

CALGARY BIRD BANDING SOCIETY

1998 ANNUAL TECHNICAL REPORT

Prepared

by

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Custodire avis

Keep watch on birds

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Some of the 1998 new bandings. Clockwise from top left: 1. Swamp Sparrow (HY-U 23 Sep IBS) 2. Fox Sparrow (HY-U 1 Sep IBS) 3. Broad-winged Hawk (AHY-U 10 Sep IBS) 4. Black-and-white Warbler (HY-M 16 Aug IBS) 5. Tennessee Warbler/Yellow Warbler hybrid? (AHY-U 21 May Dunbow Rd) 6. Gray-cheeked Thrush (HY-U 17 Sep IBS). All photos by CBBS

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EXECUTIVE SUMMARY

The Calgary Bird Banding Society (CBBS) was incorporated in March 1995. The main objective of CBBS remains conducting migration monitoring and other banding-based studies at Inglewood Bird Sanctuary (IBS), a federal Migratory Bird Sanctuary.

Neotropical migrant birds are considered to be at risk because of resource exploitation both on their wintering and breeding grounds. IBS has long been known as an important migration site for Neotropical migrants. Located within 80-km of the Rocky Mountains, IBS is a necessary component of the Canadian Migration Monitoring Network.

The 1998 migration monitoring program follows pilot efforts in 1992 and 1994 and the full fall programs completed in 1995 through 1997. Twelve mist-nets were operated for a minimum of 6 hours per day on 61 of the 70 days between 25 July and 2 October. Volunteers and Banders-in-Charge contributed a total of 178 man-days to the banding projects (i.e. MAPS and migration monitoring). A total of 4371 net-hours yielded 1,898 new bandings of 64 species. Approximately 97% were Neotropical migrants. New bandings were relatively spread out over the season this year - 54% in August and 42% in September.

Recaptures totalled 556 involving at least 376 different birds of 42 species; including several birds originally banded as early as 1992. Two Swainson's Thrushes banded during fall migration in previous years and recaptured this year again provided rare re-encounters of migrants. Other recaptures included a 4+ years old White-breasted Nuthatch, a 5+ years old Black-capped Chickadee, a 7+ years old House Wren, a 5+ years old Warbling Vireo, and a 5+ years old Yellow Warbler.

Banding data was integrated with census data and incidental observations to generate Estimated Daily Totals (EDTs). EDTs were split into migrants and known or probable stopovers (PKS) in order to illustrate migration. A total of 116 species were detected including 23 species of warbler and vireo.

The MAPS site was operated again in 1998, building on previous data gathered since 1992. A total of 112 birds were captured, of which 75 were new bandings. A Veery was banded for the first time since 1992 and 3 Warbling Vireos from previous years were recaptured. Interestingly no unbanded Warbling Vireos were captured.

Nineteen mortalities occurred during the mist-netting of 2980 birds, 11 of which resulted from predation (1 by a Gray Squirrel, 3 by Sharp-shinned Hawks, 1 by a Black-billed Magpie, and 6 by a fork-horn Mule Deer buck). In addition, 36 injuries were recorded.

Spring banding was conducted at Dunbow Road for the second consecutive year. Banding occurred on 16 of 26 days from 9 May - 3 June. A total of 305 net-hours resulted in 288 captures of which 161 were new bandings. An interesting capture on 21 May was an apparent Yellow Warbler/Tennessee Warbler hybrid (see frontispiece).

During 1998 CBBS received support from the Baillie Fund, Friends of Environment, Canadian Wildlife Service, Shell Environmental Fund, Manning Diversified Forest Products, and Alberta Sport, Recreation, Parks and Wildlife.

INTRODUCTION

The Calgary Bird Banding Society (CBBS) was incorporated on 22 March 1995 with the following objectives:

- Quantify long-term population trends of Neotropical migratory birds using constant effort mist-netting at Inglewood Bird Sanctuary;
- Promote involvement and expertise in bird banding; and
- Promote conservation of Neotropical migratory birds by fostering public awareness and understanding of Neotropical migratory birds;

Although the primary project of the CBBS is monitoring of migratory birds at Inglewood Bird Sanctuary (IBS) in Calgary, complimentary projects are also undertaken:

- a Monitoring Avian Productivity and Survivorship (MAPS) station was established at IBS in 1992 and continued in 1993 and 1995-1998;
- pilot spring banding was initiated in 1997 at Dunbow Road just south of Calgary and continued in 1998;
- pilot MAPS monitoring was established at Ranger Creek in Banff National Park in 1998; and
- a member of the CBBS has initiated a program to monitor birds that strike office buildings, modeled after the successful FLAPS program in Toronto.

As of 1998 the Calgary Bird Banding Society's Inglewood Bird Sanctuary site is a fully designated member of the Canadian Migration Monitoring Network coordinated and managed by Bird Studies Canada. Establishment of this formal association of key migrant monitoring sites across Canada significantly increases the value of the work conducted at each site.

FUNDING AND ACKNOWLEDGEMENTS

Funding for CBBS migration monitoring at IBS during 1998 was provided by:

- a grant through The James L. Baillie Memorial Fund from a contribution by Environment Canada, supplemented with funds raised through the annual Baillie Birdathon (\$500);
- funds raised by the CBBS through participation in the Baillie Birdathon (approximately \$2400 net) including a \$1,000 gross pledge from Imperial Oil Resources;
- a grant from Friends of Environment through Bird Studies Canada on behalf of the Canadian Migration Monitoring Network (\$1830);
- a grant from Canadian Wildlife Service through Loney Dickson (\$2,000);
- a grant from the Shell Environmental Fund to purchase additional mist-nets (\$1050);
- a grant from Friends of Environment to purchase a laptop computer to facilitate data entry and analysis (\$2900);
- a grant from Manning Diversified Forest Products (\$1,000); and
- a grant from Alberta Sport, Recreation, Parks and Wildlife to fund production of the 1998 (\$625) annual technical report.

Additional contributions in kind were made by Environment Canada - Brenda Dale (Peterson warbler field guide and standardized colour charts), Brian Couronne (screen tent), Dick Graham (banding table), and Inglewood Bird Sanctuary (materials for construction of steps and bridges). Steps and bridges were designed by Shonna and Al Mcleod and constructed by Steve Lane.

The majority of the funds were used to provide a per diem to Banders-in-Charge (BIC), cover BIC travel costs, and cover migration monitoring administrative costs (field data sheets, propane, batteries, film etc.).

Field data forms for migration monitoring were modified from forms designed for the Last Mountain Lake Observatory in Saskatchewan. We acknowledge LMLO's spirit of cooperation in sharing digital copies of these forms for our use.

MIGRATION MONITORING

Background

Neotropical migrants are birds that breed in the Nearctic biogeographic realm and winter in the Neotropics. The Neotropical migratory bird system involves some 5-10 billion birds of over 150 species (Greenberg 1992). Recent (1978-1988) trends in data from the Breeding Bird Survey indicate that a majority of Neotropical migrants in eastern North America decreased in their population index (Sauer & Droege 1992). Although destruction of tropical forests on the wintering grounds has been implicated in this decline, increasing concern is being raised about the potential effect of accelerated land-use changes on breeding grounds.

Inglewood Bird Sanctuary (IBS) is a federal Migratory Bird Sanctuary known as an important site for migrating passerines. IBS is strategically located within 80-km of the Rocky Mountains (Fig. 1) and is a unique and valuable addition to the Canadian Migration Monitoring Network coordinated and managed by Bird Studies Canada. IBS is located within Calgary greatly facilitating the potential for volunteer involvement. Pilot Neotropical migrant monitoring covering only a portion of the fall migration season was undertaken in 1992 and 1994 while full fall migration monitoring has occurred since 1995. Monitoring songbird population change based on fall mist-netting has been shown to be an effective technique (Dunn *et al.* 1997; Appendix 1).

Methods and Study Site

The fall migration of Neotropical migrants was monitored in 1998 at Inglewood Bird Sanctuary (IBS). IBS is comprised of 35 hectares of mature riverine balsam poplar forest known for its large number of songbirds during fall migration. Constant effort mist-netting (i.e. constant number of nets in permanent locations for constant time period each day) and collection of associated morphometric and other data (e.g. age, sex, wing chord, weight, capture net, time of capture, fat reserves) from each bird captured was carried out each day, weather permitting, during fall migration. Nets were operated from 25 July through 2 October. Twelve 12-m 1¼" mist-nets were operated in permanent net lanes for a minimum of 6 hours each day beginning at sunrise. As spring conditions at the site are wetter than during fall, spring migration is not monitored due to potential adverse environmental impact.

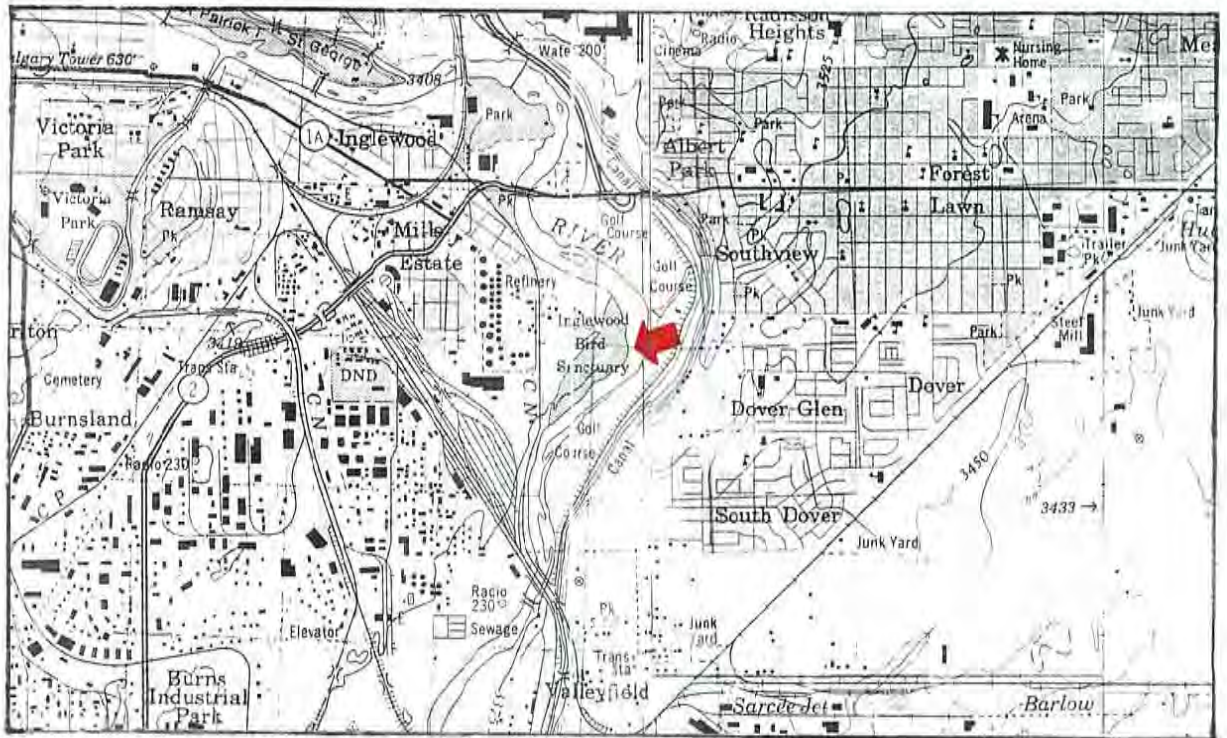
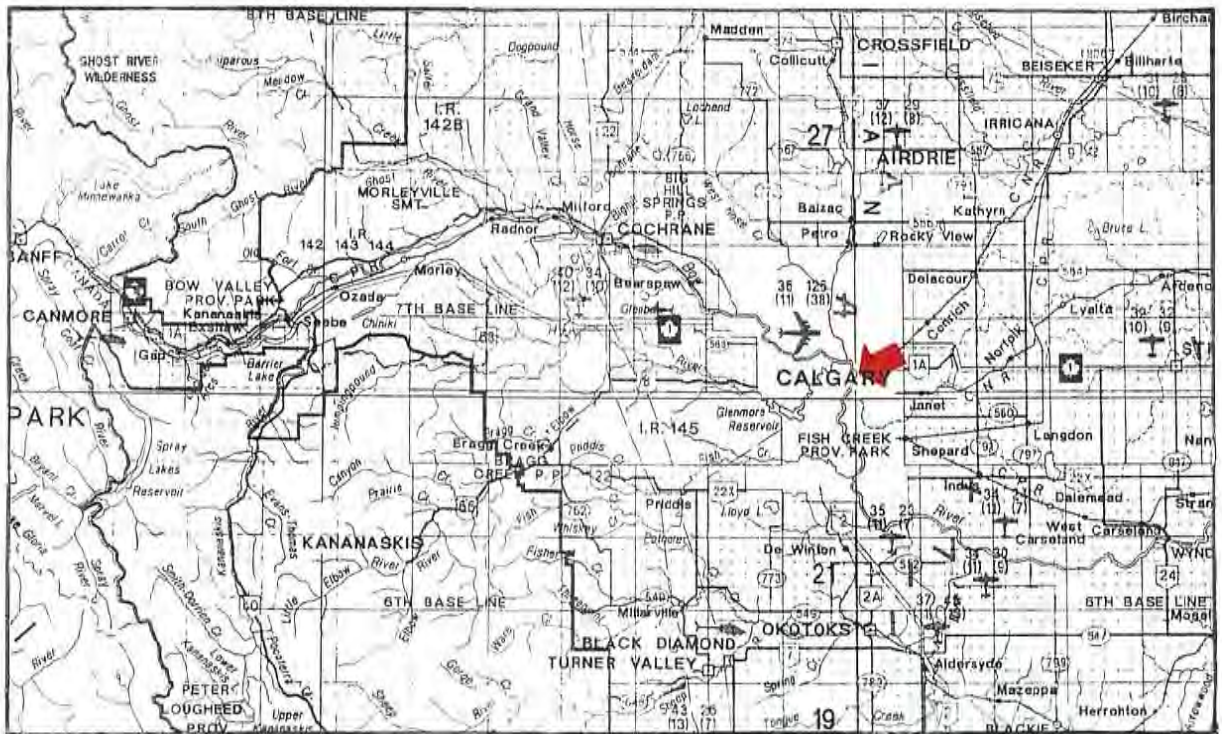


Figure 1. Topographic maps at 1:250,000 (top) and 1:50,000 (bottom) scales showing location of Inglewood Bird Sanctuary in southwestern Alberta. North is up.

Migration monitoring procedures have been developed for IBS based on standardizations outlined in *A manual for monitoring bird migration* (McCracken *et al.* 1993), *Recommended methods for monitoring bird migration* (Hagan *et al.* 1994) and *Recommended methods for monitoring bird populations by counting and capture of migrants* (Hussell and Ralph 1996), modified to accommodate the specific requirements of the IBS site (Appendix 2). Net locations and the daily census route are shown on Figure 2.

Coverage

Fall migration monitoring at IBS was conducted from 25 July - 2 October. Standardized constant-effort mist-netting was conducted for a minimum of 6 consecutive hours starting at sunrise on each day that conditions allowed. Additionally, a standardized census was taken 2-3 hours from the start of the netting. During 1998, a coverage of 87.1% was achieved. That is, mist-netting occurred on 61 of the 70 target days for a total of 4371 net-hours (Table 1, Figure 3). Inclement weather and/or the unavailability of a qualified bander-in-charge resulted in 9 days without banding.

Daily census were obtained on 50 of the 61 days on which mist-netting occurred. A census is not obtained when the number of migrants or personnel shortage would result in unacceptable risk to captured birds.

New Bandings

A total of 1,898 new bands were placed on birds of 64 species (Table 2). Of these, 1,842 (97%) were Neotropical migrants (Dobkin 1992). Days on which 50 or more new bandings occurred were 13, 22, 23, 25, 26, 31 August and 8, 21, 27 September. Approximately 54% of new bandings occurred in August and 42% in September. A summary of new bandings at IBS from 1992-1998 is presented in Table 3.

Initiation of migration monitoring was moved up to 25 July. Although capture rates during the last week of July were low, additional data will be necessary to completely evaluate the value of starting earlier than 1 August. Operations were not extended beyond the first 2 days of October based on low capture rates in previous years and the lack of encouragement during the last week of September of this year.

A banding station adds another dimension to understanding the avifauna at a site and the IBS station is no exception. Several species were recorded during banding operations that are infrequently reported by bird watchers. A Broad-winged Hawk on 10 September, a Gray-cheeked Thrush on 17 September, a Nashville Warbler on 28 August, a Black-throated Green Warbler on 5 August, Fox Sparrows (2) on 1 and 9 September, and Swamp Sparrows (7) on 4, 16, 17, 18, 23, 29 September provided rare records of these species for IBS.

