Birds of Manitou Island, Keweenaw County, Michigan: Findings of the Manitou Island Bird Survey 2002-2009

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INTRODUCTION

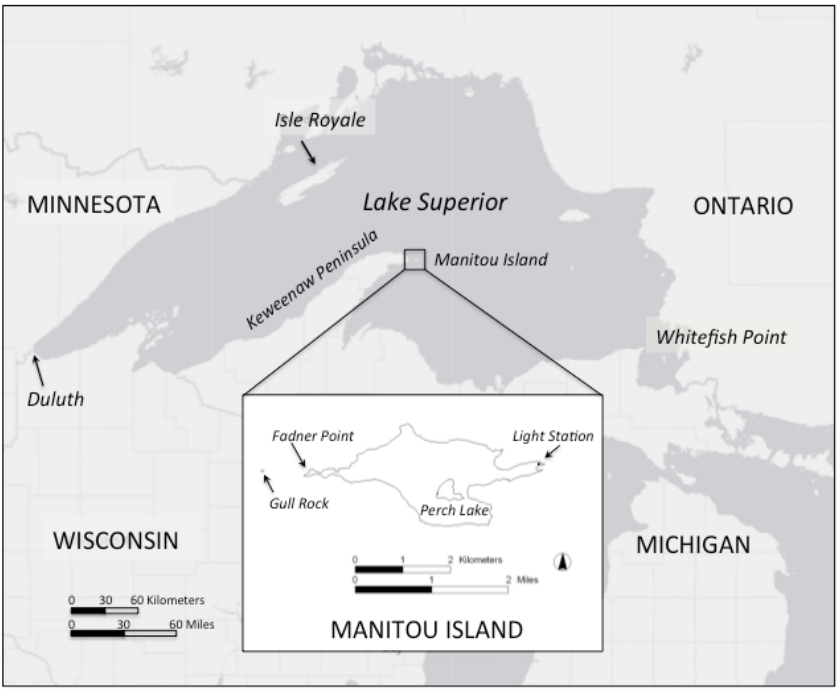
Millions of North American birds traverse the Western Hemisphere during their annual spring and fall migrations. The Great Lakes can present a formidable challenge to raptors and landbirds (i.e., passerines/near-passerines) navigating these huge inland seas, and as a result many are forced to concentrate along the shoreline and offshore islands during migration (Perkins 1964, Wormington et al. 1986, Diehl et al. 2003). These *de facto* stopover areas may provide critical resources to enable birds to continue their long journeys (Macdade et al. 2011). As many species, especially neotropical migrants, have experienced precipitous declines over the past half-century, their conservation, including the identification and protection of stopover areas utilized during migration, has become a top priority of federal, state, and non-profit conservation organizations (Ewert and Hamas 1995, Bonter et al. 2009).

The Keweenaw Peninsula, located in Michigan's western Upper Peninsula, is an ancient and massive series of basalt flows that extends approximately 60 mi (97 km) northeasterly into Lake Superior, the largest of the Great Lakes. As a result of its unique geography and isolated location within Lake Superior, the Keweenaw serves as a major migratory corridor for numerous migratory birds (Binford 2006). Notable among these flights is the spring movement of diurnal raptors, which follow updrafts along exposed ridges

to concentrate by the hundreds (and occasionally thousands) at the West Bluff of Brockway Mountain, near Copper Harbor and approximately 8.5 mi (14 km) from the tip of the peninsula (Peacock 1992a, b, Binford 2006). A similar, well-known concentration site for spring raptors on Lake Superior is Whitefish Point, located 130 mi (209 km) southeast of the Keweenaw Peninsula (Devereuxt et al. 1985).

Located approximately three mi (5 km) offshore in Lake Superior, Manitou Island represents the eastern terminus of the Keweenaw Peninsula (Figure 1). Though the geographic position of Manitou at the end of the Keweenaw suggests its potential significance as a migratory bird stopover site, ornithologists have visited previously only twice (Wood 1933, Binford 2006). In 2002, the authors and others initiated a survey to gain an understanding of the island's relative importance to breeding and migratory birds, and particularly to document raptor migration over the island and nearby Lake Superior. Our results indicate significant flights of diurnal raptors, waterbirds, and landbirds occurring at Manitou Island, with a total of 222 species documented during the survey period 2002-2009.

Figure 1. Map of Manitou Island, Keweenaw Co., Michigan, showing location in Lake Superior and proximity to the Keweenaw Peninsula.



METHODS

Study Site

Manitou Island is approximately 1000 ac (405 ha), and extends three mi (5 km) on its east/west axis and one mi (2 km) on its north/south axis. The western tip of the island, Fadner Point, lies almost three mi (5 km) from the easternmost tip of the Keweenaw Peninsula. Gull Rock, a small islet hosting little more than a lighthouse, is 0.5 mi (0.8 km) west of Fadner Point and was included in the survey area (Figure 1).

Unlike the topography of most of the Keweenaw Peninsula, Manitou Island is relatively flat, with the highest point less than 50 ft (15 m) above Lake Superior. The island is comprised of igneous basalt and sedimentary conglomerate rocks. There is no running water on the island, though 35 ac (14 ha) Perch Lake lies near its center. Most of Manitou's shoreline is composed of rocky outcrops, with the exception of two sandy beaches along the southwest shore. Two semi-sheltered bays are situated on the east end of the island, where the Manitou Island Light Station is located (Figure 1).

