2					
Nashville Warbler	1		9	5	5	1		15		5
Northern Parula					+					
Yellow Warbler	4	4	7	11	5	1	1	4	15	1
Chestnut-sided Warbler	7	2	1	7	2		2			2
Magnolia Warbler	1	1			+	2				
Yellow-rumped Warbler	3	4	2	5	3	9	2	6	1	

(continued)

Table 1. *Continued*

Species	PB	KD	LI	WP	OI	JHR	WD	MI	SB	SI
Black-throated Green Warbler	18		4		1	9	6	2		
Blackburnian Warbler	1	1	1	1	1	1	2	2		
Yellow-throated Warbler		1								
Pine Warbler	3		2					2		1
Palm Warbler					+					
Blackpoll Warbler				1	+					
Cerulean Warbler							1			
Black-and-white Warbler	4		1	2	+	8	2	1		
American Redstart	8	1	7	25	2	5	8	6		1
Ovenbird	20			4	1	5	14	3		
Northern Waterthrush	1			1						
Kentucky Warbler				1						
Mourning Warbler	7	1		4	+	1				
Common Yellowthroat	14	6	5	10	4	5	4	8	1	4
Hooded Warbler	1									
Wilson's Warbler					1					
Canada Warbler	7	1		+	3		1	1		
Yellow-breasted Chat							1			
Scarlet Tanager	6				+		1			
Northern Cardinal	6	4								
Rose-breasted Grosbeak	2			1						
Indigo Bunting	8	4			2	2	2			
Dickcissel				1						
Eastern Towhee	3	6			1					
Chipping Sparrow	7	33	5	3	2	2	10	3		2
Clay-colored Sparrow	6	6	2	3	1		3			
Field Sparrow	1	10								
Vesper Sparrow		9								
Savannah Sparrow	2		4	6	+			1		
Grasshopper Sparrow		1					2			
Le Conte's Sparrow				1	+					
Song Sparrow	11	16	11	11	2	6		6	14	5
Swamp Sparrow	3		1	7	1			4	3	3
White-throated Sparrow	2		2	3	2		2	2		
White-crowned Sparrow					+					
Dark-eyed Junco					1					
Lapland Longspur					1					
Bobolink	2	1		67	+					4
Red-winged Blackbird	12	29	50	65	2	3		8	28	
Eastern Meadowlark	1	1			1					
Western Meadowlark			1		2					1
Yellow-headed Blackbird			63	9	+				5	
Rusty Blackbird				2						
Brewer's Blackbird			1	15					4	
Common Grackle	7	6	1	10	+	9	3			
Brown-headed Cowbird	3	7	6	23	+		1	10	4	
Baltimore Oriole	1	3		5	+	1	1	1		1
Purple Finch				6	+	1		1		
House Finch	6	14								
Pine Siskin			5	2	+					
American Goldfinch	20	11	2	4	+	6	2	1	1	
Evening Grosbeak			7	9	+					
House Sparrow	2	2								

Table 2. Comparative abundance of birds detected on breeding bird surveys in 7 lake beach/dune habitats. A = Abundant (occurred on over 75% of sites). C = Common (occurred on 51–75% of sites). FC = Fairly Common (occurred on 26–50% of sites). U = Uncommon (occurred on 11–25% of sites). R = Rare (occurred on 1–10% of sites). *Wetland means sedge meadow, ephemeral pool, bog, swamp, and interdunal wetland. Numbers in parentheses indicate number of sites surveyed.

Species	sand beach (n = 24)	foredune (n = 15)	backdune grassland/ savanna (n = 10)	heathlike backdune (n = 6)	open dune swale/ wetland* (n = 10)	forested dune ridge & swale (n = 13)	tombolo/ sand ridge (n = 5)	Overall
White Pelican	—	—	—	—	—	—	U	R
Double-crested Cormorant	U	—	—	—	—	—	—	R
Great Blue Heron	—	—	—	—	C	—	—	R
Green Heron	—	—	—	—	FC	—	—	R
Black-crowned Night-Heron	—	—	—	—	—	—	U	R
Canada Goose	U	—	—	—	—	—	—	U
Green-winged Teal	—	—	—	—	U	—	—	R
Mallard	C	—	—	—	FC	—	U	U
Blue-winged Teal	R	—	—	—	FC	—	U	R
Gadwall	—	—	—	—	U	—	—	R
Common Merganser	R	—	—	—	—	—	—	R
Red-breasted Merganser	U	—	—	—	—	—	—	U
Turkey Vulture	—	—	U	U	—	U	—	U
Bald Eagle	R	—	—	—	U	U	—	U
Northern Harrier	—	U	U	—	R	—	—	U
Sharp-shinned Hawk	—	—	—	—	—	R	—	R
Cooper's Hawk	—	—	—	—	—	R	—	R
Red-shouldered Hawk	—	—	—	—	—	R	—	R
Broad-winged Hawk	—	—	—	—	—	FC	—	R
Red-tailed Hawk	—	—	R	—	—	—	—	R
American Kestrel	—	—	R	—	—	—	—	R
Merlin	—	U	FC	FC	—	FC	—	FC
Ring-necked Pheasant	—	—	—	—	—	R	—	R
Ruffed Grouse	—	—	—	—	—	U	—	R
Wild Turkey	—	—	—	—	—	R	—	R
Virginia Rail	—	—	—	—	U	—	—	R

Black-bellied Plover	R	—	—	—	—	—	U	R
Lesser Golden Plover	R	—	—	—	—	—	—	R
Semipalmated Plover	R	—	—	—	—	—	—	R
Piping Plover	R	—	—	—	R	—	—	R
Killdeer	FC	C	C	FC	R	—	—	FC
Greater Yellowlegs	R	—	—	—	R	—	—	R
Lesser Yellowlegs	R	—	—	—	—	—	—	R
Willet	R	—	—	—	R	—	—	R
Spotted Sandpiper	FC	C	FC	—	FC	—	FC	FC
Upland Sandpiper	—	—	R	—	—	—	—	R
Whimbrel	R	—	—	—	R	—	—	R
Hudsonian Godwit	R	—	—	—	R	—	—	R
Marbled Godwit	R	—	—	—	—	—	R	R
Ruddy Turnstone	U	—	—	—	—	—	—	R
Red Knot	R	—	—	—	—	—	—	R
Sanderling	FC	—	—	—	—	—	—	U
Semipalmated Sandpiper	U	—	—	—	—	—	—	U
Western Sandpiper	R	—	—	—	—	—	—	R
Least Sandpiper	FC	—	—	—	—	—	—	U
White-rumped Sandpiper	R	—	—	—	—	—	—	R
Baird's Sandpiper	R	—	—	—	—	—	—	R
Pectoral Sandpiper	R	—	—	—	—	—	—	R
Buff-breasted Sandpiper	R	—	—	—	—	—	—	R
Dunlin	U	—	—	—	—	—	—	R
Short-billed Dowitcher	R	—	—	—	R	—	—	R
American Woodcock	—	—	—	FC	—	—	—	R
Wilson's Phalarope	—	—	—	—	R	—	—	R
Franklin's Gull	R	—	—	—	—	—	—	R
Bonaparte's Gull	U	—	—	—	—	—	—	R
Ring-billed Gull	A	—	—	—	FC	—	—	FC
Herring Gull	C	—	—	—	—	—	—	U
Caspian Tern	U	—	—	—	—	—	—	R
Common Tern	U	R	—	—	—	—	—	R
Black Tern	R	—	—	—	—	—	—	R
Mourning Dove	—	—	C	—	—	C	FC	U
Black-billed Cuckoo	—	—	—	—	—	FC	—	R

(continued)

Table 2. *Continued*

Species	sand beach (n = 24)	foredune (n = 15)	backdune grassland/ savanna (n = 10)	heathlike backdune (n = 6)	open dune swale/ wetland* (n = 10)	forested dune ridge & swale (n = 13)	tombolo/ sand ridge (n = 5)	Overall
Yellow-billed Cuckoo	—	—	—	—	—	R	—	R
Great Horned Owl	—	—	—	—	—	R	—	R
Barred Owl	—	—	—	—	—	R	—	R
Whip-poor-will	—	—	—	—	—	R	—	R
Chimney Swift	R	R	U	U	R	U	R	U
Ruby-throated Hummingbird	—	—	U	—	—	FC	—	R
Belted Kingfisher	—	—	—	—	FC	R	—	R
Red-bellied Woodpecker	—	—	—	—	—	R	—	R
Yellow-bellied Sapsucker	—	—	—	—	—	R	—	R
Downy Woodpecker	—	—	R	—	—	FC	—	R
Hairy Woodpecker	—	—	—	—	—	FC	—	R
Northern Flicker	FC	FC	C	C	U	C	FC	FC
Pileated Woodpecker	—	—	—	—	—	U	—	R
Olive-sided Flycatcher	—	—	—	—	—	U	—	R
Eastern Wood-Pewee	—	—	—	—	—	C	—	U
Yellow-bellied Flycatcher	—	—	—	—	—	U	—	R
Alder Flycatcher	—	—	—	—	C	FC	—	U
Willow Flycatcher	—	—	—	—	U	U	—	R
Least Flycatcher	—	—	—	—	—	FC	—	R
Eastern Phoebe	—	—	U	—	—	U	—	R
Great Crested Flycatcher	—	—	—	—	—	FC	—	R
Eastern Kingbird	—	U	FC	U	C	C	FC	FC
Horned Lark	U	U	R	R	—	—	R	U
Purple Martin	U	FC	U	R	R	U	R	U
Tree Swallow	A	A	A	FC	FC	A	A	A
Northern Rough-winged Swallow	FC	FC	U	U	U	U	C	FC
Bank Swallow	FC	FC	U	R	—	—	FC	FC
Cliff Swallow	FC	FC	—	—	—	—	FC	U
Barn Swallow	FC	FC	FC	FC	FC	—	FC	FC
Blue Jay	—	—	U	—	—	C	FC	FC

American Crow	FC	U	FC	FC	U	A	U	FC
Common Raven	—	—	R	—	R	FC	R	U
Black-capped Chickadee	—	—	FC	—	FC	C	FC	FC
Tufted Titmouse	—	—	—	—	—	R	—	R
Red-breasted Nuthatch	—	—	—	—	—	FC	—	U
White-breasted Nuthatch	—	—	—	—	—	FC	—	U
Brown Creeper	—	—	—	—	—	U	—	R
House Wren	—	—	—	—	—	FC	—	R
Winter Wren	—	—	—	—	—	C	—	R
Sedge Wren	—	—	—	—	FC	—	—	R
Golden-crowned Kinglet	—	—	—	—	—	U	R	U
Blue-gray Gnatcatcher	—	—	—	—	—	R	—	R
Eastern Bluebird	—	—	C	FC	—	—	—	U
Veery	—	—	—	—	—	FC	R	R
Hermit Thrush	—	—	—	—	—	U	—	R
Wood Thrush	—	—	—	—	—	FC	—	R
American Robin	U	U	FC	FC	U	A	U	FC
Gray Catbird	—	—	C	FC	FC	FC	FC	FC
Brown Thrasher	—	—	FC	U	—	FC	U	U
Cedar Waxwing	—	—	U	U	—	A	U	U
European Starling	FC	U	U	R	U	FC	FC	FC
Solitary Vireo	—	—	—	—	—	U	—	R
Yellow-throated Vireo	—	—	—	—	—	U	R	R
Warbling Vireo	—	—	FC	—	U	FC	FC	U
Red-eyed Vireo	—	—	U	—	U	A	R	U
Tennessee Warbler	—	—	—	—	—	R	—	R
Nashville Warbler	—	—	—	—	R	A	R	U
Yellow Warbler	—	—	FC	U	A	R	FC	FC
Chestnut-sided Warbler	—	—	FC	—	R	C	U	FC
Magnolia Warbler	—	—	—	—	—	U	—	R
Yellow-rumped Warbler	—	—	—	—	U	A	—	U
Black-throated Green Warbler	—	—	—	—	FC	FC	—	U
Blackburnian Warbler	—	—	—	—	FC	A	—	U
Pine Warbler	—	—	U	—	—	U	—	R
Northern Waterthrush	—	—	—	—	—	R	—	R
Blackpoll Warbler	—	—	—	—	—	R	—	R

(continued)

Table 2. *Continued*

Species	sand beach (n = 24)	foredune (n = 15)	backdune grassland/ savanna (n = 10)	heathlike backdune (n = 6)	open dune swale/ wetland* (n = 10)	forested dune ridge & swale (n = 13)	tombolo/ sand ridge (n = 5)	Overall
Cerulean Warbler	—	—	—	—	—	R	—	R
Black-and-White Warbler	—	—	—	—	—	FC	U	R
American Redstart	—	—	R	—	C	A	U	U
Ovenbird	—	—	—	—	—	C	—	R
Mourning Warbler	—	—	R	—	—	FC	—	R
Common Yellowthroat	—	—	A	U	A	R	FC	FC
Hooded Warbler	—	—	—	—	—	R	—	R
Wilson's Warbler	—	—	—	—	R	—	R	R
Canada Warbler	—	—	—	—	FC	U	—	R
Scarlet Tanager	—	—	—	—	—	U	—	R
Northern Cardinal	—	—	R	—	—	U	—	R
Rose-breasted Grosbeak	—	—	—	—	—	U	—	R
Indigo Bunting	—	—	FC	—	—	FC	—	R
Dickcissel	—	—	R	—	—	—	—	R
Eastern Towhee	—	—	U	R	—	U	—	R
Chipping Sparrow	—	—	FC	—	—	A	U	FC
Clay-colored Sparrow	—	—	FC	FC	—	—	—	U
Field Sparrow	—	R	U	R	—	—	—	R
Vesper Sparrow	—	R	R	R	—	—	—	R

Savannah Sparrow	—	U	FC	—	—	—	—	R
Song Sparrow	—	U	C	FC	A	FC	C	FC
Swamp Sparrow	—	—	—	—	C	R	—	R
White-throated Sparrow	—	—	—	—	U	FC	—	R
Bobolink	—	R	U	R	—	—	R	R
Red-winged Blackbird	U	U	FC	U	A	R	FC	FC
Eastern Meadowlark	—	R	FC	R	—	—	—	R
Western Meadowlark	—	—	—	—	—	—	R	R
Yellow-headed Blackbird	—	—	—	—	U	—	—	R
Rusty Blackbird	—	—	R	—	—	—	—	R
Brewer's Blackbird	—	—	U	U	—	—	—	R
Common Grackle	U	U	FC	FC	FC	U	R	FC
Brown-headed Cowbird	U	R	FC	R	U	FC	FC	FC
Baltimore Oriole	—	—	FC	—	R	FC	—	U
Purple Finch	—	—	—	—	—	U	—	R
House Finch	—	—	U	—	—	U	—	R
Pine Siskin	—	—	—	—	—	U	—	R
American Goldfinch	—	U	C	FC	FC	FC	C	FC
Evening Grosbeak	—	—	—	—	—	U	—	R
House Sparrow	R	—	U	R	—	U	R	R

the earth's crust as the last ice sheets departed, characterized the period. A tremendous amount of sediment deposition occurred near and around drowned river mouths in lake plains, leading to the formation of sand beaches (technically called sand "berms"), bars, and spits (The Nature Conservancy 1994). Long sand spits, such as Long Island/Chequamegon Point (Figure 2), Wisconsin Point (Figure 3) and Minnesota Point, and Long Point on Lake Erie, were gradually established by accretions of water-borne sand, whose origins were eroded quartzose sandstone (Martin 1965).

Present lake levels were reached about 2,500 years ago (The Nature Conservancy 1994).

Owing to their geologic origins

and changeable conditions, Wisconsin's Great Lakes' sand beaches and dunes are dynamic, ancient communities: they have been continually shaped and influenced structurally by sediments transported and deposited by longshore currents over many thousands of years, and by wave action, storm surge, fluctuating water levels, and vegetative succession (often affected by natural events—e.g. fire—or by human-made disturbances).

Sand beaches and dunes depend critically on and are critical to the continued transport of sediments. When this is interrupted, when shoreline development blocks sand replenishment from wave action, the beach will be scoured, and endless, expensive "beach nourishment"



Figure 2. Long Island, with broad Sand Cut in center, forms a barrier spit with Chequamegon Point in lower portion of aerial photo. (Photo courtesy of Apostle Islands National Lakeshore, U.S. National Park Service)

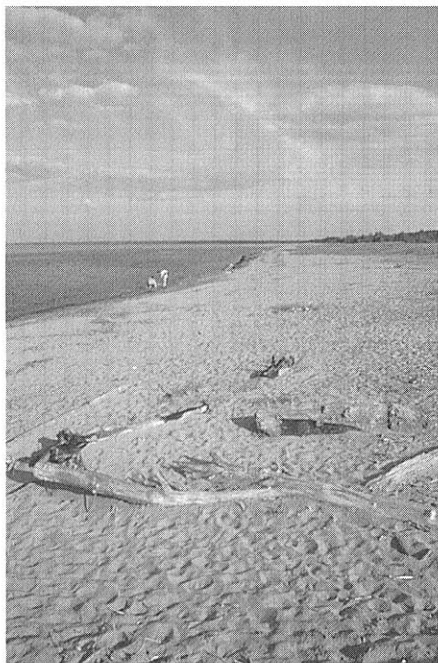


Figure 3. Wisconsin Point. (Photo by Meg Turville-Heitz)

projects may be necessary, typified by the artificial beaches created along Miami's shores (Myers and Ewel 1990). Beach replenishment is extremely costly. The U.S. Army Corps of Engineers participated in 56 major beach nourishment projects between 1950 and 1993 in the U.S. at a total cost of almost \$1.5 billion, with almost \$900 million coming from the federal government (Dean 1996).

On the Great Lakes, both residential development and recreational traffic pose a threat to the continued viability of lake beaches and dunes. "This [threat] destroys and fragments communities and populations," commented The Nature Conservancy (1994), "impairs system functions such as sand transport and impoverishes nat-

ural diversity. Dunes are also prone to accelerated erosion. For example, large, relatively unvegetated blowouts develop into parabolic dunes when pedestrian or vehicular traffic, or removal of overstory vegetation, destabilizes sand and exposes it to wind erosion."

Onshore winds are also a key factor in dune creation and continuity. Dune sand grains typically range in size from 0.15mm to 0.30mm; grains less than 0.15mm generally present a smooth surface that winds pass over (Jacobson 1968).

"Sand dunes like snow drifts have a gentle slope on the windward side and a steep slope on the leeward side," wrote Jacobson. "Sand impelled by the wind ascends on the windward slope and comes to rest on the lee side. Thus a dune advances in the direction the wind is blowing by excavation of material from the windward side and deposition on the leeward side. If not arrested dunes would march inland and engulf roads, buildings and villages—a feat they have often accomplished."

Sand transport and dune formation are also affected by colonizing grasses, such as American beach grass (*Ammophila breviligulata*) on Lakes Michigan and Superior and the dune reed or sand reed (*Calamovilfa longifolia* var. *magna*) on Lake Michigan. Stabilization of shifting, wind-blown sands occurs first by these grasses; these are the dominant stabilizers of Great Lakes foredunes. They may also be present to a limited extent in the upper beach zone, beyond the wash of waves, except in storms. These species grow upward and laterally, outpacing burial by sand. The stems of these grasses stymie the flow of surface winds so that drifting sand grains drop around

and near the colonizing grasses, and contribute to dune build-up. Along Lake Michigan, especially at Point Beach State Forest, stands of little bluestem (*Schizachyrium scoparium*) occur as an intermediate stage in dune colonization between the forest edge and dune crests (Van Denack 1961). Forbs such as beach pea (*Lathyrus maritimus* var. *glaber*), beach wormwood (*Artemisia campestris*), silverweed (*Potentilla anserina*), gray goldenrod (*Solidago nemoralis*), and starry false-Solomon's seal (*Smilacina stellata*), also help stabilize the dune (Curtis 1959, Salamun and Stearns 1978, Judziewicz and Koch 1993).

Plants that adapt to windswept, volatile coastal conditions are especially hardy and responsive to the demanding physical conditions. Sea rockets (*Cakile* spp.), for example, produce a "two-stage" fruit that allows the plant to remain both at the original beach site and to colonize a new one: the bottom half of the fruit detaches during storm wave action and remains buried with dead parent material, while the upper half is carried away to a new site (Myers and Ewel 1990).

Lake dune plant succession—from sand to herbaceous cover, to shrubs or scattered trees, to forest—is similar to succession on inland oak and pine barrens, where fire or some other disturbance may create a blow-out area. Lake dunes are arguably more dynamic because of the energetic interplay of an open topography with wind, wave, and ice action.

DESCRIPTION OF HABITAT TYPES AND PLANT COMMUNITIES

Lake beach and dune communities have continued to evolve during

the past 2,500 years. These communities are geomorphologically diverse. Judziewicz and Koch (1993) preferred using the term "sandscapes" when describing sand spits in the Apostle Islands because of the variety of sand landforms present: cusped forelands on Raspberry, Stockton, and South Twin islands, barrier beaches at Big Bay (Figure 4) and Amnicon Bay on Madeline Island, tombolo on York Island, double tombolo at Presque Isle Point on Stockton Island, beaches, barrier spit—Long Island, and true sand spits at Cat and Outer (Figures 5a and b) islands.

