



**2004 BREEDING BIRD SURVEY
ISLE ROYALE NATIONAL PARK, MICHIGAN**

RESOURCE MANAGEMENT REPORT 04-1

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ABSTRACT

Isle Royale National Park, Michigan, established a formal breeding bird survey in 1994. This program has continued from 1995 to 2004 with the objective of annually determining the size and composition of passerine communities on Isle Royale, as well as to monitor and compare populations over time. Although data collection began in 1994, analysis of data begins in 1996 due to standardization of point-count locations in that year. In 2004, point counts were conducted at Isle Royale National Park from June 17th to the 30th, using eight park trails as transects. Only 126 of 130 points were surveyed, with four missed due to unfavorable weather conditions. Species diversity values were calculated for each transect, and ranged from 0.88 to 0.95, with a nine-year island-wide average of 0.92. A total of 56 species and 1090 individuals were recorded. The number of species is only slightly below the eight-year (1996-2003) average of 57 for Isle Royale, while the number of individuals is well below the eight-year average of 1394. The five most common species heard accounted for 43% of all individuals. The majority of individuals are neotropical migrants, comprising an average of 49% of the annual breeding songbirds on Isle Royale. Continental migrants account for an average of 37%, and resident species account for an average of 14% from 1996-2004. Species of possible concern due to declining numbers on Isle Royale include the Black-throated Blue Warbler, the Chestnut-sided Warbler, the American Redstart, the Swainson's Thrush, and the Chipping Sparrow. The Chipping Sparrow has shown the most dramatic decline of any Isle Royale species between 1996 and 2004. Island-wide numbers for each species are included for 1996-2004, and numbers per transect are included for 2004.

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INTRODUCTION

Isle Royale National Park (ISRO), Michigan, established a formal breeding bird survey in 1994 as a means of integrating island population data with other studies conducted in the region. The impetus for establishing a survey was due to concerns regarding decline in neotropical species. The survey objectives are to 1) determine the size and composition of the neotropical migrant, continental migrant, and resident communities of passerines and other species that are detectable by point count protocols at ISRO, 2) to annually monitor these communities and make general comparisons between years, and 3) to compare the status of these communities with other regional populations.

From 1996-2004, the breeding bird survey has been conducted to expand on the annually collected data. The current eight routes were standardized in 1996. Therefore, data analysis begins with 1996 data. For further data analysis, background, and historical information regarding ISRO's breeding bird survey, reference should be made to the 1996 report (Beeman and Oelfke 1996).

METHODS

In an effort to continue the standardized annual survey for songbirds (with a window of approximately June 10th – 30th), breeding bird surveys were conducted from 17 June to 30 June 2004. The primary focus species are passerines, including neotropical migrants, continental migrants, and resident species. Standardized five-minute point-counts were conducted along transects at various locations across the island to monitor relative abundance and species composition of the songbird communities.

Study Sites

Eight park trails are used as survey transects with census points (130 total) located along them at intervals of approximately .4 km (.25 mi.). Transects are established in each region of the park (east, west, and central), as well as one offshore location: Passage Island (PASS). Transects on the main island are: the Mt. Franklin Trail from Three Mile to Lane Cove (TMLC), the Mt. Ojibway loop (MTOJ), the Indian Portage Trail from Lake Richie to the Greenstone Ridge (LRGR), the Indian Portage Trail from Chippewa Harbor to Lake Richie (CHLR), the Ishpeming Trail (ISTR), the Feldtmann Lake Trail (FELK), and the Greenstone Ridge Trail at Windigo (WIND). Transect length varies, as does the number of points along them (Table 1). Each point is permanently marked with a small aluminum research tag on the back of a specific tree. Maps of each route, and locations and descriptions of each tag and tree are found in Natural Resource Management (NRM) files. As necessary, the points along a route may be flagged the day prior to surveying, and wilderness rangers and trail crew should be notified so that flagging is not removed. Unfound tags should be noted since tagged trees could become victim to beaver cutting or windfall.

Census Techniques and Analysis of Data

Each point was visited once between 0530 (approximately ½ hour before sunrise) and 1000 EDT by one skilled observer and usually one recorder. Weather conditions were recorded at each point, and no counts were conducted during periods of rain, heavy fog, or when wind speeds were >16 km/hr (10 mph). Point counts were 5 minutes in duration, broken down into one-minute intervals, during which all species were recorded and categorized as "seen", "heard", or "flyover". Since minor problems can result from differing recording techniques, a brief training session to standardize recording techniques is recommended for all recorders to avoid confusion and inaccurate data entry. The use of 4-letter bird codes (Appendix 1) should not be used in the field if the recorder is unfamiliar with these codes. Full or partially abbreviated names are preferred, otherwise codes tend to be invented by recorders and are sometimes difficult to interpret during data entry. Birds not heard or seen during the count, but present at a census point immediately before or after the count period, or while walking between points, were recorded as "miscellaneous". Miscellaneous species are not included in the data analysis. For most non-songbird species the sampling protocol of this survey is not suitable. Non-focal species, such as gulls, waterfowl, wetland species, raptors, Common Loons, and birds heard but not identified during point counts (recorded as unknown) are also not included in data analysis.