The majority of Manitou Island's overstory vegetation is comprised of boreal forest heavily populated with Balsam Fir (*Abies balsamea*), Paper Birch (*Betula papyrifera*), Mountain Maple (*Acer spicatum*), and Showy Mountain-ash (*Sorbus decora*) (Marr et al. 2009). White Spruce (*Picea glauca*), a dominant tree species in many boreal forests, is uncommon on Manitou Island, sometimes occurring as an emergent or super-canopy tree (Marr et al. 2009). White Pine (*Pinus strobus*), common on the adjacent mainland, is also notably absent on Manitou, and represented by only two known specimens located on opposite ends of the island (pers. obs.). Additional forest communities on Manitou include northern shrub thicket dominated by Tag Alder (*Alnus incana*), rich conifer swamps (associated with Perch Lake) dominated by Morthern White-cedar (*Thuja occidentalis*), and poor conifer swamps dominated by Black Spruce (*Picea mariana*) and Labrador Tea (*Ledum groenlandicum*) (Marr et al. 2009). The understory vegetation of Manitou is dominated by Canada Yew (*Taxus canadensis*), which thrives in the absence of large ungulates (i.e, White-tailed Deer [*Odocoileus virginianus* and Moose [*Alces alces*]) (Marr et al. 2009, pers. obs.). Open habitats on Manitou are restricted to the rocky shoreline and a small grassy yard associated with the light station on the east end of the island. The combination of shallow soils and frequent high winds has resulted in large areas of dense windfall, and when combined with the

dense yew renders overland travel at Manitou exceedingly difficult (Marr et al 2009, pers. obs.). Maintained trails on the island are limited to one path leading 0.8 mi (1 km) from the dock in the northeast bay to the light station managed by the Keweenaw Land Trust.

Survey Methods

From 2002-2009, twenty visits were made to Manitou Island for a total of 89 aggregate days of observation. The duration of visits varied from 2-17 days, with 1-5 observers, and occurred between the dates of 20 April and 8 October. During migration, the majority of observations were made from the east and west ends of Manitou Island. Observers opportunistically recorded all species encountered on the island, including the total number of individual birds. In addition to the east and west ends of the island, other localities regularly surveyed for birds included Perch Lake (where a rowboat is available), and the south and (more commonly) north shore during island traverses.

Stationary counts were used for surveying raptors and waterbirds. In general, counts were conducted in the early morning, and lasted for 3-8 hours depending upon the flight intensity. On the west end of Manitou (Fadner Point), the spring raptor count recorded all eastbound and westbound raptors crossing between Manitou and the mainland. Waterbird counts recorded all individuals observed flying between Manitou and the mainland on the west end (northerly in the spring and southerly in the fall), and all individuals moving southeast to northwest in the spring, or the mirror direction in the fall, past the lighthouse point on the east end.

In May 2007, raptors were observed from the east end of Manitou Island to determine if they attempted to cross Lake Superior. Individual raptors were recorded leaving the island and observed until they were either out of sight (via a spotting scope) or redirected westward and returned to Manitou. If a raptor did not turn back and return to Manitou we considered it to have attempted to make the crossing.

Surveys for breeding birds utilized the protocol of the Michigan Breeding Bird Atlas, which categorizes species' breeding status as Confirmed, Probable, Possible, or Observed depending on evidence of nesting or offspring, behavior, and other criteria (Brewer et al. 1991, Chartier et al. 2011). In 2002, in an attempt to establish breeding bird abundance and diversity, one of the authors (J. Youngman) conducted point counts. A total of 22 stations distributed at an average of 400-m intervals across the island (in order to

avoid overlap) were surveyed by recording all individuals seen or heard during a 10-min stationary count. All stations were visited during calm conditions on 18-20 June between 0530-1030 hours EDT.

RESULTS

A total of 222 species (including swan sp. and jaeger sp.) was encountered during the survey period 2002-2009 (Table 1). As predicted by its geographic position off the end of the Keweenaw Peninsula, a number of casual, accidental, and locally rare species were recorded, including Harlequin Duck (*Histrionicus histrionicus*), Arctic/Pacific Loon (*Gavia artica/ pacifica*)*, Snowy Egret (*Egretta thula*), Black Vulture (*Coragyps atratus*)*, Swainson's Hawk (*Buteo swainsoni*), California Gull (*Larus californicus*)*, Great Black-backed Gull (*Larus marinus*), Rock Pigeon (*Columba livia*), Yellow-billed Cuckoo (*Coccyzus americanus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), American Three-toed Woodpecker (*Picoides tridactylus*)*, Say's Phoebe (*Sayornis saya*)*, Scissor-tailed Flycatcher (*Tyrannus forficatus*)*, Carolina Wren (*Thryothorus ludovicianus*), Northern Mockingbird (*Mimus polyglottos*), Smith's Longspur (*Calcarius pictus*)*, Yellow-throated Warbler (*Setophaga dominica*), Prairie Warbler (*Setophaga discolor*), Field Sparrow (*Spizella pusilla*), Grasshopper Sparrow (*Ammodramus savannarum*), and House Sparrow (*Passer domesticus*).[1]

[1]Records of Michigan casual or accidental species, indicated with an asterisk, were reviewed and accepted by the Michigan Bird Records Committee.