Table 1. Migration Coverage and Capture Rates - Fall 1998

Date	Net-hours	Captures				Total	Captures/100 Net-hours
		New Bandings	Recaptures	Escapes	Mortalities		
25-Jul	57.7	10	3	1	0	14	24
26-Jul	0.0	0	0	0	0	0	n/a
27-Jul	72.8	18	3	5	0	26	36
28-Jul	77.4	15	3	1	0	19	25
29-Jul	75.9	11	9	2	0	22	29
30-Jul	75.7	12	5	3	0	20	26
31-Jul	0.0	0	0	0	0	0	n/a
01-Aug	0.0	0	0	0	0	0	n/a
02-Aug	0.0	0	0	0	0	0	n/a
03-Aug	0.0	0	0	0	0	0	n/a
04-Aug	72.9	37	7	2	0	46	63
05-Aug	73.2	35	9	2	0	46	63
06-Aug	89.3	48	14	0	1	63	71
07-Aug	0.0	0	0	0	0	0	n/a
08-Aug	72.2	32	13	3	1	49	68
09-Aug	72.0	21	4	1	0	26	36
10-Aug	0.0	0	0	0	0	0	n/a
11-Aug	69.1	17	14	2	0	33	48
12-Aug	0.0	0	0	0	0	0	n/a
13-Aug	74.6	58	14	3	0	75	101
14-Aug	74.6	31	9	1	0	41	55
15-Aug	73.4	68	28	0	0	96	131
16-Aug	74.2	48	23	3	0	74	100
17-Aug	71.7	14	12	0	0	26	36
18-Aug	73.6	35	28	0	0	63	86
19-Aug	73.6	35	15	0	0	50	68
20-Aug	71.5	16	12	0	0	28	39
21-Aug	48.9	28	10	0	0	38	78
22-Aug	56.7	63	13	11	2	89	157
23-Aug	76.1	54	25	3	0	82	108
24-Aug	76.9	31	12	0	0	43	56
25-Aug	60.1	121	14	30	0	165	275
26-Aug	77.7	82	16	4	0	102	131
27-Aug	72.7	21	16	1	1	39	54
28-Aug	74.7	30	12	2	0	44	59
29-Aug	69.3	32	5	1	0	38	55

Table 1. Migration Coverage and Capture Rates - Fall 1998

Date	Net-hours	Captures				Total	Captures/100 Net-hours
		New Bandings	Recaptures	Escapes	Mortalities		
30-Aug	0.0	0	0	0	0	0	n/a
31-Aug	71.2	71	15	2	0	88	124
01-Sep	71.6	30	14	3	0	47	66
02-Sep	73.5	22	9	2	0	33	45
03-Sep	73.1	46	8	2	0	56	77
04-Sep	72.4	24	7	0	0	31	43
05-Sep	72.3	33	10	1	1	45	62
06-Sep	71.9	8	9	1	0	18	25
07-Sep	73.4	4	2	0	0	6	8
08-Sep	74.4	58	5	3	0	66	89
09-Sep	75.5	32	10	2	1	45	60
10-Sep	74.1	15	3	2	0	20	27
11-Sep	74.5	7	2	0	0	9	12
12-Sep	73.0	45	7	0	0	52	71
13-Sep	74.5	46	6	0	0	52	70
14-Sep	75.5	32	7	0	0	39	52
15-Sep	74.2	14	2	0	0	16	22
16-Sep	79.2	20	1	0	0	21	27
17-Sep	74.1	19	5	3	1	28	38
18-Sep	60.4	39	5	2	0	46	76
19-Sep	61.5	22	15	0	0	37	60
20-Sep	69.9	30	15	1	0	46	66
21-Sep	74.8	78	8	0	0	86	115
22-Sep	72.3	22	4	0	0	26	36
23-Sep	74.2	57	4	2	7	70	94
24-Sep	75.1	46	8	1	0	55	73
25-Sep	49.8	4	4	1	0	9	18
26-Sep	73.5	15	5	0	0	20	27
27-Sep	73.6	6	4	0	1	11	15
28-Sep	74.8	4	1	1	0	6	8
29-Sep	65.9	7	3	0	0	10	15
30-Sep	81.1	9	2	0	0	11	14
01-Oct	74.9	6	3	0	0	9	12
02-Oct	52.7	4	5	0	0	9	17
Total	4371.4	1898	556	110	16	2580	59

LEGEND:

-  BANDING STATION
-  MIGRATION CENSUS ROUTE
-  NON CENSUS ROUTE
-  SANCTUARY (NON-RESERVE)
-  SANCTUARY (RESERVE)

MAPS NET LOCATIONS:
1-8, 10, 15

MIGRATION NET LOCATIONS:
1, 4, 5, 7, 8, 10, 12, 13-15, 17, 18

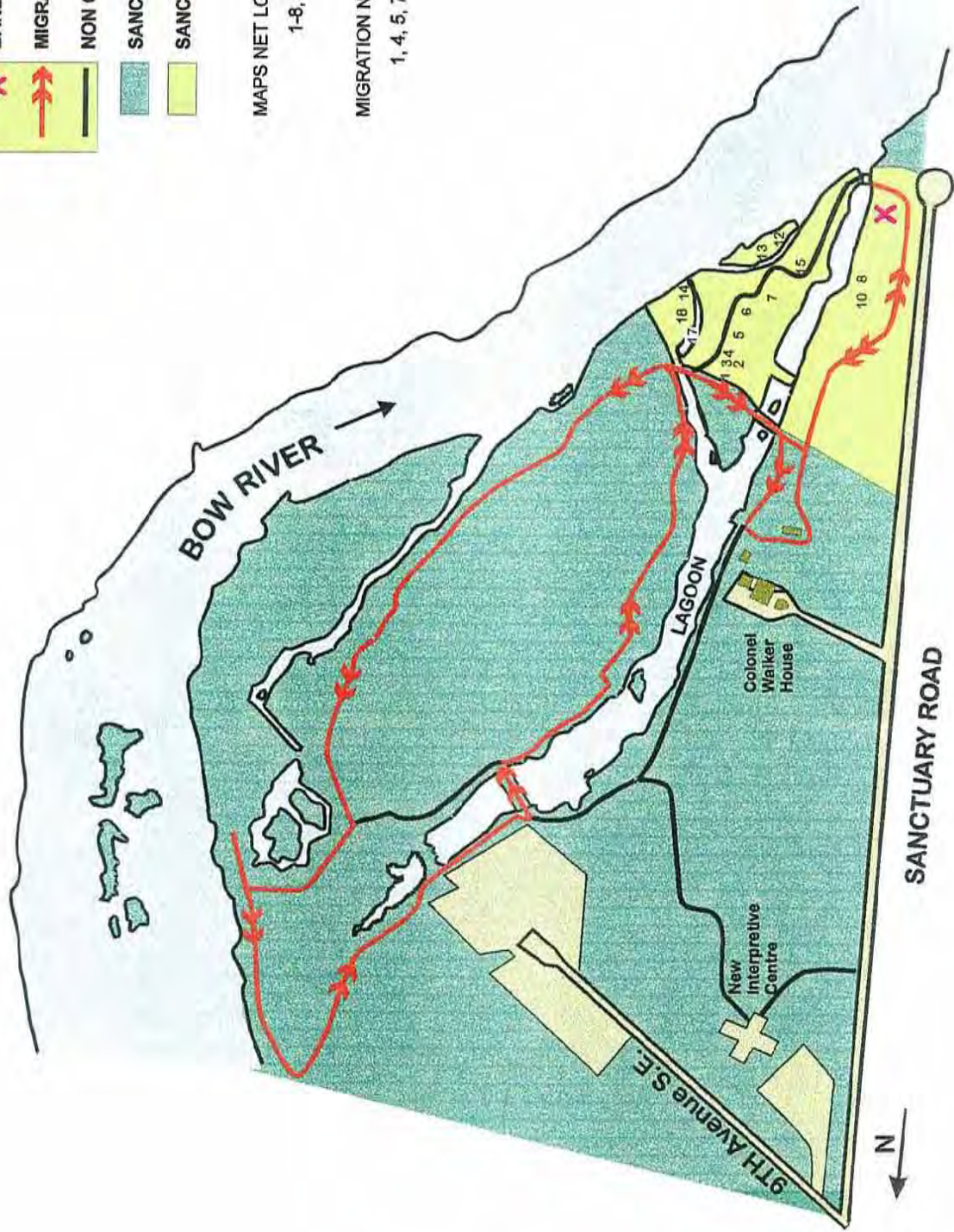


Figure 2. Schematic of Inglewood Bird Sanctuary migration monitoring station

Figure 3. Capture Rates at Inglewood Bird Sanctuary - Fall 1998

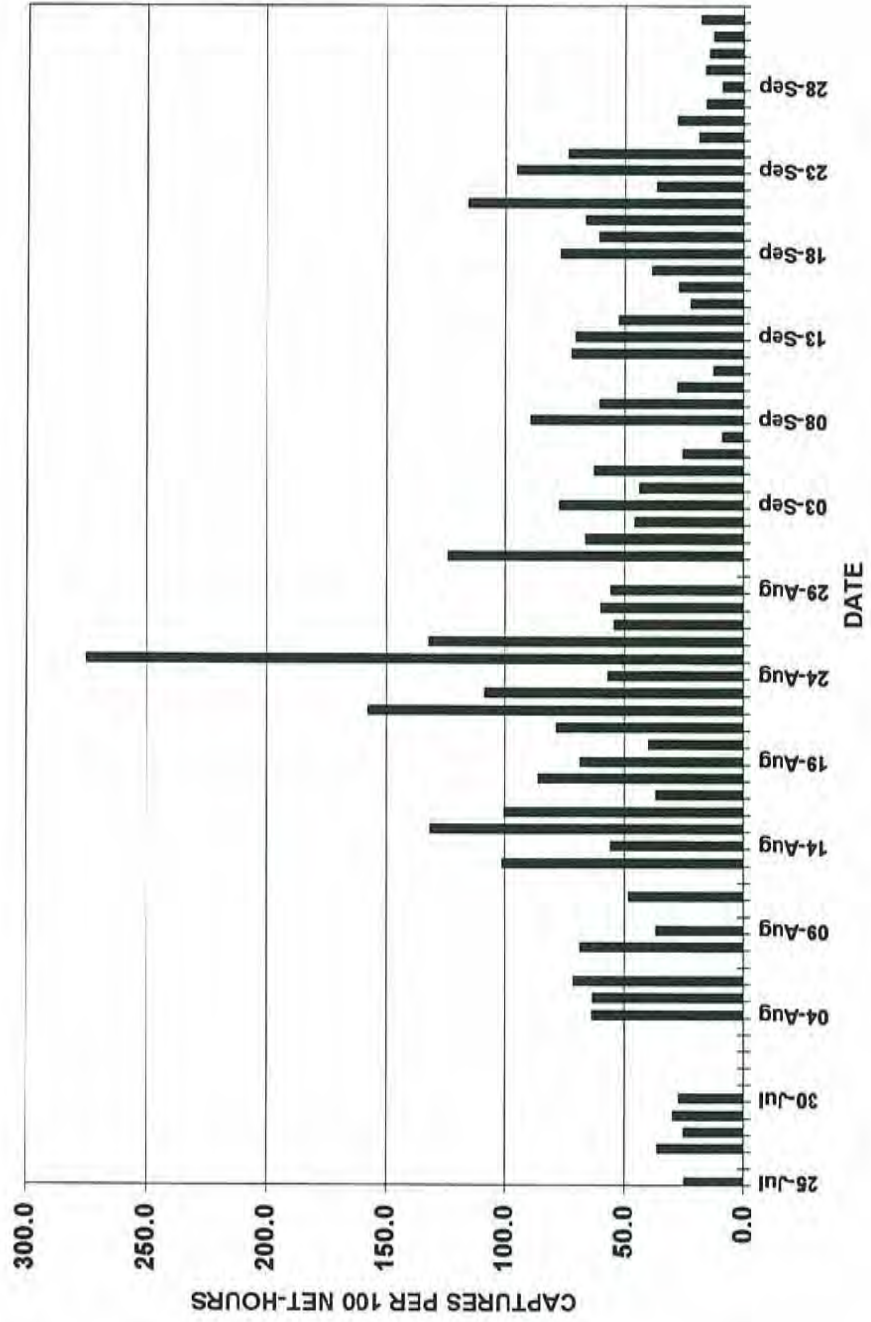


Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1998

	July							Aug																	
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Sharp-shinned Hawk																									
Broad-winged Hawk																									
Solitary Sandpiper											1	1	1					1		1	1	4	1		
Spotted Sandpiper											2	1													
Belted Kingfisher							1				1										1			1	
Downy Woodpecker												2	1							1				1	
Northern Flicker			1	1																					
Olive-sided Flycatcher																									
Western Wood-Pewee											2	2	1											1	
Trail's Flycatcher											1									1		5	2		
Least Flycatcher					1								1					1		2	1			1	
Eastern Kingbird			1	1	1						2	1				2				4		1		2	
Warbling Vireo																1						3	1	2	
Red-eyed Vireo																						1		2	
Black-billed Magpie																									
Black-capped Chickadee												1	1	1						1					
Red-breasted Nuthatch			1																	1				1	
White-breasted Nuthatch					1																			1	
House Wren	3		4	2	1							6	1		2							2	1		
Golden-crowned Kinglet																									
Ruby-crowned Kinglet																									
Veery																								1	
Gray-cheeked Thrush																									
Swainson's Thrush							1																		
Hermit Thrush																									
American Robin	4		1	1	2						4	1	1			1		2					5		
Gray Catbird											1	2										1			
Cedar Waxwing	2		2	1	1										3	1							1		
Tennessee Warbler			4	2	2						1	2	3		7	2		2		6	4	10	1		
Orange-crowned Warbler							1						1							1					
Nashville Warbler																									
Yellow Warbler			2	2	3						4	6	10		3	5		2		4	2	9	7	1	
Magnolia Warbler																						1		1	

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1998

	Aug														Sept										
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	
Sharp-shinned Hawk								1									1								
Broad-winged Hawk																									
Solitary Sandpiper		1		1																					1
Spotted Sandpiper																									
Belted Kingfisher	1					2																			
Downy Woodpecker				1																					1
Northern Flicker																									
Olive-sided Flycatcher						1																			
Western Wood-Pewee	1				1																				
Trill's Flycatcher	3	2	2	3	2	3	3	2			1		2				1		1						1
Least Flycatcher	2		1				2	1									1								
Eastern Kingbird		1	1		1						1														
Warbling Vireo	1	1			1		1	3														2			
Red-eyed Vireo					1						1					2		1	1						
Black-billed Magpie																									
Black-capped Chickadee	1																								1
Red-breasted Nuthatch									1																
White-breasted Nuthatch																									
House Wren	3		2	1	2		1	2	2	3			2	2	2	1	2								1
Golden-crowned Kinglet																									
Ruby-crowned Kinglet																									1
Veery																									
Gray-cheeked Thrush																									
Swainson's Thrush					1	3		2		1						1							1	3	1
Hermit Thrush																	1	1							
American Robin	1	1				1																			1
Gray Catbird																1									
Cedar Waxwing																									
Tennessee Warbler	5	1		1	6	2	1	4	1	3			1												
Orange-crowned Warbler		1	1	2	2	2	1	4	2		4	1	12	6	3	5	2	2	3	6	9				3
Nashville Warbler											1														
Yellow Warbler	3	2	2	7	9	2		2	1								1	1	1						
Magnolia Warbler													1												

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1998

	July							Aug																	
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Yellow-rumped Warbler	1																								
Black-throated Green Warbler				1	1						6	10	16								22	10	13	12	3
Townsend's Warbler												1													
Palm Warbler																									
Blackpoll Warbler																									
Black-and-White Warbler																									
American Redstart																									2
Ovenbird				1																	1	3	3	2	
Northern Waterthrush				1	1						2	1	1		1						2	1	4	3	2
Connecticut Warbler																									
Mourning Warbler																									
MacGillivray's Warbler																									
Common Yellowthroat																									
Wilson's Warbler													1								1	1	2		1
Canada Warbler																									
Western Tanager																									
American Tree Sparrow																									
Chipping Sparrow											2											6	2	1	
Clay-coloured Sparrow					1						1	5		5	2	1						2		1	1
Fox Sparrow																									
Song Sparrow											2	1			1							1	2		
Lincoln's Sparrow							2							2										1	
Swamp Sparrow																									
White-throated Sparrow																									
White-crowned Sparrow																									
Dark-eyed Junco																									
Rose-breasted Grosbeak																									1
Brown-headed Cowbird												1													
Baltimore Oriole			2	2		1						2													
Purple Finch																									
American Goldfinch												1													
Total	10	0	18	15	11	12	0	0	0	0	37	35	48	0	32	21	0	17	0	58	31	68	48	14	

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1998

	Aug														Sept									
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10
Yellow-rumped Warbler																								
Black-throated Green Warbler																								
Townsend's Warbler																								
Palm Warbler																								
Blackpoll Warbler	1																							
Black-and-White Warbler																								
American Redstart																								
Ovenbird	1	1																						
Northern Waterthrush																								
Connecticut Warbler																								
Mourning Warbler																								
MacGillivray's Warbler																								
Common Yellowthroat																								
Wilson's Warbler	2	3	3	5	11	2	2	14	9	4	5	2	1	1										
Canada Warbler																								
Western Tanager	1																							
American Tree Sparrow																								
Chipping Sparrow	1																							
Clay-coloured Sparrow																								
Fox Sparrow																								
Song Sparrow	3																							
Lincoln's Sparrow																								
Swamp Sparrow																								
White-throated Sparrow																								
White-crowned Sparrow																								
Dark-eyed Junco																								
Rose-breasted Grosbeak																								
Brown-headed Cowbird																								
Baltimore Oriole																								
Purple Finch																								
American Goldfinch																								
Total	35	35	16	28	63	54	31	121	82	21	30	32	0	71	30	22	46	24	33	8	4	58	32	15

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1998

	Sept																															Oct		Total			
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2															
Yellow-rumped Warbler							1	2	8	7																											
Black-throated Green Warbler																		2																			
Townsend's Warbler																																					
Palm Warbler											1																										
Blackpoll Warbler										3																											
Black-and-White Warbler										2	1		1																						1		
American Redstart						1																															
Ovenbird	1	1					1			1	1																										
Northern Waterthrush																																					
Connecticut Warbler																																					
Mourning Warbler																																					
MacGillivray's Warbler																							1													1	
Common Yellowthroat																																					
Wilson's Warbler	3	2	4	1	1	2	1	1	2	1	6	2										1	1	1	1										1		
Canada Warbler																																					
Western Tanager																																					
American Tree Sparrow																		1	1	1																	
Chipping Sparrow																																					
Clay-coloured Sparrow	1													1																							
Fox Sparrow																																					
Song Sparrow													1	2																							
Lincoln's Sparrow																																					
Swamp Sparrow																																					
White-throated Sparrow	1	6																																			
White-crowned Sparrow																																					
Dark-eyed Junco																																					
Rose-breasted Grosbeak																																					
Brown-headed Cowbird																																					
Baltimore Oriole																																					
Purple Finch																																					
American Goldfinch																																					
Total	7	45	46	32	14	20	19	39	22	30	78	22	57	46	4	15	6	4	7	9	6	4	6	4	1	2	1	3	2	2	1	1	3	2	1		