Table 1: Transects surveyed, length of transects, and number of census points. Total number of tagged survey points = 130.

Transect	Transect Length Km (Mi)	Number of Points
Passage Island (PASS)	1.3 (0.8)	4
Three Mile-Lane Cove (TMLC)	6.9 (4.3)	16
Chippewa Harbor-Lake Richie (CHLR)	6.4 (3.9)	16
Mt. Ojibway Loop (MTOJ)	8.2 (5.1)	19
Lake Richie-Greenstone (LRGR)	7.8 (4.8)	20
Ishpeming Trail (ISTR)	7.0 (4.3)	18
Feldtmann Lake Trail (FELK)	7.0 (4.3)	16
Windigo-Sugar Mt. (WIND)	8.3 (5.1)	21

Simpson's Index diversity measurement

Species diversity values were calculated for each transect using the Simpson's Index (Hair 1980), a measurement of population diversity. Values range from 0 to 1 (0%-100%) and represent the probability that two individuals, drawn at random from a population, belong to different species. The Simpson's Index has been integrated into a Microsoft Excel© file for ease of calculation. An outline of how the file works and a copy of Simpson's Index methods are located in NRM hardcopy files.

RESULTS

The highest number of species (37, or 66%) was recorded on the LRGR transect, while the lowest number of species (9, or 16%) was recorded on the PASS transect (Table 2). A total of 56 species and 1090 individuals were recorded across the island (Table 3) in 2003. Five species accounted for 43% of the total number of individuals recorded during the five-minute counts: White-throated Sparrow (10%), Ovenbird (9%), Nashville Warbler (8%), Winter Wren (8%), and Red-eyed Vireo (7%). These were also among the most numerous species in the 1996-2003 surveys. Since 1996, 86 focal species have been recorded during the breeding bird surveys, either on point counts or as miscellaneous.

Table 2: Total numbers of species and individuals for each transect surveyed at Isle Royale NP, 2004.

TRANSECT	NUMBER OF KNOWN SPECIES/INDIVIDUALS	NUMBER OF UNKNOWN INDIV. (Not included in data calculations)
PASS	9/28	0
TMLC	33/187	1 Warbler
CHLR	24/99	1 Warbler
MTOJ	31/174	1 completely unknown
LRGR	37/201	0
ISTR	24/101	1 Warbler
FELK	30/156	0
WIND	28/144	2 Woodpeckers

Table 3: Total number of species and individuals recorded and the number of transects on which they were detected, 2004.

	<u>Number of Individuals</u>	<u>Number of Transects</u>
<u>Dowitchers (Scolopacidae)</u>		
Common Snipe	7	3
<u>Swifts (Apodidae)</u>		
Chimney Swift	2	1
<u>Kingfishers (Alcedinidae)</u>		
Belted Kingfisher	1	1
<u>Woodpeckers (Picidae)</u>		
Downy Woodpecker	7	3
Hairy Woodpecker	9	3
Northern Flicker	9	5
Pileated Woodpecker	10	4
Yellow-bellied Sapsucker	2	2
<u>Flycatchers (Tyrannidae)</u>		
Alder Flycatcher	9	3
Least Flycatcher	1	1
Yellow-bellied Flycatcher	12	3
<u>Vireos (Vireonidae)</u>		
Philadelphia Vireo	1	1
Red-eyed Vireo	78	7
<u>Crows, Jays (Corvidae)</u>		
American Crow	23	4
Common Raven	13	5
Blue Jay	36	7
<u>Chickadees (Paridae)</u>		
Black-capped Chickadee	29	8
<u>Creepers (Certhiidae)</u>		
Brown Creeper	24	4
<u>Nuthatches (Sittidae)</u>		
Red-breasted Nuthatch	26	7
White-breasted Nuthatch	1	1
<u>Wrens (Troglodytidae)</u>		
Winter Wren	92	8
<u>Kinglets (Regulidae)</u>		
Golden-crowned Kinglet	13	6