Table 1. Species, mode of occurrence, and breeding status for 222 bird species recorded at Manitou Island on 20 visits (89 days of observation) between 2002-2009.

Species	Mode of occurrence [a]	Breeding status[b]
Canada Goose, *Branta canadensis*	transient	confirmed[c]
swan, *Cygnus* sp.	transient	
Wood Duck, *Aix sponsa*	transient	possible
Gadwall, *Anas strepera*	transient	
American Wigeon, *Anas americana*	transient	
American Black Duck, *Anas rubripes*	transient	observed
Mallard, *Anas platyrhynchos*	transient	possible
Blue-winged Teal, *Anas discors*	transient	possible
Northern Shoveler, *Anas clypeata*	transient	
Northern Pintail, *Anas acuta*	transient	
Green-winged Teal, *Anas crecca*	transient	observed
Redhead, *Aythya americana*	transient	
Ring-necked Duck, *Aythya collaris*	transient	
Greater Scaup, *Aythya marila*	transient	
Lesser Scaup, *Aythya affinis*	transient	
Harlequin Duck, *Histrionicus histrionicus*	transient	
Surf Scoter, *Melanitta perspicillata*	transient	observed
White-winged Scoter, *Melanitta fusca*	transient	
Long-tailed Duck, *Clangula hyemalis*	transient	
Bufflehead, *Bucephala albeola*	transient	
Common Goldeneye, *Bucephala clangula*	transient	possible
Hooded Merganser, *Lophodytes cucullatus*	transient	
Common Merganser, *Mergus merganser*	transient	confirmed
Red-breasted Merganser, *Mergus serrator*	transient	confirmed
Red-throated Loon, *Gavia stellata*	transient	
Arctic/Pacific Loon, *Gavia arctica/pacifica*	vagrant	
Common Loon, *Gavia immer*	transient	possible
Pied-billed Grebe, *Podilymbus podiceps*	transient	
Horned Grebe, *Podiceps auritus*	transient	
Red-necked Grebe, *Podiceps grisegena*	transient	
Double-crested Cormorant, *Phalacrocorax auritus*	transient	possible
American White Pelican, *Pelecanus erythrorhynchos*	transient	observed
American Bittern, *Botaurus lentiginosus*	transient	
Great Blue Heron, *Ardea herodias*	transient	observed
Snowy Egret, *Egretta thula*	vagrant	
Black Vulture, *Coragyps atratus*	vagrant	observed
Turkey Vulture, *Cathartes aura*	transient	possible
Osprey, *Pandion haliaetus*	transient	possible
Bald Eagle, *Haliaeetus leucocephalus*	transient	confirmed
Northern Harrier, *Circus cyaneus*	transient	
Sharp-shinned Hawk, *Accipiter striatus*	transient	possible
Cooper's Hawk, *Accipiter cooperii*	transient	
Northern Goshawk, *Accipiter gentilis*	transient	
Red-shouldered Hawk, *Buteo lineatus*	transient	observed
Broad-winged Hawk, *Buteo platypterus*	transient	possible

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Species	Mode of occurrence [a]	Breeding status[b]
Swainson's Hawk, *Buteo swainsoni*	vagrant	
Red-tailed Hawk, *Buteo jamaicensis*	transient	observed
Rough-legged Hawk, *Buteo lagopus*	transient	observed
Golden Eagle, *Aquila chrysaetos*	transient	
American Kestrel, *Falco sparverius*	transient	probable
Merlin, *Falco columbarius*	transient	probable
Peregrine Falcon, *Falco peregrinus*	transient	observed
Sandhill Crane, *Grus canadensis*	transient	
Black-bellied Plover, *Pluvialis squatarola*	transient	
American Golden-Plover, *Pluvialis dominica*	transient	
Semipalmated Plover, *Charadrius semipalmatus*	transient	
Piping Plover, *Charadrius melodus*	transient	
Killdeer, *Charadrius vociferous*	transient	possible
Spotted Sandpiper, *Actitis macularius*	transient	possible
Solitary Sandpiper, *Tringa solitaria*	transient	observed
Greater Yellowlegs, *Tringa melanoleuca*	transient	observed
Lesser Yellowlegs, *Tringa flavipes*	transient	observed
Upland Sandpiper, *Bartramia longicauda*	transient	
Whimbrel, *Numenius phaeopus*	transient	
Hudsonian Godwit, *Limosa haemastica*	transient	
Marbled Godwit, *Limosa fedoa*	transient	
Ruddy Turnstone, *Arenaria interpres*	transient	observed
Red Knot, *Calidris canutus*	transient	
Sanderling, *Calidris alba*	transient	
Semipalmated Sandpiper, *Calidris pusilla*	transient	observed
Least Sandpiper, *Calidris minutilla*	transient	
White-rumped Sandpiper, *Calidris fuscicollis*	transient	
Baird's Sandpiper, *Calidris bairdii*	transient	
Pectoral Sandpiper, *Calidris melanotos*	transient	
Dunlin, *Calidris alpina*	transient	observed
Stilt Sandpiper, *Calidris himantopus*	transient	
Wilson's Snipe, *Gallinago delicata*	transient	
American Woodcock, *Scolopax minor*	transient	confirmed
Bonaparte's Gull, *Chroicocephalus philadelphia*	transient	
Ring-billed Gull, *Larus delawarensis*	transient	possible
California Gull, *Larus californicus*	vagrant	
Herring Gull, *Larus argentatus*	transient	confirmed[c]
Great Black-backed Gull, *Larus marinus*	vagrant	
Caspian Tern, *Hydroprogne caspia*	transient	
Common Tern, *Sterna hirundo*	transient	
Forster's Tern, *Sterna forsteri*	transient	
jaeger, *Stercorarius sp.*	transient	
Rock Pigeon, *Columba livia*	vagrant	
Mourning Dove, *Zenaida macroura*	transient	possible
Yellow-billed Cuckoo, *Coccyzus americanus*	vagrant	