Beach and dune communities exhibit distinct slope profiles as a result of erosion and sediment deposition, with the area from the water's edge (wash zone) to the reach of the highest storm waves, or upper beach, known as the beach zone (also called strand zone or storm beach zone). For purposes of later discussion in relation to birds observed, I refer to the beach zone as the *strand*. The strand ranges from open unvegetated beach or mudflat with occasional dead wood and cobble present to <10% grass cover 0–1m tall on upper portions of the sand beach.

Comparing Lake Michigan's and Lake Superior's beaches, Curtis (1959) wrote: "*The beaches of Lake Superior resemble those of Lake Michigan in microtopography but differ considerably in vegetation, with a greatly reduced number of species except in completely protected bays. In fact, long stretches of Lake Superior beach, often several miles in length, can be found which have not a single seed plant except for a few stragglers in areas of buried organic debris.*"

Sand beach plants that do occur

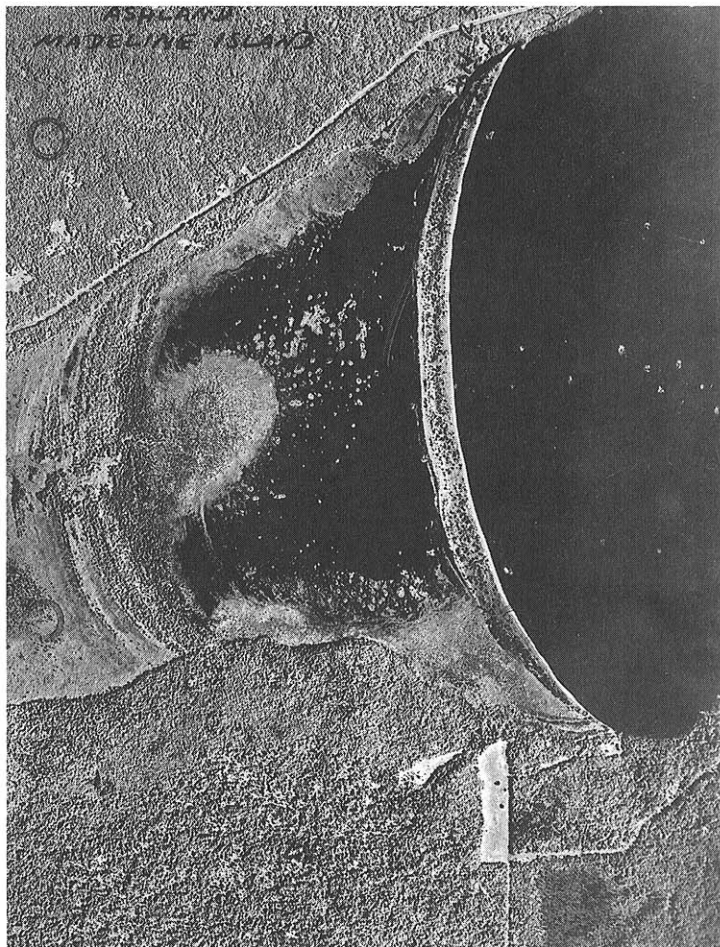


Figure 4. Big Bay, Madeline Island, with barrier beach and lagoon. (Photo courtesy of UW-Madison Department of Landscape Architecture)

are annuals, or short-lived perennials that grow from transient rhizomes or tubers. A fairly large number of species, however, have adapted to the ever-changing coastal conditions (Curtis 1959).

Characteristic or dominant Wisconsin lake beach plants are: sea rocket (*Cakile edentula*), winged pigweed (*Cycloloma atriplicifolium*), sea-side spurge (*Euphorbia polygonifolia*), and silverweed. Common associates

on Lake Michigan include: beach pea, common horsetail (*Equisetum arvense*), quack grass (*Agropyron repens*), and butter and eggs (*Linaria vulgaris*) (Salamun and Stearns 1978, McEachern 1991). Curtis (1959) noted that *Cakile edentula* occurred in higher densities where concentrations of Herring Gulls loafed but drew no conclusions about the relationship.

Sand beach is comprised primarily



a



b

Figures 5a and b. Outer Island Sand Spit strand and dunes, with beach grass, beach pea, common hairgrass, short-leaf fescue, beach wormwood, common juniper, and sand cherry in stabilized dunes. (Photos by S.W. Matteson)

of sands, but gravel or cobble and gravel comprise portions of open beach at many sites on both Great Lakes. Cobble/gravel beach, that is, a beach dominated exclusively by cobble or gravel, or some combination of the two, is not included in the discussion below.

Walking inland from the strand, I have found that the dune fields of Lake Michigan and Superior exhibit variations of the following habitat types that can be associated with lake beach and dune avifauna: 1) young (active) dune—**foredune**—sloping back from the beach, with up to 70% grass and forb cover 0–1m tall and no trees; sometimes bordered on the landward side by 2) mud flat or **open dune swale/wetland**—defined here as wet depression, ephemeral pool, sedge meadow dominated by sedges (*Carex*) and rushes (*Juncus*) in early successional stages, (rarely) interdunal wetland, and/or alder thicket; then, a stabilized backdune, sometimes preceding a dune swale/wetland, featuring 3) **heath-like backdune**—dominated by mat-forming trailing (creeping) juniper (*J. horizontalis*) and common juniper (*Juniperus communis*), 0–1.2m tall (55–80% cover), interspersed with grasses, forbs, and lichens that present a heath-like aspect; and/or 4) **backdune grassland/savanna**, punctuated by blowout areas and featuring a mix of grasses, forbs, shrubs, and areas with “dune copse”—saplings 3–6m tall and/or trees >6m comprising 10–30% cover, which grade into a 5) **forested dune ridge/swale**—old dune ridge dominated by a mix of conifers and hardwoods >6m, with occasional openings or clearings in the canopy due to the effects

of fire or senescence. Forested swales sometimes included swamps or bogs. A variant ridge is the 6) **tombolo/sand ridge**—occurring on southwestern Long Island and Seagull Bar, and at Stockton Island; vegetative cover ranged from open and sparse on Long Island and Stockton Island on Lake Superior to tree/sapling/shrub-dominated on Lake Michigan’s Seagull Bar (Figure 6).

Lake dune plants, as one might expect, are highly xerophytic, but in the swales occur mesophytes, or hydrophytes if standing water is present or if a depression is close to the water table. As indicated above, open swales vary in type from ephemeral pools and wet areas to established sedge meadows. Rushes (*Juncus* spp.)—particularly wire-rush or lake-shore rush (*Juncus balticus* var. *littoralis*), sedges (*Carex* spp.), and bladderworts (*Utricularia* spp.) predominate in the early successional stages. A very rare type of swale is the interdunal wetland, described by The Nature Conservancy (1994) as an “alkaline shoredune pond-marsh.”

(Note: The terms “Lake Michigan only” and “Lake Superior only” used below refer *only* to a comparison of plant species occurrence for the Wisconsin shores of Lakes Michigan and Superior and are not meant to imply limited presence elsewhere.)

Typically, dunes encompass interdunal wetlands, which may feature several rare plants, notably: 1) selago-like spikemoss or northern spikemoss (*Selaginella selaginoides*) (state endangered species) (Lake Michigan only), 2) marsh grass-of-parnassus



Figure 6. Flooded eastern tip of Seagull Bar, Lake Michigan, 6 June 1990. Randy Hoffman is set to "broad-jump" stream. (Photo by S. W. Matteson)

(*Parnassia palustris*) (state endangered) (Lake Superior only; also inland in Douglas County), 3) dwarf lake iris (*Iris lacustris*) (federally threatened, state threatened) (Lake Michigan only; see Salamun and Stearns 1978)—discovered by naturalist Thomas Nuttall on Mackinac Island, Lake Michigan, in 1810 (Guire and Voss 1963), 4) false or sticky asphodel (*Tofieldia glutinosa*) (state threatened) (Lake Michigan only and inland), 5) Garber's sedge (*Carex garberi*) (Lake Michigan only—documented by R. Moran at Kohler Dunes, 29 June 1978; BER files), 6) lenticular sedge or shore sedge (*Carex lenticularis*) (state threatened), 7) variegated scouring rush (*Equisetum variegatum*) (state species of special concern), 8) small fringed or lesser fringed gentian (*Gentian-*

opsis procera) (state species of special concern) (Lake Michigan only), 9) bird's-eye or Mistassini primrose (*Primula mistassinica*)—typically found on rocks, cliffs, and gravel shores (Gleason and Cronquist 1991) but noted by Salamun and Stearns (1978), 10) Ohio goldenrod (*Solidago ohioensis*) (state species of special concern) (Lake Michigan only), 11) small purple bladderwort (*Utricularia resupinata*) (state species of special concern), 12) Robbins spike-rush (*Eleocharis robbinsii*) (state species of special concern), and 13) slender arrow-grass (*Triglochin palustre*) (state species of special concern) (Salamun and Stearns 1978, E. Epstein *in litt.*, Bureau of Endangered Resources 1993a,b).

The BER's Natural Heritage Inventory (1993b) lists 10 lake dune

plants, three of which also occur on lake beaches, as state endangered or threatened. They are: sand reed (threatened); Garber's sedge (threatened); dune thistle (*Cirsium pitcheri*, state and federally threatened), also known as Pitcher's thistle, named after its discoverer, Dr. Zina Pitcher, who apparently found the plant when he served as an army surgeon from 1822 to 1837 while stationed at Fort Brady on eastern Lake Superior (Guire and Voss 1963); thickspike (or dune) wheatgrass (threatened) (*Agropyron dasystachyum* var. *psammophilum*); northern comandra (*Geocaulon lividum*) (endangered); dwarf lake iris; clustered broomrape or sand cancer-root (*Orobanche fasciculata*) (threatened); sand dune willow or heart-leaved willow (*Salix cordata*) (endangered); dune goldenrod (*Solidago spathulata* var. *gillmani*) (threatened)—on both lake beach and lake dune; and Lake Huron tansy (*Tanacetum huronense*) (endangered, probably extirpated)—on both lake beach and lake dune. Nuttall discovered Lake Huron tansy during the same 1810 expedition to Mackinac Island where he found dwarf lake iris (Guire and Voss 1963).

Regionally, the Nature Conservancy (1994) has identified 131 elements in the Great Lakes basin that are "critically imperiled or rare on a global scale." Thirty-one of these elements are natural community types; among these is the interdunal wetland. The sand dune, however, is among the most prominent. Important endemics include dune thistle; Houghton's goldenrod (*Solidago houghtonii*), discovered by botanist Douglass Houghton in 1839 on the

north end of Lake Michigan (Guire and Voss 1963); and an insect, the Lake Huron locust (*Trimerotropis huroniana*). These species join the open beach/foredune obligate Piping Plover as federally listed species.

Characteristic open dune/sand ridge plant species on Lake Michigan include: sand reed, thickspike wheatgrass, beach grass, beach pea, silverweed, evening-primrose (*Oenothera oakesiana*), Canada wild-rye (*Elymus canadensis*), beach wormwood, common milkweed (*Asclepias syriaca*), starry false Solomon's seal, and gray goldenrod. Common associates include: yarrow (*Achillea millefolium*), sand (rock) cress (*Arabis lyrata*), horseweed (*Conyza canadensis*), draba (*Draba reptans*), rough fleabane (*Erigeron strigosus*), boneset (*Eupatorium perfoliatum*), horsemint (*Monarda punctata*), Canada blue grass (*Poa compressa*), sand cherry (*Prunus pumila*), pin cherry (*Prunus pensylvanica*), smooth (meadow, wild) rose (*Rosa blanda*), bush-honeysuckle (*Diervilla lonicera*), sand dune willow, sandbar-willow (*S. interior*), shining willow (*S. lucida*), broadleaf willow (*S. myricoides*) (Lake Michigan only), poison ivy (*Rhus radicans*), summer grape (*Vitis aestivalis*), and (locally) little bluestem (Guire and Voss 1963, Salamun and Stearns 1978, McEachern 1991, Bureau of Endangered Resources 1993a).

Also occurring on open Lake Michigan dunes, typically foredunes, are: dune thistle, dune goldenrod, American dunegrass (*Elymus mollis*), clustered broomrape, and sand coreopsis (*Coreopsis lanceolata* var. *lanceolata*)—state species of special concern (Salamun and Stearns 1978,

Bureau of Endangered Resources 1993b).

Characteristic open dune species on Lake Superior (prominently in the Apostle Islands) include: beach grass with common associates beach pea, beach wormwood, false-heather (beach heath) (*Hudsonia tomentosa*), common juniper, trailing juniper, sand cherry, common hairgrass (*Deschampsia flexuosa*), Canada wild-rye, a fescue (*Festuca saximontana*), ticklegrass (*Agrostis scabra*), sand cress, bastard-toadflax (*Comandra umbellata*), evening primrose, fireweed (*Epilobium angustifolium*), Canada goldenrod (*Solidago canadensis*), and roses (*Rosa* spp.), particularly smooth rose (Judziewicz and Koch 1993, Bureau of Endangered Resources 1993b).

Notably absent from dune fields in the Apostle Islands are prairie plants and plants from the jack pine barrens community (Judziewicz and Koch 1993).

With dune stabilization on backdunes, mat-forming shrubs such as trailing and common junipers are prominent. Other common backdune shrubs include sandbar willow, shining willow, sand dune willow (dominant on Long Island dune crests), slender willow (*Salix gracilis*), broadleaf willow (Lake Michigan only), roses (*Rosa* spp.)—particularly smooth rose, sand cherry, and locally, poison ivy.

Lichen heaths are also prominent on backdunes, especially in the Apostle Islands where the reindeer mosses *Cladonia mitis*, *C. rangiferina*, *C. chlorophaea*, and *C. cristatella* are most common (Judziewicz and Koch 1993). False-heather and blueberries (*Vaccinium* spp.) are also typical heath plants. Occasionally, locally,

bearberry (*Arctostaphylos uva-ursi*) on both lakes, and Canada yew (*Taxus canadensis*) on Lake Michigan, are prominent (Salamun and Stearns 1978, Judziewicz and Koch 1993). Ericaceous species become established in low-moisture, acidic conditions. Noted Jacobson (1968): “These [woody shrubs and semi-woody herbaceous plants] first appear scattered among the grasses and forbs . . . and often initially take hold at the edge of a swale or on the leeward side of a dune.”

In addition to the backdune heath zone, a mix of grasses and forbs, interspersed with shrubs and scattered saplings and trees comprise a backdune savanna zone.

Locally, on Lake Michigan, rare or endangered species such as northern comandra, dwarf lake iris, smooth phlox (*Phlox glaberrima* ssp. *interior*), and low nut-grass (*Scleria verticillata*), occur on stabilized dunes and ridges (Salamun and Stearns 1978).

Succession leads to a forested dune ridge with dominance by xerophytic trees, particularly Hill's oak (*Quercus ellipsoidalis*), red pine (*Pinus resinosa*), and jack pine (*P. banksiana*) on Wisconsin's Lake Superior dunes and red oak (*Q. rubra*) on Wisconsin's Lake Michigan dunes.

Saplings and trees that are often common or present on stabilized dunal systems include: cottonwood (*Populus deltoides*) (Lake Michigan only), white pine (*Pinus strobus*), red pine, hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), white cedar (*Thuja occidentalis*), quaking aspen (*Populus tremuloides*), balsam poplar (*P. balsamifera*), American beech (*Fagus grandifolia*, especially at Whitefish Dunes), (locally) sugar maple (*Acer saccharum*), red maple

(*A. rubrum*), paper birch (*Betula papyrifera*), and white ash (*Fraxinus americana*) (Lake Michigan only).

Naturally, open, young lake dunes do not have the structural diversity associated with older stabilized dunes and ridges. And old forested dune ridges are structurally far more complex, with second growth oak and pine forests and some boreal elements predominant on Lake Superior. Along Lake Michigan, northern mesic forest elements occur north of Sheboygan County; southern mesic forest elements occur in fragments from Sheboygan to Racine counties (Curtis 1959, Salamun and Stearns 1978); and oak savanna and prairie remnants occur in association with beaches and dunes in Racine and Kenosha counties (Van Denack 1961).

At the Kenosha Sand Dunes, Sanders (1969) depicted successional zones that began with the storm beach, followed by a grassy and shrubby foredune (geologically 6,000 years old), then a cottonwood-oak dune ridge complex (8,000 years old), then wet prairie, then, further inland, an old (10,000 years) oak-maple dune ridge.

Along western Lake Michigan, lake dunes occur amidst lacustrine ridges and swales paralleling the old shoreline; they are all part of 2 to 3km-wide bands along ancestral Glacial Lake Chicago, which lay about 17m higher than present levels (Sanders 1969, Albert 1995). To the south, in Indiana, the dunes developed from a similar beach-ridge origin, but they arose during a period that pre-dated the western Lake Michigan shore development. Storm winds played an important developmental role as

well. Southern Lake Michigan dunes are exposed directly to strong northwesterly winds sweeping across the lake, whereas western Lake Michigan dunes, especially those at Point Beach, which projects out into Lake Michigan, experience winds from several different directions. The resultant effect: a series of relatively low ridges and blowouts at Point Beach (Figure 7), Kohler Dunes State Natural Area (Figure 8) and other western Lake Michigan dunes, compared to dunes that reach 60–120m high along Lake Michigan's southern shores.

More often than not, similarities between Lake Michigan south shore dunes and western Lake Michigan lake dunes are evident, especially when comparing similar dune pioneering and stabilizing plants. As Van Denack (1961) noted: "The same pioneer grasses are prominent: beach grass, sand reed grass, and little bluestem. The same juniper and bearberry mat-formers; willow, poplar, and juniper shrubs; pioneering birches, pines, and white cedar are found; and the dominant hemlocks occur in both the northern and southern locations."

At Point Beach State Forest, Van Denack described six kinds of beach and dune habitats, beginning with the strand zone:

"a) the undulating strand extend[s] from the lake to the first dunes, b) the foredune ridge (1.3–3 m high except where obliterated by high lake-level wave action) extend[s] in a line down the beach . . . c) the interdune trough [contains] small hillocks of sand blown in by southwesterly winds, d) the main or front-dune ridge [is] broken in a series of hills 3–8 m high by southwesterly or northeasterly winds, e)



Figure 7. Small interdunal wetland encompassed by grass-and-juniper dominated backdunes adjacent to northern hardwoods and pines at Point Beach State Forest. (Photo by S.W. Matteson)

[then there is a] *maze of compound blow-outs and sand draws*, f) [and then] *the back rim of the blowout area lead[s] rather abruptly to the forest margin.*”

Van Denack’s general description is as applicable today as it was in the early 1960’s (though plant succession is much more evident on dune ridges), largely due to the active state of Point Beach’s dunal system, which has been influenced markedly by the area’s low topography, the Point’s geographic protrusion into Lake Michigan, and the area’s history of intensive logging in the 1860’s and 1870’s.

HABITAT CHANGES: HISTORICAL PERSPECTIVES

Point Beach and Lake Michigan shore—At the time of the original

land survey of the Point Beach area in the mid-1830’s, the area adjacent to where the current lighthouse stands was dense with white pine, hemlock, black ash (*Fraxinus nigra*), and American beech. About a mile north of the lighthouse, the forest along the dune ridge was dominated by what one surveyor called “rolling” hemlock, with mixed stands of white pine, fir, white birch, beech, and white cedar present. North of the current state forest boundary the surveyor noted “*the land adjoining the lake . . . is high rolling, sandy. Covered with white pine.*” South of the lighthouse, about a mile south of Molash Creek, the dune ridge was covered with hemlock, black ash in the swales, and beech and white birch; there was a “*thick undergrowth of*



Figure 8. Backdunes at Kohler Dunes State Natural Area, punctuated by sand blow-outs, with common and trailing junipers, sand reed, beach grass, Canada wild-rye, little bluestem, common fleabane, beach wormwood, thickspike wheatgrass, sand cress, sand cherry, and silverweed characterizing the open vegetation. (Photo by S.W. Matteson)

[white] pine." The land around Molash Creek was "rolling, [with] hemlock, birch, beech, black ash, and [white] pine." Speckled alder (*Alnus rugosa*) was also present in the swales.

The Point Beach region in the 1850s was renowned for its vast stands of hemlock. The use of hemlock for its bark and lumber, stated Van Denack, "gave rise in the 1860's to a thriving tanning industry on the site of the original village of Two Creeks, 5 miles north of Point Beach." Van Denack summarized what happened in subsequent years:

"Encouraged by the Pfister and Vogel leather tannery, the villagers logged the hemlock extensively within a radius of 12 miles. By 1863 the little village had become a thriving port, shipping hemlock bark to

other ports by a fleet of lake steamers. In obtaining the bark, the tree was felled, and the wood sold for ties. So intensive was this logging that within 20 years the hemlock bark supply was exhausted, and the leather company had to resort to importing bark for its tanning purposes.

"The great fire of 1870 (known locally as the 'Peshtigo fire' because it began near the town in Marinette County) further destroyed the timber. Under pressure of high wind, the fire swept along the shores of Green Bay and spread through Brown, Kewaunee, and Door counties and across the northern part of Manitowoc County where Point Beach is now located. [There] about half the timber was 'burnt out' and . . . at a later period other fires also raged in the neighborhood."

There are no reliable published estimates of the presettlement size of

Wisconsin's lake dune and beach communities, but based on accounts from historians, naturalists, and early ornithologists, the communities were extensive along portions of Lake Michigan and well represented (as they are today) along southern and western Lake Superior.