Table 3 continued

Number of individuals

Number of transects

<u>Thrushes (Turdidae)</u>		
American Robin	33	7
Hermit Thrush	62	7
Swainson's Thrush	12	4
Veery	6	3
<u>Waxwings (Bombycillidae)</u>		
Cedar Waxwing	24	3
<u>Wood-Warblers (Parulidae)</u>		
American Redstart	16	5
Black-and-White Warbler	9	5
Blackburnian Warbler	9	4
Black-throated Blue Warbler	8	3
Black-throated Green Warbler	39	8
Canada Warbler	4	3
Common Yellowthroat	4	3
Chestnut-Sided Warbler	31	5
Magnolia Warbler	55	7
Mourning Warbler	9	3
Nashville Warbler	90	8
Northern Parula	1	1
Northern Waterthrush	3	2
Ovenbird	101	7
Palm Warbler	1	1
Pine Warbler	2	2
Yellow Warbler	1	1
Yellow-rumped Warbler	22	7
<u>Emberizids (Emberizidae)</u>		
Chipping Sparrow	4	4
Song Sparrow	10	4
Swamp Sparrow	9	5
White-throated Sparrow	107	8
<u>Cardinals (Cardinalidae)</u>		
Indigo Bunting	1	1
<u>Tanagers (Thraupidae)</u>		
Scarlet Tanager	3	2
<u>Blackbirds (Icteridae)</u>		
Common Grackle	4	2
Red-winged Blackbird	1	1
<u>Finches (Fringillidae)</u>		
American Goldfinch	1	1
Evening Grosbeak	2	1
Purple Finch	1	1

56 Species 1090 total known individuals

Table 4: Simpson's Index Diversity values, ranging from 0-1 (0%-100%), for transects surveyed from 1996-2004. The eight-year average for diversity values is also given. DV = Diversity Value.

TRANS	1996 DV	1997 DV	1998 DV	1999 DV	2000 DV	2001 DV	2002 DV	2003 DV	2004 DV	Range of Variation	Avg. DV
PASS	0.58	0.75	0.95	0.84	0.76	0.91	0.93	0.87	0.88	37%	0.83
TMLC	0.93	0.94	0.96	0.95	0.94	0.94	0.95	0.94	0.95	3%	0.94
CHLR	0.95	0.95	0.95	0.94	0.94	0.93	0.95	0.95	0.93	2%	0.94
MTOJ	0.93	0.93	0.95	0.95	0.94	0.94	0.94	0.95	0.94	2%	0.94
LRGR	0.92	0.92	0.95	0.95	0.94	0.93	0.94	0.94	0.94	3%	0.94
ISTR	0.93	0.93	0.95	0.94	0.94	0.93	0.95	0.94	0.94	2%	0.94
FELK	0.94	0.94	0.96	0.94	0.95	0.93	0.93	0.95	0.95	3%	0.94
WIND	0.90	0.86	0.92	0.90	0.88	0.87	0.88	0.90	0.90	6%	0.89

Table 5: Comparisons from 1996-2004 of species and individuals, including number of points surveyed. (See Appendix 4 for specific numbers per species, and Appendix 5 for specific numbers by transect.)

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of points surveyed	133	122	130	130	129	130	130	130	126
Number of species (average of 57, 1996-2003)	57	58	61	60	60	54	52	54	56
Number of individuals (average of 1394, 1996-2003)	1429	1261	1028	1609	1440	1425	1511	1450	1090

DISCUSSION

When data are analyzed by transect, there is a difference in which species are present and what their abundance is in relation to the differing forest types across the island. Since 1996 the WIND transect has characteristically shown lower diversity than other transects (Table 4), likely a result of the differing, more monotypical forest type (maple/yellow birch) that dominates the Greenstone Ridge on the west half of the island. Data show fewer species on this transect and a higher proportion of the most common species, which lowers diversity values. The Feldtmann Lake transect, also on the west end of the island, has much more variety in habitat and consequently shows diversity similar to the other transects.

In general, there is a noticeable difference annually in mean diversity between the peripheral island transect (PASS, Table 4) and the main island transects. Passage Island is atypical among ISRO breeding bird survey transects because of its small landbase with only four survey points. It shows a marked range of diversity (37%, Table 4), with sizeable yearly change in values. These fluctuations can likely be attributed to the small landbase on this transect, along with a common occurrence of disproportionately high numbers of several individual species, probably groups of migrants, which is traditional on this transect and consequently drops the diversity value. Higher fluctuation in Passage Island diversity appears to be a prevalent component of this transect.

Table 4 shows Isle Royale as having rather high diversity on most transects with a nine-year island-wide average, including Passage Island, of 0.92. Diversity values for the eight transects ranged from 0.88 to 0.95 in 2004. The nine-year average for diversity values of the other six transects (excluding PASS and WIND) shows both a stable range of variation and a high (94%) percentage of diversity (Table 4). This is an encouraging general sign for the health of the ISRO songbird population.