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Species	Mode of occurrence [a]	Breeding status[b]
Black-billed Cuckoo, *Coccyzus erythropthalmus*	transient	possible
Snowy Owl, *Bubo scandiacus*	transient	
Great Gray Owl, *Strix nebulosa*	transient	
Long-eared Owl, *Asio otus*	transient	
Short-eared Owl, *Asio flammeus*	transient	
Northern Saw-whet Owl, *Aegolius acadicus*	transient	
Common Nighthawk, *Chordeiles minor*	transient	observed
Eastern Whip-poor-will, *Caprimulgus vociferus*	transient	possible
Chimney Swift, *Chaetura pelagica*	transient	possible
Ruby-throated Hummingbird, *Archilochus colubris*	transient	possible
Belted Kingfisher, *Megaceryle alcyon*	transient	confirmed
Red-headed Woodpecker, *Melanerpes erythrocephalus*	vagrant	
Yellow-bellied Sapsucker, *Sphyrapicus varius*	transient	
Downy Woodpecker, *Picoides pubescens*	transient	
Hairy Woodpecker, *Picoides villosus*	transient	
American Three-toed Woodpecker, *Picoides dorsalis*	transient	
Black-backed Woodpecker, *Picoides arcticus*	transient	
Northern Flicker, *Colaptes auratus*	transient	
Pileated Woodpecker, *Dryocopus pileatus*	transient	
Olive-sided Flycatcher, *Contopus cooperi*	transient	possible
Eastern Wood-Pewee, *Contopus virens*	transient	possible
Yellow-bellied Flycatcher, *Empidonax flaviventris*	transient	probable
Alder Flycatcher, *Empidonax alnorum*	transient	probable
Least Flycatcher, *Empidonax minimus*	transient	possible
Eastern Phoebe, *Sayornis phoebe*	transient	
Say's Phoebe, *Sayornis saya*	vagrant	observed
Great Crested Flycatcher, *Myiarchus crinitus*	transient	possible
Eastern Kingbird, *Tyrannus tyrannus*	transient	possible
Scissor-tailed Flycatcher, *Tyrannus forficatus*	vagrant	
Northern Shrike, *Lanius excubitor*	transient	
Blue-headed Vireo, *Vireo solitarius*	transient	possible
Warbling Vireo, *Vireo gilvus*	transient	observed
Philadelphia Vireo, *Vireo philadelphicus*	transient	observed
Red-eyed Vireo, *Vireo olivaceus*	transient	probable
Blue Jay, *Cyanocitta cristata*	transient	possible
American Crow, *Corvus brachyrhynchos*	transient	probable
Common Raven, *Corvus corax*	transient	confirmed
Horned Lark, *Eremophila alpestris*	transient	
Tree Swallow,*Tachycineta bicolor*	transient	possible
No. Rough-winged Swallow, Stelgidopteryx serripennis	transient	
Bank Swallow, *Riparia riparia*	transient	
Cliff Swallow, *Petrochelidon pyrrhonota*	transient	possible
Barn Swallow, *Hirundo rustica*	transient	possible
Black-capped Chickadee, *Poecile atricapillus*	transient	confirmed
Boreal Chickadee, *Poecile hudsonicus*	transient	possible