Among the early writers of this century, Goldthwait (1907) provided the only extensive written account of Lake Michigan beaches and dunes, notably deforested in some places. In 1905, he spent the months of July, August, and September, and well into the fall, traversing the Lake Michigan shore from Kenosha County north to Washington Island, around the peninsula down to Green Bay and then up to Marinette. Most of this journey was spent on foot, but he used "gasoline fishing boats" to maneuver the northern Door County coast, and took a train at some point south of Manitowoc and also north of Green Bay. Where beaches were prominent, he recorded detailed measurements of their height.

Goldthwait's description of areas south and north of Two Rivers in Manitowoc County, including portions of what is now Point Beach State Forest and the Point Beach Scientific Area, is noteworthy:

"South of the town of Two Rivers the low red clay upland slopes gently toward the shore, and is bordered by a swamp and an outer belt of dunes. It seems likely that these dunes are in part shore deposits of higher stages, worked over by the wind; but no definite beaches were found there.

"Northeast of the town this dune belt broadens and forms a wide coastal belt of sand hills, enclosing many acres of swampy woodland, between Two Rivers and the lighthouse.

"A mile northeast of town, behind the dunes, an old terrace and bluff of a 17-foot stage appears on the west side of the shore road opposite the ball grounds. This is the first remnant of an abandoned shore-line north of Centerville, 15 miles away. After following the bluff for a short distance, the road passes along a series of beaches of gravel and sand—two well marked ridges on the western side, rising more than 20 feet above the level of the lake, and lower, flatter beaches on the eastern side, ranging from 10 to 15 feet in altitude. Farther on, near J. Wilsman's house, the beaches attain their best development, the highest rising to 26 feet above the lake, with an unusually steep back slope, a second ridge at 23 feet, and several lower bars in the fields east of the road. At this point the road rises to the crest of the highest bar and follows it rather closely until it breaks up into the dunes. Behind the 26-foot beach, several rods northwest of Mr. Wilsman's house, higher dune-like ridges of sand may be followed through the woods to Molas [sic] Creek, where they join the dunes already mentioned, near the road. These dunes are rather high, rising probably 50 feet above the lake, usually irregular in outline, but with occasional ridge-like form that suggests the presence of beaches higher than the 26-foot level. They are no doubt the product of the extinct lake. . . .

"From Molas [sic] Creek northward to the lighthouse the shore passes through a wilderness of sand hills, where deforesting within the last thirty years has allowed the wind to freshen up the dunes into a state of active existence. Along the outer border of the dune belt, north of the lighthouse, the lake is rapidly cutting back into the sand hills, and exposing their thinly stratified structure."

In southeastern Wisconsin, along open sandy lands west and south of

Kenosha, Goldthwait took a train north from the Illinois border along dune ridges adjacent to extensive beaches, where the state endangered Piping Plover used to nest, and which today is lined with miles of concrete and stone riprap. He wrote: *"North of the State [Illinois] line the railroad obliquely ascends the bluff by a long grade, and thence to Kenosha follows slightly higher ground, among indistinct beach ridges and dune ridges. . . . The road to Kenosha at [section 28] follows a ridge whose crest is 48 feet above the lake. . . . The greater height at this point may be due to the accumulation [of] wind-blown sand. The extension of these beaches has been traced by Alden and others. The highest Glenwood beach lies about a mile and half west of the city. . . . In places the beach gives way to a terrace and low bluff of till."*

Effects of habitat changes on the Piping Plover and other shorebirds—In 1924, the beaches and dunes south of Kenosha were still relatively undisturbed and Gromme (1924) (Figure 9) described the "plover" beach at Chiwaukee as *"very broad and gravelly in places, and typical for piping plover, of which we observed about a dozen."*

The dunes south of Kenosha were especially impressive. In 1930, about 10km south of Kenosha, Gromme (1930) photographed a Piping Plover nest (Figure 10) and observed that *"back 100 feet from the shore the dunes rise and extend inland for nearly a mile. The area is wild and probably extends for several miles along the shore. Piping plover nest [was] a depression in sand lined with tiny bits of gravel and containing 4 eggs."*

Not only were the dunes impres-

sive in the 1920's and early 1930's, but portions of the southeastern Wisconsin shore still reflected its pre-settlement character: a rich mosaic of open, sparsely vegetated beaches, dunes, and dune ridges adjoining prairie and oak openings. But marked changes were coming with creeping urbanization. For the Piping Plover, its days were numbered. The Milwaukee Public Museum's Herbert Stoddard (1923) wrote:

"Suspecting that the rare Piping Plovers might be nesting on a certain stretch of beach, a short distance south of Kenosha, Clarence Jung and the writer made a special trip to investigate on May 28th of this year. After considerable search each found a nest, and another was located by the writer on June 4th. . . . About four pair frequented this locality, which seems to be the only remaining breeding spot on the Wisconsin shore of Lake Michigan, south of Green Bay. It is very doubtful whether this little colony will survive much longer, as the whole district is ripe for development, which indeed has already commenced."

Stoddard delighted in the birdlife associated with this undisturbed prairie/lake beach/dune complex. He observed 200 each of "rare" Black-bellied Plovers and Ruddy Turnstones *"with a lesser number of Red-backed Sandpipers [Dunlin] . . . feeding in mixed flocks on the low knolls and around the sloughs of the prairie that parallels the lake shore for a considerable distance at this point. These prairies are entirely uncultivated, and the original prairie flora still persists. It astonished us greatly to see the beach-loving Turnstones feeding on the closely-cropped knolls fully a quarter of a mile from their usual habitat."*

But for Stoddard these observa-



Figure 9. Owen J. Gromme banding a Sanderling at Cedar Grove shore, 2 September 1926. (Photo courtesy of Milwaukee Public Museum)

tions were bittersweet; he was troubled by what was happening to the region: "Bartramian Sandpiper or Upland Plovers were also quite numerous, a few of which were breeding. Their attractive calls, mixed with the mellow whistles of four varieties of true Plovers, filled the air with wild melody. . . . All the data on the shore birds frequenting this strip of original prairie should be gathered next spring before it is too late. The growing industrial towns of Waukegan and Kenosha have already changed the character of much of this flat strip of lake shore. A recent real-estate development known as 'Chiwaukee' on the south border of that part of the prairie favored by the shore birds, points to further changes. The right of way of an electric railroad promises to divide lengthwise the already narrow strip of prairie. In fact, the whole western shore of Lake

Michigan, from Green Bay on the north to the Indiana Dunes on the south seems to have been suddenly 'discovered.' Cottages and subdivisions are springing up everywhere and competing with the factories for the last remaining strip of shore line."

Gone today are the undisturbed beaches and expansive dry prairies adjacent to lake shore dunes.

Long Tail and Little Tail Points—Two other Lake Michigan sites have suffered too, but for a different omnipresent reason. Long Tail Point and Little Tail Point in lower Green Bay have historically at times contained long stretches of sandy beach, but periodic high lake levels combined with seiche activity and storm surge have significantly reduced or eliminated sand beach habitats as



Figure 10. Nesting Piping Plover, with clutch of 4 eggs, at Edithton Beach, 6 miles south of Kenosha, 10 June 1930. (Photo by Owen J. Gromme, courtesy of Milwaukee Public Museum)

well as significant amounts of emergent wetlands. In the 1920's, for example, lake levels were quite low. Gromme (1923) described Little Tail Point during an outing with the Milwaukee Public Museum: "... a narrow strip of land, extends diagonally out into Green Bay for nearly a mile. . . . The entire south side of Little Tail is composed of low boggy ground, and the bulrushes grow out in the shallow water of the bay for a hundred yards or more, while the center is high and dry, overgrown with tall grass and thickets. The north side for its full length, is bordered by a broad sandy beach, and many bars and shallows which were every day frequented by hundreds of Bonaparte and Herring Gulls which could be seen all day long either flying up and down the beach or noisily squabbling out on the bars. . . .

This type of beach was well suited to the Spotted Sandpipers and their cheery calls could be heard most any time as they flew up ahead of us, and out over the water. The heavy growth of bushes and grasses offered abundant shelter for their nests, several of which we found and photographed."

Long Island/Chequamegon Point—

For economic and geographic reasons, the Wisconsin Lake Superior shore, with the exception of the Duluth-Superior and Ashland areas, has not experienced the same extent of development as that witnessed along the Lake Michigan shore, although recreational use has been steadily increasing as individuals increasingly seek remote sites to recreate. Arguably the best example of a lake beach

and dune system occurs on Long Island/Chequamegon Point (Figure 11), an area nearly as pristine today as when Native Americans first occupied it. And Long Island and the northwestern tip of Chequamegon Point will remain so in perpetuity due to its status as part of the Apostle Islands National Lakeshore.

Bona (1990) speculated that Long Island came into existence as a barrier spit 1050–1700 years ago when the Kakagon River shifted its mouth from Chequamegon Bay to its present site on Lake Superior. Some time in the 1490's, perhaps the same year that Columbus "discovered" America, a nomadic Ojibwa clan—part of the Crane totem family—discovered Chequamegon Point (Warren 1974), then as now a long, slender peninsula that shapes the eastern reaches

of Chequamegon Bay on Wisconsin's Lake Superior shore, and one of the state's major staging areas for migrating shorebirds.

"The Cranes," wrote ethnographer William Warren in 1852, *"claim the honor of first having pitched their wigwams, and lighted the fire of the Ojibways, at Shaug-ah-waum-ik-ong, a sand point or peninsula lying two miles immediately opposite the Island of La Pointe [Madeline Island]. . . . In former times the distance is said to have been much less, the action of the waves having since gradually washed away the sand of which it is composed."*

The Ojibwa apparently did not remain encamped on Chequamegon Point for long, since war parties of their enemies, the Fox and Sioux, threatened to interrupt their peace. They sought refuge instead on Ma-



Figure 11. WDNR wildlife manager Fred Strand (during Piping Plover survey) walking the southeastern edge of the Sand Cut, Long Island/Chequamegon Point, 2 June 1983. (Photo by S.W. Matteson)

deline Island (home of the "Golden-breasted Woodpecker" [Northern Flicker]), periodically canoeing across to Chequamegon Point to hunt elk, moose, deer, bear, and waterfowl (Warren 1974). It was here on the western end of Chequamegon Point that a fierce battle occurred between the Ojibwa and Sioux.

The following brief account leaves a strong impression of rolling sand topography perhaps considerably more inclined and elevated than at present. "At the time," several hundred years ago, wrote Warren, the *"extreme western end where the [Sioux] lay in ambush, is said in those days to have been covered with numerous sand hillocks, which the winds and waves have since nearly blown and washed away. Early one morning, two Ojibwa lads crossed over to the point to hunt ducks: on landing they were attacked . . . with loud yells. For some time the two youths, protected by the numerous sand-hills, defended themselves, and evaded the attempts of their enemies, who wished to take them captives."*

Since the early 1800's or about 1840 (Martin 1965, Bona 1990), the western end of the Chequamegon Point peninsula has periodically opened to Lake Superior as a result of storm surge and high water levels. The 6.4km stretch of land standing apart from the peninsula was, accordingly, named Long Island. The gap separating the two pieces of land became known as the "Sand Cut," with water only about .5 to 1.2m deep (Martin 1965). At the time of the original land survey in 1852, the vicinity of the Sand Cut area was apparently free of water and was described by a surveyor as *"sand prairie covered with a light growth of grass."*

In 1929, Ashland historian Guy Burnham (1930) wrote:

"The writer . . . remembers visiting Long Island during the early nineties. . . . There was a breach right through the island to the open lake, and the engineers, from an annual appropriation for that purpose, were trying to stop this breach from getting larger by dumping, as we remember, stone and slabs and other material. But it seemed impossible to fill the gap, which was a half mile or so in width. While the water was shallow where the break had occurred, the filling quickly disappeared in the sand."

In 1974, Jim Harris and I waded across a narrow channel of hip-deep water to reach Long Island while surveying the Wisconsin shore of Lake Superior for nesting colonial waterbirds. We found 2 pairs of Piping Plovers, one each on Long Island and Chequamegon Point (Harris and Matteson 1975). Since 1975, the breach between the island and Chequamegon Point has been closed (McEachern 1991).

Long Island, part of the region's glacial lake plain, varies from 75 to 380m wide and comprises 12 parallel sand ridges reaching 4.6m high that alternate with swales at or below lake level (McEachern 1991). At the time of the original land survey in 1852, the ridges were dominated by a forest composed of red pine, white pine, white birch, and quaking aspen, alternating with alder thickets and sphagnum-sedge bogs in the swales (Bona 1990, Judziewicz and Koch 1993). Judziewicz and Koch (1993) also believe that oaks and jack pine were present. The original land surveyor considered the soil to be "third rate" as the surveyors so often did when describing areas with sandy soils. *"Long Island is mostly a*

sandy pine barren but will be . . . sold for fishing and other purposes," wrote the surveyor in 1852.

Poor soils, alder thickets, and bogs deterred logging and farming on the island. Historically, at least since the advent of merchant forts and trading centers in the area from the mid-1600's through the 1830's, Long Island was used seasonally. The U.S. Coast Guard built the "Old LaPointe" lighthouse in 1858 in a northwestern section of the island, then 40 years later moved it to the island's northwestern tip. A second LaPointe lighthouse, equipped for three families, was built on the eastern shore in 1938 and used for several years. A few families have also had small inholdings on the island over the past 200 years; about 40 acres remain in private ownership, but the rest of the island was acquired by the National Park Service in 1986 (McEachern 1991, J. Van Stappen pers. comm.).

BIRDS OF SAND BEACH AND DUNE COMMUNITIES

One might think the avian community to be depauperate on lake beaches and dunes and adjacent community types during the breeding season. Jung (1930), however, made this observation during a June outing on eastern Lake Michigan: "*A walk along a sandy shore, however, unfolds new delights. Before you, a spotted sandpiper flutters in a pitifully helpless manner, the telltale of a carefully hidden nest. A savannah sparrow tries to sneak quietly through tall grass in order to attract the intruder away from her naked little ones. Into the knot hole of a dead poplar disappears a flicker, to feed her*

young. At the edge of a clump of cat-tails a fuzzy little black powder puff with enormous feet, tells of the family interests of a sora rail. There is no end of nests and nestlings now."

Lake beach and dune avifauna, due to the variety of lake dune microhabitats and edge components, the influence of adjacent habitats, and the interrelated factors of geography, climate, microclimate, edaphic factors, and plant succession, reflects a mixed bird diversity representing elements from other community types described in this series, especially prairies, all northern forest types, pine-oak barrens, and savannas. As a result of all these factors, many species are present during the breeding season, typically foraging or loafing, and few may be actually nesting. A total of 208 species were documented (Tables 1 and 4) for this paper, including many late migrants.

Breeding birds inhabiting Great Lakes' beach and dune communities vary in species richness and density according to plant community structure and composition. In general, avian species richness and density on lake dunes increase with plant community succession (Van Orman 1976). But low density and low richness or evenness (and hence diversity) do not imply or denote low conservation value and significance. What better example to illustrate this point than the occurrence on sand beaches of the federally endangered and threatened Piping Plover (Figure 12).

Absent from the Wisconsin shore of Lake Michigan as a nester since 1948 and from the Wisconsin shore of Lake Superior since 1983 (Figure



Figure 12. Foraging Piping Plover on Long Island, 1 June 1979. (Photo by S.W. Matteson)

13), the Piping Plover is one of three Wisconsin endangered breeding birds representing the lake beach community. Loss of nesting habitat and its effect on breeding Piping Plovers on Lake Michigan has been discussed. Along our Great Lakes' shores, it used to nest on extensive, undisturbed beaches in Kenosha, Door, and Oconto counties, as well as on Long Island and Chequamegon Point, and at sites in the Duluth-Superior Harbor. Its absence as a breeding bird along the Wisconsin shore of Lake Superior after the early 1980's is not related to breeding habitat loss here but probably to localized as well as extralimital factors (nest predation, storms, human disturbance—Figures 14a and b, residential and commercial development on/near the breeding and wintering grounds, gull invasions, chemical contaminants?) contributing to a regional population decline.

Piping Plovers generally require

broad, barren, sand beaches, with scattered areas of gravel, bits of which typically line nest cups (SWM, pers. obs.; Haig *et al.* 1988). In 1987 and 1988, two beach areas at the southern end of Long Island and northern Chequamegon Point had mean widths of about 35m and 46m, respectively, well within the average widths (generally, 30–40m, though some beaches in Michigan's Upper Peninsula averaged 63m and 83m) of typical Piping Plover nesting beaches in the upper Midwest and Great Plains (Nordstrom 1990).

The Common Tern and Caspian Tern are the other two representative beach community species, although the Caspian Tern has been an irregular and rare nesting species (recently of dredge spoil islands), and the Common Tern has abandoned mainland sand beach habitats for sparsely vegetated islands, typically dredge spoil sites such as Interstate Island in the Duluth-Superior

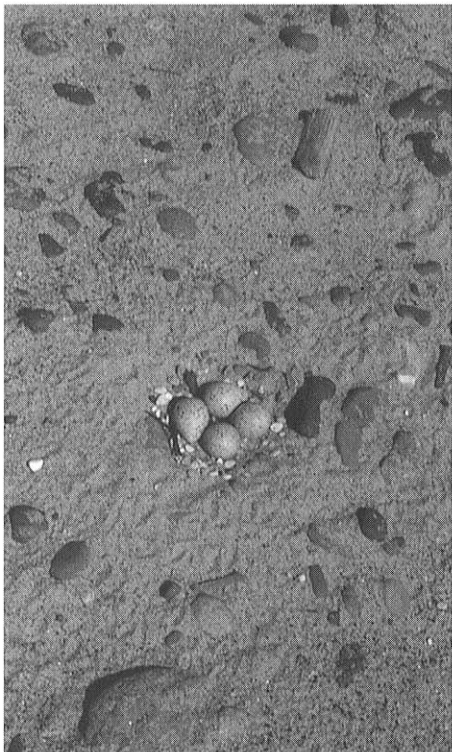


Figure 13. Clutch of 4 Piping Plover eggs, southeastern Long Island, 35 m west of lake edge, 2 June 1983. (Photo by S.W. Matteson)

Harbor (Figure 15). Both of these species are very sensitive to human disturbance, a factor contributing to their abandonment of mainland beach habitats (Matteson 1988, 1993).

If a breeding population of the Piping Plover becomes reestablished in the state, the most likely location is the Long Island/Chequamegon Point area. Based on my surveys of likely nesting habitat along Lakes Michigan and Superior, the beach and dune expanses here could probably support 10–15 breeding pairs. Nordstrom (1990) investigated the

potential invertebrate resources available to Piping Plovers on Long Island/Chequamegon Point and other sites in the Great Lakes during 1987 and 1988 and found that Long Island/Chequamegon Point and another site contained invertebrate biomass 6–10 times greater than 17 other Great Lakes sites, with mean biomass greater in the wash zone than in the upper beach. Nordstrom documented the presence of invertebrates from 3 families at Long Island/Chequamegon Point: Chironomidae (midges) (62% of samples collected), Dolichopodidae (long-legged flies) (8%), and Tenebrionidae (darkling beetles) (8%).

Except for the Killdeer and Spotted Sandpiper (discussed below), and the very rare Piping Plover, summer inhabitants of the strand are not birds, but arthropods. Carabid beetles (Carabidae), tiger beetles (*Cicindela spp.*), lightning bugs (Lampyridae), crane flies (Tipulidae), cabbage butterflies (Pieridae), ground and field crickets (Gryllidae), Stone's grasshopper (Acrididae), burrowing spiders (Lycosidae), and sphecids wasps (Sphecidae) are some of the more common arthropods that inhabit sandy beaches and open dunes (Sanders 1969, Ballard 1991). It is the shorebird foraging at the water's edge, however, that readily comes to mind when we associate animal life with these areas.

Migrant Shorebirds—Thirty-seven (not including accidentals) of 49 nearctic shorebird species occur in Wisconsin (Table 3), ranging from common species such as Least Sandpiper to rare, casual species, such as the Red Phalarope. At least two of



a



b

Figure 14a. Author standing by fresh airplane tire tracks that came within 25 m of Piping Plover nesting site and 4 young on Chequamegon Point during 7 July 1979. (Photo by Kim Bro) Figure 14b. Ashland "short-order" cook riding ATV across Long Island/Chequamegon Point Sand Cut, 2 June 1983—the last year a clutch of Piping Plover eggs was documented in Wisconsin. (Photo by S.W. Matteson)



Figure 15. Fred Strand and natural resources technician Don Goodermote search for Common Tern chicks to band on Interstate Island, Duluth-Superior Harbor, 19 June 1991. Ring-billed Gull colony in background. (Photo by S.W. Matteson)

these, Short-billed Dowitcher and Sanderling, experienced significant population declines in North America during 1972–1983 (Howe *et al.* 1989). Prior to these declines, most shorebirds suffered serious losses from the nineteenth century into the early twentieth century when they were hunted for sport and food. Especially hard hit were Eskimo Curlew (now federally endangered), Lesser Golden Plover, and Hudsonian Godwit. In Louisiana in 1821, about 200 people harvested 48,000 Lesser Golden Plovers during a single day in the New Orleans area (Helmert 1992).