Fifty-six species were recorded during the 2004 survey, near the average of 57 from previous years (Table 5). The number of individuals in 2004 (1090) is well below the average of 1394. Great fluctuation in yearly numbers has been shown in other regional surveys as well (Niemi *et al*, 1997). In 2004, windy and stormy conditions were common throughout the morning hours in mid-June, making completion of some routes difficult. Four survey points (three on ISTR and one on CHLR) were missed entirely due to problems with wind on points dominated by aspen forest. The ISTR and CHLR routes also had severely diminished numbers of individuals calling during surveys, and the MTOJ and TMLC transects also had lower numbers than in previous surveys. All of these low numbers of singing individuals appear to be due to poor weather conditions. Though weather conditions were marginal on these routes, they were acceptable within methodology guidelines. The remaining four routes experienced occasional gusting winds, but were conducted on relatively calm mornings. Regional weather patterns, such as drought or a late winter season, have been shown to contribute to yearly variation in species presence on other breeding bird survey transects as well (Niemi *et al*, 1997).

The number of individual neotropicals recorded at ISRO steadily declined as a percentage of the annually inventoried population between 1996 and 2000, while continental migrants and residents had either fluctuated or increased (Figure 1). Since 2000, the neotropical numbers have fluctuated similar to the continentals and residents. Neotropicals make up an average of 49% of the censused individuals (with a 10% range of fluctuation, 46-56%), while continentals average 37% (a 7% range of fluctuation, 33-40%) and residents average 14% (a 6% range of fluctuation, 9-17%). It is possible that neotropicals have a longer range of fluctuation, and future surveys will reveal a rebound. When the number of species observed between 1996 and 2004 is compared, neotropicals may be showing part of a longer trend, while continentals and residents are showing a shorter sinusoidal trend (Table 6).

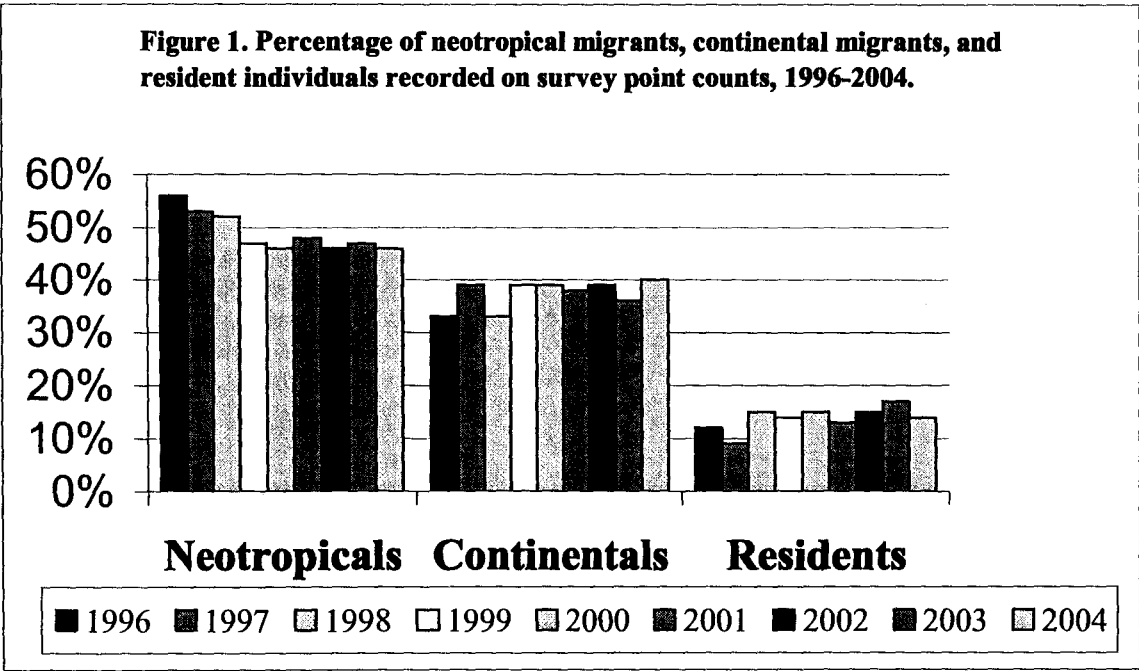


Table 6: Number of neotropical migrants, continental migrants, and residents, by species, recorded on survey point counts, 1996-2004.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average
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Neotropicals	24	29	28	26	24	23	20	24	24	25
Continental	20	18	20	20	24	19	21	19	22	20
Residents	12	11	12	13	11	12	10	11	10	11

Threats to the population of ISRO songbirds are likely to occur in either migration or wintering habitats because 99% of the park's landbase is protected from development, and issues of predation elsewhere (mostly due to raccoons expanding their range) are not applicable. Whether ground, shrub, or tree nesters, songbirds at ISRO are likely to face a historically normal amount of predation. The numbers of individuals per species that are observed yearly during the survey appear to be either stable or increasing, regardless of migratory or residential status, with exceptions discussed below.