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Species	Mode of occurrence [a]	Breeding status[b]
Red-breasted Nuthatch, *Sitta canadensis*	transient	probable
White-breasted Nuthatch, *Sitta carolinensis*	transient	
Brown Creeper, *Certhia americana*	transient	possible
Carolina Wren, *Thryothorus ludovicianus*	vagrant	
House Wren, *Troglodytes aedon*	transient	
Winter Wren, *Troglodytes hiemalis*	transient	confirmed
Sedge Wren, *Cistothorus platensis*	transient	
Golden-crowned Kinglet, *Regulus satrapa*	transient	confirmed
Ruby-crowned Kinglet, *Regulus calendula*	transient	possible
Eastern Bluebird, *Sialia sialis*	transient	possible
Veery, *Catharus fuscescens*	transient	possible
Gray-cheeked Thrush, *Catharus minimus*	transient	
Swainson's Thrush, *Catharus ustulatus*	transient	confirmed
Hermit Thrush, *Catharus guttatus*	transient	probable
Wood Thrush, *Hylocichla mustelina*	transient	
American Robin, *Turdus migratorius*	transient	probable
Gray Catbird, *Dumetella carolinensis*	transient	possible
Northern Mockingbird, *Mimus polyglottos*	vagrant	observed
Brown Thrasher, *Toxostoma rufum*	transient	observed
European Starling, *Sturnus vulgaris*	transient	observed
American Pipit, *Anthus rubescens*	transient	observed
Bohemian Waxwing, *Bombycilla garrulus*	transient	
Cedar Waxwing, *Bombycilla cedrorum*	transient	confirmed
Lapland Longspur, *Calcarius lapponicus*	transient	
Smith's Longspur, *Calcarius pictus*	vagrant	
Snow Bunting, *Plectrophenax nivalis*	transient	
Ovenbird, *Seiurus aurocapilla*	transient	probable
Northern Waterthrush, *Parkesia noveboracensis*	transient	possible
Black-and-white Warbler, *Mniotilta varia*	transient	probable
Tennessee Warbler, *Oreothlypis peregrina*	transient	possible
Orange-crowned Warbler, *Oreothlypis celata*	transient	
Nashville Warbler, *Oreothlypis ruficapilla*	transient	probable
Mourning Warbler, *Geothlypis philadelphia*	transient	possible
Common Yellowthroat, *Geothlypis trichas*	transient	probable
American Redstart, *Setophaga ruticilla*	transient	confirmed
Cape May Warbler, *Setophaga tigrina*	transient	observed
Northern Parula, *Setophaga americana*	transient	probable
Magnolia Warbler, *Setophaga magnolia*	transient	confirmed
Bay-breasted Warbler, *Setophaga castanea*	transient	observed
Blackburnian Warbler, *Setophaga fusca*	transient	possible
Yellow Warbler, *Setophaga petechia*	transient	observed
Chestnut-sided Warbler, *Setophaga pensylvanica*	transient	possible
Blackpoll Warbler, *Setophaga striata*	transient	possible
Black-throated Blue Warbler, *Setophaga caerulescens*	transient	possible
Palm Warbler, *Setophaga palmarum*	transient	observed

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Species	Mode of occurrence [a]	Breeding status[b]
Pine Warbler, *Setophaga pinus*	transient	
Yellow-rumped Warbler, *Setophaga coronata*	transient	confirmed
Yellow-throated Warbler, *Setophaga dominica*	vagrant	
Prairie Warbler, *Setophaga discolor*	vagrant	
Black-throated Green Warbler, *Setophaga virens*	transient	probable
Canada Warbler, *Cardellina canadensis*	transient	probable
Wilson's Warbler, *Cardellina pusilla*	transient	possible
American Tree Sparrow, *Spizella arborea*	transient	
Chipping Sparrow, *Spizella passerina*	transient	probable
Clay-colored Sparrow, *Spizella pallida*	transient	possible
Field Sparrow, *Spizella pusilla*	vagrant	observed
Vesper Sparrow, *Pooecetes gramineus*	transient	
Savannah Sparrow, *Passerculus sandwichensis*	transient	observed
Grasshopper Sparrow, *Ammodramus savannarum*	vagrant	observed
Le Conte's Sparrow, *Ammodramus leconteii*	transient	
Fox Sparrow, *Passerella iliaca*	transient	
Song Sparrow, *Melospiza melodia*	transient	possible
Lincoln's Sparrow, *Melospiza lincolnii*	transient	possible
Swamp Sparrow, *Melospiza georgiana*	transient	confirmed
White-throated Sparrow, *Zonotrichia albicollis*	transient	confirmed
Harris's Sparrow, *Zonotrichia querula*	transient	
White-crowned Sparrow, *Zonotrichia leucophrys*	transient	
Dark-eyed Junco, *Junco hyemalis*	transient	possible
Scarlet Tanager, *Piranga olivacea*	transient	possible
Rose-breasted Grosbeak, *Pheucticus ludovicianus*	transient	
Indigo Bunting, *Passerina cyanea*	transient	observed
Bobolink, *Dolichonyx oryzivorus*	transient	observed
Red-winged Blackbird, *Agelaius phoeniceus*	transient	possible
Eastern Meadowlark, *Sturnella magna*	transient	
Western Meadowlark, *Sturnella neglecta*	transient	obseved
Rusty Blackbird, *Euphagus carolinus*	transient	
Common Grackle, *Quiscalus quiscula*	transient	observed
Brown-headed Cowbird, *Molothrus ater*	transient	
Baltimore Oriole, *Icterus galbula*	transient	observed
Purple Finch, *Carpodacus purpureus*	transient	possible
Red Crossbill, *Loxia curvirostra*	transient	
White-winged Crossbill, *Loxia leucoptera*	transient	possible
Common Redpoll, *Acanthis flammea*	transient	
Pine Siskin, *Spinus pinus*	transient	possible
American Goldfinch, *Spinus tristis*	transient	possible
Evening Grosbeak, *Coccothraustes vespertinus*	transient	possible
House Sparrow, *Passer domesticus*	transient	observed

[a] Binford (2006)

[b] Brewer et al. (1991)

[c] Confirmed breeding on Gull Rock

Summer Residents

A total of 125 species were encountered during the summer months of June and July. Based on Michigan Breeding Bird Atlas classification criteria, 18 species were confirmed as breeding, 17 species were probably breeding, 55 species were possibly breeding, and 35 species were observed but not suspected of breeding (Table 1) (Brewer et al. 1991, Chartier et al. 2011). Birds in the latter category—representing 28% of summer residents recorded—were classified as such because they are vagrants (e.g., Say's Pheobe [*Sayornis saya*], Black Vulture [*Coragyps atratus*]), late transients (e.g., raptors and shorebirds [*Accipitridae* and *Scolopacidae*]), or lack of suitable breeding habitat on Manitou Island (e.g., Bobolink [*Dolichonyx oryzivorus*], Baltimore Oriole, [*Icterus galbula*]).