Habitat loss has certainly been a factor in the recent decline of other shorebirds such as the Snowy Plover (Figure 16) and Mountain Plover, and, of course, the Piping Plover

(Haig *et al.* 1988, Helmert 1992). Organophosphate pesticides are a probable factor threatening shorebirds, especially on the wintering grounds in Central and South America where DDT, banned in the U.S. in 1972, is widely used (Helmert 1992).

Shorebirds that pass through Wisconsin most likely feed mainly on chironomid larvae (blood worms) and adults (midges) during migration largely because they are often the most abundant invertebrates present in the interior U.S. (Eldridge 1992) and along shorelines in the Great Lakes (Nordstrom 1990). Blood worms, incidentally, feed on periphyton (algae) that live on both living and dying plants in open, shallow-water habitats (Helmert 1992).

Shorebirds are renowned for re-



Figure 16. Snowy Plover, Two Rivers, Lake Michigan, 28 April 1991. Note the dark ear patch. (Photo by Charles Sontag)

sponding to spatial variations in prey densities and exploiting different foraging sites based on invertebrate abundance (Connors *et al.* 1981). Generally, most shorebird species (but not snipes and yellowlegs) forage at sites where short (less than one-half the height of the bird) vegetation comprises less than 25% of the ground cover, the remainder of the ground being open (Helmers 1992).

Shorebirds feeding on invertebrates along the strand or in shallow water can be classified as one or more of the following types: 1) *gleaner*—picks or gleans food from the substrate or water surface; 2) *sweeper*—sweeps for food in the water column; 3) *prober*—probes for food in the substrate. Sand beach and dune communities are uniquely sup-

portive of shorebird foraging requirements because they provide relatively open coastal habitats rich in invertebrate life. Shorebird foraging guilds are presented in Table 3.

To take advantage of peak abundance levels in summer invertebrates, adult shorebirds of several species generally depart their breeding grounds before young have fledged; this leads to staggered migration flights. Unlike neotropical passerines, shorebirds depend on a few, highly productive stop-over sites where they “fatten up” on invertebrates before their long-distance migrations, which for several species amounts to 12,000km between breeding grounds and wintering sites (Helmers 1992). It becomes especially important, therefore, to pre-

Table 3. Foraging guilds of shorebirds occurring in Wisconsin 1

Species	Foraging Guild 2	Water depth (cm) 2	Status
Black-bellied Plover	terrestrial/aquatic gleaner ³	dry-4	FCM
Lesser Golden Plover	terrestrial/aquatic gleaner	dry-4	FCMe, UMw
Semipalmated Plover	terrestrial/aquatic gleaner	dry-4	FCMe, UMw
Piping Plover	terrestrial/aquatic gleaner	dry-4	RM, RSRn
Killdeer	terrestrial/aquatic gleaner	dry-4	CM, CSR
American Avocet	aquatic gleaner/sweeper ⁴	8-21	UM, CaSR
Greater Yellowlegs	aquatic gleaner	1-12	FCM, RSR
Lesser Yellowlegs	aquatic gleaner	1-12	CM, RSR
Solitary Sandpiper	aquatic gleaner	1-12	FCM
Willet	aquatic gleaner	1-12	UM, CaSR
Spotted Sandpiper	terrestrial/aquatic gleaner/prober ⁵	dry-1	CM, CSR
Upland Sandpiper	aquatic/terrestrial gleaner	0 (wet)-11	FCMe, UMw, FCSRc, USRwc
Whimbrel	terrestrial/aquatic gleaner/prober	dry-16	USpMen, RFMe
Long-billed curlew	terrestrial/aquatic gleaner/prober	dry-16	CaSpM, CaSV
Hudsonian Godwit	aquatic prober	4-17	USpM, RFM
Marbled Godwit	aquatic prober	4-17	USpM, RFM
Ruddy Turnstone	terrestrial/aquatic gleaner/prober	dry-2	CSpMe, USpMwcn, UMne, RFMwc, RSRc
Red Knot	aquatic prober/gleaner	0 (wet)-11	UMne, RME
Sanderling	aquatic prober/gleaner	0 (wet)-4	FCM-LSM, UME
Semipalmated Sandpiper	aquatic prober/gleaner	0 (wet)-4	CM
Western Sandpiper	aquatic prober/gleaner	0 (wet)-4	UM
Least Sandpiper	aquatic prober/gleaner	0 (wet)-4	CM
White-rumped Sandpiper	aquatic prober/gleaner	0 (wet)-4	UM
Baird's Sandpiper	aquatic prober/gleaner	0 (wet)-4	USpM, FCFMe, UFME
Pectoral Sandpiper	aquatic prober/gleaner	0 (wet)-11	CM
Purple Sandpiper	terrestrial/aquatic gleaner/prober	dry-2	CaSpM, CalFeaWM
Dunlin	aquatic prober/gleaner	0 (wet)-11	CMe, FCMw, USVne
Stilt Sandpiper	aquatic prober/gleaner	0 (wet)-11	RSpM, UFM
Buff-breasted Sandpiper	aquatic prober/gleaner	0 (wet)-11	CaSpM, RFM
Ruff (exotic)	aquatic gleaner	1-12 cm ?	RSpM, CaFM, AS
Short-billed Dowitcher	aquatic prober/gleaner	0 (wet)-11	FCM, RSRc
Long-billed Dowitcher	aquatic prober/gleaner	0 (wet)-11	USpM, FCFM
Common Snipe	aquatic prober/gleaner	0 (wet)-11	CM, FCSRnc, RSRsc, UWRs, RWRcnw
American Woodcock	aquatic/terrestrial prober/gleaner	0 (wet)-11	FCM, FCSRnc, USRs
Wilson's Phalarope	aquatic gleaner	6-22	FCSpm, UFM, USRWne
Red (Grey) Phalarope	aquatic gleaner	unknown: usually far offshore	UM

1 Species occurring as accidental (Robbins 1991), except Ruff, are excluded; status is from Robbins (1991).

2 adapted from Helmers (1992)

3 gleaner = picks or gleans food from the substrate or water surface

4 sweeper = sweeps for food in the water column

5 prober = probes for food in substrate

AS = Accidental in summer

(continued)

Table 3. *Continued*

CaFM = casual fall migrant
CalFeaWM = casual late fall and early winter migrant
CaSpM = casual spring migrant
CaSpMe = casual spring migrant east
CaSR = casual summer resident
CaSV = casual summer visitant
CM = common migrant
CMe = common migrant east
CSR = common summer resident
FCFM = fairly common fall migrant
FCFMe = fairly common fall migrant east
FCM = fairly common migrant
FCMe = fairly common migrant east
FCM-LSM = fairly common migrant on Lakes Superior and Michigan
FCMw = fairly common migrant west
FCSpM = fairly common spring migrant
FCSR _e = fairly common summer resident east
FCSR _{nc} = fairly common summer resident north and central
RFM = rare fall migrant
RFMe = rare fall migrant east
RFMw _c = rare fall migrant west and central
RM = rare migrant
RME = rare migrant elsewhere
RSpM = rare spring migrant
RSR = rare summer resident
RSR _e = rare summer resident east
RSR _n = rare summer resident north
RSR _{se} = rare summer resident south and east
RWR _{cnw} = rare winter resident central, north, and west
UFM = uncommon fall migrant
UFME = uncommon fall migrant elsewhere
UM = uncommon migrant
UME = uncommon migrant elsewhere
UM _{ne} = uncommon migrant north and east
UMw = uncommon migrant west
UMw _c = uncommon migrant west and central
USpM = uncommon spring migrant
USpM _{en} = uncommon spring migrant east and north
USpMw _{cn} = uncommon spring migrant west, central, and north
USRs = uncommon summer resident south
USRw _c = uncommon summer resident west and central
USRw _{ne} = uncommon summer resident west, north, and east
USV _{ne} = uncommon summer visitant north and east
UWRs = uncommon winter resident south

serve important shorebird staging areas. On southwestern Lake Superior, Wisconsin Point-Minnesota Point and Long Island-Chequamegon Point are the most important shorebird staging areas. The Outer Island Sand Spit along with other Apostle Islands' sandscapes are also important shorebird stop-over sites (SWM, pers. obs).

In Green Bay, when water is low and chironomids are plentiful, Sea-gull Bar, Peshtigo Point, Little Tail Point, Long Tail Point, Point Au Sa-ble, and Barkhausen Refuge are the most important stop-over sites; with high lake water, coastal impound-ments, riverine marshes, and flooded farm fields become important. Ruddy Turnstone, Sanderling, and

Red Knot can be fairly common at several of these sites, with Dunlin, Least Sandpiper, and Semipalmated Sandpiper very common at Barkhausen Refuge (Tom Erdman, pers. comm.).

Along the shore of Lake Michigan from the Door peninsula south, important staging areas include the dredge spoil impoundments at Manitowoc, Kewaunee, and Milwaukee, particularly after fresh spoil has been recently deposited. Also important are: beach frontage at Bailey's Harbor; a shore area south of Point Beach State Forest and north of Two Rivers; a 3km stretch of beach between Two Rivers and Manitowoc; and shoreline at Sheboygan from North Point south to the city's marina. During spring in these areas, high numbers of Ruddy Turnstones and Whimbrels may be seen, especially during the third week of May. For example, it is not uncommon at this time to see 2–3,000 Ruddy Turnstones and 100–200 Whimbrels at the Manitowoc impoundment alone, although numbers may vary greatly from year to year, with up to 2,000 Whimbrels occurring on rare occasions. Red Knots are also fairly regular, but in far fewer numbers, typically less than 5 (Charles Sontag, pers. comm.).

Shorebirds are best observed with a spotting scope; anything less does not provide the same measure of enjoyment in appreciating the variety of rich plumages these remarkable shore denizens exhibit, to say nothing about the lost opportunity to identify species in a mixed flock. Away from the Great Lakes, shorebirds can be best observed during spring and fall at inland lake shores,

and in mud flats and open agricultural habitats where ephemeral pools and ploughed fields provide rich invertebrate food sources. Black-bellied and Golden Plovers, for example, forage in wet ploughed fields for earthworms (Wishart *et al.* 1981).

Observations of Lake Michigan shorebirds in surveys used for this paper were scant compared to those noted on Lake Superior, apparently due to more extensive coverage along Lake Superior. For example, there were at least 16 consecutive years of observations during roughly the same time period at 2 Lake Superior sites compared with no more than 5 consecutive years of observations at 2 Lake Michigan sites (Table 4).

Fairly common shorebirds I encountered frequenting Lake Superior's beach community during late May/early June and early July 1978–1994, were: Least Sandpiper, Sanderling, Semipalmated Sandpiper, Semipalmated Plover, Killdeer, Lesser Yellowlegs, Spotted Sandpiper, Ruddy Turnstone, and Dunlin. Overall, however, on both lakes combined, except for Killdeer, Spotted Sandpiper, and to a lesser extent Sanderling, these species were uncommon to rare on breeding bird surveys in lake beach and dune habitats because they mostly occur just prior to and just after the Natural Areas Breeding Bird Survey period of 28 May–4 July (Table 2). These species are typically common and fairly abundant on both lakes earlier and later in the spring and summer, respectively.

Less common overall on Lake Superior except sometimes locally and

Table 4. Ten lake beach and dune sites surveyed along Lakes Michigan and Superior during 1970–1995.

Site	Years Surveyed	No. Surveys ¹	No. NABBS ²	No. Species Observed ³
KD	1980, 1988, 1991–1995	8	8	64
PB	1978, 1984, 1988, 1990– 1993, 1995	19	17	103
WD	1976, 1987, 1988, 1990, 1991	5	5	51
JHR	1993–1995	3	3	65
SB	1983, 1987–1991, 1993	8	8	54
LI	1974, 1978–1995	41*	9	109
MI	1985, 1990, 1992, 1994	4	4	50
SI	1988, 1994, 1995	3	2	30
OI	1974, 1976, 1977, 1979, 1982, 1984, 1989, 1991, 1994	22	5	123
WP	1970, 1971, 1976–1990, 1991, 1994	19	17	112
TOTAL:		132	78	208

1—Surveys include Natural Areas Breeding Bird Surveys and sometimes additional visits to search for and document breeding birds.

2—Systematic Natural Areas Breeding Bird Surveys following prescribed routes.

3—Includes several species noted during survey period that were late migrants.

*—Includes 17 daily visits in 1988.

*—Includes at least 6 daily visits each in 1976 and 1977.

Sites: KD = Kohler Dunes State Natural Area; PB = Point Beach State Forest; WD = Whitefish Dunes State Park; JHR = Jackson Harbor Ridges; SB = Seagull Bar; LI = Long Island; MI = Madeline Island Big Bay Sand Spit and Bog; SI = Stockton Island Tombolo; OI = Outer Island Sand Spit; WP = Wisconsin Point.

in late spring were: Black-bellied Plover, Lesser Golden-Plover, Greater Yellowlegs, and Short-billed Dowitcher. Occurring infrequently to rarely, usually in late May or early June, sometimes earlier in May, were: Piping Plover, Willet, Whimbrel, Hudsonian Godwit, Marbled Godwit, Red Knot, White-rumped Sandpiper, Baird's Sandpiper, Pectoral Sandpiper, Buff-breasted Sandpiper, Common Snipe—a common interior migrant, American Woodcock, and Wilson's Phalarope. Willet, Whimbrel, Hudsonian Godwit, and Marbled Godwit were observed foraging along the wash zone and in sandbar shoals and shallow waters.

Except for nesting Killdeer, Spotted Sandpiper, and Piping Plover (up to the early 1980's only), all shorebirds encountered were late-spring or "early fall" (before mid-July) migrants, or possibly stragglers that remained in the area throughout the summer.

Very rare (sighted only once) on Lake Superior sand beaches, and not observed in Lake Michigan breeding bird surveys for this paper, were: Upland Sandpiper, an interior grassland and barrens species; Solitary Sandpiper, a fairly common interior migrant at flooded fields and small pond edges; and the Western Sandpiper, an uncommon migrant in Wis-

consin (Robbins 1991). Charles Sontag (pers. comm.) has seen this latter species regularly along with several of the "peeps" (Least Sandpiper, Semipalmated Sandpiper, Sanderling, Pectoral Sandpiper, Dunlin, Baird's Sandpiper, White-rumped Sandpiper) along Lake Michigan beaches, mainly during fall migration.

Bradstreet (1977) reported that at Long Point, Lake Erie, Semipalmated Plover, Piping Plover, Black-bellied Plover, Ruddy Turnstone, Spotted Sandpiper, both yellowlegs, Pectoral Sandpiper, Baird's Sandpiper, Least Sandpiper, Dunlin, and Sanderling preferred the wash zone to ephemeral beach pools for foraging in spring (1 April–30 June). Killdeer and dowitcher species preferred the latter. During July and August, however, most species above preferred beach pools due presumably to an abundant food supply; exceptions were Black-bellied Plover, Ruddy Turnstone, Spotted Sandpiper, and Sanderling, which foraged in the wash zone.

Migrant and Breeding Open-water Birds—Regarding waterbirds observed from the strand (and dunes) during summer, I observed Common Loons somewhat regularly though widely dispersed, along and out from Lake Superior's shores during the breeding season, but seldom along Lake Michigan. Sightings along both coasts generally occur more frequently during migration (Robbins 1991).

Very rarely seen during the summer as a late migrant or nonbreeding bird would be the arctic-breeding Red-throated Loon—I saw

only one on Lake Superior during 1978–1995. Bernard (1967) described this bird as a rare transient and summer visitant in Douglas County, "noted mainly at Wisconsin Point, Superior." And Temple and Harris (1985) noted that this bird, absent during summer, is an "uncommon spring migrant and rare fall migrant" in the Apostle Islands. Extremely rare during any season would be another arctic breeder, the Pacific Loon. Robbins (1991) noted that Red-throated Loons are best observed during spring and fall "off the southern Ozaukee County bluffs" when 30–40 birds might sometimes be observed on any one spring day and 20–30 on a peak fall day.

Very rare, too, during the summer on Lakes Michigan and Superior would be an observation of a Horned Grebe or Western Grebe, with the latter the most likely to be observed. Even rarer during summer would be a sighting of an Eared Grebe or Red-necked Grebe, species that typically frequent interior lakes (Robbins 1991). Bernard (1967) noted that although Red-necked Grebes are generally rare spring migrants on Lake Superior, they may be occasionally common in spring. And Sam Robbins (pers. comm.) commented that during fall, Horned Grebes are regular migrants along the Lake Michigan coast, with dozens or more regularly seen between northern Milwaukee County and Manitowoc. Temple and Harris (1985) described the Horned Grebe and Red-necked Grebe as absent during summer in the Apostle Islands, but "fairly common" and "uncommon," respectively, as spring and fall migrants.

Beginning in the early 1980's, I began to see the American White Pelican during late spring in the Apostle Islands; not regularly, but intermittently during the decade, flying low over the Long Island Sand Cut area, or (once) loafing on Gull Island's cobble beach. A flock of 24 was observed on Long Island by Doug Beltman (*in litt.*) during the summer of 1988. Tangentially, in 1995 I accompanied Tom Erdman to a denuded corner of Cat Island in lower Green Bay to witness the first hatching of a White Pelican chick in Wisconsin during this century. A small colony of White Pelicans nested on the island during 1994 and 1995; no chicks hatched out in 1994; 1 fledged in 1995 (Tom Erdman, pers. comm.).

Although not treated extensively in this paper, it is worth noting that open cobble/gravel beaches, historically, have been important nesting sites on islands off the Door County peninsula for colonial waterbirds, such as Caspian Tern, Double-crested Cormorant, Herring Gull, Ring-billed Gull, and in pole-sized trees, Great Blue Heron (Jackson 1927); in recent years, Black-crowned Night-Herons have occupied shrubs and young trees on some Lake Michigan island shores. And Cattle Egrets and Snowy Egrets have occurred on Cat Island in lower Green Bay.

A bird somewhat commonly observed at local beach sites along Lakes Michigan and Superior is the Double-crested Cormorant. This bird numbered less than 100 in the entire state during the early 1970's, but its breeding population has grown exponentially and in 1994

numbered over 8,000 nesting pairs (Matteson *et al.*, unpubl. data). I have observed cormorants off-shore foraging for small-sized fish from most sandscapes in the Apostle Islands during summer, and often found them in early morning loafing at the tips of sandy island peninsulas. And I have observed this bird commonly in Green Bay and off the Door County peninsula.

Extremely rare at any time of year would be a Brant, an arctic inhabitant. Doug Beltman (*in litt.*) observed one intermittently during the spring and summer on Long Island in 1988.

Sometimes observed in bays or loafing on sandy beaches in family groups or foraging in young grassy dunes during summer is the Canada Goose. And somewhat commonly observed just off shore or loafing on shore at this time of the year is the ubiquitous Mallard, and on Lake Superior and northern Lake Michigan (Door County and northern Green Bay), the Common Merganser and Red-breasted Merganser. Sometimes encountered in sheltered bays and creeks contiguous to the strand or in ephemeral pools is the Blue-winged Teal. Occasionally observed off the Door County coast during summer is the Common Goldeneye (Sam Robbins, pers. comm.).

In 1985, I observed an immature White-winged Scoter loafing on Long Island during a mid-summer afternoon. A rare summer sighting such as this on Lake Superior at or near barrier beaches and sand spits is not unexpected because these sites provide important refugia for migrants and nonbreeding birds. White-winged, Surf, and Common

Scoters have been recorded as rare spring migrants on Wisconsin Point (Bernard 1967).

Migrant raptors and songbirds—A variety of waterfowl species may be more commonly observed from shore in far greater number during spring and fall migration. And it is during spring and fall migration that lake beach and dune communities often come alive with thousands of migrants, from passerines to raptors, particularly in the Apostle Islands, except that hawk numbers are generally far less here in the fall (Temple and Harris 1985).

There are few more rewarding experiences than to be motionless on an Outer Island dune during a September or early October morning, when, just after sunrise, waves of sparrows, kinglets, and warblers fly relatively low out over the dunes. On two separate occasions, while stationed in a heath-like dune at south Outer in late September, a Yellow-rumped Warbler and White-crowned Sparrow, respectively, alighted on my boot as I sat next to a weathered pine stump. Meanwhile, overhead, at different elevations passed large flocks of American Robins, Blue Jays, Rusty Blackbirds, Pine Siskins, Cedar Waxwings, and Northern Flickers. Spring passerine migration is equally rewarding here: Harris and Jaeger (1978) observed "spectacular flights with up to 1000 and even 3000 individuals passing in a half hour period."

Broad-winged Hawks and Sharpshinned Hawks are the most abundant migrant raptors along our Great Lakes' coasts (Robbins 1991).

The Cedar Grove area, in Sheboy-

gan County, and the Little Suamico area in lower Green Bay, are two of the most renowned locations on Lake Michigan for observing raptor migrations. Tessen (1976) provided this commentary on hawk movements above the sand ridge at Cedar Grove:

"By late August the hawks begin to move south, especially if the wind is north and westerly, since they prefer a tailwind. A few hawks, depending on the weather, may be seen almost any day from August through November, but usually the spectacular migrations appear on chilly days when the wind is strong from the northwest. It is best to arrive early, bring a lunch, choose a seat on the ridge . . . relax—if you can—and watch the show."