Table 3. New Bandings at Inglewood Bird Sanctuary

Year	1992	1994	1995	1996	1997	1998
Start	03-Aug	18-Aug	01-Aug	31-Jul	31-Jul	25-Jul
Finish	22-Sep	09-Sep	30-Sep	12-Oct	15-Oct	02-Oct
# Days	26	20	54	70	65	61
Species						
Wood Duck			1			
Sharp-shinned Hawk	2	2		1	5	4
Cooper's Hawk				1	1	
Northern Goshawk				1		
Broad-winged Hawk						1
Solitary Sandpiper	3	2	3	14	13	14
Spotted Sandpiper		1	2		3	3
Belted Kingfisher	2	2	8	8	6	8
Yellow-bellied Sapsucker			1			
Downy Woodpecker		1	2	3	5	7
Northern Flicker	2	1	4	8	7	3
Olive-sided Flycatcher	3		3		5	2
Western Wood-Pewee	6	4	11	2	33	8
Yellow-bellied Flycatcher			1			
Trail's Flycatcher	24	16	29	25	50	36
Least Flycatcher	16	5	16	9	30	14
Dusky Flycatcher			2	1		
Western Flycatcher			1		1	
Eastern Phoebe		1				
Eastern Kingbird	1	2	7	18	17	19
Blue-headed Vireo	1		1	1	2	
Warbling Vireo	8	15	13	18	27	18
Philadelphia Vireo	1					
Red-eyed Vireo	3	1	2	4	3	12
Blue Jay				1		
Black-billed Magpie			2	1	8	2
N Rough-winged Swallow					2	
Black-capped Chickadee	9	12	7	17	5	19
Red-breasted Nuthatch		3		2		4
White-breasted Nuthatch	1	1	6		4	4
Brown Creeper	1					
House Wren	3	3	50	45	52	49
Golden-crowned Kinglet	2		2	1	1	1
Ruby-crowned Kinglet	3	1	10	18	20	14
Townsend's Solitaire				1		
Veery	2					1
Gray-cheeked Thrush	1					1
Swainson's Thrush	34	13	17	52	10	28
Hermit Thrush	4		3	14	6	9
American Robin	5	11	114	81	81	31
Gray Catbird		1		5	7	6
Brown Thrasher					3	
European Starling			2			
Cedar Waxwing	12	1	42	14	67	11
Tennessee Warbler	43	5	33	30	52	74
Orange-crowned Warbler	24	36	177	116	86	207

Table 3. New Bandings at Inglewood Bird Sanctuary

Year	1992	1994	1995	1996	1997	1998
Start	03-Aug	18-Aug	01-Aug	31-Jul	31-Jul	25-Jul
Finish	22-Sep	09-Sep	30-Sep	12-Oct	15-Oct	02-Oct
# Days	26	20	54	70	65	61
Species						
Nashville Warbler				1	2	1
Yellow Warbler	56	19	44	62	137	91
Chestnut-sided Warbler	1					
Magnolia Warbler	9	4	2	2	4	4
Yellow-rumped Warbler	293	171	496	92	191	638
Black-throated Green Warbler					1	1
Townsend's Warbler	1				1	2
Palm Warbler		3	7	4	3	8
Bay-breasted Warbler			1			
Blackpoll Warbler	17	5	17	8	6	30
Black-and-white Warbler	4	1	1	2		3
American Redstart	19	4	3	6	4	20
Ovenbird	22	6	10	30	11	38
Northern Waterthrush	22	8	23	56	46	26
Connecticut Warbler	2	2	4	4	1	3
Mourning Warbler	4	2	5	10	3	9
MacGillivray's Warbler	2		3	8	10	6
Common Yellowthroat		1	6	1	8	10
Wilson's Warbler	121	68	102	175	119	113
Canada Warbler	1			2	1	3
Western Tanager	1	1	12	1	3	2
American Tree Sparrow			10	3	3	7
Chipping Sparrow	4	1	29	14	151	27
Clay-coloured Sparrow		1	1	6	21	37
Savannah Sparrow		1			2	
Fox Sparrow	1	1	1			2
Song Sparrow		1	9	9	15	18
Lincoln's Sparrow	9	7	53	28	13	59
Swamp Sparrow				2		7
White-throated Sparrow	13	11	73	28	39	77
Harris's Sparrow			1			
White-crowned Sparrow	5	4	20	24	22	21
Dark-eyed Junco	5	3	15	15	3	10
Rose-breasted Grosbeak	6				1	3
Red-winged Blackbird			4			
Common Grackle			3			
Brown-headed Cowbird			1	2	2	1
Baltimore Oriole	4		21	12	12	8
Purple Finch		1			2	1
Pine Siskin					2	
American Goldfinch	3			2	4	2
Total	841	466	1549	1121	1455	1898
Species	52	48	61	59	64	64
Net-hours	934	1078	3456.4	4547.2	4608.3	4371.4
Bandings/100 Net-hours	90.0	43.2	44.8	24.7	31.6	43.4

The *Oporornis* warblers are often difficult to detect and identify through conventional bird watching. During 1998 migration monitoring at IBS 3 Connecticut Warblers, 9 Mourning Warblers and 6 MacGillivray's Warblers were banded. A study of differences between Mourning and MacGillivray's Warblers captured at IBS has been underway since 1996. All birds are photographed when initially captured and additional morphometric detail and plumage characteristics documented.

After three years of highly standardized monitoring a few species are showing highly consistent occurrence rates: 14, 13, 14 Solitary Sandpipers in 1996, 1997, 1998 respectively; 18, 17, 19 Eastern Kingbirds in 1996, 1997, 1998 respectively; 50, 45, 52, 49 House Wrens in 1995, 1996, 1997, 1998 respectively; and 20, 24, 22, 21 White-crowned Sparrows in 1995, 1996, 1997, 1998 respectively. These results suggest that migration monitoring at Inglewood will detect even modest population declines over time. Two species that have shown a decline from 1996-1998 are Northern Waterthrush (56, 46, 26) and Swainson's Thrush (52, 10, 28). Declines such as these occurring over 3 years are not necessarily significant. Additional years of data will confirm whether declines are actually occurring or that the variation in numbers monitored simply reflects a natural range of variation.

It is interesting to examine the phenology of migrant species that are monitored at Inglewood Bird Sanctuary. Based on total new captures some species evidence a consistent window of occurrence year-to-year while other species are variable. Appendix 3 presents by species and year: first and last date of capture; occurrence window within which 90% of birds are captured; and median capture date. Note that for species with ≤ 6 captures in a year, the individual capture dates are indicated and median date and 90% capture interval are not applicable.

Recaptures

Recaptures at IBS totalled 556 involving 376 different birds of 42 species (Appendix 4). Recaptures were highest in resident species: Black-capped Chickadee 41 recaptures compared to 19 new bandings; and House Wren 73 recaptures compared to 49 new bandings. However some resident species evidence a lower recapture rate suggesting that migrants swell the ranks: Yellow Warbler 19 recaptures compared to 91 new bandings. A few species appear to use IBS for moulting or pre-migratory foraging: Swainson's Thrush 9 recaptures compared to 28 new bandings; Tennessee Warbler 38 recaptures compared to 74 new bandings; Ovenbird 37 recaptures compared to 38 new bandings; and Northern Waterthrush 32 recaptures compared to 26 new bandings. Some species do not appear to linger at IBS: Red-eyed Vireo no recaptures compared to 12 new bandings; Chipping Sparrow no recaptures compared to 37 new bandings; and Clay-coloured Sparrow 1 recapture compared to 37 new bandings.

Estimated Daily Totals (EDTs)

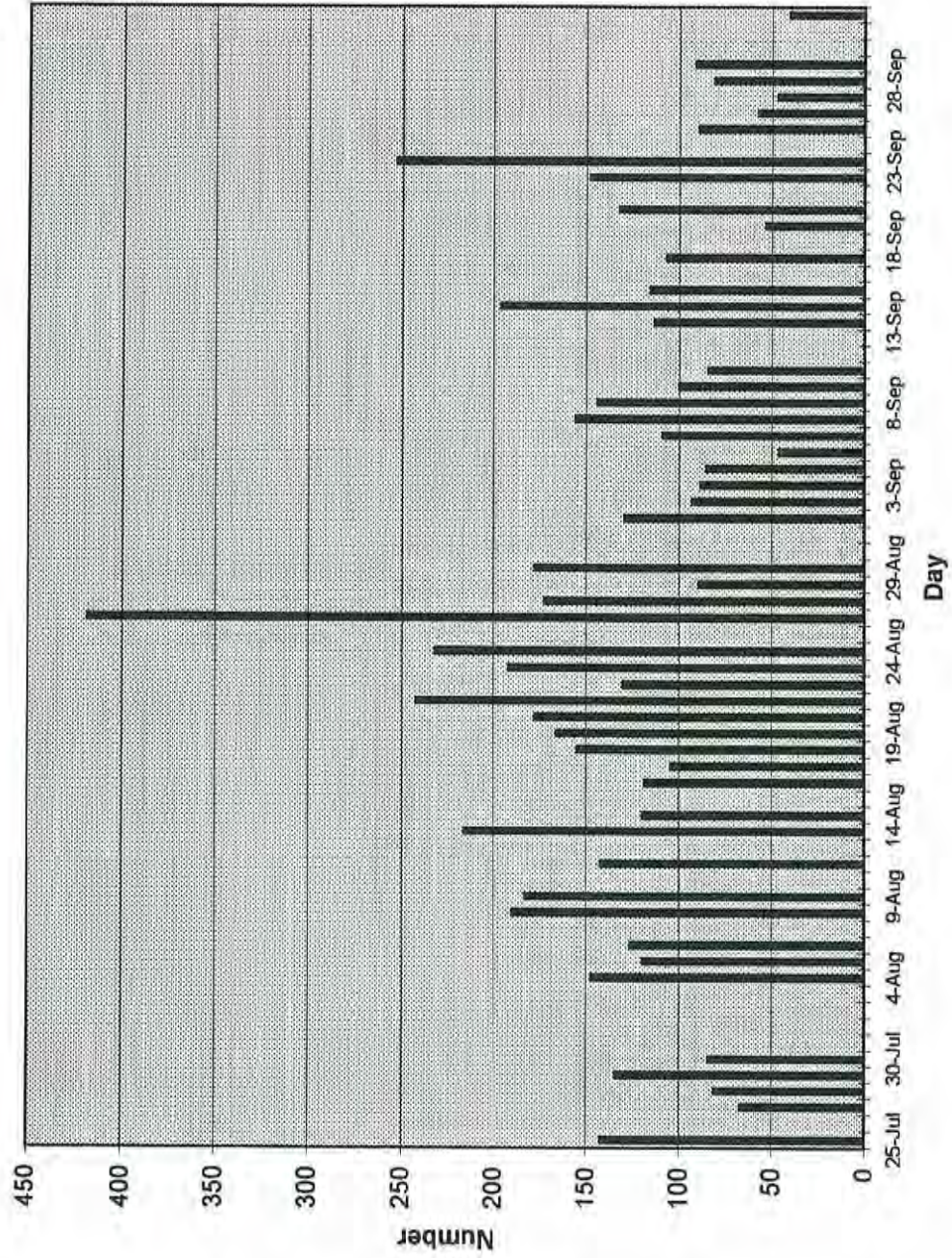
The estimated daily totals (EDTs) represent the total number of birds, by species, detected at the IBS migration monitoring site each day. Each EDT incorporates capture data as well as a standardized census and any casual observations made during banding operations. The EDTs, after removal of probable and known stopovers (PKS), give an overall description of bird migration. EDT is secondary to mist-netting at Inglewood, as a monitoring measure. If high capture rates and/or personnel shortage create a risk to the welfare of the birds, a census (and therefore an EDT) is not done. Appendices 5 and 6 summarize the migrant and PKS components respectively of the EDTs by species and day. Figure 4 illustrates the intensity of observed migration during the migration monitoring period.

The EDTs at IBS during the 1998 fall migration documented 116 species seen, heard or captured. This total includes 23 species of warblers and vireos, 6 species of flycatcher and 19 sparrow and other finch species. Of the 116 species, a number were single sightings of one individual bird. Some of the more interesting observations were a Yellow-bellied Flycatcher on 1 September, 2 Black-throated Green Warblers on 18 August and 1 Red Crossbill on 25 September.

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Figure 4. Migrants at Inglewood Bird Sanctuary - Fall 1998



MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS)

Background

The Monitoring Avian Productivity and Survivorship (MAPS) Program is a cooperative effort among public agencies, private organizations, and bird banders of North America. It provides long-term data on population and demographic parameters for target landbird species throughout the continent. The 1998 field season was MAPS tenth year of North American operation.

MAPS utilizes standardized, constant-effort mist-netting during the breeding season at a continent-wide network of stations. Annual regional indices of adult population size and post-fledging productivity are estimated from capture data during the breeding season. Annual regional estimates are made of adult survivorship, adult population size and recruitment into the adult population from capture-recapture data.

The continent is divided into eight major regions based on biogeographical and meteorological considerations, and each region has, within it, target species. IBS falls into the Northwest Region whose target species are:

- Dusky Flycatcher;
- Western Flycatcher complex;
- Swainson's Thrush;
- American Robin;
- Warbling Vireo;
- Orange-crowned Warbler;
- Yellow Warbler;
- MacGillivray's Warbler;
- Wilson's Warbler;
- Song Sparrow;
- Lincoln's Sparrow;
- "Oregon" Dark-eyed Junco.

All of these species have been captured at IBS although only American Robin, Warbling Vireo, Yellow Warbler, Song Sparrow, and Lincoln's Sparrow are breeders. MAPS data is provided to the Institute for Bird Populations in Point Reyes, CA where it is integrated with data from the other stations in North America.

Objectives

The main objective of the MAPS Program is to contribute to an integrated avian population monitoring system for selected North American landbirds. The indices and estimates obtained:

- determine annual changes and, ultimately, longer-term trends in population and demographic parameters of target species in each region;
- relate these trends to readily-measured environmental co-variates such as climatic factors, habitat type, and management practice; and
- refine current population models and develop new ones.

Methods

The MAPS Program consists of standardized constant-effort mist netting during the breeding season. The breeding season is considered to extend from May through mid-August and is divided into 10 ten-day periods. Ten 30-mm mist-nets are operated for 6 hours from sunrise on one day in each of the ten-day periods. Mist-netting commences the first ten-day period during which the great majority of the breeding adults of the target species have established territories and migrant individuals of these species are no longer passing through the area. The operation of the mist-nets must continue for a minimum of three periods in the adult "super-period" and two periods in the young "super-period". For IBS the start period is period 4 (31 May - 9 June) and coverage entails 7 of the 10 ten-day periods.

An additional requirement is to record the type and distribution of vegetation present at the MAPS station. Because changes in the vegetation at a station can cause changes in breeding populations and demographic parameters, the type and distribution of the vegetation must be described each year using the provided U.S. Vegetation Cover Classification System.

Coverage

1998 marked the sixth year of the MAPS project at IBS since 1992. Lack of qualified personnel precluded gathering data in 1994. In 1998 415.3 net-hours were achieved over 7 periods.

Results

The number of each species captured, by date, during 1998 are summarized in Table 4. The number of each species that were banded, recaptured, or escaped before banding are summarized in Table 5 for 1998 as well as five previous years during which MAPS was conducted.

Discussion

New banding numbers continue to fluctuate (Table 5). Highlights in 1998 included the first Veery banded since 1992, Gray Catbirds captured in breeding condition, and the recapture of 3 Warbling Vireos banded in previous years (Table 4). Surprisingly no unbanded Warbling Vireos were captured.

The number of migrants detected during MAPS continues to vary from year to year. In 1993 and 1996 several migrant sparrows and/or warblers were captured. During both of these years, cold temperatures and/or snowfalls persisted well into May. In 1998 migrant warblers were caught in mid-July through early August suggesting an early fall migration.

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Table 4. Inglewood Bird Sanctuary MAPS Summary - 1998

Species	Date			6 June			10 June			30 June			5 July			17 July			25 July			06-Aug			Total	
	Banded	Other		Banded	Other		Banded	Other		Banded	Other		Banded	Other		Banded	Other		Banded	Other		Banded	Other			
Downy Woodpecker																									1	
Hairy Woodpecker																										1
Western Wood-Pewee					1																					1
Least Flycatcher					1																					1
Eastern Kingbird										1	1															2
Warbling Vireo						2																				3
Black-capped Chickadee										2	1															5
House Wren				1	1					2	3															20
Veery																										1
Swainson's Thrush				1																						1
American Robin				1							1															12
Gray Catbird				2	1						1															6
Cedar Waxwing				1							1															10
Tennessee Warbler																										6
Orange-crowned Warbler																										1
Yellow Warbler						2					1															16
Yellow-rumped Warbler																										3
Ovenbird																										1
Northern Waterthrush																										2
Wilson's Warbler																										1
Clay-coloured Sparrow																										6
Song Sparrow																										1
Lincoln's Sparrow																										2
Brown-headed Cowbird																										1
Baltimore Oriole																										1
House Sparrow				1																						2
Total Birds	7	6		12	3		6	7	6	4	10	4	7	3	27	10	112									
Total Species	6	4		7	3		4	5	4	2	7	1	3	3	14	6	26									
Net-Hrs	59			60			58		59		60		59		60		415									
Captures/100 Net-Hrs	22			25			23		17		23		17		62		27									

Note: Other = recaptures + escapes

Table 5. Inglewood Bird Sanctuary MAPS Summary 1992-1998

	New Bandings						Recaptures					
	1992	1993	1995	1996	1997	1998	1992	1993	1995	1996	1997	1998
American Kestrel			1									
Downy Woodpecker	1	3	1	5	4	1	2	1		5		
Hairy Woodpecker	1	1	1			1						
Yellow-shafted Flicker	1	1	1									
Flicker Intergrade			2						1			
Northern Flicker				2								
Western Wood-Pewee	6	1	1	1	1	2	2	3				1
Trail's Flycatcher				3	3							
Least Flycatcher	14	8	3	2	3	4	9	4	1			
Eastern Kingbird	2	1			3	1						1
Warbling Vireo	7	7	1	4	2		1		1	1		3
Red-eyed Vireo	1											
Black-billed Magpie				1	2							
Tree Swallow	3											
Bank Swallow	1											
Black-capped Chickadee	5	7	5	9	2	3	3	2	5	1		2
White-breasted Nuthatch	3	4		2				1	2			
House Wren	5	11	9	9	13	8	1	3	11	7	10	11
Veery	2					1	4					
Swainson's Thrush	10	8	6	4	3	1	1		2			
American Robin	21	6	26	25	23	10					6	2
Gray Catbird	3			1	1	4	1					2
European Starling			1									
Cedar Waxwing	27	8		6	1	9	2	3				1
Tennessee Warbler	1	6		7	1	3		1		1		3
Orange-crowned Warbler						1						
Yellow Warbler	20	14	7	2	6	9	16	16	5	3	2	6
Myrtle Warbler	10					2						1
American Redstart		1										
Ovenbird	3			1		1	1					
Northern Waterthrush						1						1
Mourning Warbler	1											
Wilson's Warbler				2		1						
Western Tanager		1	3	1	2							
Chipping Sparrow		7			1							
Clay-coloured Sparrow		1				6						
Song Sparrow		1		1		1						
Lincoln's Sparrow		3	1	2	5	2		2		1	1	
White-throated Sparrow				2						1		
Rose-breasted Grosbeak				1								
Common Grackle			1		2							
Brown-headed Cowbird	6				3		2	2				
Baltimore Oriole	3	7	2	8	9	1		1		4	1	
Purple Finch		1										
American Goldfinch	2	2		1								
House Sparrow	2					2						
Total	161	110	72	102	90	75	45	39	25	26	21	34
Species	27	24	18	25	21	24	13	12	6	10	6	12

PERSONNEL

Volunteer participation in all of the CBBS projects continues to be the key to the success of our research efforts. Banding at IBS is done in an area of the sanctuary designated "reserve" and off-limits to the public. The Area Manager has made it a condition of operation that no more than 3 people are in the reserve at one time, in order to minimize impact. Thus, on any given day, a Bander-in-Charge and 2 volunteers carry out the banding.