A total of 32 species (25% of summer residents) was recorded during 22 10-min point counts conducted in June 2002. The most common species encountered were Winter Wren (*Troglodytes hiemalis*), Nashville Warbler (*Oreothlypis ruficapilla*), White-throated Sparrow (*Zonotrichia albicollis*), American Crow (*Corvus brachyrhynchos*), Magnolia Warbler (*Setophaga magnolia*), Yellow-rumped Warbler (*Setophaga coronata*), and Red-eyed Vireo (*Vireo olivaceus*). These seven species comprised 68% of all birds encountered during point-count surveying (Table 2).

Table 2. Frequency and abundance of breeding species on Manitou Island recorded from 22 10-min point counts, 18-20 June 2002.

Species	Total individuals	# counts	% counts
Winter Wren	35	21	96
Nashville Warbler	33	19	86
White-throated Sparrow	16	12	55
American Crow	13	10	46
Magnolia Warbler	8	7	32
Yellow-rumped Warbler	8	7	32
Red-eyed Vireo	7	6	27
Alder Flycatcher	5	4	18
Black-capped Chickadee	5	4	18
Golden-crowned Kinglet	5	3	14
Red-breasted Nuthatch	4	4	18
American Redstart	4	3	14
Swainson's Thrush	4	3	14
Yellow-bellied Flycatcher	3	3	14
Blue Jay	3	2	9
Common Loon	3	2	9
Black-and-white Warbler	2	2	9
Black-throated Green Warbler	2	2	9
Least Flycatcher	2	2	9
Mourning Warbler	2	2	9
Blue-headed Vireo	1	1	5
Brown Creeper	1	1	5
Cedar Waxwing	1	1	5
Common Yellowthroat	1	1	5
Eastern Wood-Pewee	1	1	5
Evening Grosbeak	1	1	5
Northern Parula	1	1	5
Ovenbird	1	1	5
Pine Siskin	1	1	5
Ruby-throated Hummingbird	1	1	5
Song Sparrow	1	1	5
Veery	1	1	5

Raptor Migration

A total of 6,768 raptors (including 1250 unidentified) representing 15 species were observed crossing between the west end of Manitou Island and the Keweenaw Peninsula during 39 aggregate days of observation (264 hours total) between 22 April and 3 June (2002-2009). The most abundant species were Broad-winged Hawk (*Buteo platypterus*; n=2198), Sharp-shinned Hawk, (*Accipiter striatus*; n=1429), and Red-tailed Hawk, (*Buteo jamaicensis*; n=1067) (Table 3).

The majority of raptors (n=5,519, or 82% of the total) were observed heading west from Manitou Island toward the Keweenaw Peninsula. The percentage of westbound species varied by species, with Merlin (*Falco columbarius*) and Cooper's Hawk (*Accipiter cooperii*) the only species for which eastbound individuals were more common (Table 3).

Two additional raptor species that were not recorded crossing from Manitou's west end were observed on the east end of the island: Black Vulture (*Coragyps atratus*) and Swainson's Hawk, (*Buteo swainsoni*). While large numbers of migrating raptors were observed from the east end of Manitou, accurately determining their numbers proved difficult as many individuals circled the east end of Manitou without crossing Lake Superior; this was especially true for kettling species such as Broad-winged Hawk (*Buteo platypterus*), Red-tailed Hawk (*Buteo jamaicensis*), and Turkey Vulture (*Cathartes aura*). The largest number of raptors observed from the east end of Manitou occurred on 24 April 2006 when high counts for the 12 species recorded totaled 1,537 individuals, with Broad-winged Hawk representing 88% of the total.

From 13-18 May 2007 (28.5 total hours), a total of 974 individual raptors representing 13 species was recorded from Manitou's east end. Observations indicated four species—Rough-legged Hawk (*Buteo lagopus*; n=1), American Kestrel (*Falco sparverius*; n=3), Northern Harrier (*Circus cyaneus*; n=3), and Sharp-shinned Hawk (*Accipiter striatus*)—attempted to cross Lake Superior without returning to Manitou. Sharp-shinned Hawk was the most numerous with 79 individuals attempting to cross, 31 of which (39%) continued until out of view. Raptors leaving the eastern tip of Manitou Island typically headed in an easterly or northeast direction over Lake Superior.

Table 3. Eastbound and westbound diurnal raptors recorded crossing Lake Superior between Manitou Island's west end Fadner Point and the Keweenaw Peninsula from 2002-2009.