"Harriers may announce the start of the performance; then the Broad-wings, an occasional Bald Eagle, punctuated with accipiters and Ospreys, ride the skyway. By the first week in October, the large buteos—Red-tailed, Red-shouldered and Rough-legged—have joined the stream of migrants. The falcons—Peregrine, Merlin and Kestrel—are sandwiched in until mid-October. By November, when the Rough-legged are at their peak, or even in late October, the scarce Goshawk may be seen. A few individuals of the Swainson's Hawk have been trapped and banded. The Turkey Vulture and the rare Golden Eagle have been seen along the ridge. In fall, hawks may be seen in numbers from five to fifteen thousand on the best days [with some daily records of 5,000–8,000 Broad-winged Hawks in September]. The spring migration is merely a trickle by comparison."

One of the best locations in spring to observe migrating raptors along the southwestern Lake Superior shore is the Outer Island Sand Spit

(Figure 17). Harris (1977) studied spring hawk migration in the Apostle Islands and documented 6,523 individual raptors (mostly Broadwings and Sharpshins) representing 14 species, with most observations occurring from south Outer. "Here," he commented, "migrants could be seen arriving on the island from the direction of Stockton Island to the southwest. At times some hawks were reaching Outer while others were flying in exactly the opposite direction off the island [reluctant to cross the open lake]. These latter birds presumably had already traveled to Outer's north end and now were retracing their route. This phenomenon occurred most strikingly at mid-day on May 8, 1976, when winds came out of the west at 10 to 13 mph. Hawks in large numbers, including ten different species, were circling over South Pond and Outer's

southern woodlands. Sharp-shinned Hawks sped along the beach with wings beating furiously, forced by the wind to pass as low as ten feet over the ground. Where the passage to Stockton was shortest, these lone birds would take out over the water, barely clearing the wave tops. The broad-winged hawks appeared hesitant to cross the water in such blustery weather. Frequently birds would hang over the beach edge then retreat over the forest, where I believe the trees broke the force of the wind. I counted 550 broad-wingeds in flight at once, scattered everywhere over the island as far north as I could see."

Commonly observed in September and into at least early October on south Outer Island is the Merlin (Figure 18), which Jackson (1941), Harris (1980), Mossman (1987), Tom Doolittle (pers. comm.), Eric



Figure 17. Outer Island Sand Spit, aerial photo of sand spit at southern end of island. (Photo courtesy of Apostle Islands National Lakeshore, U.S. National Park Service)



Figure 18. Merlin, foraging, south Outer Island, 24 September 1980. (Photo by S.W. Matteson)

Epstein (BER files), Bill Smith (pers. comm.), and I observed hunting low along beaches and dunes, and from which Merlins departed over open water to pursue passerines, a hunting strategy that met with mixed success (Jackson 1941; SWM, pers. obs.). Jackson (1941) reported the following Merlin observations during 7–16 September 1919 on south Outer:

“The hawks seemed to arrive on the island in pairs or more and were most plentiful on a long stretch of flat brushy land at the southwest end of the island frequented by numerous small birds such as sparrows, warblers, and flickers. As many as six hawks could be counted at one time and nearly always some bird was being chased by them. The flickers seemed to be harassed the most, at least as judged by the awful fuss they made. Their rapid notes of fright were continually heard from close-by

to far-away, which made one way to estimate the number of hawks. . . . Savannah sparrows and other small birds were attracted to the beach by the accumulation of seeds and insects, and here was a particularly productive hunting ground for the hawks. The smaller birds seldom uttered a note when chased. At times one would fly out over the lake to catch an insect, and as if from nowhere a hawk would skim out after it with scarcely a wing-beat. The small bird would see the enemy just in time to fly circles around it, shoot straight up or straight down, or go through so many rapid angles and tacks that it was difficult to follow with the eye. Unless the hawk made a capture with the first swift strike it usually failed. The hawks were bold and often completely disregarded the presence of the fieldmen [sic].”

From this September visit, Jackson reported that 15 Merlins were “collected,” and their (14) stomach con-

tents analyzed. The analyses revealed the following items: Purple Martin (1), Red-breasted Nuthatch (2), Gray-cheeked Thrush (1), Swainson's Thrush (1), Hermit Thrush (1), Cedar Waxwing (1), Yellow-throated Vireo (1), Philadelphia Vireo (1), Black-throated Green Warbler (1), *Dendroica* sp. (3), Chipping Sparrow (1), Vesper Sparrow (1), Song Sparrow (2), Lincoln's Sparrow (4), Pine Siskin (1), House Sparrow (1), Odonata (dragonfly, 2), and *Vanessa* sp. (3)—a brush-footed butterfly—Nymphalidae, most likely the red admiral *Vanessa atalanta*.

Mossman (1987) observed Merlins at the lighthouse located near the island's north end, near the lagoon, and at beaver flowages and in pine barrens. Observing Merlin behavior at the lighthouse grounds, and also at the sand spit, he wrote:

"Two, and sometimes 3–4 immatures were present continually around the lighthouse grounds during the period 11–20 Sept[ember], and 1–2 were present thereafter. Here they made rather cruel sport of harrassing flickers, and they occasionally captured yellow-rumped and palm warblers. Like the warblers and flickers, they were fairly unaffected by our presence, and they often passed within 3m of us during their pursuits. One chased a yellow-rumped warbler that was perched beside me on the picnic table, and actually brushed my back with its primaries in passing. I saw one capture a palm warbler on the lighthouse grounds on 14 Sep[tember], an unidentified (palm or yellow-rumped) warbler that had wandered 20m off the north shore on the same date, and a yellow-rump that was feeding on the beach among driftwood on the sand spit on 23 Sep[tember]. . . . I saw merlins chase birds as large as raven, bald eagle, peregrine, and each other, evi-

dently for 'sport', 'practice', or the heck of it."

Epstein (*in litt.*) once observed a Merlin flying toward south Outer from the direction of Michigan Island on September 14, 1990. He commented in his field notes: "*Merlin approached . . . ca 1300 [hrs], very low, wing tips almost touching water. Seen first 1/4 to 1/2 mile from spit. Shorebirds on beach west of bog included 2 Semipalmated Sandpipers, Baird's Sandpiper, several small flocks of Sanderlings, Black-bellied Plover. Merlin chased Sanderlings, didn't catch anything but pursuit was fantastic: with 180 degree turns, incredible bursts of speed, twists and turns. Sanderling being pursued stayed very close (within 3 feet) [to] lake surface. The Merlin suddenly 'braked', rose to a height of 10 feet, peeled off, [and] attacked a second flock of Sanderlings several hundred feet down beach.*"

By comparison here, the occasional southbound Peregrine Falcon I observed did not exhibit characteristic chase behavior and cruised low over the dunes, nevertheless spooking loafing gulls and causing passerines to drop suddenly into sparse grasses. This was not the case in mid-September 1993 when Eric Epstein (pers. comm.) watched a Peregrine attack and kill a Merlin! Van Stappen and Doolittle (1995) commented on the regional and national importance of the Outer Island Sand Spit to staging falcons.

BREEDING SEASON OBSERVATIONS—RESULTS AND DISCUSSION

Observations by habitat type are presented below.

Strand—In general, the most commonly observed species in the strand zone during the breeding season are colonial waterbirds: Herring Gull, Ring-billed Gull, irregularly the Bonaparte's Gull, the locally regular Caspian Tern, the uncommon and local Common Tern and Forster's Tern (The latter occurs very rarely along Lake Superior and was not listed on surveys used for this paper.), and the occasional to fairly common loafing Double-crested Cormorant.

Birds frequenting the strand zone are typically scavengers, prominently gulls, feeding on dead fish such as carp or lake trout. But there are also Killdeer, Spotted Sandpiper, American Crow, Red-winged Blackbird, Common Grackle, and sometimes American Robin, attracted to the water's edge to feed on invertebrates and other food items.

In a study of birds inhabiting southern Lake Michigan beaches and dunes, Van Orman (1976) found that the Common Grackle "was the most common beach exploiter," feeding on dead alewives (*Alosa pseudoharengus*). American Robins, Empidonax flycatchers, and female Red-winged Blackbirds also were observed foraging along beaches. Other birds he observed were: Great Blue Heron (once), Snowy Egret (once), Mallard, Spotted Sandpiper, American Crow, Gray Catbird (once), European Starling, Northern Cardinal, and Song Sparrow.

Early avian succession is similar in lake beach and dune communities on both lakes due to similarities in grass and forb successional stages.

On both Lakes Michigan and Superior I occasionally found Killdeer nesting in the upper reaches of the strand with no vegetative cover, and Spotted Sandpiper amid grasses of 10–30% cover. Killdeer are habitat generalists that occupy relatively flat open ground free of woody vegetation. Often they will nest on cleared grass, gravelly, or bare ground areas near parking lots or buildings in the most public of places. Beals (1958) documented 2 Killdeer nests with eggs on "sparsely vegetated" sand dunes along the east side of Stockton Island. Spotted Sandpipers commonly place their nests at the base of plants in semi-open habitats (Oring *et al.* 1983).

On 6 July 1919, Jackson (1942) found a Tree Swallow nest "composed of weed straws and gull feathers" in a driftwood log (Figure 19) on the south Outer Island beach. *"Examination disclosed a hollow log about 8 inches in diameter imbedded in the sand. At one end was a hollow used by the swallows as an entrance as was indicated by tracks in the sand where the birds touched before entering the log. . . . The nest was 34 inches from the entrance and when an opening was made in the log there, it disclosed five feathered young, three of which flew out one by one."*

Historically, as mentioned earlier, Common Terns (Figure 20) nested on sand beaches and sandy peninsulas in Wisconsin, but over the last 25–50 years they have shifted largely to dredge spoil islands and other artificial islands (Matteson 1988). I also found small colonies of Herring and Ring-billed Gulls on upper mainland sand beach habitats, but these invariably failed due to mammalian predation by raccoon, red



Figure 19. Tree Swallow nest in beached hollow log, Outer Island, 6 July 1919. (Photo by Harry H. Sheldon)

fox, and mink. On dredge spoil islands, however, where sand habitats resembled mainland beach and dune habitats, large colonies of Ring-billed Gulls occupied entire islands.

Foredune—Moving inland from the strand, on active dunes (foredune) partially stabilized by *Ammophila* on Lake Superior and dune reed on Lake Michigan, with little or no woody vegetation present, I commonly found Spotted Sandpiper and occasionally Savannah Sparrow, present or nesting in short, grassy cover 60–80%, and occasionally Horned Lark. Savannah Sparrow breeds in a wide array of grass habitats where grasses and forbs are of relatively short to moderate height. On Lake Superior, I also found Spotted Sand-

piper nesting in short, mixed grass-heath 60–90%.

Bobolink, another grassland species and a WDNR species of special concern, was absent from Lake Superior dune habitats but fairly common locally in grassy Lake Michigan dunes. Common Grackle was fairly common but in low numbers in grassy foredunes on both lakes. Eastern Meadowlark, a grassland habitat generalist that prefers mesic sites over dry habitats (Sample and Hoffman 1989), was rare to absent in grassy foredunes on both lakes. The same foraging hirundinids were present—Purple Martin (rare), and the swallows: Tree, Northern Rough-winged (uncommon), Bank Cliff, and Barn Swallow.

Van Orman (1976) found that sparrows (Field, Song, and Vesper) were the dominant inhabitants of the beach grass-cottonwood community at dunes on southern Lake Michigan, comprising 45% of the total number of individuals detected. He found that Field Sparrow and Red-winged Blackbird had the highest breeding density in beach grass-cottonwood followed by Song Sparrow, Vesper Sparrow, Mallard, Brown Thrasher, European Starling, Brown-headed Cowbird, Eastern Kingbird, and Killdeer.

Van Orman (1976) and McCracken *et al.* (1981) noted that in open sand dune communities breeding bird species richness was low with generally low densities; though densities varied depending on vegetation type, amount of water present, and adjacent community type.

Backdune heath, grassland/savanna, and sand ridge—In Wisconsin heath-



Figure 20. Adult Common Tern settling on 2 eggs at Ashland Pier colony site, Chequamegon Bay, Lake Superior, 8 June 1988. (Photo by S.W. Matteson)

like backdune and backdune grassland/savanna, as shrubs and saplings/trees became more pronounced, dune inhabitants included: American Redstart (uncommon to rare in conifers, Lake Superior only), Black-capped Chickadee (fairly common in scrubby backdune grassland/savanna), Mourning Dove (sometimes found in dune copse, more regularly along forested edges of old dunes), and Eastern Bluebird (rare to uncommon in backdune grassland/dune heath on Lake Superior; uncommon to locally common in mixed grass/dune heath on Lake Michigan). Jackson (1942) found bluebirds nesting in dead pine stubs on Outer Island in 1919.

Also occurring in backdune grassland and heath-like backdune: Red-eyed Vireo (in dune copse—Long

Island), Yellow Warbler and Common Yellowthroat (both commonly associated with dune copse and shrubby thickets, and open dune swale and wetlands), Indigo Bunting (fairly common in backdune grassland/savanna and forested dune edge and opening, Lake Michigan; absent from Lake Superior dune and forested dune ridge surveys), Dickcissel (extremely rare, Lake Superior; absent from Lake Michigan surveys), Chipping Sparrow (abundant in forest edge; fairly common in dune copse), Clay-colored Sparrow (fairly common locally in backdune grassland/savanna where shrubs were >40% cover, otherwise uncommon to absent; fairly common locally in heath-like backdune), Field Sparrow (uncommon in backdune grassland, Lake Michigan only; absent from Lake Superior surveys),

Vesper Sparrow (common at Kohler Dunes State Natural Area but uncommon to rare in backdune grassland on Lake Michigan; absent on Lake Superior dunes), Song Sparrow (abundant in shrubby thickets, and fairly common in backdune grassland/savanna and heath-like backdune), and Brewer's Blackbird (uncommon in heath-like backdune, except at Wisconsin Point, Lake Superior).

American Woodcock was observed rarely—only from Lake Superior—in heath-like backdune adjacent to pine savanna.

Extremely rare was the Western Kingbird. I observed one perched on a common juniper in a backdune on Outer Island in late spring. Eastern Kingbird was locally common in dune copse and forested dune edge; occasionally foraging over beaches and dunes.

Other species included: American Crow (fairly common, backdune grassland/savanna), Horned Lark (uncommon to rare in backdune grassland), Gray Catbird (locally common: shrubby backdune grassland/savanna; observed by McCracken *et al.* (1981) in a variety of mid-successional dune habitats on Long Point), European Starling (fairly common in backdune grassland/savanna along Lake Michigan, locally common along Lake Superior), Red-winged Blackbird (fairly common, typically found in marshes adjacent to a strand, occasionally in shrubby thickets, and sometimes in backdune grassland), Western Meadowlark (extremely rare; a narrow sand ridge protruding into a boggy lagoon at the Stockton Island tombolo was the site of the only occur-

rence on all lake dune and beach surveys—E. Epstein, pers. comm.; this species typically occurs in dry upland short-grass sites), Common Grackle (fairly common, backdune grassland/savanna), Brown-headed Cowbird (fairly common: dune copse, forested dune ridge and swale, and tombolo/sand ridge), Baltimore Oriole (fairly common, dune oak copse), and American Goldfinch (common: backdune grassland/savanna, shrubby thickets, creek edge; occasionally observed flying over grassy dunes near the forest edge).

During late spring and summer, I have observed the following species foraging for insects in and over dunes: Chimney Swift, Northern Flicker, Eastern Phoebe, Eastern Kingbird, Horned Lark, the hirundinids, and Eastern Bluebird.

Open dune swale and other wet habitats—At open sedge-rush habitats in shallow pools adjacent to the strand, I encountered, rarely, lone Wilson's Phalaropes foraging for invertebrates. This species typically nests in wet meadows in grasses 10–30cm tall, often adjacent to a permanent or semi-permanent wetland (Eldridge 1992). In Wisconsin, it is all but restricted to sedge meadows in occurrence (Mossman and Sample 1990).

To observe other phalarope species, such as Red-necked Phalarope, most likely you would have to venture far off shore, a sighting one might describe as fortuitous. Extremely rare would be an observation of the Red Phalarope, a pelagic species that H.L. Stoddard (1947) was so intent on collecting for the Milwaukee Public Museum in the 1920's that he once swam a quarter-mile out

into Lake Michigan with his gun floating on a log to see if a Red Phalarope was mixed in among Red-necked Phalaropes. It wasn't.

Immature and subadult Bald Eagles were regular visitors to the southern Long Island shore during late spring and early summer, perhaps attracted to the concentrations of Eurasian carp that inhabited the shallow western bay waters and occasionally the seasonal pools created by storm surge.

Where lake beaches and dunes were adjacent or contiguous to streams, creeks, and lagoons, Belted Kingfishers were present. In shallow sedge marshes adjacent to sand spits, baymouth bars, or dune ridges, there occurred somewhat commonly (in low numbers) Common Yellowthroat—characteristic of sedge meadow, wet prairie, alder thicket/shrub carr, fen and open bog, northern hardwood swamp, and pine/oak barrens; Swamp Sparrow—characteristic of the same habitat types as Common Yellowthroat, with the exception of pine/oak barrens, also found in boreal forest edges; Red-winged Blackbird; occasionally Sedge Wren—characteristic of sedge meadow and open bog; and rarely Marsh Wren and Yellow-headed Blackbird.

An occasional Great Blue Heron, Spotted Sandpiper, Semipalmated Plover, and rarely a Green Heron, foraged in interdunal wetlands on Lake Superior. Interdunal wetlands in general attract and may support a few pairs of Song Sparrow, Red-winged Blackbird, and Common Yellowthroat, although I did not find evidence of nesting at 5 sites I visited on Lakes Michigan and Superior.

Also present in shrubby thickets adjacent to interdunal pools were Gray Catbirds and Common Grackles, species fairly widespread in a variety of community types, where shrubs and saplings predominate.

Forested dune ridge—Discussion of birds inhabiting wooded dune ridge habitats overlaps with information presented in previous articles from this series, specifically articles on birds inhabiting northern mesic forests (Hoffman 1989a), boreal forests (Mossman *et al.* 1990), northern swamps and bogs (Hoffman and Mossman 1993), as well as pine and oak barrens (Mossman and Epstein 1991). Table 2 summarizes and compares the abundance of birds documented for this paper. The more common species detected along dune ridge edges in shrubs/saplings and in woods within 100–150m of the open dune/forest edge were:

1) Northern Flicker, a bird observed in early successional forest types (Beals 1960; this paper); 2) Eastern Kingbird, a species that occurred commonly in shrubby dune swale habitats (McCracken *et al.* 1981; this paper), also characteristic of pine and oak barrens (Mossman and Epstein 1991), early successional northern mesic forest (Hoffman 1989a, this paper), shrub carr and shrubby/sapling sedge meadows (Mossman and Sample 1990), and found in brushy dry and dry-mesic prairies (Sample and Hoffman 1989) and farmland/woody edges; 3) Tree Swallow, a habitat generalist, observed foraging along forested dune ridge edges and over open beaches and dunes; on Lake Erie, typically associated with mid-to-late dune suc-

cession and mature dune woodlands (McCracken *et al.* 1981); 4) Blue Jay, a species associated (this paper) with mature beech and oak forests, and which nests in mature oak-maple dunes (Van Orman 1976, McCracken *et al.* 1981) and is common in a variety of dry to dry-mesic forests (Mossman and Epstein 1991); 5) American Crow, another habitat generalist, occurred commonly along mixed wooded dune ridge edges; 6) Black-capped Chickadee, observed commonly in a variety of wooded dunes and on sand ridges, often in shrubby openings and along forest edges; a species found in a wide variety of northern and southern forest types; 7) American Robin, a species found in northern Wisconsin pine forest edges and openings (Hoffman and Mossman 1990), shrubby sedge meadows (Mossman and Sample 1990), brushy dry and dry-mesic prairies (Sample and Hoffman 1989), alder thickets and shrub-carr (Hoffman 1989b), coniferous northern Wisconsin swamps and bogs (Hoffman and Mossman 1993), and generally observed in a variety of open, shrubby woods, and forested edges, dominated by shrubs and saplings (Mossman and Epstein 1991), including wooded dune ridge edge and sand ridge edge (this paper).

8) Cedar Waxwing, typically found in pole-sized deciduous northern mesic forests (Hoffman 1989a), shrub-carr (Hoffman 1989b), bog forests of tamarack and black spruce (Hoffman and Mossman 1993), and observed (this paper) in mixed conifer-hardwood dune ridge edge and openings, and in Long Island tamarack-white pine bogs. 9) Red-eyed Vireo, noted in oak-maple-hemlock

forested dunes (Van Orman 1976, McCracken *et al.* 1981, this paper), jack pine ridge (this paper), and forested dune swales (McCracken *et al.* 1981, this paper), baymouth bars with pines-hardwoods (Hoffman and Mossman 1993, this paper), also in early successional to mature northern mesic forests (Hoffman 1989a), hardwood bogs and swamps, tamarack and black spruce bogs (Hoffman and Mossman 1993, this paper), white birch forests in the Apostle Islands and on Isle Royale (Beals 1960), and early successional birch/aspen boreal forest as well as fir-dominated boreal forest (Mossman *et al.* 1990).