Without donated time, primarily by members of the Calgary Bird Banding Society, the high degree of success achieved would not have been possible. Sincere appreciation is extended to all of the people listed in Table 6 who donated approximately 8 hours on each day indicated.

Banders-in-Charge (BIC)

No salaried staff are involved in any CBBS projects. However, in order to cover as many days as possible during the spring banding and migration monitoring projects it continues to be necessary to bring in several Banders-in-Charge (BIC) from outside Calgary. In order to attract out-of-town BICs a daily per diem and travel allowance is offered. This arrangement provides an incentive for qualified individuals to assume the BIC duties and imposes accountability on the BIC to complete field data sheets and input data. The per diem decided upon by the general membership for the 1998 field season was \$100/day for out-of-town BICs and \$50/day for local BICs. No per diems are paid until all duties of the BIC, including data entry, have been fully discharged.

Table 6. Number of days of effort contributed by various individuals at Inglewood Bird Sanctuary in 1998.

Individual	MMonitoring		MAPS	
	BIC	Vol	BIC	Vol
Grahame Booth	9 ¹		3 ¹	
Doug Collister	9 ¹	2	1 ¹	1
Ross Dickson	7 ¹			
Rainer Ebel	18 ²			
Garry Hornbeck		5		
Clive Jackson		2		
Stefan Jungkind	5 ²			
Dwight Knapik		6		1
Steve Lane		9		
Shonna McLeod		22		2
Arlette Malcolm		5		
Greg Meyer	13 ³		3 ¹	1
Pat Mitchell		10		3
El Peterson		5		1
Gwen Smiley		1		1
Cyndi Smith		1		
Don Stiles		6		
Alexandra Torn		3		1
Michael Vassal		2		
Catherine Watson-McDonald		2		
Linda Wiggins		3		
Bruce Wilson		5		
Scott Wilson		7		3
Total	61	96	7	14

¹ donated ² received per diem ³ partially donated

1998 SPRING BANDING

The CBBS initiated a spring banding project in 1997 on private property 22-km SSE of the City of Calgary, approximately 1.5-km S of the Bow River that has become known as Dunbow Road.

The sampled habitat on the property is comprised of 3 different vegetation types. The first area is a balsam poplar ravine with a predominantly willow understorey. Spring melt water from the surrounding area flows N through this area into a small pond before spilling out and flowing ultimately into the Bow River. The second area is comprised of two parallel caragana hedges, and the third area is a scrubby aspen forest with a thick red-osier dogwood understory. Five 30-mm mist-nets were located in each of the three habitat types for a total of 15 nets. The site protocol followed that prescribed for fall migration monitoring at IBS.

During 1998, a banding effort of 304.5 net-hours resulted in a total of 288 captures (Table 7). This total is comprised of 161 new bandings, 110 recaptures, 17 escapes, and 3 mortalities. Table 8 provides a listing of new bandings by species for both 1997 and 1998. Several birds banded in 1997 were recaptured in 1998 (see Significant Recaptures). A noteworthy capture was an apparent Yellow Warbler/Tennessee Warbler hybrid on 21 May (see frontispiece).

Various individuals who contributed volunteer effort to this project (Table 9), are gratefully acknowledged for their time in cutting net lanes and supporting the BICs.

Special thanks once again to Norma Jensen, who graciously allows us the use of her property for this project.

Table 7. New Bandings at Dunbow Road - Spring 1998

Month Day	May																	Jun			Total							
	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		29	30	31	01	02	03	
Yellow-bellied Sapsucker	1																											1
Red-naped Sapsucker												1																1
Downy Woodpecker	1																							1				2
Northern Flicker																												1
Trail's Flycatcher																				1								2
Least Flycatcher																				4								9
Tree Swallow	2																						1					3
Black-capped Chickadee	1	5	1	1				2				1																11
House Wren				1				1			3	2																23
Swainson's Thrush	2	2	2																									6
American Robin	2	2	2			1				1																		10
Cedar Waxwing																												4
Orange-crowned Warbler	1	1	1			2		2		2																		9
Yellow Warbler																												23
Yellow-rumped Warbler	3							1																				4
Northern Waterthrush	1				1	1																						4
Chipping Sparrow	1	1																										3
Clay-coloured Sparrow																												28
Vesper Sparrow																												1
Lincoln's Sparrow																												2
White-throated Sparrow																												2
White-crowned Sparrow																												4
Brown-headed Cowbird																												3
American Goldfinch																												5
Total	7	18	0	13	5	5	0	5	7	9	0	11	17	0	0	17	0	0	18	0	0	7	11	4	0	7	161	
Species	6	9	0	9	4	4	0	2	5	5	0	4	4	0	0	7	0	0	9	0	0	5	6	3	0	3	24	

Table 8. New Bandings at Dunbow Road 1997-1998

Year	1997	1998
Start	07-May	09-May
Finish	05-Jun	03-Jun
# Days	24	16
Species		
Cooper's Hawk	1	
Yellow-bellied Sapsucker	3	1
Red-naped Sapsucker	1	1
Downy Woodpecker	4	2
Northern Flicker		1
Western Wood-pewee	2	
Traill's Flycatcher	4	2
Least Flycatcher	10	9
Warbling Vireo	2	
Tree Swallow	1	3
Black-capped Chickadee	41	11
House Wren	19	23
Golden-crowned Kinglet	2	
Ruby-crowned Kinglet	7	
Veery	1	
Swainson's Thrush	19	6
American Robin	22	10
Gray Catbird	1	
Cedar Waxwing	3	4
Orange-crowned Warbler	11	9
Nashville Warbler	1	
Yellow Warbler	15	23
Yellow-rumped Warbler	19	4
Townsend's Warbler	2	
Blackpoll Warbler	1	
American Redstart	2	
Northern Waterthrush	3	4
Chipping Sparrow	10	3
Clay-coloured Sparrow	36	28
Vesper Sparrow	2	1
Song Sparrow	1	
Lincoln's Sparrow	7	2
White-throated Sparrow	2	2
White-crowned Sparrow	31	4
Brown-headed Cowbird	3	3
Baltimore Oriole	1	
Pine Siskin	1	
American Goldfinch	8	5
Total	299	161
Species	37	24
Net-hours	2299	1304.5
Bandings/100 Net-hours	13.0	12.3

Table 9. Number of days of effort contributed by various individuals at Dunbow Road in 1998.

Individual	Spring Banding	
	BIC	Vol
Grahame Booth	4 ¹	
Doug Collister	3 ¹	
Brian Couronne		2
Dick Graham		2
Dwight Knapik		2
Steve Lane		2
Shonna McLeod		4
Greg Meyer	5 ³	
Pat Mitchell		1
Dale Paton	4 ¹	
El Peterson		3
Gwen Smiley		1
Alexandra Torn		3
Catherine Watson-McDonald		1
Linda Wiggins		1
Bruce Wilson		1
Scott Wilson		1
Total	16	24

¹ donated ² received per diem ³ partially donated

SIGNIFICANT RECAPTURES

All recaptures of birds banded in previous years are listed below. Seven of these significant recaptures are of particular interest. An IBS White-breasted Nuthatch not detected since 1995 showed up in 1998 at IBS. An IBS Black-capped Chickadee originally banded in 1994 was recaptured in 1998 as at least a 5-year old. An IBS House Wren originally banded in 1992 was recaptured in 1998 as at least a 7-year old. Two Swainson's Thrushes banded at IBS during fall migration in 1996 and 1997 respectively were recaptured during fall migration 1998. These two birds represent rare recaptures of migrants at the same site year-to-year. This phenomena occurred at IBS in 1997 (3 Swainson's Thrushes), 1996 (1 Swainson's Thrush) and 1993 (1 Yellow-rumped Warbler). An IBS Warbling Vireo originally banded in 1994 was recaptured in 1998 as at least a 5-year old. An IBS Yellow Warbler originally banded in 1995 was recaptured in 1998 as at least a 5-year old.

Yellow-bellied Sapsucker 8051-65119 Banded as AHY-F by Grahame Booth at Dunbow Road on 19 May 1997. Recaptured there as ATY-F on 13 May 1998. At least 3 years old.

Eastern Kingbird 1461-63750 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 1 August 1997. Recaptured there as AHY-U on 4 August 1998. At least 2 years old.

Downy Woodpecker 1461-02314 Banded as AHY-F by Greg Meyer at Inglewood Bird Sanctuary on 13 July 1996. Recaptured there once in 1997 and as AHY-F on 11 August and 27 September 1998. At least 3 years old.

White-breasted Nuthatch 1461-84757 Banded as AHY-M by Doug Collister at Inglewood Bird Sanctuary on 12 August 1995. Recaptured there as ASY-M on 29 July 1998. At least 4 years old.

Black-capped Chickadee 1950-45258 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 6 September 1994. Recaptured there once in 1995, 3 times in 1996, once in 1997 and as AHY-U on 19 September 1998. At least 5 years old.

... 1980-79991 Banded as AHY-F by Grahame Booth at Inglewood Bird Sanctuary on 22 July 1995. Recaptured there 6 times in 1996, twice in 1997 and as AHY-U on 9 September 1998. At least 4 years old.

... 1990-57154 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 1 August 1997. Recaptured there as AHY-U on 20 August and 15 September 1998. 1 year old.

... 2050-70849 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 3 September 1997. Recaptured there as AHY-U on 23 August 1998. 1 year old.

... 2120-00102 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as AHY-U on 12 May 1998. At least 2 years old.

... 2120-00103 Banded as AHY-F by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as AHY-F on 27 May 1998. At least 2 years old.

... 2120-00105 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as ASY-M on 10, 14, 21, 27 & 31 May 1998. At least 2 years old.

... 2120-00107 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as ASY-M on 9 May 1998. At least 2 years old.

... 2120-00109 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as AHY-U on 10, 12, 14, 18, 21, 24 & 30 May 1998. At least 2 years old.

... 2120-00110 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as ASY-M on 24 May 1998. At least 2 years old.

... 2120-00113 Banded as AHY-F by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as AHY-F on 21 May 1998. At least 2 years old.

... 2120-00114 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as AHY-U on 10 & 14 May 1998. At least 2 years old.

... 2120-00117 Banded as AHY-F by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as ASY-F on 10, 14 & 27 May 1998. At least 2 years old.

... 2120-00125 Banded as AHY-M by Rainer Ebel at Dunbow Road on 8 May 1998. Recaptured there as AHY-M on 14 & 27 May 1998. At least 2 years old.

... 2120-00128 Banded as AHY-M by Rainer Ebel at Dunbow Road on 9 May 1998. Recaptured there as AHY-U on 14 May 1998. At least 2 years old.

... 2120-0019 Banded as AHY-F by Doug Collister at Dunbow Road on 31 May 1997. Recaptured there as AHY-F on 21 May 1998. At least 2 years old.

... 3500-89670 Banded as AHY-U by Greg Meyer at Dunbow Road on 28 May 1997. Recaptured there as AHY-U on 10 May 1998. At least 2 years old.

House Wren 1910-52261 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 21 July 1992. Recaptured there once in 1993, 3 times in 1995, 3 times in 1996, twice in 1997 as well as AHY-M on 5, 25 & 29 July and 4, 6 & 8 August 1998. At least 7 years old.

Swainson's Thrush 1461-63572 Banded as AHY-U by Stefan Jungkind at Inglewood Bird Sanctuary on 4 August 1997. Recaptured there as AHY-U on 29 July and 23 August 1998. At least 2 years old.

... 1451-67159 Banded as AHY-F by Grahame Booth at Inglewood Bird Sanctuary on 1 August 1996. Recaptured there as AHY-U on 29 July 1998. At least 3 years old.

American Robin 1142-49046 Banded as ASY-F by Greg Meyer at Inglewood Bird Sanctuary on 14 June 1997. Recaptured there as ASY-F on 30 June 1998. At least 3 years old.

... 1142-49201 Banded as ASY-U by Rainer Ebel at Dunbow Road on 8 May 1997. Recaptured there four more times in 1997 as well as AHY-U on 10 May 1998. At least 3 years old.

... 1142-49217 Banded as AHY-M by Stefan Jungkind at Dunbow Road on 3 June 1997. Recaptured there as ASY-M on 13 & 30 May 1998. At least 2 years old.

... 1142-49221 Banded as AHY-F by Stefan Jungkind at Dunbow Road on 4 June 1997. Recaptured there as AHY-F on 12 & 18 May 1998. At least 2 years old.

Warbling Vireo 1950-45076 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 20 August 1994. Recaptured there twice in 1996, once in 1997 as well as AHY-U on 15 August 1998. At least 5 years old.

... 2050-70837 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 28 August 1997. Recaptured there as AHY-M on 10 June 1998. 1 year old.

... 2050-70961 Banded as AHY-U by Greg Meyer at Inglewood Bird Sanctuary on 6 September 1996. Recaptured there as ASY-U on 6 June 1998. At least 3 years old.

Yellow Warbler 1950-45519 Banded as AHY-F by Doug Collister at Inglewood Bird Sanctuary on 16 August 1995. Recaptured there once in 1996 as well as ASY-F on 30 July 1998. At least 4 years old.

... 1950-45878 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 19 August 1996. Recaptured there once in 1997 as well as ASY-M on 6 June, 5 July, and 15 & 18 August 1998. 2 years old.

... 1980-79983 Banded as ASY-M by Grahame Booth at Inglewood Bird Sanctuary on 7 July 1995. Recaptured there once in 1996, twice in 1997 as well as ASY-M on 7 July and 22 August 1998. At least 5 years old.

... 1990-57104 Banded as AHY-M by Stefan Jungkind at Dunbow Road on 2 June 1997. Recaptured there as AHY-M on 1 & 3 June 1998. At least 2 years old.

... 2070-42756 Banded as U-U by Dale Paton at Inglewood Bird Sanctuary on 11 August 1997. Recaptured there as AHY-F on 9 August 1998. At least 1 year old.

... 2120-00181 Banded as AHY-F by Stefan Jungkind at Dunbow Road on 30 May 1997. Recaptured there as ASY-F on 24 May and 1 June 1998. At least 2 years old.

Clay-coloured Sparrow 2120-00157 Banded as AHY-M by Rainer Ebel at Dunbow Road on 14 May 1997. Recaptured there as AHY-U on 13 May 1998. At least 2 years old.

... 2120-00176 Banded as AHY-U by Stefan Jungkind at Dunbow Road on 29 May 1997. Recaptured there as AHY-M on 20 May 1998. At least 2 years old.

Vesper Sparrow 1461-05331 Banded as AHY-U by Doug Collister at Dunbow Road on 31 May 1997. Recaptured there as AHY-U on 21 May 1998. At least 2 years old.

Brown-headed Cowbird 1461-05333 Banded as AHY-F by Stefan Jungkind at Dunbow Road on 2 June 1997. Recaptured there as ASY-F on 30 May 1998. At least 2 years old.

Baltimore Oriole 8051-65131 Banded as ASY-F by Grahame Booth at Inglewood Bird Sanctuary on 4 July 1997. Recaptured there as AHY-F on 13 August 1998. At least 3 years old.

MORTALITIES AND INJURIES

It continues to be a goal of the CBBS to achieve as low a rate of casualties as possible during all banding projects. Our objective is to come as close to zero as possible. Casualties here refer to all injuries, minor and serious, including fatalities.

Table 10 presents all 1998 casualties during the spring banding, MAPS and migration monitoring projects combined. Note that the number captured, by species, is only given where that species experienced injury or mortality.

Mortality rates for all CBBS banding projects have remained at acceptable levels of 0.53%, 0.69%, 0.64% and 0.64% for 1995, 1996, 1997, and 1998 respectively. Injury rates dropped in 1998 to 1.21% from the 2.29% experienced in 1997 but remained higher than the 0.82% and 1.15% levels experienced in 1995 and 1996 respectively. Increases through 1997 was in part due to an increased awareness of banding personal to record even slight abrasions. The decrease in 1998 is not unexpected considering CBBS members are steadily increasing their skill in mist-net extraction techniques. In spite of apparent improvement the CBBS reviews each casualty to determine the potential to reduce or avoid occurrences in the future.