Species of possible concern

Certain species that use Isle Royale for breeding have been noted regionally or locally as possible concern species. Included in this group are the Black-throated Blue Warbler, Chestnut-sided Warbler, American Redstart, and Swainson's Thrush, all of which are neotropical migrants. The Chipping Sparrow, a continental migrant, may be a species of concern based on ISRO data.

The Black-throated Blue Warbler has been noted during both surveys and personal observations to call irregularly, and has therefore varied in detectability during surveys. This variability is possibly one of the reasons for fluctuation in numbers on the survey (Table 7). During the 20th century, the Black-throated Blue Warbler had declined in general throughout Michigan, with pockets of higher concentration remaining, including the west half of ISRO (Binford, 1991). On ISRO, between 1996 and 2004, the decline has been only slight. On the North American Breeding Bird Survey, the Black-throated Blue Warbler had increased significantly in Michigan and non-significantly in Ontario between 1980 and 2002 (Sauer, J. R. *et al.*, 2003). ISRO is near the northwest edge of the Black-throated Blue Warbler's range (National Geographic Society, 1999).

The Chestnut-sided Warbler has shown a notable decline on ISRO between 1996 and 2004 (Table 7). Across Michigan, Minnesota, and Ontario populations had a non-significant decline between 1980 and 2002, while in Wisconsin the trend was a significant increase (Sauer, J. R. *et al.*, 2003). ISRO is well within the range of the Chestnut-sided Warbler (National Geographic Society, 1999).

The American Redstart has also shown a strong decline on ISRO surveys since 1996 (Table 7). In all states bordering Lake Superior, and in Ontario, the Redstart has shown either non-significant or significant increases on breeding bird surveys between 1980 and 2002 (Sauer, J. R. *et al.*, 2003). As with most other wood-warblers, Ehrlich *et al.* (1988) considered the American Redstart to be a species of concern due to deforestation of tropical winter habitats. ISRO is well within the range of the American Redstart (National Geographic Society, 1999).

The Swainson's Thrush has been considered a common nesting species on ISRO (Johnsson *et al.*, 1981), particularly on the barrier islands of the Rock Harbor area (personal observation). It had shown a steady decline in the seven years between 1994-2000, with data showing a strong negative correlation (Table 7). Between 2000 and 2003 the Swainson's Thrush had been steady at 9 individuals per year, with a rebound to 12 individuals in 2004. Regionally, populations have shown a non-significant decrease in Ontario, and a non-significant increase in Minnesota between 1980 and 2002 (Sauer, J. R. *et al.*, 2003). Ehrlich *et al.* (1988) included the Swainson's Thrush in a list of neotropical migrant species that may benefit from local monitoring. ISRO is well within the range of the Swainson's Thrush (National Geographic Society, 1999).

The Chipping Sparrow has shown the strongest negative trend of any species on ISRO surveys between 1996 and 2004. There has been a very steady decline in this species, from 22 individuals detected in 1996 to only four detected in 2004. Populations regionally had done well between 1980 and 2002, with a significant increase in Wisconsin, non-significant increases in Michigan and Minnesota, and a non-significant decrease in Ontario (Sauer, J. R. *et al.*, 2003). ISRO is well within the range of the Chipping Sparrow (National Geographic Society, 1999).

Table 7: Annual numbers (1996-2004) of the Black-throated Blue Warbler, Chestnut-sided Warbler, American Redstart, Swainson's Thrush, and Chipping Sparrow.

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Black-throated Blue Warbler	5	11	8	15	3	5	12	6	8
Chestnut-sided Warbler	79	65	31	55	46	41	50	45	31
American Redstart	47	20	42	41	30	27	24	21	16
Swainson's Thrush	17	19	11	12	9	9	9	9	12
Chipping Sparrow	22	21	19	21	15	9	17	9	4

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Appendix 1: Field names used for bird species. Scientific names are those accepted by the American Ornithologist's Union (7th edition A.O.U. Checklist, 1998) and its supplements.