10) Yellow-rumped Warbler, characteristic cedar swamp bird and found in tamarack and black spruce bogs (Hoffman and Mossman 1993, this paper), conifer-loving in boreal and northern mesic forests (Hoffman 1989a, Mossman *et al.* 1990), and observed (this paper) in dune cedar swales, jack pine swales, and generally along mixed coniferous-hardwood dune ridge edge; 11) Black-throated Green Warbler, one of the most common forest species in mature conifer-dominated (except pines) and mixed hardwood northern mesic woods, northern swamps and bogs, and boreal forests (Beals 1960, Hoffman 1989a, Mossman *et al.* 1990, and Hoffman and Mossman 1993) and detected in these forest communities along dune ridges and swales and in associated bogs and swamps (this paper); 12) Blackburnian Warbler, observed (in low number) in conifer-dominated, mixed conifer-hardwoods on dune ridges and swales (this paper), typically found in mature northern

mesic forests (Hoffman 1989a), in mixed conifer-hardwoods in the Apostle Islands where conifers are predominant (Beals 1960), in fir-dominated boreal forests (Mossman *et al.* 1990), and in northern cedar swamps and northern swamps and bogs with hemlock or mature coniferous-hardwoods present (Hoffman and Mossman 1993).

13) Chestnut-sided Warbler, observed (this paper) in dune ridge openings and along edges in young hardwood stands, and sometimes in jack pine swale, but commonly found in deciduous saplings in northern mesic forests (Hoffman 1989a), especially in stands with abundant white birch present (Beals 1960), and on sandy soils with an early successional stage of forest regeneration (Mossman and Epstein 1991); 14) Nashville Warbler, detected (this paper) in mixed coniferous-hardwood lake dune ridge edges and in jack pine ridge and swale, found generally in pole-sized coniferous and mixed coniferous-hardwood northern mesic forests (Hoffman 1989a), prominent in pine stands—especially red pine—in the Apostle Islands (Beals 1960), characteristic of forested bogs—preferring tamarack, spruce, and fir, and co-dominant in cedar swamps (with Winter Wren, Black-throated Green Warbler, and Ovenbird) (Hoffman and Mossman 1993, this paper—Long Island bog), observed often in aspen-birch boreal forest edges (Mossman *et al.* 1990), detected in pine and oak barrens' woods (Mossman and Epstein 1991), and in northern and central sedge meadows succeeding to open bogs with conifers (Mossman and Sample 1990).

15) American Redstart, a species common in mid-successional upland forests in southern Wisconsin (Bond 1957), observed (this paper) in quaking aspen, paper birch, Hill's oak, and young white pine, as well as balsam fir and jack pine, on forested dune ridge edges and in Hill's oak and jack pine swale, also in tamarack bog on Long Island, and in speckled alder along the shores of Allouez Bay (Robbye Johnson, pers. comm.); observed commonly by Van Orman (1976) in rugged dune ridges and swales dominated by American beech, sugar maple, and eastern hemlock, with a mostly maple understory; found in sapling and pole-sized deciduous woods (Hoffman 1989a); prominent in pine and birch-maple stands in the Apostle Islands (Beals 1960); noted in pines-hardwoods at baymouth bars and in shrubby northern hardwood swamps (Hoffman and Mossman 1993); detected in fir-dominated boreal forest and birch/aspen boreal forest (Mossman *et al.* 1990), and in dense shrubs/saplings of pine and oak barrens (Mossman and Epstein 1991).

16) Chipping Sparrow, common in mid-successional dune woods in openings and edges on Long Point (McCracken *et al.* 1981), in jack pine stands on southern Lake Michigan (Van Orman 1976), along dune ridge edges in oaks and pines—both Lakes Michigan and Superior (this paper), in coniferous northern swamps and bogs (Hoffman and Mossman 1993, this paper), in open barrens with low—less than 1m—woody vegetation (Mossman and Epstein 1991), and in coniferous saplings of northern mesic forests

(Hoffman 1989a); and 17) Common Grackle, typically an edge species, observed in shrubby forested dune ridge edges and dune copse (this paper), common in shrubby damp areas and edges of boreal forest (Mossman *et al.* 1990), in both alder thickets and shrub-carr (Hoffman 1989b), in shrubby sedge meadows (Mossman and Sample 1990), in fen and shrub habitats behind Lake Superior baymouth bars, and in tamarack-white cedar sloughs, oak savannas, and red oak-sugar maple forests on Long Point, Lake Erie, (McCracken *et al.* 1981).

In recent years, several pairs of breeding Merlins have been identified along the Lake Superior shore, including the Apostle Islands (Doolittle and Balding 1995). Other raptors present (irregularly) during summer in lake beach and dune communities include the Turkey Vulture, Bald Eagle, Northern Harrier—observed foraging in and over dunes on Long Island, Broad-winged Hawk (rare), Cooper's Hawk (rare), Sharp-shinned Hawk (rare)—the latter three species in forested dune ridges, and American Kestrel (rare).

Overall, what emerges from surveys conducted in lake beach and dune grass, forb, and woody habitats between 1970 and 1995 is a rich assemblage of bird species representative of several community types. The opportunities for birders abound since a variety of edge species, and species attracted to open habitats and forest openings, respond to dynamic coastal, topographic, edaphic, and disturbance factors along the Great Lakes, and use lake beach and dune communi-

ties for foraging and resting, and occasionally, nesting.

DESCRIPTION OF SITES

The following 6 sites of 27 listed below are representative of quality sand beach and dune communities along the Wisconsin Great Lakes. Two of the sites—Long Island and Outer Island in the Apostle Islands—are owned and managed by the National Park Service and not easily accessible, except by boat. This lack of accessibility is a principal reason why these sites have remained relatively pristine and undisturbed by humans, except for some logging in the nineteenth century and perhaps occasional fires. Wisconsin Point is accessible by car and unlike the previous sites has received considerable human traffic.

The other three sites, located on Lake Michigan: Kohler Dunes State Natural Area, Point Beach State Forest, and Whitefish Dunes State Park (Figure 21), have received considerable human use, but they have been successfully managed and retain to varying degrees outstanding features of lake beach and lake dune communities.

Other lake beach and dune sites (some featuring dune ridge-swale topography) on Lake Michigan include:

- 1) Kenosha Sand Dunes in Kenosha County (T2N R23E S7SE,8), with about 1km of well-developed dunes featuring dune succession of fore-dune-swale-wet prairie; but the shoreline here is entirely rip-rapped, with no beach present; 2) Fox Point Clay Bluffs and Beach in Milwaukee County (T8N R22E S9,16), featuring



Figure 21. Strand, dunes, and gulls at Whitefish Dunes State Park. (Photo courtesy of Wisconsin Department of Natural Resources)

beach and offshore bars naturally nourished by sediments; 3) Cedar Grove Ornithological Station in Sheboygan County (T13N R23E S30), occurring on about 12ha of low, abandoned dunes.

In Door County: 4) Clay Banks Beach (T26N R26E S3NW), about 25ha of beach-ridge-swale topography; 5) Sturgeon Bay Canal Beach and Ridges (T27N R26E S22SESE,23) featuring a small tract of low, undeveloped dunes and old beach ridges; 6) Newport Conifer-Hardwoods (T32N R29E S28,29,33) featuring a variety of forest types with hardwoods stabilizing a portion of low dunes, and sand beach covering about 1km; 7) Hotz Tract (T32N R29E S4,9), with almost 2km of undeveloped low dunes; 8) Detroit Island Beach (T33N R29E

S13,24), featuring about 12ha of sand beach, interdunal swale, and backdunes; 9) Jackson Harbor (formerly Furrer Beach and Dunes) (T34N R30E S27,28), about 20ha of beach, dunes, and beach pools known to harbor unique and localized Great Lakes plants; and 10) Jackson Harbor Ridges (T34N R30E S28SE), an important refugia for several Great Lakes coastal plant species and featuring about 13ha of low dunes, sand flats, shallow ponds, marshy areas, and stabilized sand ridges with a mixed conifer-hardwood forest—all 4 latter sites occurring on Door County's Washington Island.

On Green Bay: 11) When water levels are low: the peninsular Little Tail Point (T25N R21E S5,6,8) and 12) Long Tail Point (T25N R21E

S19,30,31,32,5) (both lake beach community only) in Brown County; 13) Ansul Patterned Dunes in Marinette County (T30N R23E S13NE; T30N R24E S18WNW), about 73ha of stabilized dune ridge with a Hill's oak-jack pine forest, and interdunal swales featuring ephemeral ponds and sloughs; and 13) Seagull Bar (Figure 22) Natural Area in Marinette County (T30N R24E S9,16), with about 2ha of lake beach and about 10ha of lake dune.

There are additional lake sites of varying size and quality, and sites that do not "fit" properly in a discussion of lake beaches and dunes, such as the botanically rich Ridges Sanctuary in Door County, which features parallel abandoned beach ridges and swales overlying a dolomite bedrock. At several locations along Lake Michigan, beach/dune

succession, when left undisturbed, has led to the establishment of mature second-growth forest cover.

On Lake Superior, additional quality sites include:

In the Apostle Islands in Ashland County: 14) Stockton Island Tom-bolo (T51N 52N R2W S1,36), with a large sedge bog and lagoon, about 11ha of barrier beach, about 2ha of lake dunes dominated by beach grass, and interdunal pools that serve as critical microhabitats for rare Great Lakes flora, such as small purple bladderwort and the shore sedge *Carex lenticularis*; 15) Rocky Island Cuspate Foreland (T53N R03W S36NE), featuring 3ha of open dunes dominated by reindeer lichens (*Cladina* spp.), beach grass, and other dune associates on the island's southeastern end; 16) Big Bay Sand Spit, Ridges and Bog Natural



Figure 22. Seagull Bar (western end), Lake Michigan. (Photo by S.W. Matteson)

Area on Madeline Island (T50N R3W S13,14,23), featuring a 200ha bog-lagoon complex and a 2.3km-long, pine-dominated backdune area adjacent to grassy foredunes and barrier beach; 17) Amnicon Bay Bog Lagoon and Beach on northeastern Madeline Island (T51N R2W S35NW), featuring a 1km-long barrier beach adjacent to an extensive bog lagoon and bog wetland; 18) Steamboat Point on northwestern Madeline Island (T51N R2W S21SE), featuring about a 1km-long cusped foreland with several grass dune species and an adjacent white pine-red oak beach ridge and grass-alder swale; 19) Western Michigan Island Beach and Dunes (T51N R01W S20SW), with a small barrier beach and up to 50m-wide dunes dominated by beach grass, beach wormwood, beach pea, common juniper, and sand cherry (Judziewicz and Koch 1993); 20) Bark Bay Slough Natural Area in Bayfield County (T51N R7W S34,35,36; T50N R7W S1,2,3; T50N R6W S6NW), featuring a baymouth bar beach nearly 1km long with ericads, speckled alder, and beach grasses and parallel beach ridges with mature white pines adjacent to a large sedge bog, fen, and lagoon; and 21) Port Wing Boreal Forest and Bog Natural Area in Bayfield County (T50N R8W S21,28), with about 1km of sand beach adjacent to a boreal forest of mixed pines and hardwoods on an old beach ridge.

Kohler Dunes State Natural Area—

Size. About 54ha: lake dune (48.5ha), interdunal wetland (4.8ha), lake beach (0.8ha), northern dry-mesic forest (0.4ha).

Location. Eastern Sheboygan County, Lake Michigan (T14N R23E S22,23), within Kohler-Andrae State Park, about 3km south of Sheboygan and about 69km north of Milwaukee.

Access. From Sheboygan go south 4.8km (3 miles) on Hwy 43 to Hwy V; drive east on V for 1.6km (1 mile) to Hwy KK; proceed south on KK for 1.6km and turn east from KK onto Old Park Road, then drive to the entrance of Kohler-Andrae State Park.

Site Description. This state natural area has two sections: 1) A 14.1ha parcel lies northwest of the Sanderling Nature Center, located 61m from Lake Michigan, and features 0.4km of open beach with sea rocket, seaside spurge, beach pea, winged pigweed, and silverweed present, active and stabilized dunes with remnants of dry-mesic white pine forest, some Norway spruce, and 5 small (<0.4ha) interdunal wetlands. The dune field here, about 152m wide and about 884m long, is largely stabilized by beach grass, sand reed, little bluestem, and junipers, except in sand blow-outs in the north end.

Scattered along 0.4km of foredune adjacent to the beach and in dune swale grows dune thistle, mostly on the foredune's back side.

2) The 40.4ha section south of the nature center features rolling active and stabilized dunes punctuated by sand blowouts. A fairly large 1.6ha interdunal wetland and two scattered smaller ones occur along the natural area's western boundary. A 0.8km nature trail called the "Creeping Juniper Nature Trail" starts at the nature center and loops back to the nature center's parking lot.

The natural area's nature trail is part of an innovative "cordwalk"—a

boardwalk tied together by rope—to prevent trampling of dune vegetation and provide a unique opportunity to become acquainted with the flora and fauna of sand dunes. The 3.1km cordwalk crosses the entire length of the natural area (both sections) beginning at the group camp area and parking lot on the south end and continuing northeast from the nature center to a parking lot at the northeast end of the natural area.

In the 1930's, a large pine plantation of Scotch (*Pinus sylvestris*), jack, and red pine was planted in what is now the natural area, but most of it has been removed because it was shading out dune plants. In fact, all of the red pine once located in the parcel north of the nature trail has been removed. A mix of red pine, jack pine, and white pine occur along the natural area's southwestern border adjacent to interdunal wetlands and in an area bordering the south end parking lot. Scotch pine is prominent in portions of the southern section and immediately northwest of the nature center.

Northern hardwoods (red oak, red maple, yellow birch *Betula alleghaniensis*, and beech) also occur intermixed in the southern and northern ends bordering the dunes. West of the nature center on the nature trail loop are pockets of Scotch pine and one small stand of Norway spruce (*Picea abies*). Lowland brush and marshy areas associated with the Black River lie west of the state natural area and parallel to the dune fields.

Stabilizing the backdunes in both state natural area sections are: sand reed, beach grass, Canada wild-rye,

thickspike wheat grass, sand cherry, common and trailing junipers, beach wormwood, silverweed, common or Philadelphia fleabane (*Erigeron philadelphicus*), sand cress, common milkweed, and willows (*Salix* spp.). In addition to sand reed, dune thistle, and thickspike wheatgrass, two other state-threatened plants occur here—both known primarily from Lake Michigan dunes: dune goldenrod and clustered broomrape.

The interdunal wetlands are dominated by lakeshore rush and the sedge *Carex viridula*, with Garber's sedge, Olney-threesquare (*Scirpus americanus*), broadleaf willow, silverweed, spotted Joe-pye-weed (*Eupatorium maculatum*), swamp milkweed (*Asclepias incarnata*), variegated scouring rush, slender arrow-grass, and another sedge (*Eleocharis* sp.) also known to occur (BER files).

Other plant species occurring in the natural area include common strawberry (*Fragaria virginiana*), red osier (*Cornus stolonifera*), evening primrose, Canada blue grass (*Poa compressa*), yellow sweet clover (*Melilotus officinalis*) and white sweet clover (*M. alba*)—prominent invaders throughout most of the dune system, common mullein (*Verbascum thapsus*), pasture or carolina rose (*Rosa carolina*), black-eyed Susan (*Rudbeckia hirta*), garden asparagus (*Asparagus officinalis*), leafy spurge (*Euphorbia esula*), Lombardy or black poplar (*Populus nigra*), white ash, cottonwood, silver maple (*Acer saccharinum*), box elder (*Acer negundo*), paper birch, and quaking aspen. In 1993, hairy puccoon (*Lithospermum croceum*) was discovered in an open area formerly occupied by Scotch pine (J. Bucholz *in litt.* to R. Hoff-

man), which had been removed by work crews.

In recent years, work crews have made a concerted effort to control exotics such as silver poplar (*Populus alba*), Lombardy poplar, leafy spurge, exotic thistles, honeysuckle (*Lonicera* spp.), and common lilac (*Syringa vulgaris*).

Of further interest is the presence of 132 species of Lepidoptera—butterflies and moths: skippers, brush-footed butterflies, wood nymph butterflies, monarch butterflies, tent caterpillar moths, giant silk moths, sphinx moths, prominent moths, tiger moths, tussock moths, and owlet or noctuid moths, including 113 species in the families Arctiidae and Noctuidae. These were documented at Kohler Dunes in 1991, including 3 moth species previously unrecorded in Wisconsin: *Copablepharon longipenne*, *Euxoa manitobana*, and *Anathix aggressa*, species typically found in the western U.S., particularly *Copablepharon longipenne*, which is disjunct from its western range (Ferge 1991).

Birds. The more common inhabitants, found typically in heath-like and grassy backdunes, are Eastern Bluebird, Common Yellowthroat, Chipping Sparrow, Clay-colored Sparrow, Field Sparrow, Vesper Sparrow, Song Sparrow, and American Goldfinch. Bobolink is uncommon to rare. Each of these species also is characteristic of pine and oak barrens. Foraging in the dunes are Common Grackle, Northern Flicker, Red-winged Blackbird, and Chimney Swift, as well as swallows foraging over sand blows—Tree, Bank, and Barn, and occasionally Northern

Rough-winged Swallow. Purple Martin also sometimes occurs here.

Among dune copse in aspen, cottonwood, paper birch, and red maple, occur Mourning Dove, Eastern Kingbird, Blue Jay, Gray Catbird, American Robin, Brown Thrasher, European Starling, (rarely) Warbling Vireo, Chestnut-sided Warbler, Indigo Bunting, Eastern Towhee, House Finch, (rarely) House Sparrow, Song Sparrow, Brown-headed Cowbird, and Northern Cardinal. Among red oak occasionally occur Baltimore Oriole, and in white cedar along the nature trail sometimes occur American Crow, Black-capped Chickadee, Blue Jay, Cedar Waxwing, and Chestnut-sided Warbler. European Starling, Chipping Sparrow, and Mourning Dove sometimes occur in pockets of Scotch pine.

In brushy swales adjacent to interdunal wetlands sometimes occur Yellow Warbler, Common Grackle, American Goldfinch, and Song Sparrow. Interdunal wetlands sometimes attract Red-winged Blackbirds, Common Grackles, and Song Sparrows, but quite often I found no birds in these small 0.4–0.8ha sites, perhaps due to their dry conditions, simple vegetative structure, and apparent low plant density.

A rare occurrence in backdune grassland in low grass and forb cover is the Grasshopper Sparrow.

Along the open beach at the north end of the state natural area, the Ring-billed Gull is prominent; sometimes in early morning Canada Geese loaf here, and occasionally Common Grackle and Killdeer forage along the strand.

Along mixed pine forest edges bordering open dunes occur Yellow

Warbler, Pine Warbler, Black-capped Chickadee, Indigo Bunting, Eastern Towhee, American Robin, and Brown-headed Cowbird. In mixed northern hardwoods and pines occur Ruby-throated Hummingbird, Eastern Wood-Pewee, Downy Woodpecker, Northern Flicker, Great Crested Flycatcher, Red-eyed Vireo, Veery, Chestnut-sided Warbler, American Redstart, Yellow Warbler (edge), Gray Catbird (edge), Indigo Bunting (edge), American Goldfinch (edge), Brown-headed Cowbird, (rarely) House Wren, and Song Sparrow (edge).

Among birds rarely observed on breeding bird surveys at Kohler Dunes were a Cooper's Hawk on 5 June 1993, Mallard, Green Heron, Black-billed Cuckoo, Yellow-bellied Flycatcher, Willow Flycatcher, Winter Wren, Warbling Vireo, Magnolia Warbler, Blackburnian Warbler, Mourning Warbler, Canada Warbler, and House Sparrow. One rare species, recorded a few days after a June breeding bird survey, was the Yellow-throated Warbler, which stayed for about a month, and sang from a large white pine along a western edge bordering the dunes and near the parking lot at the natural area's northern end (Noel Cutright, pers. comm.). The detection of several of these species no doubt is associated with the adjacent Black River marsh system, which runs parallel to the state natural area, and with northern hardwood and white pine stands bordering the dune fields. Some of these birds, however, such as Yellow-bellied Flycatcher and Blackburnian Warbler, may have been late migrants; it's not uncommon for migrants to be still present along the

lakeshore during the first week of June.

Point Beach State Forest—Size.

About 1,212ha; 10.4km long and 2.4km wide, including 70.7ha in the Point Beach Ridges State Natural Area.

Location. Point Beach State Forest (T20N R25E, S4, 5, 8, 9, 16, 17, 20, 21, 29, 31, 32) lies parallel to Lake Michigan mostly east of Hwy O immediately north of the city of Two Rivers, Manitowoc County.

Access. From northern Manitowoc County, take Hwy 42 south to Hwy V, go east to Hwy O and then about 3.2km (2 miles) south on Hwy O to the state forest entrance. From Two Rivers, take Hwy O (Sandy Bay Road) northeast about 6.4km (4 miles) to the state forest entrance.

Site Description. Point Beach is characterized by alternating ridges and wet swales that parallel the lakeshore. Forest cover, mostly second-growth, consists of mixed northern hardwoods and pines: white pine, red pine, hemlock, white cedar, yellow birch, white birch, red maple, red oak, and black cherry (*Prunus serotina*). Black ash, tamarack (*Larix laricina*), and occasionally white cedar occur in swales. Red maple, hemlock, and birch are common, with several red pine plantations established on ridges and backdunes.