Table 10. Casualties During 1998 Banding Projects

Species	Number Captured	Injuries		Mortalities	
		Number	Type	Number	Cause
Solitary Sandpiper	16	2	wing abrasion		
Spotted Sandpiper	3	1	leg abrasion		
Belted Kingfisher	10	1	wing abrasion		
Hairy Woodpecker	1	1	cut wing pit		
Black-capped Chickadee	114	2	cut foot	1	net left open overnight
		1	broken leg		
House Wren	207	1	leg abrasion		
		1	treated for shock		
Veery	5	1	wing abrasion		
Swainson's Thrush	45	1	cut leg		
		1	SSHA attack		
American Robin	66	6	wing abrasion	1	SSHA predation
		2	broken leg	1	net left open overnight
		1	cut wing pit		
		1	pulled tongue		
Gray Catbird	19	1	leg abrasion		
Cedar Waxwing	28			1	shock
Tennessee Warbler	121	1	broken leg		
Orange-crowned Warbler	277	1	treated for shock		
Yellow Warbler	175			1	shock
Yellow-rumped Warbler	772	1	wing abrasion	6	Mule Deer predation
		1	cut foot	1	shock
				1	left in bird bag overnight
Ovenbird	79	1	wing abrasion		
		1	treated for shock		
Northern Waterthrush	71	1	wing abrasion		
Wilson's Warbler	149	2	broken leg	1	SSHA predation
				1	BBMA predation
Lincoln's Sparrow	84			1	SSHA predation
				1	probable squirrel predation
White-throated Sparrow	100	1	broken leg		
American Tree Sparrow	8			1	shock
Baltimore Oriole	11	1	broken leg		
		1	cut foot		
Purple Finch	2			1	strangled in net
Total	2980	36	(1.21%)	19	(0.64%)

EQUIPMENT AND SUPPLIES

Mist-nets

At the end of the 1998 banding season the mist-net inventory consisted of 18 30-mm nets. Of these 1 is new, 8 are in good condition, 9 need repair to varying degrees and 1 is good but quite old. The 9 nets needing repair will be assessed and repaired if possible during 1999 spring banding at Dunbow Road. Through a grant from the Shell Environmental Fund an additional 6 AVINET 30-mm nets have been purchased in preparation for the 1999 season.

Additionally, CBBS has ten 12-m x 38-mm mist-nets donated by Loney Dickson of the Canadian Wildlife Service, all currently in serviceable condition. These nets are used to conduct pilot banding.

Net Poles and Re-bar Stakes

At present a sufficient supply of useable poles and stakes exists to carry CBBS through the 1999 banding season.

Banding Equipment

Each BIC was once again responsible for providing his/her own banding pliers, circlip pliers, wing rule, Pyle, etc. This system has worked well. CBBS supplies an electronic weigh scale, bird holding bags, propane stove, banding table and chairs, a protective tarp, camera, several field guides etc.

The AC/DC powered weigh scale, Canon EOS Rebel G camera, and optical devices for aiding in skulling, acquired during 1996, continue to work well. An exciting addition during 1998 was a COMPAQ laptop computer to facilitate data entry and analysis, particularly in the field. We again acknowledge those agencies that provided funding for this equipment.

APPENDIX 1

MONITORING SONGBIRD POPULATION CHANGE WITH AUTUMN MIST NETTING

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Abstract: Counts of migrating birds potentially could be used to detect population change. This technique would be especially valuable for tracking species poorly monitored by breeding and wintering season counts, such as boreal-nesting songbirds that winter in the tropics. Numbers of migrants counted vary with weather and other factors, however, and we need to demonstrate that migration counts give accurate results. Population trends for 1978-91 were calculated for 13 songbird species captured during autumn mist netting at 2 sites in southern Michigan. All species were northern-nesters occurring at the study sites only as transients. Annual indices of abundance were derived from a multiple regression of daily number of newly-captured birds on independent variables for date, weather, moon phase and year. Trends in the annual capture indices were significantly and positively correlated with trends in breeding bird survey (BBS) data from presumed breeding grounds in Michigan and Ontario, and were of similar magnitude. The results suggest that intensive, standardized netting can be a useful population monitoring tool.

Key words: breeding bird survey, Michigan, migration, mist net, monitoring, neotropical migrant, Ontario, populations, songbirds, trends

The primary method of monitoring change in numbers of North American songbirds is the BBS (Peterjohn 1994, Peterjohn and Sauer 1994). Some species and populations are poorly covered by this roadside survey, however, either because they occur at such low densities that they are not recorded in sufficient numbers for meaningful analysis, or because they breed in inaccessible regions (e.g. beyond the northern extent of the road network in Canada).

A possible means of filling these gaps in coverage is to count birds during migration. Uncommon birds from large expanses of breeding range may concentrate sufficiently at migration count sites to be seen in reasonable numbers (similar to raptors at hawk lookouts; Titus and Fuller 1990), and species with inaccessible breeding and wintering grounds can be counted as they pass through human-populated areas in spring and autumn. Such monitoring would be valuable especially for boreal forest songbirds that winter in Central America and South America (see list in Dunn and Huswell 1995).

A crucial question, of course, is whether migration counts can actually detect trends in population. There are many sources of variation in migration counts that might obscure changes in bird numbers (Dunn and Huswell 1995), among which weather is perhaps the most im-

portant (Richardson 1978, Pyle et al. 1993). A few pioneering analyses have shown that migration count trends, particularly when corrected for weather effects, correspond to an encouraging degree with independent measures of population change (Huswell 1981, Hagan et al. 1992, Huswell et al. 1992, Pyle et al. 1994). These analyses all had limitations, however, and certain other comparisons have not been convincing (Svensson 1978, Marchant 1992; see full discussion of validation studies in Dunn and Huswell 1995). There is need for more work on the validation of migration monitoring as a population monitoring tool.

The aim of this paper is to determine whether trends in numbers of birds captured during partially standardized autumn mist-netting correspond with trends detected by the BBS, for species without locally-breeding populations. The capture data come from 2 banding stations operated by Raymond J. Adams in southwestern Michigan. Neither site exhibits notable concentration of migrants. Most of the sites analyzed thus far (and all those showing correspondence of results to independent data) were ones that concentrate migrants in various degrees due to coastal geography. If migration monitoring is to be a practical means of monitoring specific target populations, it may be necessary to place

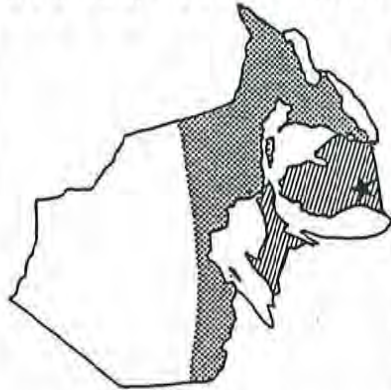


Fig. 1. Location of mist-netting sites (star) and areas of BBS coverage for Michigan (fine shading) and Ontario (diagonal shading). Although the Michigan BBS region covers the entire state, none of the species analyzed breeds as far south as Kalamazoo.

stations in regions lacking geographic features that concentrate migrants. Therefore, it is important to find out if these sites can produce good results. We compare data from 2 such sites that are close enough to be sampling the same population of migrants, so any differences cannot be ascribed to geographical variation in population trend. If trends differ between these sites, we must conclude that one or both is unsuited to monitoring population change.

A second important feature of this study is that we restrict our analysis to species whose entire breeding range is north of the study site. Some previous validation studies included residents and/or migrants that breed in the vicinity of the migration station, and compared migration trends to BBS trends from the same region (Dunn and Huswell 1995). In these cases, migration count trends might be similar to BBS trends simply because many of the birds counted "on migration" were actually individuals that were already (in spring) or still (in fall) on their breeding territories. By restricting our analysis to species that only breed farther north, we are able to determine whether mist-netting can detect trends in species that are present solely as transients. The results bear on the potential value of this method for monitoring species that breed beyond the coverage area of the BBS.

We thank the Kalamazoo Nature Center banders and BBS volunteers who collected

data. J. Sauer and N. Nur reviewed the manuscript. This is Ontario Ministry of Natural Resources contribution No. 95-03.

METHODS

Study Areas

Data in this paper are for 1978-91, from 2 netting sites at the Kalamazoo Nature Center in Kalamazoo, Michigan (42.9°N, 85.3°W; Fig. 1). The sites are about 0.75 km apart. We considered the sites both separately (to determine whether there were important differences between them) and combined (to enlarge the number of species in our analysis). Because the netting program was not designed for the purpose described here, number and location of nets were not completely standardized.

The "River" site had a complex of 12 m long, 30-mm mesh, 4-panel nets in second growth open riparian woodland and marsh shrub. Number of nets varied annually from 30 to 35. The "Marsh" site had 15-80 nets of the same type, in shrub vegetation bordering a marsh and woodland. Vegetation was not controlled at either site and increased in height during the study period, but nets at the Marsh site were moved occasionally to keep them in shrubby habitat.

Weather permitting, mist nets were operated daily from early August to mid-November, from shortly after dawn until early afternoon. The River site was poorly covered in November, and the Marsh site was rarely covered before 25 August. In the prime September-October migration period, an average of 6 and 5 days per year were missed in the River and Marsh areas, and the maximum days missed in a year in both areas combined was 11. Nets were added and discontinued in both of these areas over the years, and not all nets were set up on every day that netting took place. On days without weather interruptions, daily net-hours (no. of nets × no. of hours operated) in the main September-October migration period for the 2 sites combined ranged from 214 to 347.

All birds captured for the first time were banded with U.S. Fish and Wildlife Service bands, and we refer to the daily mist net captures of unbanded birds as "banding totals".

Data selection and effort standardization

Species chosen for analysis had breeding ranges whose southern limits were north of

Kalamazoo, so presence of local residents or dispersing juveniles were not complicating factors in the analyses or in interpretation of the results. In addition, BBS trends based on at least 10 survey routes had to be available either for Michigan or Ontario. Finally, the species had to meet sample size criteria that we set for each netting appropriate migration window there had to be at least 10 times as many days on which the species was captured (all years combined) as the number of independent variables in the analysis. In addition, there had to be an average of at least 25 individuals captured each fall.

These criteria resulted in 13 species being selected for analysis: golden-crowned kinglet (*Regulus satrapa*), ruby-crowned kinglet (*R. calendula*), hermit thrush (*Catharus guttatus*), Swainson's thrush (*C. ustulatus*), Tennessee warbler (*Vermivora peregrina*), Nashville warbler (*V. ruficapilla*), magnolia warbler (*Dendroica magna*), yellow-rumped warbler (*D. coronata*), black-throated green warbler (*D. virens*), bay-breasted warbler (*D. castaneola*), Canada warbler (*Wilsonia canadensis*), dark-eyed junco (*Junco hyemalis*), and white-throated sparrow (*Zonotrichia albicollis*). For 2 of these species (bay-breasted and Tennessee warblers), there were insufficient BBS data from Michigan to compare with trends in Kalamazoo banding totals.

We used the same species-specific migration periods as defined at Long Point, Ontario, located at about the same latitude 650 km east of Kalamazoo (Hussell et al. 1992). Only first captures were used in analyses. To standardize for any variation in daily effort (mainly in no. of nets in operation), daily captures (i.e., no. of newly-banded birds) were converted to number/100 net-hours. Days with no netting were omitted.

Statistical analyses

Justification of Analytical Approach.—We calculated annual indices of abundance using a modification of the regression model described by Hussell et al. (1992). In broad terms, this is an ANCOVA model that assigns variability in log-transformed daily counts to year, day within the season, moon phase and weather. For example, daily counts are highly skewed (many low counts, a few high ones; Fig. 2), to allow use of standard statistical programs, daily counts were log-transformed to improve normality of distribution and change multiplicative effects to

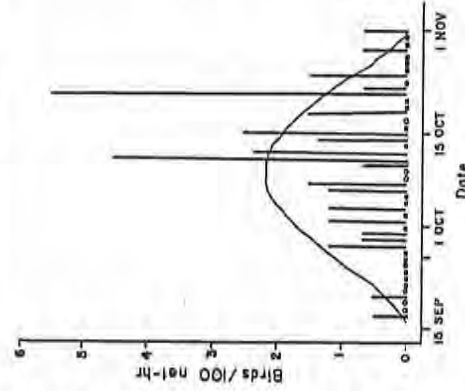


Fig. 2. Number of white-throated sparrows captured per 100 net-hours in 1990 (both areas combined). Curved line shows long-term average (average daily capture over all yrs). Squares indicate days with no captures, circles show days with no netting.

additive ones. In addition, there is a seasonal pattern to migration such that more birds were expected in the middle of the season than at the beginning or end. By adjusting for seasonal pattern, the analysis determines whether a given day's count is lower or higher than expected for its date.

Weather is the most probable cause of a daily count differing markedly from the expected value for a given date (Dunn and Hussell 1995). Thus, weather effects should be taken into account simultaneously with date to avoid attributing a high bird count to large population size. The analysis does this by determining whether a particular weather condition consistently leads to a larger or lower count than otherwise expected. Weather correction has been shown to increase the detectability of significant population trends (Pyle et al. 1994). Moon phase has also been shown to have significant effects on migrant numbers (D. J. T. Hussell, unpubl. data), presumably because nocturnal migratory behavior differs on very dark versus very bright nights. Any variability not attributable to date, weather and moon phase is assigned to the "year" variables. The annual index is the estimated mean daily count in a given year when

other independent variables are held at their long-term average values.

One danger in this sort of analysis is overfit, due to having too many variables relative to the number of cases. We are therefore careful about sample size criteria and limit the number of independent variables. The weather and moon phase variables chosen for inclusion were ones shown by previous analyses, and confirmed by this one, to have significant effects on results in at least some species (that may respond differently to specific weather variables; Hussell 1981, unpubl. data; Darby 1985). We included the same variables in the analyses for each species so that results would be directly comparable among them. Possible correlation among weather variables is not a problem, because that has no effect on the final annual indices, and we are not attempting to determine which weather effects are most important.

Details of Analysis.—The dependent variable was $\log(n + 1)$, where n is the daily number of first-time captures per 100 net-hours, and 1 is added to allow log transformation of zeros. Cases were weighted by a variable proportional to the number of net-hours contributing to each day's count (assumed to be inversely proportional to the error variance of the transformed count), so that days with low effort (e.g., from rain interruptions) had reduced influence on results.

Before the full analysis, a preliminary regression was done with only *day* and *day²* as independent variables, to describe a simple pattern of bird abundance through the season ($day = 0$ for a day near the center of the species-specific migration window). The aim of the preliminary run was to identify and remove cases that had low predicted values and were major contributors to a poor distribution of residuals, in violation of the assumptions of the regression model (Hussell 1981). Cases that had predicted values less than 0 birds in the preliminary run were excluded from the second regression analysis. This exclusion had the effect of narrowing the migration window for inclusion of data in the analysis (equally for all yrs) by removing cases at the start and/or end of the season.

The full regression (with the reduced dataset) included the following independent variables: dummy variables for each year except for one reference year (e.g., $Y80 = 1$ if year = 1980, otherwise $Y80 = 0$), first-through sixth-order *date* (day-of-the-year) terms, *moon phase* (days

from nearest new moon and its square), and 13 weather variables. The first-through sixth-order *date* terms allowed description of a relatively complex seasonal pattern of abundance while avoiding overfit that might result from inclusion of additional higher order terms. The weather variables were constructed from data provided by the U.S. National Oceanic and Atmospheric Administration from Lansing, Michigan (precipitation) and from Grand Rapids, Michigan (all other weather data). *Precipitation* was the daily accumulated amount from midnight to noon. Other variables were means of the hourly values at 1300, 1600, 1900, and 2200 hours from the previous day and at 0100, 0400, 0700, and 1000 hours of the current day. These variables were: *cloud cover* (in tenths), square root of *horizontal visibility* distance, and first- and second-order terms for *temperature difference from normal* and for 4 *wind speed/direction* terms. Normal temperature was calculated from a fourth power polynomial regression of mean temperature on day for all dates 1 July–30 November, 1970–91. Mean daily wind speed was the mean of the every-third-hour wind values, and mean wind direction was derived by vector addition of the every-third-hour values of wind speed and direction (measured to the nearest 10°). The 4 *wind speed/direction* variables used in the regressions were constructed from the mean wind speed and mean wind direction as described by Hussell (1981).

The annual index of abundance is derived from the regression estimate of the adjusted mean for year of the transformed daily count (that is, the estimate of the mean transformed count in each year under standardized conditions, represented by the mean values over all years of the independent variables describing date, moon phase and weather). If we assume that transformation of the daily counts normalizes the distribution of the residuals in the regression, then the adjusted mean transformed count will provide an estimate of the median count in the original scale (not the mean). To obtain an estimate of the mean count in the original scale, we add one-half the estimated error variance of the regression to the adjusted mean transformed count (Finney 1941, Basker, 1972, Sprugel 1983), before converting in the original scale by exponentiating and subtracting 1. The resulting annual index represents an estimate of the mean daily count that would be expected in that year under standard

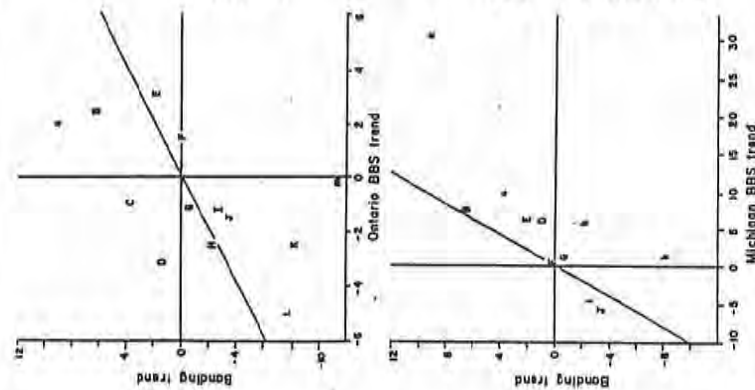


Fig. 3. Trends in Michigan banding totals (2 sites combined) compared with BBS trends for Ontario (top) and Michigan (bottom). Diagonal lines represent equality of trends from the 2 sources. Letters represent species as follows (lower case indicates BBS sample size of 10–15 routes, upper case indicates >15 routes): A = golden-crowned kinglet, B = hermit thrush, C = Swainson's thrush, D = yellow-rumped warbler, E = magnolia warbler, F = black-throated green warbler, G = white-throated sparrow, H = ruby-crowned kinglet, I = dark-eyed junco, J = Nashville warbler, K = Canada warbler, L = Tennessee warbler, M = bay-breasted warbler.