<u>CODE NAME</u>	<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
ALFL	Alder Flycatcher	<i>Empidonax alnorum</i>
AMCR	American Crow	<i>Corvus brachyrhynchos</i>
AMGO	American Goldfinch	<i>Carduelis tristis</i>
AMRE	American Redstart	<i>Setophaga ruticilla</i>
AMRO	American Robin	<i>Turdus migratorius</i>
BASW	Barn Swallow	<i>Hirundo rustica</i>
BAWW	Black-and-white Warbler	<i>Mniotilta varia</i>
BBCU	Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
BBWA	Bay-breasted Warbler	<i>Dendroica castanea</i>
BCCH	Black-capped Chickadee	<i>Poecile atricapillus</i>
BEKI	Belted Kingfisher	<i>Ceryle alcyon</i>
BHCO	Brown-headed Cowbird	<i>Molothrus ater</i>
BHVI	Blue-headed Vireo	<i>Vireo solitarius</i>
BKWA	Blackburnian Warbler	<i>Dendroica fusca</i>
BLJA	Blue Jay	<i>Cyanocitta cristata</i>
BRCR	Brown Creeper	<i>Certhia americana</i>
BRTTH	Brown Thrasher	<i>Toxostoma rufum</i>
BTBW	Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
BTGW	Black-throated Green Warbler	<i>Dendroica virens</i>
CAWA	Canada Warbler	<i>Wilsonia canadensis</i>
CEWW	Cedar Waxwing	<i>Bombycilla cedrorum</i>
CHSP	Chipping Sparrow	<i>Spizella passerina</i>
CHSW	Chimney Swift	<i>Chaetura pelagica</i>
CMWA	Cape May Warbler	<i>Dendroica tigrina</i>
COGR	Common Grackle	<i>Quiscalus quiscula</i>
CORA	Common Raven	<i>Corvus corax</i>
COSN	Common Snipe	<i>Gallinago gallinago</i>
COWA	Connecticut Warbler	<i>Oporornis agilis</i>
COYE	Common Yellowthroat	<i>Geothlypis trichas</i>
CSWA	Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
DEJU	Dark-eyed Junco	<i>Junco hyemalis</i>
DOWO	Downy Woodpecker	<i>Picoides pubescens</i>
EABB	Eastern Bluebird	<i>Sialia sialis</i>
EAKB	Eastern Kingbird	<i>Tyrannus tyrannus</i>
EAWP	Eastern Wood-Pewee	<i>Contopus virens</i>
EVGR	Evening Grosbeak	<i>Coccothraustes vespertinus</i>
GCKI	Golden-crowned Kinglet	<i>Regulus satrapa</i>
GCFL	Great Crested Flycatcher	<i>Myiarchus crinitus</i>
GRJA	Gray Jay	<i>Perisoreus canadensis</i>
HAWO	Hairy Woodpecker	<i>Picoides villosus</i>
HETH	Hermit Thrush	<i>Catharus guttatus</i>
INBU	Indigo Bunting	<i>Passerina cyanea</i>
LEFL	Least Flycatcher	<i>Empidonax minimus</i>
MAWA	Magnolia Warbler	<i>Dendroica magnolia</i>
MAWR	Marsh Wren	<i>Cistothorus palustris</i>
MOWA	Mourning Warbler	<i>Oporornis philadelphia</i>
NAWA	Nashville Warbler	<i>Vermivora ruficapilla</i>

(Appendix 1 continued)

<u>CODE NAME</u>	<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
NOCA	Northern Cardinal	<i>Cardinalis cardinalis</i>
NOFL	Northern Flicker	<i>Colaptes auratus</i>

NOPA	Northern Parula	<i>Parula americana</i>
NOWA	Northern Waterthrush	<i>Seiurus noveboracensis</i>
OSFL	Olive-sided Flycatcher	<i>Contopus cooperi</i>
OVEN	Ovenbird	<i>Seiurus aurocapillus</i>
PAWA	Palm Warbler	<i>Dendroica palmarum</i>
PHVI	Philadelphia Vireo	<i>Vireo philadelphicus</i>
PIGR	Pine Grosbeak	<i>Pinicola enucleator</i>
PISI	Pine Siskin	<i>Carduelis pinus</i>
PIWA	Pine Warbler	<i>Dendroica pinus</i>
PIWO	Pileated Woodpecker	<i>Dryocopus pileatus</i>
PUFI	Purple Finch	<i>Carpodacus purpureus</i>
RBGR	Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
RBNU	Red-breasted Nuthatch	<i>Sitta canadensis</i>
RCKI	Ruby-crowned Kinglet	<i>Regulus calendula</i>
REVI	Red-eyed Vireo	<i>Vireo olivaceus</i>
RWBB	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
SCTA	Scarlet Tanager	<i>Piranga olivacea</i>
SEWR	Sedge Wren	<i>Cistothorus platensis</i>
SOSP	Song Sparrow	<i>Melospiza melodia</i>
SWSP	Swamp Sparrow	<i>Melospiza georgiana</i>
SWTH	Swainson's Thrush	<i>Catharus ustulatus</i>
TEWA	Tennessee Warbler	<i>Vermivora peregrina</i>
VEER	Veery	<i>Catharus fuscescens</i>
WBNU	White-breasted Nuthatch	<i>Sitta carolinensis</i>
WIFL	Willow Flycatcher	<i>Empidonax traillii</i>
WIWR	Winter Wren	<i>Troglodytes troglodytes</i>
WTSP	White-throated Sparrow	<i>Zonotrichia albicollis</i>
WWCR	White-winged Crossbill	<i>Loxia leucoptera</i>
YBCH	Yellow-breasted Chat	<i>Icteria virens</i>
YBFL	Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>
YBSA	Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
YEWA	Yellow Warbler	<i>Dendroica petechia</i>
YHBL	Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
YRWA	Yellow-rumped Warbler	<i>Dendroica coronata</i>

Appendix 2: Miscellaneous species recorded before, after, or between points, 2004.