Point Beach State Forest includes: about 1,539m of beach adjacent to extensive dunes and swales; a 117ha campground and recreation area; the Wilderness Ridge Natural Area—3.2ha of ridge and swale mixed hardwoods, white pine, and hemlock; and the Point Beach Ridges State Natural

Area, 70.7ha of the following community types: northern mesic forest (36.4ha), northern wet-mesic forest (20.2ha), lake dune (8.1ha), lake beach (4.8ha), and pine plantation (1.2ha). Two large cedar swamps occur in the northern half of the forest.

Soils are predominantly sand, with layers of organic muck in the swales and cedar swamps. Molash Creek, about 5.6km long, runs through southern portions of the forest into Lake Michigan.

The distinctive ridge and swale topography features a diversity of common and rare plant species, including a variety of shrubs, grasses, forbs, ericads—such as trailing arbutus, and several native orchids. On the upper beaches and dunes, sand reed, beach grass, beach pea, and clustered broom-rape are dominant, with three endangered and threatened species also present: dune-willow (endangered), dune thistle (threatened), and thickspike wheatgrass (threatened).

A variety of mammals occurs here, including white-tailed deer, red fox, grey squirrel, cottontail rabbit, raccoon, skunk, porcupine, and chipmunk. But, campers and hikers beware, the site is renowned for its mosquitoes.

Woodland Dunes, a 303ha privately held nature center, lies 3.2km south of Two Rivers and 3.2km inland. From a landscape perspective, it has been linked by BER's Natural Heritage Section to the Point Beach Ridges State Natural Area and described as the "Point Beach Ridges-Woodland Dunes Macrosite." Woodland Dunes, although not representative of a lake beach and dune

complex, contains many of the remarkable botanical and avian features of dune ridges and swales associated with the Point Beach State Forest. But there are also notable differences, particularly the presence of southern community elements.

Woodland Dunes has 9 different plant communities, including wet-mesic southern hardwoods, mesic northern hardwoods, shrub-carr, dry meadow, wet meadow, sedge meadow, emergent aquatic, conifer plantation, and agricultural (Steffen 1979). The similarities and differences in birdlife from that found at Point Beach are mentioned below.

Birds. During the breeding season at Point Beach, on open dry beach, Killdeer nest, American Crow and Common Grackle feed on dead alewives, and thousands of Ring-billed Gulls and scores of Herring Gulls loaf. A few Canada Geese, too, may loaf along stretches of upper sand beach. Ring-billed Gulls and Caspian Terns commonly forage in near-shore waters. Bonaparte's Gull sometimes occurs along the shore as well. Rarely observed at Point Beach during summer is the Common Tern. These species have also been recorded at Woodland Dunes, although the terns mostly in low number or rarely.

Other shorebirds observed (uncommonly to rarely) during the breeding season along the beach at Point Beach include: Black-bellied Plover, Ruddy Turnstone, Sanderling, and Dunlin. None of these typically coast-loving species have been observed at Woodland Dunes during summer.

Shorebirds and birds not observed at Point Beach but recorded at

Woodland Dunes during summer due to the abundance of wetland habitats are: Common Loon (rarely), Black-crowned Night-Heron (rarely), American Bittern, Least Bittern, Blue-winged Teal, Green-winged Teal, Wood Duck, Osprey (rarely), Northern Harrier, Common Gallinule (rarely), American Coot, Virginia Rail, Sora, American Woodcock, Common Snipe, Upland Sandpiper, Greater Yellowlegs (rarely), Wilson's Phalarope (rarely), Little Gull (very rare), Marsh Wren, and Yellow-headed Blackbird.

In sand reed-beach grass-beach pea strand and foredune habitats at Point Beach, Savannah Sparrow and Spotted Sandpiper sometimes occur. Spotted Sandpiper also frequents the sandy edges of Molash Creek near Lake Michigan. Savannah Sparrow is much more abundant at Woodland Dunes, where it occurs in agricultural and grass habitats and sedge meadow. Northern Flicker, Purple Martin (in low number and infrequently), Tree Swallow, Northern Rough-winged Swallow, Cliff Swallow (rarely), Barn Swallow, and American Goldfinch have been observed foraging in and over foredunes and backdunes, including dune copse, and along forested dune edges bordering open backdunes. Eastern Bluebird, Bobolink, and Eastern Meadowlark (rarely) occur in low number in mixed grass and shrubby backdunes. Clay-colored Sparrow and (rarely) Field Sparrow occur in low, brushy backdunes. Northern Harrier, Western Meadowlark, Dickcissel, Grasshopper Sparrow, Henslow's Sparrow, and Vesper Sparrow, all documented in grass habitats at Woodland Dunes, have not been re-

corded at Point Beach.

Horned Lark (in low numbers), Rock Dove, and Common Nighthawk occur at Woodland Dunes during summer but have not been observed during breeding bird surveys at Point Beach.

The Great Blue Heron, Green Heron, Black Duck, Mallard, Belted Kingfisher, and Red-winged Blackbird have been observed at Molash Creek near the sandy outlet on Lake Michigan. Except for Black Duck and Baltimore Oriole, these same species have also occurred in marsh habitats at Woodland Dunes. American Redstart, Common Yellowthroat, Song Sparrow, and American Goldfinch have also occurred at Molash Creek in shrubby thickets. Baltimore Oriole occurred once at the creek edge.

Seldom observed in flight over forested dune edges at Point Beach is American Kestrel (found at Woodland Dunes in low number), and Turkey Vulture, a species not recorded at Woodland Dunes. Also inhabiting shrubby dune edges and dune copse are Eastern Kingbird, Gray Catbird, Black-capped Chickadee, Eastern Towhee, and Song Sparrow.

In wooded dune ridge habitats at Point Beach, Great Crested Flycatcher, Veery, Red-eyed Vireo, Ovenbird, and Black-throated Green Warbler commonly occur (all in white pine-red pine-white birch); in red maple-hemlock-cedar occur Veery, Scarlet Tanager, Common Grackle, Eastern Wood Pewee, and Chimney Swift (rarely); in white pine-hemlock-white birch commonly occur Ovenbird, Red-eyed Vireo, Black-throated Green Warbler (in

hemlock), and occasionally Magnolia Warbler; and in northern white cedar-white birch ridge, with scattered hemlock, commonly occur Ovenbird, Red-eyed Vireo, and Veery. In canopy openings occur Northern Flicker, Indigo Bunting, Eastern Wood-Pewee, Least Flycatcher, Great Crested Flycatcher, American Robin, House Wren, Chestnut-sided Warbler, Eastern Towhee, Song Sparrow, and House Finch (the latter 5 also along wooded dune edges bordering open dunes).

Other species observed in mixed-wooded dune ridges include: Merlin (rarely), Ruffed Grouse, Wild Turkey (rarely), Mourning Dove (also in dune copse and along Molash Creek), Black-billed Cuckoo, Downy Woodpecker, Hairy Woodpecker, Pileated Woodpecker, Blue Jay, American Crow, Black-capped Chickadee, Red-breasted Nuthatch, White-breasted Nuthatch, Brown Creeper, Blue-gray Gnatcatcher (recorded only once; typically a southern mesic to wet-mesic forest bird), Wood Thrush (rarely), Cedar Waxwing, European Starling (rare), Yellow-throated Vireo (rarely), Solitary Vireo (uncommon and in low number; not recorded at Woodland Dunes), Magnolia Warbler, Yellow-rumped Warbler, American Redstart, Hooded Warbler (recorded only once), Northern Cardinal, Rose-breasted Grosbeak, Chipping Sparrow, White-throated Sparrow, Brown-headed Cowbird, and House Sparrow.

In moist to wet forested swales at the Point Beach Ridges Natural Area occur the Red-shouldered Hawk, Barred Owl, Ruby-throated Hum-

mingbird (rarely), Olive-sided Flycatcher, Alder Flycatcher (alder/shrub thickets), Nashville Warbler, Yellow Warbler, Common Yellowthroat, Northern Waterthrush, Canada Warbler, Veery, and American Goldfinch. In black ash swales occur Scarlet Tanager and American Redstart. In hemlock-cedar-black ash swales are Chimney Swift, Veery, Black-throated Green Warbler, Blackburnian Warbler, Mourning Warbler, and Common Grackle. Also occurring are: Canada Warbler, Winter Wren (uncommon), Sedge Wren, Northern Waterthrush (in cedar swale), Yellow-rumped Warbler, Black-throated Green Warbler, Blue Jay (in cedar swale), House Wren and House Finch (in open black ash swale), Song Sparrow (in alder thickets), Swamp Sparrow, and White-throated Sparrow. Along swale edges and openings occur Black-and-White Warbler, Blue Jay, Northern Waterthrush, Indigo Bunting, Great Crested Flycatcher, American Crow, Common Yellowthroat, Barn Swallow, American Robin, and Eastern Towhee.

All of these dune ridge and swale birds have been documented in ridge and swale habitats at Woodland Dunes as well (Steffen 1979). In addition, some species typically occurring in, or restricted to, southern Wisconsin have been recorded at Woodland Dunes. These include: Yellow-billed Cuckoo, Acadian Flycatcher (rarely), Willow Flycatcher, White-eyed Vireo, Blue-winged Warbler, Cerulean Warbler, and Louisiana Waterthrush, as well as Blue-gray Gnatcatcher and Hooded Warbler. The Sharp-shinned Hawk, Gray Partridge, Great Horned Owl, Whip-

poor-will, Red-headed Woodpecker, Yellow-bellied Flycatcher, Golden-crowned Kinglet, Ruby-crowned Kinglet, Blue-winged Warbler, Northern Parula Warbler, Connecticut Warbler, Purple Finch, Brewer's Blackbird, and White-crowned Sparrow also absent from Point Beach lake dune ridge and swale surveys examined for this paper, have occurred rarely at Woodland Dunes. More common at Woodland Dunes, but not observed at Point Beach: Red-tailed Hawk, Broad-winged Hawk, Ring-necked Pheasant, Eastern Phoebe, Brown Thrasher, Warbling Vireo, and Golden-winged Warbler.

The most rare of all Woodland Dunes' sightings was that of a Carolina Wren in 1976 (Steffen 1979), a rare occurrence anywhere in Wisconsin.

Whitefish Dunes State Park—Size. About 162ha +, including the 92.9ha Whitefish Dunes State Natural Area.

Location. South of Cave Point on Lake Michigan in eastern Door County (T28N R27E S2,3,10).

Access. From Sturgeon Bay take Hwy 57 northeast through the town of Institute; then 1.6 km (1 mile) northeast of Valmy take Clark Lake Road directly east and northeast to the park entrance.

Site Description. Tans and Dawson (1980) described the area as containing "the best developed open and stabilized Lake Michigan sand dunes and high quality beach in the state." This, despite the fact that roughly one-half of the historic beach/lake dune system has been compromised by human development. A rich assemblage of plant species, several restricted to Great

Lakes' coasts, occurs in active and stabilized dunes. Many species found here represent a broad array of community types, including: lake beach, lake dune, dry-mesic, mesic, and wet-mesic prairie, bracken grassland, oak barrens, southern dry forest, southern wet forest, northern dry forest, northern dry-mesic forest, northern mesic forest, northern wet-mesic forest, northern wet forest, southern wet forest, shrub carr, cedar glade, and even boreal forest.

The Whitefish Dunes State Natural Area features 47.3ha of northern mesic forest dominated by beech and sugar maple, with balsam fir, white pine, hemlock, white birch, yellow birch, red oak, white cedar, hornbeam (*Ostrya virginiana*), and mountain maple (*Acer spicatum*). Round-leaved dogwood (*Cornus rugosa*), beaked hazelnut (*Corylus cornuta*), choke cherry (*Prunus virginiana*), and bristly black currant (*Ribes lacustre*) are predominant in the shrub layer on old dune ridges in northern and northeastern portions of the natural area. There are also 26.7ha of lake dune parallel to the shore, 14.1ha of northern wet-mesic forest (white cedar, fir, and hemlock) northeast of the northern mesic forest, 3.2ha of beach, and 1.6ha of northern sedge meadow bordering Clark Lake in the northern end of the park.

Also present is a large area of old field, mixed conifers-hardwoods, and grazed woods dominated by white cedar, fir, mountain maple, and white birch in the southern portions of the park.

Nearly 3km of beach and lake dune extend beyond the Natural Area border southwest toward White-

fish Bay, but most of it has been altered by homes and roads. Rising lake levels are an omnipresent threat to beach and foredune erosion. The beach is unvegetated and heavily used during summer, but sea rocket and seaside spurge have occurred here and can colonize the beach, along with sand reed and beach grass.

Foredune grass, forb, and shrub species include: thickspike wheatgrass, beach grass, sand reed, Virginia wild-rye (*Elymus virginicus*), dune thistle, beach pea, white sage (western mugwort) (*Artemisia ludoviciana*), common milkweed, poison ivy, smooth rose, spreading dogbane (*Apocynum androsaemifolium*), Canada yew (rare), starry false Solomon's-seal, and red osier dogwood. Mountain maple, white birch, white cedar, and hemlock occur rarely on foredunes.

On the backside of foredunes grading into backdunes commonly occur: poison ivy and Canada yew, with wild sarsaparilla (*Aralia nudicaulis*), big-leaved aster (*Aster macrophyllus*), round-leaved dogwood, mountain maple, bush-honeysuckle, wild strawberry, sand cherry, pin cherry, bracken fern (*Pteridium aquilinum*), thimbleberry (*Rubus parviflorus*), and beach wormwood; rare are: yarrow, thimbleweed (*Anemone cylindrica*), sand cress, beaked hazelnut, mountain honeysuckle (*Lonicera dioica*), Canada mayflower (*Maianthemum canadense*), white sage, common milkweed, red osier dogwood, rough fleabane, bedstraw (*Galium* sp.), dwarf lake iris, evening primrose, choke cherry, smooth sumac (*Rhus glabra*), red raspberry (*Rubus strigosus*), buffalo berry (*Shepherdia cana-*

densis), sticky catchfly (*Silene antirrhina*), American highbush cranberry (*Viburnum trilobum*), the state threatened dune goldenrod, and sweet white violet (*Viola pallens*).

Among tree species on the backside of foredunes, paper birch, balsam fir, and sugar maple are abundant to common; yellow birch, balsam poplar, and quaking aspen are rare.

On backdunes, bush-honeysuckle, thimbleberry, and false Solomon's-seal are dominant; commonly occurring are: columbine (*Aquilegia canadensis*), white sage, wood strawberry (*Fragaria vesca*), common juniper, poison ivy, staghorn sumac (*Rhus typhina*), and yellow goat's beard (*Tragopogon pratensis*). The following species occur rarely: yarrow, smooth Juneberry (*Amelanchier laevis*), thimbleweed, sand cress, dwarf lake iris, common milkweed, American bittersweet (*Celastrus scandens*), red osier dogwood, beaked hazelnut, Canada wild-rye, mountain honeysuckle, white sweet clover, evening primrose, smooth Solomon's-seal (*Polygonatum biflorum*), pin cherry, choke cherry, American mountain ash (*Pyrus americana*), smooth sumac, bristly black currant, smooth rose, red raspberry, sticky catchfly, Canada yew, and lowbush blueberry (*Vaccinium angustifolium*).

Bigtooth aspen (*Populus grandidentata*) and paper birch occur commonly; occurring rarely in backdunes are red maple, yellow birch, and quaking aspen.

On stabilized backdune blowouts occur the co-dominants Canada bluegrass and orange hawkweed (*Hieracium aurantiacum*), with bracken fern and staghorn sumac

common; rare here are: thimbleweed, common milkweed, wild strawberry, common blackberry (*Rubus allegheniensis*), and yellow goat's beard.

In wooded dunes, mature American beech is dominant, with sugar maple, white pine, and eastern hemlock common. Canada yew dominates much of the eastern and northern dune slopes.

Birds. Nearly 20 years ago, Libby Zimmerman wrote: "*In May, Barred Owls and Pileated Woodpeckers called from the cedar swamp near Clark Lake. Brown Creepers seemed sporadic, but they probably bred there. Winter Wrens are easy to hear in spring migration, associated with low mats of yew, but have either disappeared or become silent by mid-June. Another forest bird observed in May only was the Hermit Thrush. The forest belongs most of all to the Ovenbird, which was the most abundant bird [in May-June 1976 and June 1977]. The other most abundant species were, in 1976, the Eastern Wood Pewee, Black-capped Chickadee, and Black-throated Green Warbler, and in 1977, the Red-eyed Vireo, Veery, American Redstart, and Black-capped Chickadee. Other typical deciduous forest birds are Broad-winged Hawk, Ruffed Grouse, Whip-poor-will, Great Crested Flycatcher, and Wood Thrush. Some interesting species to look for here are Cerulean, Chestnut-sided, and Canada Warblers.*" (Tessen 1979)

The birdlife is similar today, with the Ovenbird the most abundant bird encountered on breeding bird surveys. In general, the beech-dominated wooded dunes contain all of the species observed by Zimmerman, as well as: Chimney Swift, Downy Woodpecker, Hairy Woodpecker,

Northern Flicker, Pileated Woodpecker (rare), Blue Jay, American Crow, Red-breasted Nuthatch (rare), White-breasted Nuthatch, American Robin, Hermit Thrush, Cedar Waxwing, Warbling Vireo, Chestnut-sided Warbler, Yellow-rumped Warbler, Common Yellowthroat, Cerulean Warbler, Canada Warbler, Pine Warbler (rare), Black and White Warbler, Baltimore Oriole, Common Grackle, Brown-headed Cowbird, Scarlet Tanager, Rose-breasted Grosbeak, White-throated Sparrow, Chipping Sparrow, and American Goldfinch (edge).

To the west and southwest of the northern mesic forest, in partially wooded dune slopes occur Mourning Dove, Purple Martin, Tree Swallow, Cliff Swallow, American Crow, American Robin, European Starling, Brown Thrasher, House Wren, Northern Flicker, Warbling Vireo, Eastern Towhee, American Goldfinch, American Redstart, and Indigo Bunting. In backdune grassland (old field), including dune copse, occur Purple Martin, Tree Swallow, Eastern Bluebird, Yellow Warbler, Indigo Bunting, Grasshopper Sparrow (rare), Clay-colored Sparrow, Common Grackle, and American Goldfinch.

Along the beach during summer occur loafing Ring-billed Gulls and Herring Gulls.

The most unlikely breeding season observation at Whitefish Dunes occurred on 15 June 1976: a lone Yellow-breasted Chat (BER files).

Long Island, Apostle Islands National Lakeshore—Size. About 5km long, within the National Park Service's

Apostle Islands National Lakeshore (AINL); 75–380m wide.

Location. Northern Ashland County on Lake Superior at the head of Chequamegon Bay (T49N R4W S13; T49N R3W S17,18,20).

Access. By motorboat, sea kayak, canoe (if waters are calm and weather favorable), or sailboat from Bayfield, Washburn, Ashland, or Madeline Island.

Site Description. Since 1975, Long Island has been connected to Chequamegon Point to form a long barrier spit. Long Island may become, as it has historically, a barrier island when separated from Chequamegon Point as a result of high water and severe storm surge. This site is comprised of 12 parallel sand ridges reaching 4.6m high that alternate with swales at or below lake level. Red pine, Hill's oak, and jack pine are dominant on dune ridges, with red pine and oak forest understory comprised mainly of common juniper, huckleberry (*Gaylussacia* sp.), lowbush blueberry, and bracken fern. Jack pine stands have an understory consisting mainly of common juniper, false-heather, bearberry, common hairgrass, sand cress, three-toothed cinquefoil (mountain white potentilla) (*Potentilla tridentata*), and reindeer lichen (*Cladonia rangiferina*). Swales are dominated by bluejoint (*Calamagrostis canadensis*), leatherleaf (*Chamaedaphne calyculata*), and fowl mannagrass (*Glyceria striata*), except at the island's northwest tip, where jack pine and willows (*Salix* spp.) predominate.

Sphagnum-sedge bogs on the island's bay side are characterized by sedges, ericads, sweet gale (*Myrica*

gale), insectivores, and sweet flag (*Acorus calamus*), with scattered white pines and tamaracks.

Interdunal pools at the island's western end are dominated by water-milfoil (*Myriophyllum heterophyllum*), with foxtail (*Alopecurus aequalis*), water star-grass (*Heteranthera dubia*), and rushes (*Juncus* spp.) and sedges (*Carex* spp.) dominating pool margins. Open dunes and swales are vegetated with grasses and willows (*Salix* spp.), and along the island's southern end, sweet gale. Dune copse of speckled alder, green ash (*Fraxinus pennsylvanica* var. *subintegerrima*), white birch, and quaking aspen are prominent along the island's southern end for about 1.6km, with dune-willow dominant on dune crests on the island's northern face, where jack pine and common juniper comprise a dune savanna inland.

The area known as the Sand Cut, which links Chequamegon Point to Long Island, has evolved over the past 20 years into a botanically rich wet sedge-and-rush meadow bordering a sand tombolo and ephemeral pools.

The National Park Service acquired approximately 200ha in 1986 and is responsible for management.