0.05; e.g., Swainson's thrush and magnolia warbler, Fig. 4). Annual indices were significantly negatively correlated in white-throated sparrow (Fig. 4), which was also the only species with a significant difference in trend between the 2 sites ($P < 0.001$). Trends from the 2 sites were not significantly correlated across all species ($r = 0.416$, $P = 0.27$, $n = 9$), but were when white-throated sparrow was excluded ($r =$

ized conditions of date, moon phase and weather.

Annual abundance indices were calculated as described above for each of the 2 netting sites, including only those species that met the sample size criteria for each site. We also ran a combined analysis (i.e., birds and net-hours from each site were added, as if all birds were captured at 1 site). This increased the number of species that met our criteria for analysis.

Trends were calculated as the slope of the log-transformed annual indices regressed on year, producing an estimated annual percent rate of change. Weights for each annual index were proportional to the number of net-hours on which each was based. There was no need to add a constant before log-transformation, because annual indices were never equal to zero. There may be nonlinear population change in at least some species, in which case linear regression is statistically inappropriate for describing trends. However, the only independent population data available for comparison of trends is from the BBS, which is analyzed with a linear route-regression technique that also ignores nonlinear change. Our method of trend analysis allows direct comparison of results from the 2 surveys.

To test for significant differences between sites, we calculated trends as described above, except that annual indices from each site were included as cases of the dependent variable, while independent variables were year, a dummy variable for site and a site-year interaction variable.

Breeding Bird Survey trends for 1979–91 were obtained for Michigan and Ontario, from the National Biological Service (BBS analysis described in Link and Sauer 1994). Because population trends vary from region to region, it is important for a comparative study like ours that we choose BBS trends for regions that represent the probable area of origin of the migrants we sampled. Possibly some southern Michigan migrants come from a much broader breeding area than simply northern Michigan or Ontario, but we limited comparison to those 2 regions because we believe they are more likely to contribute to the stream of migrants passing through southern Michigan than are regions further west or east (Fig. 1). We calculated Spearman rank correlations (1-tailed significance tests) between the trends in Kalamazoo banding totals and those in BBS.

Table 1. Correlation between trends in Kalamazoo, Michigan banding totals and trends in BBS from Ontario and Michigan.

Netting site	No. of species ^a	Ontario ^b	Michigan
River	9	0.521 (0.587)	0.92***
Marsh	9	0.521 (0.657)	0.57+
Combined	11	0.69*** (0.587)	0.84***

^a Spearman rank correlation coefficients. r_s 1-tailed significance: ** = $P \leq 0.001$, *** = $P \leq 0.01$, + = $P \leq 0.05$, 1 = $0.05 \leq P \leq 0.1$.

^b Sample size at River alone insufficient for dark-eyed junco, at Marsh for Canada warbler, and at both sites for black-throated green warbler.

^c Not in parentheses shows r_s when analysis includes Tennessee warbler (at 3 non-pairwise) and bay-breasted warbler (combined areas only).

RESULTS

Trends in Kalamazoo banding totals (based on either area alone or on both areas combined) were positively correlated with BBS trends in both Michigan and Ontario (Table 1). A multiple regression of combined Michigan banding trends on BBS trends from both Ontario and Michigan ($n = 11$ species) showed that Michigan BBS trends explained 60% of the variance in Michigan banding trends (1-tailed $P = 0.002$), Ontario BBS trends explained 43% ($P = 0.014$) and Michigan and Ontario BBS trends together explained 75% of the variance in banding trends ($P = 0.002$; a significant increase in amount of variance explained by Michigan BBS alone). The BBS trends from Ontario and Michigan were not strongly correlated with each other ($r = 0.40$, $P = 0.22$, $n = 11$).

Correlation between trends from independent population monitoring programs is only one indication that they are tracking change in the same way. Ideally, magnitude of trends should also be the same. Plots of the banding trends for the 2 sites combined versus BBS trends indicated that this was generally the case (Fig. 3).

Annual indices were significantly correlated with BBS indices only in 3 species (1-tailed Spearman rank r_s of residuals from combined area trend): in golden-crowned kinglet, hermit thrush and dark-eyed junco.

Agreement between the 2 netting sites varied among the 9 species analyzed in common. In golden-crowned kinglet the fluctuations in annual indices matched closely (Fig. 4; Spearman rank r_s of residuals from trends at each site = 0.83, $P < 0.001$, $n = 13$ yr). Most often (7 species), indices from the 2 sites were positively related, but less strongly (P just over or under

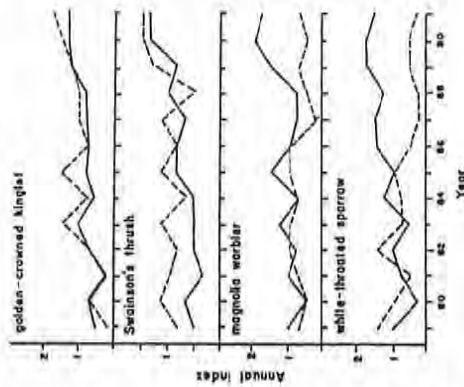


Fig. 4. Comparison of annual indices from the 2 netting sites for a sample of species. Solid line = River, dashed line = Marsh.

0.783, $P = 0.02$, $n = 8$). Overall, trends from the River site were more negative than those from the Marsh site (8 of 9 species; Fig. 5). However, comparisons to BBS did not indicate that one site clearly gave better results than the other.

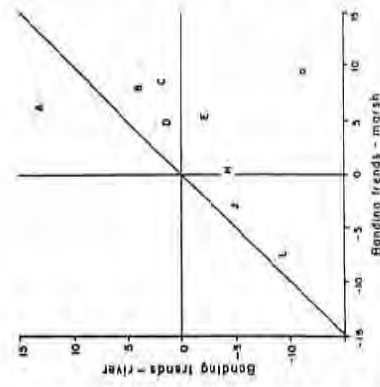


Fig. 5. Comparison of banding trends from River and Marsh. Species codes and diagonal line as for Fig. 3.

DISCUSSION

These results provide the strongest evidence to date that relatively standardized netting of migrants can monitor population levels. Our study is the first test based solely on a comparison of transient species (i.e., those with no locally-breeding population) with BBS trends from an appropriate distant portion of the breeding range. The results demonstrated a good level of agreement between trends based on migration counts and on the BBS, even though fall netting totals include young of the year and might be expected to show less correspondence to BBS than would trends based on spring netting.

Larger sample size (no. of species) did not necessarily improve results. There were discrepancies in trend for certain species (e.g., Fig. 3), and strength of correlation between migration count trends and BBS trends depended mainly on the selection of species in each comparison (Table 1).

Several possible reasons explain discrepancies for particular species. Both migration counts and BBS doubtless suffer from lack of precision and biases (which may differ from species to species), and neither program's results can be considered an unbiased indicator of true population trends. Mist netting was not as standardized as it could have been (see METHODS). The BBS sample is small in some species, and these include all those with most marked divergence between BBS and banding trends (Fig. 3). Finally, migration counts and BBS are not sampling the same populations. Michigan and Ontario BBS are uncorrelated (11 species) and a combination of Ontario and Michigan BBS explains more of the variance in Michigan banding trends than does BBS from either region alone. The lack of BBS correlation between regions indicates that breeding populations in Michigan and Ontario are changing independently, at least in part, and that migrants from both Michigan and Ontario are probably represented in the captures at Kalamazoo. Annual indices derived from spring migration counts of white-throated sparrows at Long Point, Ontario, were also better explained by correlation with BBS indices from 2 regions of Ontario than by correlation with BBS indices from either region alone (Hussell 1981).

Determining the true causes of discrepancy between BBS and migration counts should

prove valuable. While agreement between results from independent sources of monitoring data bolsters our confidence that a given trend is real, examining the causes of discrepancy may show us ways to improve our surveys.

We observed divergence in trends from the River and Marsh sites (Fig. 5), even though they are only 0.75 km apart. Differences were small in most species, but significant in white-throated sparrow, and the River site had generally more negative trends. The most likely cause of these discrepancies is differential growth in vegetation. Migrants are selective in foraging habitat (Hutto 1985, Moore and Simons 1982), so if habitat is altered, numbers of birds caught can change independently of any trend in population size. Moreover, netting efficiency is related to habitat condition, and catch rate is reduced as vegetation grows above net height. Vegetation at both locations grew up throughout the study period, but some nets at the Marsh site were moved to keep them in habitat of a particular successional stage.

MANAGEMENT IMPLICATIONS

Our results indicate that intensive and daily banding at a site without a particularly high volume of migration can detect long-term population change quite similar to that detected by the BBS, even in species that are present in an area solely as transients. The positive results of this and other comparative studies make a case for tightening procedures at existing migration count stations to improve potential for population monitoring, and for starting new stations to fill geographic or species gaps in BBS coverage. A Migration Monitoring Council has prepared a set of recommended guidelines for operation of migration count stations for population monitoring purposes (Hussell and Ralph 1995). The Council is also developing a network of stations to track population change in songbirds whose breeding range extends north of BBS coverage (Dunn 1996). However, use of migration counts to monitor populations is a young field and, like any other monitoring method, should not be accepted uncritically. Further work is needed to improve data collection and analysis methods and to validate results from additional stations.

Although we found that sites without much concentration of migrants are potentially useful for monitoring populations, they may not be ideal. A large number of nets was required to

obtain sufficiently large sample sizes of target species, so long-term monitoring would require a great deal of effort. There was evidence that habitat change led to bias. Certain concentration sites may be less vulnerable to habitat change (e.g., exposed coastal areas where habitat is naturally maintained at an early successional stage). Whatever the location of a migration monitoring station, operators should prevent vegetation change as far as possible (Hussell and Ralph 1985).

Finally, despite overall agreement between trends from independent monitoring programs, trends for individual species can differ (Fig. 3). They can even differ between nearby stations with the same monitoring technique, as did white-throated sparrow in this study (Fig. 5). In deciding how much reliance to place on a given trend, consideration should be given to sample size, significance level and limitations of the particular monitoring program or migration site. Independent corroboration is always desirable.

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APPENDIX 2

MIGRATION MONITORING PROTOCOL

Inglewood Bird Sanctuary

This migration monitoring protocol is based on methods described in section 6.9 of Hagan *et al.* (1994) and reflects modifications required to optimize migration monitoring at Inglewood Bird Sanctuary in Calgary.

Goals and Objectives

The Calgary Bird Banding Society (CBBS) will conduct intensive monitoring of fall bird migration at the Inglewood Bird Sanctuary (IBS) during the months of July-October. The intent of the CBBS is to maintain an ongoing long-term commitment to this project. Migration data will be collected in a standardized manner and will be integrated with similar data from other monitoring projects as part of a continent-wide analysis of population trends.

Definition of Monitored Area

The monitored area will include the entire Inglewood Bird Sanctuary, located adjacent to the Bow River in the City of Calgary, Alberta (see map). Birds seen or heard, on or above adjacent lands and the Bow River will be included.

Definition of Count Period

The daily count period will start at sunrise and continue for the first six hours following sunrise.

Personnel Requirements

There will be at least two participants present each day, weather permitting, during the migration monitoring period. This will include a Bander-in-Charge (BIC) and one other participant capable of completing a daily census. Due to constraints imposed by the Area Manager, a maximum of three persons may participate within the restricted area of the sanctuary at one time on any given day. The third person may be a trainee, participant or other observer.

Migration Count Methods

Three sources of data will be integrated into an estimated daily total (EDT) of migrants at IBS. These sources of data are a daily census, birds captured, and casual observations.

Daily Census

A daily census will be taken along a predetermined route (Figure 2). The census should begin two or three hours after sunrise, although weather conditions or numbers of captured birds may force it to be delayed until later in the morning. This census will cover the majority of the sanctuary and should take approximately 1 hour to complete. All birds seen or heard on or above IBS and adjacent lands will be counted and recorded (see data form). The census taker must be an experienced birder with the ability to identify all or most of the expected species by sight and sound. More than one census taker may participate with this fact noted.

Mist-Netting

The CBBS will operate a minimum of ten 12-m x 30-mm mist-nets at standardized locations in the reserve portion of IBS (Figure 2). Mist-nets will be open each day for six hours starting at sunrise. This requirement will only be waived when dictated by adverse weather conditions, potential for capture of more birds than can be handled safely or the unavailability of a qualified bander-in-charge. All birds captured, recaptured, repeating (same day) or killed will be recorded. Closure and opening times must be recorded (see data form).

The minimum data taken from each captured bird will be species, age and sex (See record-keeping procedures below). Wing chord, body mass, skull ossification, fat condition and moult condition will also be measured unless there are more birds being captured than can be processed in a reasonable amount of time or other extenuating circumstances. An attempt to band all birds captured will be maintained although no individual bird will be held for more than one hour.

Checking for trapped birds should take place at least every 30 minutes. The order in which the nets are checked is not critical although the usual sequence is: 8, 10, 15, 12, 13, 7, 5, 4, 1, 14, 17, 18. Nets 7, 13, 12, and 15 are re-checked on the return trip.

Incidental Observations

Throughout the day, personnel will make note of any birds in the station area or near net lanes, apart from the ones counted on census or captured in banding operations. These casual observations may be written down at or near the times they take place (see EDT data form). Data collected will include species, number of birds, time seen and other comments such as location, direction of travel and behaviour. Care should be taken not to duplicate entries although the length of time observed may be helpful in estimating numbers of probable or known stopovers and residents.

Probable and Known Stopovers (PKS)

It is desirable to separate birds that are resident or which have remained at the migration site for more than one day. These birds are termed probable and known stopovers (PKS) (Hussell and Ralph 1996). Including PKS in the estimated daily total of migrants can mask the true profile of migration. In the case of IBS, a number of species that occur in large numbers during the migration monitoring period fall into this category.

Retraps of birds banded previously are obvious stopovers and can easily be separated when tallying the estimated daily total. Other individual birds can also be assigned to the PKS category with confidence. These include previously-banded birds that are seen but not captured, birds of rare species that are highly unlikely to be new birds each day, birds that can be identified as individuals, and known resident species regularly present in specific locations.

A number of species at IBS are both resident in small numbers and occur as migrants to a greater or lesser degree. Other species are migrants but use IBS as a roosting or loafing area. In both these cases differentiating PKS from migrants on any given day is problematic. Further compounding this uncertainty is the fact that contract banders, lacking intimate knowledge of IBS and its avifauna, may be used for a sizeable portion of the migration monitoring period. Thus identification of PKS appears destined to be inconsistent, perhaps seriously so, if subjective assessment is entertained.

In order to limit the uncertainty associated with identification of PKS at IBS, members of the CBBS have categorized species as primarily migrants or PKS. All individuals of a PKS species are deemed PKS unless definitive evidence dictates otherwise (e.g. banded individuals). It is recognized that a small number of individuals will be incorrectly classified under this scheme. However the "known" error associated with this scheme may be preferable to the unknown error of "guesstimating" PKS for migratory species. At least it will be consistent.

Below is a current although not necessarily exhaustive list of species deemed PKS at IBS:

American White Pelican	Common Goldeneye
Double-crested Cormorant	Common Merganser
Great Blue Heron	Osprey
Canada Goose	Swainson's Hawk
Wood Duck	Red-tailed Hawk
Mallard	American Kestrel
Gadwall	Merlin
American Wigeon	Peregrine Falcon

Ring-necked Pheasant
Franklin's Gull
Ring-billed Gull
California Gull
Herring Gull
Rock Dove
Great Horned Owl
Downy Woodpecker
Hairy Woodpecker
Northern Flicker

Pileated Woodpecker
Black-billed Magpie
American Crow
Common Raven
Black-capped Chickadee
White-breasted Nuthatch
European Starling
Red-winged Blackbird
Brown-headed Cowbird
House Sparrow

Estimated Daily Total (EDT)

An estimated daily total number of individuals of each species present in the station area will be made at the end of each day. Totals **must** be compiled by all personnel present after all other record-keeping for the day has been completed. Personnel **must** arrive at a consensus for each species. The method for arriving at the EDT is taken directly from McCracken *et al.* 1993, section 6.4. This publication should be referred to for detailed specifications. A brief summary follows:

- on log sheets (see data form), record the numbers of species banded, retrapped, seen on census and casually observed;
- run down the list on the log sheet asking for other observations. Some judgements must be made and can include good estimates but not extrapolations. It **must not include repeated counts of the same birds**. Take behaviour, time of day, and other relevant circumstances into account; and
- the estimated daily total is derived from data that appear in the four columns of the log sheet. Inspect all of these numbers together, and **along with all other participants**, derive the best estimate of the number of birds present that day.
- the number of each species deemed Migrants and PKS are indicated in the appropriate cell on the EDT data sheet.

Record-Keeping Procedures

Clear and concise records must be kept for all activities performed during normal operation of the bird banding station at IBS. The following data forms are expected to be filled out for every day, before leaving the field:

- *Daily Log* - includes the names of all participants present including Bander-in-Charge (BIC), census taker and volunteer helpers. A short narrative is included focusing on bird migration, bird injuries and mortalities, non-avian fauna and flora, and any management of the station that had to be performed;
- *Field Banding Sheet* - contains space for all data taken from individual birds captured by mist-netting. The minimum data recorded on these sheets for banded birds must include disposition code, band number, species, age, sex, time banded, trap number and bander. Secondary data, listed in order of importance, will also be collected whenever possible - wing chord, skull ossification, mass, cloacal protuberance (CP), brood patch (BP), fat condition and primary moult. **An entry is necessary for each new banding, recapture, escape and mortality;**
- *Net Log* - this form contains columns for the opening and closing times for each net, total amount of time each net is up, as well as space to record brief weather data at specific times during the day;
- *Estimated Daily Totals* - this form is the end result of each day's effort from all personnel involved at the migration monitoring station. It contains columns for each species of bird likely to occur during fall migration at IBS. Next to the species names are columns for numbers of newly banded birds, repeat captures, census tally and casual observations. Casual observations may be recorded in the appropriate area on the 2nd side of this EDT form. From this data and discussion amongst the day's participants, a daily estimated daily total is arrived at for each species.