TRANSECT
TMLC

SPECIES
VEER, YBFL, MAWA, NOFL, GCKI, SWSP (2), BLJA,
GRJA (2), BAWW, COGR, HAWO, BTGW (2), NOWA,

	BCCH, COYE, CEWW (3), BRCR, PUFI, CORA, PIWO, YRWA
PASS	BLJA, ALFL, COYE, PISI
MTOT	NOFL, HAWO, YBFL, OSFL, MOWA, RBNU (2), BCCH, ALFL, YBSA
FELK	BAWW, PISI (2), NOPA, BCCH (3)
ISTR	NOPA, BAWW, AMBI, RBNU, CSWA, AMRE, NOWA, PIWO
CHLR	BTGW, CSWA (3), NOFL, GCKI, BKWA, MOWA (2), SWSP, NOPA
WIND	BRCR (2), OVEN
LRGR	COYE, BTBW (3), SWSP, BAWW, BCCH, BKWA

Appendix 3: Species recorded in only one survey between 1996-2004, during 5-minute counts or miscellaneous between points.

Barn Swallow, 1998 (Misc. 1994)
Brown-headed Cowbird, (Misc. 1996)
Connecticut Warbler, (Misc. 1998)
Eastern Bluebird, 2000
Marsh Wren, 2000
Tree Swallow, (Misc. 2000)
Willow Flycatcher, (Misc. 1998)
Yellow-billed Cuckoo, 2000
Yellow-breasted Chat, 1997
Yellow-headed Blackbird, (Misc. 1996)
Yellow Warbler, 2004

Appendix 4: Species regularity on Isle Royale and yearly numbers during 5-minute point counts, 1996-2004. Within code name box, r=resident, c=continental migrant, n=neotropical migrant (Ehrlich, *et al.*, 1988).

CODE NAME	1996	1997	1998	1999	2000	2001	2002	2003	2004	MISC
--------------	------	------	------	------	------	------	------	------	------	------

ALFL, n	21	11	11	11	13	14	23	17	9	
AMCR, c	47	25	16	45	46	39	21	37	23	
AMGO, c	3				3				1	1994, 1996
AMRE, n	47	20	42	41	30	27	24	21	16	
AMRO, c	28	26	29	44	46	46	52	35	33	
BASW, n			1							1994
BAWW, n	9	20	12	20	13	9	10	10	9	
BBCU, n		3			3	7				2000, 2001
BBWA, n		1	1		1	1	1	1		
BCCH, r	18	9	20	38	44	37	54	59	29	
BEKI, c			2					1	1	2000
BHCO, c										1996
BHVI, c	1		4	1	1	1	4	1		2003
BKWA, n	6	12	15	8	6	5	12	13	9	
BLJA, r	37	11	26	43	53	31	55	45	36	
BRCR, r	1	3	17	23	23	25	39	20	24	
BRTH, c										
BTBW, n	5	11	8	15	3	5	12	6	8	
BTGW, n	77	38	58	75	101	71	58	69	39	
CAWA, n	6	6	7	4	4	4	3	4	4	
CEWW, c	20	46	2	17	5	17	24	28	24	
CHSP, c	22	21	19	21	15	9	17	9	4	
CHSW, n			1	2		3	2	4	2	1999, 2001
CMWA, n	13	14	11	4				3		
COGR, c	20	4	3	10	4	6	2	10	4	
CORA, r	24	22	10	28	14	16	9	17	13	
COSN, c	8	6	10	9	9	9	11	16	7	
COWA, n										1998
COYE, c	4	2	4	4	5	4	12	6	4	
CSWA, n	79	65	31	55	46	41	50	45	31	
DEJU, c	1					1				
DOWO, r	11	6	20	17	30	8	6	8	7	
EABB, c					1					1994
EAKB, n				1						1999, 2001
EAWP, n			2	1		1				
EVGR, r	5	14	5	5		4			2	2000
GCFL, n		2	1							
GCKI, c		8	14	11	20	19	27	13	13	
GRJA, r	4	1	2	5	2		6	9		
HAWO, r	7	4	3	8	9	13	16	22	9	
HETH, c	21	39	45	81	76	63	61	72	62	
INBU, n	2	3	1	3				1	1	2002, 2003
(Appendix 4 continued)	1996	1997	1998	1999	2000	2001	2002	2003	2004	MISC
LEFL, n	10	6	10	3	2			3	1	
MAWA, n	38	50	41	54	47	67	61	73	55	
MAWR, c					1					
MOWA, n	22	15	16	14	10	14	13	26	9	
NAWA, n	145	85	61	147	102	132	136	111	90	