Species	Eastbound	Westbound	Total	% Westbound
Turkey Vulture	50	188	238	79
Osprey	2	2	4	50
Bald Eagle	31	170	201	85
Northern Harrier	26	32	58	55
Sharp-shinned Hawk	524	905	1429	63
Cooper's Hawk	2	1	3	33
Northern Goshawk	0	2	2	100
Unidentified *Accipiter*	50	22	72	31
Red-shouldered Hawk	0	1	1	100
Broad-winged Hawk	49	2149	2198	98
Red-tailed Hawk	86	981	1067	92
Rough-legged Hawk	46	95	141	67
Unidentified *Buteo*	253	788	1041	76
Golden Eagle	3	12	15	80
American Kestrel	36	76	112	68
Merlin	18	14	32	44
Peregrine Falcon	3	14	17	82
Unidentified falcon	17	6	23	26
Unidentified eagle	0	1	1	100
Unidentified raptor	53	60	113	53
Total	**1249**	**5519**	**6768**	**82**

Waterbird Migration

Spring waterbird counts were conducted on 47 aggregate days (389.75 hours total) between 23 April and 3 June (2002-2009). Spring waterbirds totaled 8,889 individuals of 25 species, with Canada Goose (*Branta canadensis*; n=4,757), Common Loon (*Gavia immer*; n=1,011), and Red-breasted Merganser (*Mergus serrator*; n=817) representing the most commonly recorded species.

Fall waterbird counts were conducted on 22 aggregate days (88.25 hours total) between 9 September and 8 October (2002-2009). Fall waterbirds totaled 11,167 individuals representing 21 species, of which 5,837 were unidentified, followed in abundance by Greater/Lesser Scaup (*Aythya marila/affinis*; n=1,948), Red-necked Grebe (*Podiceps grisegena*; n=1,808), and Common Loon (*Gavia immer*; n=407) (Table 4). The highest single-day total for waterbirds was recorded on 6 October 2009 with 3,422 and 999 individuals passing Manitou's east and west end, respectively.

Table 4. Results of spring and fall waterbird surveys 2002-2009 from stationary points on the east and west ends of Manitou Island.

Species	Spring	Fall
Canada Goose	4757	213
goose species	800	42
Wood Duck	1	0
Gadwall	7	2
American Wigeon	3	48
American Black Duck	4	2
Mallard	10	12
Blue-winged Teal	4	126
Northern Pintail	0	14
Green-winged Teal	16	12
teal species	24	50
Redhead	0	28
Ring-necked Duck	3	0
Greater Scaup	33	74
Lesser Scaup	9	1
scaup species	33	1948
Surf Scoter	2	9
White-winged Scoter	208	149
Dark-winged Scoter	2	3
Long-tailed Duck	185	0
Bufflehead	38	0
Common Goldeneye	30	25
Hooded Merganser	2	0
Common Merganser	48	4
Red-breasted Merganser	817	30
merganser species	111	181
Red-throated Loon	34	21
Arctic/Pacific Loon	1	0
Common Loon	1011	407
loon species	45	11
Horned Grebe	1	103
Red-necked Grebe	113	1808
Double-crested Cormorant	154	7
unidentified waterbird	383	5837
Total	**8889**	**11167**

Landbird Migration

A significant number of migrating landbirds (passerines and near-passerines) were recorded during the survey period at Manitou Island. The pattern of landbird migration was similar in both spring and fall; birds were observed arriving to the east end from Lake Superior after dawn for approximately two hours, and birds concentrated on the west end at Fadner Point, with individuals often observed leaving Manitou to continue westward to the mainland Keweenaw (e.g., 271 passerines leaving the west end on 1 June 2008 between 0610-1246 EDT). Diurnal migrants such as Blue Jay (*Cyanocitta cristata*), Black-capped Chickadee (*Poecile atricapilla*), American Robin (*Turdus migratorius*), blackbirds (Icteridae), and finches (Fringillidae) were often recorded flying to the east end from the interior and subsequently heading back west.

We noted several exceptionally high counts for landbirds at Manitou Island, including 129 Northern Flickers (*Colaptes auratus*) on 29 April 2004 and 81 flickers (in 4 hours) on 29 April 2006 (all leaving Manitou's west end for the mainland); 30 Yellow-bellied Flycatchers (*Empidonax flaviventris*) on 31 May 2008 (widely distributed though concentrated on the west end); ≥100 Ruby-crowned Kinglets (*Regulus calendula*) on 29 April 2004 (widely distributed though concentrated on west end); 5 Gray-cheeked Thrushes (*Catharus minimus*) on 20 September 2005 (east end); and 21 Rose-breasted Grosbeaks (*Pheucticus ludovicianus*) in a single flock on the west end (Binford [2006] incorrectly listed the location as east end) on 18 May 2007 (Binford 2006, Binford 2009).

The most exceptional flight of landbirds (mainly warblers and thrushes) recorded on Manitou Island occurred on 7 September 2009, when an estimated 22,500 to 45,000 individuals flew past the east end from Lake Superior. The event began shortly after dawn (0717 EDT) and lasted approximately 1.5 hours, at a rate of 250 (counted) to 500 (estimated) birds per minute; the flight peaked at approximately 0800 EDT. During the event very few migrants made landfall, instead continuing their flight westerly (presumably to Manitou's west end and/or the mainland Keweenaw), with many birds flying just above the surface of Lake Superior. Preceding this massive flight were several days of mild weather with a light west or southwest wind. By dawn on 7 September, winds had switched to the northwest. According to weather data, most of the region was under a high-pressure system, with an upper level front moving over Lake Superior

(Steven Fleegel, National Weather Service; pers. comm.). The lack of fallout conditions (i.e., inclement weather) suggests that the flight may have been associated with ideal conditions for a trans-Superior flight during the early September peak for neotropical passerine migration in Michigan's Upper Peninsula.