Knowledge, Skills and Experience Required

The most stringent criteria applies to the Bander-in-Charge (BIC). The BIC must be a qualified bird bander holding mist-netting authorization. The BIC must have good identification skills and be able to use the age and sex keys contained in the CWS bird banding manual and Pyle (1997). The BIC must exercise good judgement as to when mist-nets should be closed due to weather or other extenuating circumstances that may endanger the birds. The BIC must be willing to train volunteers.

The census taker must be an experienced birder who is able to identify all or most species of birds by sight and sound. Training will be provided by the CBBS to ensure an adequate supply of research volunteers capable of maintaining the migrant monitoring project. This training will consist of hands-on experience taking birds out of nets, record keeping, and census taking. An emphasis will be placed on bird identification by sight and sound as well as increasing the participants' ability to recognize situations which may compromise the safety of the birds.

Potential Habitat Changes

The habitat at IBS consists of mature riparian balsam poplar forest with a well developed shrub understorey. The CBBS does not anticipate any significant habitat changes during the foreseeable future. Nevertheless, vegetation at IBS will be monitored for potential change. The MAPS project at IBS utilizes 7 of the net lanes involved in migration monitoring. The MAPS protocol includes yearly vegetation monitoring.

Site-specific Field Procedures

The Area Manager at IBS has placed some restraints on field procedures. These restraints are intended to reduce human impact within the environmentally sensitive reserve portion of IBS where all bird-banding will be performed.

- A maximum of three persons will be in the reserve at any one time.
- Personnel must stay on the established pathways.
- Personnel must minimize their exposure to the general public while in the reserve and should wear low-visibility clothing.
- All captured European Starlings and House Sparrows must be destroyed.

All questions and enquiries should be referred to the Area Manager. Spring migration monitoring is currently not authorized in the reserve due to the potential for increased environmental impact.

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Daily Log

Calgary Bird Banding Society

Date	
Location	
Bander-in-Charge	
Volunteer	
Volunteer	

Narrative

Bird Migration

Bird Injuries and Mortalities

Non-avian Fauna and Flora

Management of the Station

Signed (BIC)

APPENDIX 3

APPENDIX 4

Recaptures at Inglewood Bird Sanctuary - Fall 1998

	July											1	2	3	4	5	6	7	8	9	10	11
	25	26	27	28	29	30	31															
Solitary Sandpiper																						1
Belted Kingfisher												1										
Downy Woodpecker														1								1
Western Wood-Pewee													1									
Trall's Flycatcher																						
Least Flycatcher																						
Eastern Kingbird				1								1										
Warbling Vireo																						
Black-capped Chickadee	1					1																
White-breasted Nuthatch						1																
House Wren	1		2	1	4							2	5	3		7						5
Ruby-crowned Kinglet																						
Veery				1																		
Swainson's Thrush					2											1						
Hermit Thrush																						
American Robin					1								1									
Gray Catbird												1					1					2
Cedar Waxwing	1																					
Tennessee Warbler				1								1	2	2		2						2
Orange-crowned Warbler																						
Yellow Warbler						2							1				1					1
Yellow-rumped Warbler												1	4		3	1						1
Blackpoll Warbler																						
Black-and-White Warbler																						
American Redstart																						
Ovenbird																						
Northern Waterthrush														2								1
Connecticut Warbler																						
Mourning Warbler																						
MacGillivray's Warbler																						
Common Yellowthroat																						
Wilson's Warbler																						
Clay-coloured Sparrow																						
Song Sparrow						3						1								1		
Lincoln's Sparrow																						
Swamp Sparrow																						
White-throated Sparrow																						
White-crowned Sparrow																						
Rose-breasted Grosbeak																						
Baltimore Oriole																						
American Goldfinch																						
Total	3	0	3	3	9	5	0	0	0	0	0	7	9	14	0	13	4	0	14			

Recaptures at Inglewood Bird Sanctuary - Fall 1998

	Aug																	
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Solitary Sandpiper							1											
Belted Kingfisher				1														
Downy Woodpecker			1					1	1									
Western Wood-Pewee																		
Trall's Flycatcher				1	3				1		1	2	1					
Least Flycatcher															1			
Eastern Kingbird		2					1											
Warbling Vireo				1			1		1	1	1	1						
Black-capped Chickadee			1				1		1	1	1	1	1					
White-breasted Nuthatch																		
House Wren		2	2	2	2	1	3	1	3			2	2	1	1	4	2	
Ruby-crowned Kinglet																		
Veery							1		1									
Swainson's Thrush												2		1				
Hermit Thrush																		
American Robin							1											
Gray Catbird		1		1												1		
Cedar Waxwing																		
Tennessee Warbler		2	1	7			3	1		1		1	2	1	3	1	1	1
Orange-crowned Warbler										1	1			1				
Yellow Warbler		1	1	3	1		3	1			1	1	1	1				
Yellow-rumped Warbler		3	1	7	5	2	10	7	3	1	7	7		4	2	1	2	
Blackpoll Warbler															1	1		
Black-and-White Warbler						1												
American Redstart				1	1							1				1		
Ovenbird		1	1	1	3	5	2		2			2		2	2	1	3	3
Northern Waterthrush		1	1	2	6	3	1	2	1	1	1	2	1		1	1	1	
Connecticut Warbler																		
Mourning Warbler												2				1		
MacGillivray's Warbler											1							
Common Yellowthroat																		
Wilson's Warbler									1			1	2	2	4	5	3	
Clay-coloured Sparrow																		
Song Sparrow					1													
Lincoln's Sparrow												1	1					
Swamp Sparrow																		
White-throated Sparrow																		1
White-crowned Sparrow																		
Rose-breasted Grosbeak								1	1									
Baltimore Oriole		1						1										
American Goldfinch				1	1													
Total	0	14	9	28	23	12	28	15	12	10	13	25	12	14	16	16	12	5

Recaptures at Inglewood Bird Sanctuary - Fall 1998

	Aug																Sep	
	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Solitary Sandpiper																		
Belted Kingfisher																		
Downy Woodpecker																		
Western Wood-Pewee																		
Trall's Flycatcher																		
Least Flycatcher																		
Eastern Kingbird																		
Warbling Vireo																		
Black-capped Chickadee		1	3						1		1		1	2		2	1	
White-breasted Nuthatch																		
House Wren		2	1		1		2			1	2					1		
Ruby-crowned Kinglet																		1
Veery																		
Swainson's Thrush											1							
Hermit Thrush							2	1				1						
American Robin																		
Gray Catbird																		
Cedar Waxwing																		
Tennessee Warbler		1	1															
Orange-crowned Warbler		3	2		1	2	1			1	2	2		1	3	2	1	
Yellow Warbler																		
Yellow-rumped Warbler		2		3	1	4				2	1			1	3			
Blackpoll Warbler		1				1												
Black-and-White Warbler																		
American Redstart			1	1														
Ovenbird			1	2				1						1				
Northern Waterthrush							2	2										
Connecticut Warbler		2	1															
Mourning Warbler				1	1		1											
MacGillivray's Warbler				1				1	1									
Common Yellowthroat							1	2						1				
Wilson's Warbler			1					1			1						1	
Clay-coloured Sparrow		1																
Song Sparrow														1				
Lincoln's Sparrow		1	2	1	3			1		1	1						1	
Swamp Sparrow							1											
White-throated Sparrow			1								1			1				
White-crowned Sparrow		1			1													
Rose-breasted Grosbeak																		
Baltimore Oriole																		
American Goldfinch																		
Total	0	15	14	9	8	7	10	9	2	5	10	3	2	7	6	7	2	1

Recaptures at Inglewood Bird Sanctuary - Fall 1998

															Oct		Total
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	
Solitary Sandpiper																	2
Belted Kingfisher																	2
Downy Woodpecker								1			1						7
Western Wood-Pewee																	1
Trall's Flycatcher																	9
Least Flycatcher																	1
Eastern Kingbird																	5
Warbling Vireo																	6
Black-capped Chickadee			10		1	1	1	1			1	1			4		41
White-breasted Nuthatch																	1
House Wren			2						1		1			1			73
Ruby-crowned Kinglet								1									2
Veery																	3
Swainson's Thrush				1						1							9
Hermit Thrush																	4
American Robin																	3
Gray Catbird																	7
Cedar Waxwing																	1
Tennessee Warbler					1												38
Orange-crowned Warbler	2	3	1	3	6		2	2	2	2	1		1	1	2		52
Yellow Warbler																	19
Yellow-rumped Warbler	2		1					1									93
Blackpoll Warbler																	4
Black-and-White Warbler																	1
American Redstart																	6
Ovenbird	1			3													37
Northern Waterthrush																	32
Connecticut Warbler																	3
Mourning Warbler																	6
MacGillivray's Warbler																	4
Common Yellowthroat										1							5
Wilson's Warbler		1		4		1									1	1	30
Clay-coloured Sparrow																	1
Song Sparrow																	7
Lincoln's Sparrow								1	1								15
Swamp Sparrow																	1
White-throated Sparrow		1	1	4		2		1		1			2				16
White-crowned Sparrow							1										3
Rose-breasted Grosbeak																	2
Baltimore Oriole																	2
American Goldfinch																	2
Total	5	5	15	15	8	4	4	8	4	5	4	1	3	2	3	5	556

APPENDIX 5

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date							July							August										
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sharp-shinned Hawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Cooper's Hawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Broad-winged Hawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Killdeer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Greater Yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lesser Yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellowlegs spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solitary Sandpiper	-	-	-	1	-	-	-	-	-	6	2	2	-	1	3	-	-	1	-	2	4	-	3	3	2
Spotted Sandpiper	4	-	-	3	5	3	-	-	3	1	2	-	-	2	-	-	-	-	1	1	-	-	2	3	1
Sandpiper spp.	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Common Snipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Herring Gull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belted Kingfisher	1	-	1	3	1	3	-	-	-	1	1	-	-	-	1	1	-	1	-	3	2	-	2	3	4
Yellow-bellied Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olive-sided Flycatcher	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Western Wood-Pewee	4	-	3	4	5	4	-	-	-	6	7	4	-	7	5	-	-	2	-	2	4	-	5	2	5
Trall's Flycatcher	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	1	3	-	5	-	-
Least Flycatcher	-	-	-	-	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-	2	2	-	-	4	-
Flycatcher spp.	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	6	-	-	-	-	-	3	-
Eastern Kingbird	12	-	7	10	26	12	-	-	-	27	19	18	-	24	23	-	14	-	28	16	-	16	18	24	-
Blue-headed Vireo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Warbling Vireo	3	-	1	1	1	1	-	-	-	-	1	-	-	3	3	-	2	-	-	-	-	-	1	8	3
Philadelphia Vireo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-eyed Vireo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Vireo spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue Jay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Tree Swallow	12	-	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N Rough-winged Swallow	2	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Swallow	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swallow spp.	3	-	-	-	2	-	-	-	-	-	-	-	-	-	1	-	4	-	5	-	-	-	-	-	-
Red-breasted Nuthatch	2	-	1	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	2	-	-	-	1	2	-

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date																									
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	
Sharp-shinned Hawk							-	1	1							1										
Cooper's Hawk							-										2									
Broad-winged Hawk							-																			
Sora							-														1					
Killdeer	1						-		2												1					
Greater Yellowlegs							-																			
Lesser Yellowlegs						6	-	3																		
Yellowlegs spp.							-																			
Solitary Sandpiper	2		1	2	5	3	-			5	1															
Spotted Sandpiper	1		4	1		1	-	2	5																	
Sandpiper spp.			2				-																			
Common Snipe							-																			
Herring Gull							-	12																		
Belted Kingfisher	3		2	1	2	1	-	2	2	2	1	3														
Yellow-bellied Flycatcher							-																			
Olive-sided Flycatcher							-																			
Western Wood-Pewee	5	3	5	3	1	5	-	1																		
Trill's Flycatcher	3	2	2	4	2	3	-	2																		
Least Flycatcher	2		1			1	-	1																		
Flycatcher spp.	1	4	6			6	-																			
Eastern Kingbird	18	36	12	4	14	8	-	1	1																	
Blue-headed Vireo							-																			
Warbling Vireo	4	4	5	1	2	1	-	4	3	2	1															
Philadelphia Vireo							-																			
Red-eyed Vireo							-																			
Vireo spp.							-																			
Blue Jay			1				-																			
Tree Swallow							-																			
N Rough-winged Swallow							-																			
Bank Swallow							-																			
Swallow spp.							-																			
Red-breasted Nuthatch			1				-	1	1	1	1															

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	September							October							Tot	Mean	Freq						
	13	14	15	16	17	18	19	20	21	22	23	24	25	26				27	28	29	30	1	2
Sharp-shinned Hawk			1	-	2	-	1	1	-	1	1	-	1	1				-	-	1	17	1	15
Cooper's Hawk				-	1	-	1	1	-									-	-		3	1	3
Broad-winged Hawk				-		-			-									-	-		1	1	1
Sora				-		-			-									-	-		5	1	4
Killdeer	1	1	5	-	2	-	-	-	-	-	-	-	-	-	1			-	-		17	2	11
Greater Yellowlegs	1	8	3	-	2	-	-	-	4	1	-	9	1	3				-	1		63	3	20
Lesser Yellowlegs				-	2	-	-	1	1									-	-		17	2	8
Yellowlegs spp.				-		-	-	-										-	-		1	1	1
Solitary Sandpiper		1		-		-	1	-	-									-	-		58	2	26
Spotted Sandpiper	1	1		-		-	-	-	-									-	-		51	2	27
Sandpiper spp.				-		-	1	-	-	1	-	-	-	1				-	-		7	1	5
Common Snipe			1	-		-	-	-	1									-	-		15	4	4
Herring Gull				-		-	-	-	-									-	-		25	25	1
Belted Kingfisher	1	1	1	-	2	-	3	3	2	-	1	3	3	1	1			-	2		84	2	41
Yellow-bellied Flycatcher				-		-	-	-	-									-	-		1	1	1
Olive-sided Flycatcher				-		-	-	-	-									-	-		4	1	4
Western Wood-Pewee				-		-	-	-	-									-	-		75	4	20
Trail's Flycatcher				-		-	-	-	-									-	-		33	2	16
Least Flycatcher				-		-	-	-	-									-	-		16	2	10
Flycatcher spp.				-		-	-	-	-									-	-		29	4	8
Eastern Kingbird				-		-	-	-	-									-	-		332	16	21
Blue-headed Vireo				-		-	-	-	-									-	-		1	1	1
Warbling Vireo			1	-		-	1	-	-									-	-		53	3	21
Philadelphia Vireo				-		-	-	-	-									-	-		1	1	1
Red-eyed Vireo				-		-	-	2	-									-	-		11	1	8
Vireo spp.			1	-		-	-	-	-									-	-		1	1	1
Blue Jay				-		-	-	1	-						1			-	-		7	1	7
Tree Swallow				-		-	-	-	-									-	-		1	1	1
N Rough-winged Swallow				-		-	-	-	-									-	-		3	3	1
Bank Swallow				-		-	-	-	-									-	-		2	1	2
Swallow spp.				-		-	-	-	-									-	-		10	3	3
Red-breasted Nuthatch				-	1	-	-	-	-									-	-		17	1	12

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date							July							August										
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
House Wren	11	-	4	8	8	4	-	-	-	-	13	8	8	-	12	6	-	13	-	6	4	-	5	3	8
Golden-crowned Kinglet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ruby-crowned Kinglet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Townsend's Solitaire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Veery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Gray-cheeked Thrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swainson's Thrush	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	2
Hermit Thrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American Robin	50	-	9	20	19	14	-	-	-	-	16	14	10	-	13	6	-	13	-	9	6	-	5	2	14
Thrush spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gray Catbird	3	-	1	1	1	1	-	-	-	-	4	1	4	-	1	-	-	-	-	-	1	-	2	1	1
Brown Thrasher	-	-	1	-	1	-	-	-	-	-	1	1	-	-	-	-	-	1	-	-	1	-	-	-	-
Cedar Waxwing	12	-	11	9	22	15	-	-	-	-	6	10	15	-	26	10	-	12	-	12	10	-	8	5	
Tennessee Warbler	-	-	6	2	5	1	-	-	-	-	2	2	5	-	7	3	-	3	-	14	6	-	1	5	14
Orange-crowned Warbler	-	-	-	-	2	1	-	-	-	-	-	1	-	-	-	-	-	2	-	4	1	-	-	1	1
Nashville Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Warbler	3	-	5	8	5	3	-	-	-	-	12	11	15	-	13	15	-	14	-	12	8	-	8	10	13
Magnolia Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
Yellow-rumped Warbler	6	-	1	7	-	-	-	-	-	-	21	21	22	-	60	41	-	26	-	47	24	-	12	15	30
Black-throated Green Warbler	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Townsend's Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Palm Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blackpoll Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-and-white Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-
American Redstart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	-	4	5	-
Ovenbird	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	6	2	-
Northern Waterthrush	-	-	1	1	-	-	-	-	-	-	4	1	2	-	3	2	-	2	-	2	3	-	4	3	1
Mourning Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MacGillivray's Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Yellowthroat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's Warbler	-	-	-	-	-	-	-	-	-	-	-	2	-	-	4	-	-	-	-	-	-	-	-	-	3
Canada Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date																								
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12
House Wren	10	8	14	5	6	8	-	12	11	2	2	-	-	2	1	2	2	1	2		2	1	4	-	-
Golden-crowned Kinglet							-					-	-									1		-	-
Ruby-crowned Kinglet							-					-	-	1										-	-
Townsend's Solitaire							-					-	-											-	-
Veery							-					-	-											-	-
Gray-cheeked Thrush							-					-	-											-	-
Swainson's Thrush			1	1	3	1	-	1	1			-	-	1							1	3	1	-	-
Hermit Thrush							-					-	-											-	-
American Robin	5	12	36	10	14	10	-	75	17	6	13	-	-	5	6	1	3		10	11	18	8	6	-	-
Thrush spp.	1						-					-	-						1					-	-
Gray Catbird	2		1	1	2	1	-		2	1	2	-	-	3	1				2	3	1	1		-	-
Brown Thrasher	1			1			-					-	-											-	-
Cedar Waxwing		6		2	2	5	-			1	2	-	-	10	3	1			3		2			-	-
Tennessee Warbler	1	8	2	7	3	3	-	1	5			-	-	4							1			-	-
Orange-crowned Warbler	1	2	11	2	3	2	-	2		6	1	-	-	8		3	5	2	2	7	7	9	3	-	-
Nashville Warbler							-			1		-	-											-	-
Yellow Warbler	19	18	32	13	6	3	-	17	2			-	-			1	2	1	2	1	2			-	-
Magnolia Warbler				1			-					-	-											-	-
Yellow-rumped Warbler	40	37	14	26	100	123	-	220	73	46	60	-	-	45	35	40	30	3	18	90	73	24	20	-	-
Black-throated Green Warbler							-					-	-											-	-
Townsend's Warbler				1			-					-	-				1				1			-	-
Palm Warbler							-					-	-	1										-	-
Blackpoll Warbler	1	1		2	3	1	-	10	4	2		-	-	5		1				2				-	-
Black-and-white Warbler							-					-	-											-	-
American Redstart	1	2			1	3	-	3	1		2	-	-					1	1	1	1			-	-
Ovenbird	2	3		1			-	3	3	3		-	-											-	-
Northern Waterthrush		4	8	1		2	-		1		1	-	-	1					1					-	-
Mourning Warbler			2	1	1	1	-	1	1			-	-		2				1	2		1		-	-
MacGillivray's Warbler			1	1			-					-	-		1					1				-	-
Common Yellowthroat							-					-	-			1			3		2	1		-	-
Wilson's Warbler	13	10	17	26	3	7	-	20	7	7	3	-	-		1		6	3	3	2	3	1		-	-
Canada Warbler	1		1	1			-					-	-					1						-	-