NOCA, r						1	1			
NOFL, c	12	5	7	18	16	5	8	7	9	
NOPA, n		4	1	4	5				1	2003, 2004
NOWA, n	3	2	2	1		2	8	4	3	
OSFL, n	1	2		1		1	1	1		2002, 2004
OVEN, n	155	135	94	155	149	151	149	148	101	
PAWA, c			1		1				1	
PHVI, n							1		1	
PISI, r		11	1	10		8		1		2001, 2004
PIWA, c			2		1				2	2003
PIWO, r	2	1	8	11	9	16	13	14	10	
PUFI, c		2		1	3		1		1	2003, 2004
RBGR, n	3	3	4	2	3	1				
RBNU, r	28	26	41	31	32	26	28	45	26	
RCKI, c	1	1		6		1	3			
RECR, r					2	3				2003
REVI, n	125	111	63	101	84	97	91	94	78	
RWBB, c	3			1	1		4		1	2002
SCTA, n	1	1	2		1			1	3	2002
SEWR, c							2	1		2002
SOSP, c	4	6	4	9	11	11	10	13	10	
SWSP, c	9	10	4	10	7	8	13	10	9	
SWTH, n	17	19	11	12	9	9	9	9	12	
TEWA, n	6	6			1					
TRSW, c										2000
VEER, n	3	6	16	17	15	10	8	6	6	
WBNU, r	3			1	1			2	1	
WIFL, n										1998
WIWR, c	72	108	64	138	108	138	145	96	92	
WTSP, c	159	151	85	158	149	144	144	139	107	
WWCR, r	25		1	2						
YBCH, n		1								
YBFL, n	5	12	13	12	7	19	23	15	12	
YBSA, c	2	1	3	8	2	3	2	1	2	
YBCU, n					1					
YEWA, n									1	
YHBL, c										1996
YRWA, c	28	28	17	32	33	22	26	28	22	

Appendix 5: Total number of species and individuals at transects, 5 minute point counts, Isle Royale, 2004.

SPECIES	CHLR	FELK	ISTR	LRGR	MTOJ	PASS	TMLC	WIND	Total Of ID
ALFL	3	4	2						9
AMCR	2			5	11		5		23
AMGO				1					1
AMRE	1	4	3		6	2			16
AMRO	4	2	3	8	7		3	6	33
BASW									0
BAWW			2	2	2		2	1	9

BBCU									0
BBWA									0
BCCH	2	5	1	3	1	4	11	2	29
BEKI							1		1
BHVI									0
BKWA	3	4	1					1	9
BLJA	1	4	7	8	3		11	2	36
BRCR	2	2		9				11	24
BTBW				2			5	1	8
BTGW	2	7	5	8	2	2	3	10	39
CAWA			2	1			1		4
CEWW		13	3		8				24
CHSP		1		1	1		1		4
CHSW								2	2
CMWA									0
COGR					1		3		4
CORA	5	4		1	1			2	13
COSN				2	2		3		7
COYE		2	1		1				4
CSWA	1		8	4	14		4		31
DEJU									0
DOWO			2	3				2	7
EABB									0
EAWP									0
EAKB									0
EVGR	2								2
GCFL									0
GCKI	1	4		1	1		4	2	13
GRJA									0
HAWO				3			3	3	9
HETH	5	14	5	8	15		9	6	62
INBU		1							1
LEFL								1	1
MAWA	7	6	6	15	10	5	6		55
MAWR									0
MOWA				3	1		5		9
NAWA	12	10	6	16	17	3	24	2	90
NOCA									0
NOFL	1		2	1	4		1		9
NOPA	1								1
NOWA		1		2					3
OSFL									0
OVEN	10	7	10	19	16		17	22	101
PAWA					1				1
PHVI								1	1
PISI									0
PIWA		1		1					2
PIWO		4		2	1			3	10
PUFI					1				1
RBGR									0
RBNU	1	6		4	3	7	4	1	26

Appendix 5 continued:

SPECIES	CHLR	FELK	ISTR	LRGR	MTOJ	PASS	TMLC	WIND	Total Of ID
RCKI									0
RECR									0
REVI	8	13	6	2	13		2	34	78
RWBB							1		1
SEWR									0
SCTA		1						2	3
SOSP		2	3	3			2		10
SWSP		2	1	1	1		4		9
SWTH		2				1	5	4	12
TEWA									0

VEER				1	1		4		6
WBNU								1	1
WIWR	7	19	6	17	11	2	16	14	92
WTSP	17	8	15	30	16	2	13	6	107
WWCR									0
YBCU									0
YBFL				4			7	1	12
YBSA				1			1		2
YEWB				1					1
YRWA	1	3	1	8	2		6	1	22

No of spec	24	30	24	37	31	9	33	28	56
No of Ind	99	156	101	201	174	28	187	144	1090