DISCUSSION

Summer residents on Manitou Island were typical for the region with a few exceptions. Notable was the absence of woodpeckers during the months of June and July despite 407 aggregate hours of observation over 17 days; six species of breeding woodpecker are found on the adjacent mainland and offshore on Isle Royale (Chartier et al. 2011). It is unclear whether the absence of woodpeckers is due to an insufficient habitat component, cool microclimate, high concentration of raptors, or some other factor.

Unusual potential breeding species encountered on Manitou Island during the summer season included singing Blackpoll Warblers (*Setophaga striata*) recorded in two locations on 19-20 June 2002 and a singing Wilson's Warbler (*Cardellina pusilla*) encountered on 18 June 2002. While these birds were found in suitable breeding habitat, their dates of occurrence did not preclude the possibility of late migrants. Wilson's Warbler is a rare and local breeding species in the Upper Peninsula and Blackpoll Warbler is not known to breed in Michigan (Chartier et al. 2011, Haas 2011).

Binford (2006) summarizes the raptor migration from mainland Keweenaw, primarily from Brockway Mountain, where Peacock's (1992a) observations indicated 15,033 eastbound and 7,191 westbound raptors, with almost all species indicating more eastbound individuals (the exceptions were Golden Eagle [*Aquila chrysaetos*] and Swainson's Hawk [*Buteo swainsoni*]). The newly established Keweenaw Raptor Survey has completed two years of surveying (2010-2011) Brockway Mountain with preliminary results indicating eastbound raptors still substantially outnumbering westbound raptors (i.e., 9579 eastbound/2598 westbound raptors in 2010, and 14,000 eastbound/2210 westbound raptors in 2011) (Skye Haas pers. comm.; KRS unpub. data). Our observations from Manitou (Table 3) suggests that the raptor migration through the Keweenaw Peninsula extends east across the three-mile water gap to Manitou Island, and includes all raptor species recorded at Brockway Mountain (Binford 2006).

Though varying by species, the high percentage of diurnal raptors observed heading west back to the Keweenaw Peninsula provides evidence that Manitou and the Keweenaw present a migration *dead-end* in the spring for many raptors attempting to cross Lake Superior (Table 3). This requires individuals to navigate around Lake Superior by continuing south and then east 250 mi (400 km) towards Whitefish Point, or south and west 230 mi (370 km) towards Duluth. The relatively low numbers of eastbound raptors (especially Broad-winged Hawk) observed crossing from the mainland suggests that incoming birds are missed arriving at Manitou because of the altitude gained by raptors migrating on thermals. Confirming whether or not raptors cross Lake Superior from Manitou Island will likely require portable radar to track kettling species that can gain altitude beyond the detectability of land-based observers.

Waterbird migration past Manitou was documented in both spring and fall. Binford (2006) recorded a large autumn waterbird migration moving eastward along the north shore of the Keweenaw Peninsula. We also documented a substantial fall waterbird flight past Manitou, likely the eastbound extension of the mainland Keweenaw flight. Additionally, we recorded distant waterbirds flying from the northwest at the east end of Manitou; once passing the island, most appeared to continue to the southeast. Although most waterbirds migrated past the eastern end of Manitou, a smaller number cut between the island and the mainland Keweenaw. Unlike Binford's mainland observations, our study also documented a significant movement of waterbirds past Manitou in the spring, including observations that changed the spring status in the Keweenaw Peninsula for Surf Scoter (*Melanitta perspicillata*), White-winged Scoter (*Melanitta fusca*), Long-tailed Duck (*Clangula hyemalis*), and Red-throated Loon (*Gavia stellata*) (Binford 2006, Binford 2009).

Our flight of 22,500 to 45,000 landbirds (250-500 birds/minute) past Manitou on 7 September 2009 was exceptional and unprecedented. Binford (2006) noted that large concentrations (or fallouts) of landbirds during spring migration in the Keweenaw Peninsula were rare and not previously recorded in the fall. The largest spring flight of landbirds documented in the Keweenaw Peninsula occurred along the north shore of Keweenaw County at Agate Harbor on 22 & 23 May 2002, when Binford (2006) extrapolated two westward flights of warblers numbering 2,925 (65 birds/minute) and 11,258 (68.2 birds/minute), respectively.

Perkins (1964) identified seven flyways across Lake Superior, including a north to south *Keweenaw Flyway* just east of the tip of the Keweenaw Peninsula and waters surrounding Manitou Island . Diehl et al. (2003) used NEXRAD radar to demonstrate that nocturnal migrants regularly cross the Great Lakes, and migrants over water frequently exhibit a dawn ascent to orientate toward the nearest landmass within 17 mi (28 km) of shore. Given that the closest land to Manitou Island lies 93 miles (150 km) to the north, 80 mi (130 km) to the east, and 40 mi (65 km) to the south, the island's isolation on Lake Superior may contribute to increased use by migratory birds, and may serve as an ideal site to test the distance at which a prominent land mass can influence landbird migration across large bodies of water. We believe that the *westward* movement of migrant landbirds observed on Manitou during *both* spring and fall migration provides evidence that migrants attempting to cross Lake Superior are being redirected by Manitou Island and the Keweenaw Peninsula, underscoring the importance of this area for influencing the movements of migratory birds.

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