Birds. The island is renowned for attracting migrant shorebirds, several of which may be present during the breeding season as late spring or early fall migrants. The following have occurred on beaches, sandbars, ephemeral dune pools, and along edges and openings of the sandy Sand Cut sedge meadow: Black-bellied Plover, Lesser Golden Plover, Semipalmated Plover, Piping Plover (rare, formerly beach-nesting), Killdeer (beach-nesting, also present

regularly in foredunes), Greater Yellowlegs (uncommon), Lesser Yellowlegs, Willet, Spotted Sandpiper (foredune-nesting), Upland Sandpiper, Whimbrel, Hudsonian Godwit (rare), Marbled Godwit (rare), Ruddy Turnstone, Red Knot (rare), Sanderling, Semipalmated Sandpiper, Least Sandpiper, White-rumped Sandpiper (rare), Baird's Sandpiper, Pectoral Sandpiper (rare), Buff-breasted Sandpiper (rare), Dunlin, Short-billed Dowitcher, Long-billed Dowitcher (early May and October only—Sam Robbins, pers. comm.), Common Snipe, and Wilson's Phalarope (rare, dune pool only).

Loafing on beaches at the island's northern and southeastern ends commonly are Canada Geese (particularly in late summer), Red-breasted Mergansers, Common Mergansers, Ring-billed Gulls, Herring Gulls, Caspian Terns, Common Terns, infrequently Bonaparte's Gulls (late spring); and also in late summer, occasionally Black Terns, Bonaparte's Gulls, and immature Double-crested Cormorants. Rare waterbird sightings along the shore have included Franklin's Gull, American White Pelican, immature White-winged Scoter, and Brant.

Savannah Sparrows occur regularly in *Ammophila/Lathyrus* habitats during summer, Horned Larks occasionally. Eastern Bluebird occurs infrequently in backdunes, sometimes in savanna-like openings. Indigo Bunting occurs occasionally in shrubby backdunes and along mixed forest edges. Western Meadowlark was observed once in backdune grasses. In dune copse occasionally occur American Redstart, Red-eyed Vireo, Nashville Warbler, Black-

throated Green Warbler, Song Sparrow, and Chipping Sparrow. Northern Harrier and sometimes Merlin infrequently hunt over dunes and the Sand Cut sedge meadow. Northern Flickers, Tree Swallows, Cliff Swallows, Northern Rough-winged Swallows, and Barn Swallows forage along the shoreline and in or over dune habitats. Common Grackles forage along the shore and in the Sand Cut area.

Yellow Warbler, Common Yellowthroat, Red-winged Blackbird, and Song Sparrow inhabit shrubby thickets adjacent to the sedge meadow. Yellow-headed Blackbird occurs rarely in the Sand Cut sedge meadow. A lone Great Blue Heron sometimes forages in the ephemeral sand pools adjacent to the sedge meadow, an area that regularly attracts immature and subadult Bald Eagles. Mallard, American Black Duck (uncommon), Green-winged Teal, Blue-winged Teal, and Gadwall also are sometimes present in the ephemeral pools, rarely Common Pintail. Observed near shore have been Common Loon, American Wigeon, Redhead, Lesser Scaup, Greater Scaup, and Redhead.

Among mixed coniferous-deciduous forested dune ridges during the breeding season occur Veery, Red-eyed Vireo, Black-throated Green Warbler, Ovenbird, American Redstart, Nashville Warbler, Common Yellowthroat, Yellow Warbler, Black-billed Cuckoo, Ruby-throated Hummingbird, Winter Wren, Hairy Woodpecker, Downy Woodpecker, Eastern Kingbird, Great Crested Flycatcher, Eastern Phoebe (nesting under eaves at interior cabin), Eastern Wood-Pewee, Song Sparrow, White-

throated Sparrow, Chipping Sparrow, Pine Siskin, Merlin (uncommon), Sharp-shinned Hawk (rare), Broad-winged Hawk, Turkey Vulture (uncommon), Long-eared Owl (rare), Ruffed Grouse (uncommon), Blue Jay, Northern Raven, American Crow, Black-capped Chickadee, Red-breasted Nuthatch, Brown Creeper, American Robin, Wood Thrush, Cedar Waxwing, Baltimore Oriole (among Hill's oak), Brown-headed Cowbird, Rose-breasted Grosbeak, Indigo Bunting, and Eastern Kingbird, in scrubby openings and dune copse, and Belted Kingfisher along edges.

In wet swales, bogs, and alder thickets occur Winter Wren (uncommon), Gray Catbird, Veery, Red-eyed Vireo, Common Yellowthroat, American Redstart, Yellow Warbler, Yellow-rumped Warbler, Black-throated Green Warbler, Blackburnian Warbler (uncommon), Tennessee Warbler (rare), Palm Warbler (rare), Golden-winged Warbler (uncommon), Chestnut-sided Warbler, Nashville Warbler, Alder Flycatcher, American Goldfinch, Song Sparrow, Chipping Sparrow, White-throated Sparrow, Red-winged Blackbird, Brown-headed Cowbird, Eastern Kingbird, Barn Swallow, Cedar Waxwing, and Common Grackle.

Outer Island Sandspit, Apostle Islands National Lakeshore—Size. 93.7ha: lake dunes and beach: 29.1ha; pine savanna: 19.4ha; northern dry forest: 4.8ha; shallow lagoon: 21.8ha; open bog: 18.6ha.

Location. Northeastern Apostle Islands (T52N R01W S2,3,10,11), about 34km from Bayfield on Lake Superior.

Access. By motorboat, sea kayak, or sailboat from Bayfield or from within the Apostle Islands.

Site Description. The sandspit extends north-south for about 2.4km. A narrow, unvegetated beach (3–6.1m wide) borders Lake Superior on the west and grades into a low foredune, 9.1–21.3m wide, stabilized by beach grass and beach wormwood; pines stand to the east. The beach on the east shore of the spit is slightly wider and lies adjacent to low dunes and swales. Vegetated portions of the east beach contain beach grass and scattered driftwood.

Foredune species include, in addition to beach grass and beach wormwood: Canada wild-rye, evening primrose, common horsetail (rare), sand cress (rare), scouring rush (*Equisetum* sp.), common juniper, beach pea, sand cherry, sandbar willow (rare), and balsam poplar (rare).

The rear side of the foredune grades into the first swale and second dune. The swales here are shallow and the dune field low and rolling. The central portion of the sand spit's dune field borders mixed coniferous woods to the east; northward it grades into a brush zone bordering the lagoon, and south it extends across a narrow spit. Beach grass and beach wormwood occur in central portions, but in fewer numbers, and they are interspersed in a more diverse vegetation that features several low shrubs, presenting a heath-like appearance. Other species include common hairgrass, slender wheat grass (*Agropyron trachycaulum*), ticklegrass, short-leaf fescue (*Festuca saximontana*), three-toothed cinquefoil, Canada wild-rye, Canada bluegrass, Canada hawkweed (*Hieracium cana-*

dense), sticky hawkweed (*H. scabrum*), false-heather, bearberry, bastard toadflax, fireweed, quack grass, sand cress, thick-leaved wild strawberry (*Fragaria vesca*), common juniper (dominant on central backdunes), sand cherry, pin cherry, and joint-tweed (*Polygonella articulata*).

North of the dunes, a white pine-dominated savanna with several small openings occurs; red and jack pine are prominent. Reindeer-moss lichens (*Cladonia* spp.) carpet the sand, especially *C. mitis* and *C. rangiferina*. Also commonly occurring in the barrens-like openings are: pearly everlasting (*Anaphalis margaritaceae*), spreading dogbane, bearberry, beach wormwood, *Carex* sp., bastard toadflax, poverty oat grass (*Panthonia spicata*), common hairgrass, fescue, Canada hawkweed, sticky hawkweed, beach heath, common juniper, cow wheat (*Melampyrum lineare*), panic grass (*Panicum columbianum*), three-toothed cinquefoil, and lowbush blueberry.

In sheltered interior woods that lie to the east occur white spruce, balsam fir, red maple, and paper birch. Together with pine savanna elements, a total of 75 species of vascular plants and lichens have been documented, including 21 species of lichens. Southeast of the pine savanna lies a mature stand of red pine.

On the sandy margins of the shallow lagoon occur rushes (*Juncus canadensis* and *J. pelocarpus*), bulrush (*Scirpus torreyi*), spike-rushes (*Eleocharis smallii* and *E. robbinsii*), three-way sedge (*Dulichium arundinaceum*), sweet gale, lance-leaved violet (*Viola lanceolata*) and creeping spearwort (*Ranunculus reptans*); southwest from

the lagoon pole-sized white pine and paper birch occur. The southern and southeastern ends of the lagoon are contiguous to an open sphagnum-sedge bog mat with Labrador-tea (*Ledum groenlandicum*), leatherleaf, bog-rosemary (*Andromeda glaucophylla*), and bog-laurel (swamp laurel) (*Kalmia polifolia*) present, and tamarack, paper birch, white pine, and black spruce occurring along the edges.

South of the lagoon, four small, isolated swales within the mixed coniferous forest support a bog-marsh flora that features occasional hummocks of sphagnum moss.

Birds. During the breeding season at the southern end of the sand spit, on sand beach and gravel bars, loaf Double-crested Cormorants, Red-breasted Mergansers, Common Mergansers, Bonaparte's Gulls (rare), Herring Gulls (which nested unsuccessfully here in 1974, 1976, and 1979), and Ring-billed Gulls. Foraging along the open beach in late spring occur Ruddy Turnstone, Sanderling, Semipalmated Sandpiper, Least Sandpiper, Dunlin, and Killdeer. Occasionally observed at this time may be Black-bellied Plover, Lesser Golden Plover, Semipalmated Plover, Greater Yellowlegs, and Baird's Sandpiper. Very rare is the Hudsonian Godwit, recorded here only once—26 May 1977 (Harris and Jaeger 1978). Killdeer occasionally nest on open gravel-sand beach in the upper reaches of the strand.

Harris and Jaeger (1978) recorded Bank, Northern Rough-winged, and Barn Swallows nesting on south Outer, the latter species observed

nesting in an abandoned fisherman's shack that no longer stands.

Spotted Sandpiper nest in fore-dune areas and rarely in heath-like backdunes. Rarely occurring in grassy backdunes is either meadowlark species. In shrubby pine savanna edges occur Song Sparrow, and in mixed pines, Chipping Sparrow. American Woodcock may nest in open areas adjacent to or within pine savanna.

Rare migrant passerines—documented as late as 28 May—that have occurred on the spit include American Pipit and Lapland Longspur, and a male Chestnut-collared Longspur in breeding plumage was observed on 27 May 1976 (Harris and Jaeger 1978).

Turkey Vulture, Bald Eagle, Northern Harrier, Sharp-shinned Hawk, Cooper's Hawk, Broad-winged Hawk, Red-tailed Hawk, and American Kestrel are occasionally observed in late May and/or early June in flight over the sand spit. Merlins regularly forage along strand and dune habitats, sometimes no more than 3m above the substrate. On 2 June 1991, I found a Merlin nest 2m from the top of a pole-sized, 15m-tall white pine. The nest was comprised of white and red pine boughs and sticks; it contained 4 eggs. The nest tree stood on a narrow sand ridge dominated by white pine and white birch, located just south of the lagoon, approximately 60m east of the lake shore.

In the spit's conifer-dominated mixed woodlands occur Mourning Dove (rare), Barred Owl (rare), Broad-winged Hawk (uncommon), Red-tailed Hawk (rare), Eastern Wood-Pewee, Veery (occasionally), Hermit Thrush, Wood Thrush,

American Robin, Cedar Waxwing, Red-eyed Vireo, Nashville Warbler, Chestnut-sided Warbler, Yellow-rumped Warbler, Black-throated Green Warbler, Blackburnian Warbler, American Redstart, Ovenbird, Purple Finch, Eastern Towhee (typically in jack pine), Dark-eyed Junco (rare), and Chipping Sparrow (usually in red pine).

Along the wooded/shrubby margins of bog and lagoon occur Alder Flycatcher, Common Yellowthroat, Yellow Warbler, Nashville Warbler, American Redstart, Canada Warbler, rarely Wilson's Warbler (which may be a late migrant or could conceivably nest here), Song Sparrow, Swamp Sparrow, White-throated Sparrow, and Red-winged Blackbird. A pair of Common Loons nested on the lagoon ("South Pond") in 1976 (Harris and Jaeger 1978). And Harris and Jaeger noted the presence of a LeConte's Sparrow on the lagoon on 28 May 1976 and earlier during May in 1976 and 1977.

Wisconsin Point—Size. About 4km long and 121.2ha in size.

Location. Northeast of the city of Superior at the northern extremity of Douglas County (T49N R13W S27,28,34,35). Wisconsin Point is bordered by Allouez Bay to the southwest and Lake Superior to the northeast. Together with the adjacent Minnesota Point, Wisconsin Point separates Lake Superior from the Duluth-Superior Harbor and the mouth of the St. Louis River.

Access. From east of Superior on Hwys 2 and 53, turn east onto Moccasin Mike Road. Follow this road for about 3.2km (2 miles) at which point

it curves northwest toward Allouez Bay and Lake Superior.

Site Description. A long, narrow barrier spit with broad, unvegetated beaches (10–20m wide) and low broken sand dunes, about 2–3m above lake level and dominated by beach grass and beach pea, occurs on the lake side. Other common dune species here include sand cherry, beach wormwood, wild-rye, evening primrose, false heather, bearberry, thick-leaved wild strawberry, common milkweed, and jointweed. Balsam poplar, white birch, green ash, and willow shrubs dominate backdune edges in patches. Pines are planted in backdunes near the west end.

The bay side is vegetated to the water's edge, except for a narrow, disturbed beach at the western end. Along the brushy water's edge occur speckled alder, sweet gale, swamp birch (*Betula pumila*), and willows (*Salix* spp.). A northern dry-mesic forest featuring mature red and white pine dominates central areas, with paper birch, white spruce, and red maple intermixed. Beaked hazel is dense and dominates the shrub layer, with mountain maple dominant in some areas.

Several moist swales occur parallel to the long axis of the spit. Boreal elements include white spruce and white cedar. A 1ha interdunal wetland behind the backdunes near the northwestern tip of Wisconsin Point, and adjacent to an alder thicket, supports a large population of the rare marsh grass-of-parnassus and variegated scouring rush; other characteristic species include sedges *Carex aurea* and *Carex viridula*, smooth scouring rush (*Equisetum laevigatum*), wire-rush, beak-rush (*Rhynchospora*

capitellata), fowl-mannagrass, common flat-topped goldenrod (*Solidago graminifolia*), sweet gale, swamp-birch, and willows (*Salix* spp.).

A blacktop road traverses the entire length of the point's bay side and passes planted pines, including Scotch pine. Weedy species predominate along the roadside; there are dense patches of poison ivy, common horsetail, and common scouring rush (*E. hyemale*) present. Management here should include closings of some turn-outs to prevent further human disturbance, which can be heavy at times, largely due to the site's proximity to urban areas.

A U.S. Coast Guard Station and breakwaters occur at the site's western end. The breakwaters may affect the longshore transport of sediments necessary for beach replenishment. This is a situation requiring further study to determine potential long-term impacts not only on the beach and dune communities but on tourism, for without the dunes and beaches the area would not receive the extensive visitation it does.

An open freshwater marsh, dominated by cattails and sedges (*Carex* and *Scirpus* spp.), with burreed (*Sparganium* spp.), water lillies (*Nuphar* and *Nymphaea* spp.), arrowhead (*Sagittaria latifolia*), rushes (*Juncus* spp.), and wild rice (*Zizania aquatica*), rims the southerly and eastward ends of Allouez Bay. Water is shallow here, about a meter deep, which allows for a fairly broad interspersed of emergent aquatics.

Birds. Due to its geographic location at the head of Allouez Bay on the extreme southwestern end of Lake Superior, this site, along with the adjacent Minnesota Point, serves

as a funnel for migrants and is one of the best sites in the state to watch waterfowl and shorebirds during spring and fall migration; hawks and passerines, too, may be numerous. Niemi *et al.* (1979) commented on the abundant passerine migration here and on Minnesota Point: "*In general, the sheer diversity of passerine species migrating through the [St. Louis River] estuary was rivaled by few areas in the upper midwest. During peak migration and when inclement weather 'grounded' migrants, the brush and wooded areas along Minnesota and Wisconsin Points were literally 'alive' with birds. . . . During transect counts . . . we often were forced to simply estimate the number of passerines (in terms of '100's') because it was impossible to count all individuals let alone identify them to species. The largest concentrations of passerines occurred during peak migration periods in mid to late May and once again in late August and early September. At these times, under proper weather conditions, thousands of passerines pass through the estuary.*"

Noteworthy records recorded from Wisconsin Point during migration include Pacific Loon, Red-throated Loon, Red-necked Grebe, White-winged Scoter, Black Scoter, Surf Scoter, Harlequin Duck, Oldsquaw, jaegers, Iceland Gull, Great Black-backed Gull, Thayer's Gull, Little Gull, Laughing Gull, Sabine's Gull, Black-legged Kittiwake, Glaucous Gull, Franklin's Gull, Arctic Tern, Red Knot, Buff-breasted Sandpiper, Whimbrel, Marbled and Hudsonian Godwits, Northern Phalarope, Red Knot, Stilt Sandpiper, Cassin's Kingbird, Parasitic Jaeger, Northern Mockingbird, Short-eared Owl, and

Hoary Redpoll (Tessen 1976, 1979; Niemi *et al.* 1977).

Niemi *et al.* (1979) listed 31 shorebird species, mainly on Wisconsin and Minnesota points, including peak migration counts in late May for Ruddy Turnstone (554), Semipalmated Sandpiper (1083), and Sanderling (261). The Piping Plover formerly nested on Wisconsin Point and across the bay on Barker's Island; it is now a rare migrant.

Common breeding season observations include Mallard (nesting in woody uplands adjacent to cattail-sedge marsh), Herring Gull and Ring-billed Gull, Common Tern—infrequently nesting on a sandy peninsula on the bay side, Northern Flicker, Eastern Kingbird, Tree Swallow foraging over dunes and along the beach, Blue Jay, Common Crow, House Wren, Gray Catbird, Brown Thrasher, American Robin, Veery, European Starling, Red-eyed Vireo, Warbling Vireo, Yellow Warbler, American Redstart, Nashville Warbler in mixed white pine-white birch stands and red pine-white pine stand edges, Yellow-rumped Warbler, Brewer's Blackbird—nesting in common juniper, Clay-colored Sparrow in heath-like backdune and pine openings on the lake side, House Sparrow, Baltimore Oriole, Common Grackle, Brown-headed Cowbird, American Goldfinch, and Chipping Sparrow; and Alder Flycatcher, Yellow Warbler, American Redstart, and Common Yellowthroat in speckled alder and other shrubs along marsh edges.

Additionally, on 2 July 1996, during a collection of terrestrial invertebrates with BER zoologist Bill Smith, I observed a territorial Spot-

ted Sandpiper amidst *Hudsonia tomentosa* in heath-like backdune (Figure 23), and found the remains of an eggshell.

A pair of Merlins has nested recently in white pine stands at the western end of the point, with the male observed several times during midsummer flying over adjacent dunes or perched on the forest edge (Eric Epstein, *in litt.*). In early July 1996, I observed an adult foraging at the point's western end.

Perhaps the rarest summer bird sighting on Wisconsin Point was of a Kentucky Warbler, observed by Robbye Johnson during a breeding bird survey on 27 June 1989. Robbye's comment (*in litt.*): "This bird was obviously way out of range and has not been seen since."

In the adjacent marsh of Allouez

Bay the following have been recorded during the breeding season: Common Loon, Double-crested Cormorant, Great Blue Heron, Common Snipe, Killdeer and Spotted Sandpiper (feeding along margins), Eastern Kingbird (feeding only), Red-winged Blackbird (nesting), Yellow-headed Blackbird (nesting), Black Tern (nesting in past years but absent as a breeding bird during recent surveys for the years 1994–1996), rarely Forster's Tern (no nesting recorded to date), Least Bittern, American Bittern, Mallard, Black Duck, Green-winged Teal, Blue-winged Teal (nesting), American Wigeon, Wood Duck, Canvasback, Virginia Rail (nesting), Sora (nesting), Tree Swallow, Barn Swallow (feeding only), Cliff Swallow (feeding only), Purple Martin (feeding only), Marsh Wren,



Figure 23. Heath-like backdune with a carpet of *Hudsonia tomentosa* at the west end of Wisconsin Point. (Photo by S.W. Matteson).

Sedge Wren, Common Grackle, Song Sparrow, and Swamp Sparrow.

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50 Years Ago in *The Passenger Pigeon*

Society members usually leave WSO annual meetings with a feeling of appreciation for the successful meeting and for the hospitality of the people hosting the event. The 1946 convention in Appleton is described in this issue.

The convention had on exhibit the plaster plaque of the Passenger Pigeon monument made by Earl Wright. Two of the talks were devoted to the Pigeon. A.W. Schorger spoke on the "History of the Passenger Pigeon in Wisconsin" and Aldo Leopold titled his talk "The Passenger Pigeon as a symbol of conservation." B.L. von Jarchow described methods of providing sites for bush-nesting birds and there was a presentation on how garden clubs go birding. There were movies of the birds of New York and Wisconsin and Irven Buss described his experiences with Pacific birds and radar. B.J. Breckenridge showed his film "Fraternizing with Feathers" after the banquet.

One action by the Board was to raise life memberships to \$50. (Excerpts from Volume 8, 1946)



Tree Sparrow by *Gerald H. Emmerich, Jr.*