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date		September														October		Tot	Mean	Freq		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				1	2
House Wren	1		2	-	2	-	-	1	-	-	2	-	4		2						195	5	37
Golden-crowned Kinglet														1		2					6	2	3
Ruby-crowned Kinglet	1	2	2	-	-	-	2	-	-	1	-	-	2		1	1					14	1	10
Townsend's Solitaire														1							1	1	1
Veery																					1	1	1
Gray-cheeked Thrush					1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Swainson's Thrush		1	2	-	2	-	-	4	-	-	1	-	1	2							31	2	20
Hermit Thrush										2				1		2					7	1	5
American Robin	8	36	46	-	16	-	2	7	-	8	6	-	14	2	22	14	13	-	-	8	576	13	44
Thrush spp.																					2	1	2
Gray Catbird																					38	2	22
Brown Thrasher																					7	1	7
Cedar Waxwing	2	9																		2	164	7	24
Tennessee Warbler								1	1	-	-	-	-	-	-	-	-	-	-	-	99	4	23
Orange-crowned Warbler	19	8	7	-	7	-	6	16	-	4	14	-	1	16		4	1	-	-	1	190	5	37
Nashville Warbler																					1	1	1
Yellow Warbler			1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	251	10	26
Magnolia Warbler																					3	1	3
Yellow-rumped Warbler	52	35	17	-	9	-	8	-	-	24	184	-	6	12		26	12	-	-	2	1823	42	43
Black-throated Green Warbler																					3	2	2
Townsend's Warbler																					3	1	3
Palm Warbler								1	-	-	1	-	-	-	-	-	-	-	-	-	4	1	4
Blackpoll Warbler								2	-	-	1	-	-	-	-	-	-	-	-	1	36	3	14
Black-and-white Warbler																					7	2	4
American Redstart		1																			34	2	16
Ovenbird								1	4	-	-	-	-	-	-	-	-	-	-	-	37	3	14
Northern Waterthrush																					45	3	18
Mourning Warbler																					13	1	10
MacGillivray's Warbler																					4	1	4
Common Yellowthroat					1	-	-	-	-	-	2	-	-	2							14	2	8
Wilson's Warbler	2	4	1	-	2	-	1	11	-	1		-	-	-	-	-	-	-	-	1	168	5	31
Canada Warbler																					4	1	4

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date					July														August							
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Warbler spp.			3													34		3									
Western Tanager	1				1																					5	
American Tree Sparrow																											
Chipping Sparrow	2				2	2					6	2				1		3		13	3				12	6	1
Clay-coloured Sparrow	1		1		2	2					7	4	5		4	2		4		5	2				3	3	
Vesper Sparrow				1											4			1								1	
Savannah Sparrow											1																
Le Conte's Saprrow																										1	
Fox Sparrow																											
Song Sparrow	3		3	2	1	2					6	3				3		4		1	2				2	2	1
Lincoln's Sparrow						2						2				1											
Swamp Sparrow																											
White-throated Sparrow																											
White-crowned Sparrow																											
Dark-eyed Junco																											
Sparrow spp.																		2									
Rose-breasted Grosbeak			1		1															5							
Brewer's Blackbird	1																			1						1	
Common Grackle											2																1
Blackbird spp.																											
Baltimore Oriole	4		6	5	11	9					3	2	2		3	5		1		4	2					7	
Purple Finch																1											2
Red Crossbill																											
Pine Siskin																											
American Goldfinch	2				5	2					4	1			3	2		6		2	4				3	1	
Total Birds	142	67	81	134	84					147	119	126		190	183		142		216	119					118	104	155
Total Species	22	19	18	23	20					21	24	21		21	29		26		28	26					27	24	28

Migrants at Inglewood Bird Sanctuary - Fall 1998

Species	Date																									
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	
Warbler spp.			45			6	-	4																		
Western Tanager	1				4																					
American Tree Sparrow																										
Chipping Sparrow	7	10	7	4	6	8	-	9	6	1	2	-	-	5				3	1	2			1			
Clay-coloured Sparrow	5	1	1	2	1	1	-	4	5	4				2	1	2		1			2					
Vesper Sparrow																										
Savannah Sparrow																										
Le Conte's Sparrow																										
Fox Sparrow														1								5				
Song Sparrow	6	2	1	1	1	1	-							1												
Lincoln's Sparrow	1			2	2	2	-	2	1	1	1	-	-	6	2	6	4	4	2	5	4	2	1			
Swamp Sparrow																1										
White-throated Sparrow				4	4	4	-	3	4	1				3	12	10	10	7	29	5	10	38	8			
White-crowned Sparrow									1	1	2	-	-	3	3	5	2	2	17	10	9					
Dark-eyed Junco						1	-									3										
Sparrow spp.	2										2															
Rose-breasted Grosbeak	2		2				-	1	2																	
Brewer's Blackbird																										
Common Grackle																										
Blackbird spp.																		5	1							
Baltimore Oriole	4	3	2			1	-		3																	
Purple Finch																										
Red Crossbill																										
Pine Siskin											1															
American Goldfinch	1	1			3				4		3			10	3	3		2		1		1				
Total Birds	166	178	242	130	192	232	-	418	173	89	178	-	-	129	93	88	85	46	109	156	144	100	84	-	-	
Total Species	32	23	33	33	27	33	-	29	28	20	30	-	-	30	21	20	23	23	20	22	21	14	16	-	-	

APPENDIX 6

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date																														
	July															August															
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18						
Pied-billed Grebe																															
American White Pelican	8		1	8	2	2					5															2					
Double-crested Cormorant	3		3	8	2	2					6	1	4		2	4		3			8				1	1					
Great Blue Heron	2			1	1							1	1		1			1			2				1						
Canada Goose	14		3	1								1	1		1	1		5		7	2				1						
Wood Duck	16		7	19	21	30					17	13	12		24	26		29		45	25			32	41	20					
Gadwall												1																			
Mallard	29		36	29	25	47					22	15	32		20	30		40		44	41			38	21	30					
American Wigeon						1									1											4					
Common Goldeneye	15		1	5	3	2					1	1	11		4	2		10		1				2		4					
Hooded Merganser																															
Common Merganser	7		9	12	5	12					2	4	8		10	8				2				6	1	2					
Osprey	1			1		1						1						1													
Bald Eagle			1																												
Swainson's Hawk					1	1														1						1					
Red-tailed Hawk			2											1				1		1						1					
Buteo spp.																															
American Kestrel	2		3									1			1					1						1					
Merlin	1																														
Ring-necked Pheasant			1	3	1	1					1				1			1		1	1			4	2	2					
Franklin's Gull																															
Ring-billed Gull	204			160	154	60						200																			
California Gull						1						10																			
Gull spp.			60								150		217		320	270		400		280	110			10	102	112					
Rock Dove	14				3	12						16			9	10		6		8	2			5	5	20					
Great Horned Owl																															
Owl spp.																															
Belted Kingfisher											1																				
Downy Woodpecker	2			1	1	3					2	3			1	2		3		2	3			2	1	2					

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date																									
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	
Pied-billed Grebe																										
American White Pelican					1	1	-	2	1																	
Double-crested Cormorant	3	5	2		3	1	-	1	3		16			5	9	13	1		1	1	7					4
Great Blue Heron	1	1	1	1	1	1	-	-	2	1	1			1		1	3		1	1						
Canada Goose	1	1	1	3	1	5	-	4	6	22	17			16	7	8	4	22	90	15	21	50	28			
Wood Duck	26	18	25	17	30	38	-	50	36	30	32			30	25	22	39	16	35	25	21	44	18			
Gadwall																										
Mallard	56	21	31	51	42	62	-	79	93	54	55			55	73	33	77	8	53	50	120	100				
American Wigeon				2	1		-		2	2				2	1						1					
Common Goldeneye			3		3	2	-		3	1				1	10	2				1	2					
Hooded Merganser					1		-															1				
Common Merganser	3	6	4	1	2	18	-	6	24	9	10			15	11	8	21	13	29	9	17	18				
Osprey	1		1	1			-		1		1			1												
Bald Eagle							-																			
Swainson's Hawk	2	1		1	1		-		1		1			1					1							
Red-tailed Hawk							-														2					
Buteo spp.							-																			
American Kestrel			1	2			-																			
Merlin							-														2					
Ring-necked Pheasant	1		1	1	1	1	-	1			1										1					
Franklin's Gull						1	-		1						3											
Ring-billed Gull	1			6	273		-	500	560	600				200	710	528	132	40	240	40	156	270	70			
California Gull							-																			
Gull spp.	220	110	185		280		-				320			80						120						
Rock Dove	15		16	4	15	2	-	10	13	5	12			3	5		32		5	3	20	14				
Great Horned Owl							-																			
Owl spp.							-																			
Belted Kingfisher							-																			
Downy Woodpecker	1	3	2	1	1	1	-	3	2	1	3			2	2	2	4	1	1	1	2	1				

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date							July							August												
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Hairy Woodpecker							1	-	-	-	1	1	-	-	2	1	-	2	-	1	-	-	-	-	-		
Northern Flicker	4	-	4	5	4	3	-	-	-	-	4	3	3	-	6	6	-	3	-	3	4	-	-	3	4	6	
Least Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Eastern Kingbird	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Warbling Vireo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Black-billed Magpie	7	-	5	7	10	16	-	-	-	-	5	6	6	-	5	28	-	19	-	1	9	-	-	5	6	9	
American Crow	-	-	-	-	-	25	-	-	-	-	-	2	4	-	2	2	-	8	-	5	4	-	-	-	-	4	
Common Raven	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Black-capped Chickadee	15	-	7	4	16	9	-	-	-	-	9	4	4	-	15	21	-	22	-	22	16	-	-	8	11	16	
White-breasted Nuthatch	-	-	-	-	2	1	-	-	-	-	2	1	-	-	-	1	-	-	-	1	-	-	-	-	1	1	2
House Wren	1	-	1	1	4	-	-	-	-	-	2	4	-	-	7	-	-	5	-	2	2	-	-	2	1	3	
Veery	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Swainson's Thrush	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
Hermit Thrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
American Robin	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Gray Catbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	1	-	-	-	-	-	-	
European Starling	50	-	39	42	115	110	-	-	-	-	20	20	7	-	23	12	-	20	-	65	28	-	-	6	54	31	
Cedar Waxwing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tennessee Warbler	-	-	-	1	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	1	1	-	-	-	-	3	
Orange-crowned Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Yellow Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	3	
Yellow-rumped Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	1	-	3	1	-	-	5	1	10	
Blackpoll Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Black-and-white Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
American Redstart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ovenbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
Northern Waterthrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	2	5	2	
Connecticut Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Mourning Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date		September														October		Avg	Freq		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			1	2
Hairy Woodpecker	1	1	-	-	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	1	16
Northern Flicker	2	2	-	-	1	-	2	2	-	1	3	-	2	1	3	2	1	-	-	-	3	43
Least Flycatcher			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Eastern Kingbird			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Warbling Vireo			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3
Black-billed Magpie	7	12	21	-	23	-	10	20	-	36	8	-	19	16	17	25	28	-	-	13	14	45
American Crow		6	2	-	6	-	5	4	-	12	1	-	6		3	1	5	-	-	3	4	36
Common Raven			-	-	-	-	-	1	-	-	-	-	2			2		-	-	7	3	5
Black-capped Chickadee	7	12	13	-	7	-	16	14	-	18	14	-	6	10	7	11	13	-	-	12	12	45
White-breasted Nuthatch	1	3	1	-	1	-	1	1	-	1	1	-	1	1	2			-	-	2	1	31
House Wren		1	-	-	-	-	2	-	-	-	-	-	1		1			-	-	-	2	24
Veery			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2
Swainson's Thrush			-	-	-	-	-	1	-	-	-	-	-	1				-	-	-	1	4
Hermit Thrush			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3
American Robin			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Gray Catbird			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4
European Starling	20	50	118	-	75	-	30	32	-	60	40	-	105		8	20	38	-	-	30	34	43
Cedar Waxwing			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2
Tennessee Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	12
Orange-crowned Warbler	1	2	-	-	-	-	1	1	-	-	1	-	2	1	1	1		-	-	-	1	17
Yellow Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9
Yellow-rumped Warbler			-	-	-	-	1	-	-	-	-	-	-	-	9			-	-	-	5	21
Blackpoll Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3
Black-and-white Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
American Redstart			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4
Ovenbird			-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	15
Northern Waterthrush			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9
Connecticut Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Mourning Warbler			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date					July										August									
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
MacGillivray's Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Yellowthroat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clay-coloured Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Song Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Lincoln's Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swamp Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rose-breasted Grosbeak	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-winged Blackbird	-	-	1	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown-headed Cowbird	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Blackbird spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Baltimore Oriole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
House Sparrow	-	-	-	2	5	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Total Birds	396	-	185	311	378	345	-	-	-	-	247	296	336	-	456	429	-	583	-	499	263	-	138	264	289
Total Species	20	-	19	20	21	22	-	-	-	-	16	18	22	-	20	20	-	22	-	25	20	-	22	20	26

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1998

Species	Date																									
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	
MacGillivray's Warbler				1															1							
Common Yellowthroat																			2							
Wilson's Warbler					1	1		4	3	3					1				1							
Clay-coloured Sparrow	1																									
Song Sparrow																										
Lincoln's Sparrow						1								2	1				1		1					
Swamp Sparrow																1										
White-throated Sparrow										1											1					
Rose-breasted Grosbeak	1																									
Red-winged Blackbird																										
Brown-headed Cowbird	1	1								6																
Blackbird spp.														60												
Baltimore Oriole															1											
House Sparrow						2			1																	
Total Birds	409	284	378	124	451	467	-	720	860	788	532	-	-	627	948	684	370	155	482	322	410	525	238	-	-	
Total Species	25	18	21	24	31	24	-	25	30	21	22	-	-	32	20	20	21	14	23	16	21	16	18	-	-	

APPENDIX 7

**CALGARY BIRD BANDING SOCIETY
1998 MEMBERSHIP LIST**

Grahame Booth
Bill Brown
Doug Collister
Alison Comack
Brian Couronne
Rainer Ebel
Dick Graham
George Halmazna
Garry Hornbeck
Clive Jackson
Stefan Jungkind
Dwight Knapik
Stephen Lane
Arlette Malcolm
Diane McIvor
Shonna McLeod
Arlette Malcolm
Greg Meyer
Pat Mitchell
Dale Paton
El Peterson
Gwen Smiley
Cyndi Smith
Don Stiles
Alexandra Torn
Mike Vassal
Catherine Watson-McDonald
Linda Wiggins
Bruce Wilson
Scott Wilson

Executive

President - Doug Collister
Vice President - Shonna McLeod
Treasurer - El Peterson
Secretary - Garry Hornbeck
Annual Report Editor - Grahame Booth

APPENDIX 8

Weather Conditions at Inglewood Bird Sanctuary - 1998 Fall Migration

Date	Nets Opened			Midpoint			Nets Closed					
	Temp deg C	Wind		Sky	Temp deg C	Wind		Sky	Temp deg C	Wind		Sky
		Beaufort	Direction			Beaufort	Direction			Beaufort	Direction	
25 Jul	14.5	0		0	22	0		0		2		0
26 Jul												
27 Jul	15	0		1	21	0		0	27	0		0
28 Jul	14	0		2	21	0		2	23	0		2
29 Jul	15	0		2					22	5	S	1
30 Jul	12	1	S	1		4	S	1	22	3	S	1
31 Jul												
1 Aug												
2 Aug												
3 Aug												
4 Aug	14	0		0	21	0		0	28	0		0
5 Aug	12	0		0	20	0		2	29	2		2
6 Aug	15	0		0					25	1	S	0
7 Aug												
8 Aug	11	0		0		0		0	24	2		0
9 Aug	11			0	20	2		0	26.5	2		0
10 Aug												
11 Aug	14	0		4	21	2		2.4	25	2		0.4
12 Aug												
13 Aug	16	5	NW	2		5	NW	1	24	2		1
14 Aug	12	0		0					25	2	SW	0
15 Aug	17	3	W	2					25	1	W	1
16 Aug	15	0		2					22	2	E	1
17 Aug	10	0		0	16	2	SE	0	20	1	S	0
18 Aug	8	0		0	13	2	SW	1	16	3	W	1
19 Aug	9	1	W	0	18	2	W	1		1	W	1
20 Aug	8	0		0	15	1	SW	0	20	3	E	0
21 Aug	12	1	W	2	15	2	NW	2	18	3	SW	2
22 Aug	12	0		0		2	N		22	3	N	0
23 Aug	12	0		1	17	0		2	22	0		0
24 Aug	8	0		0	17	0		1	23	1	W	1
25 Aug	8	0		0					23	1	W	0
26 Aug	15	0		1	19	0		1	22	1	N	1
27 Aug	8	0		0	15	0		2	22	0		2
28 Aug	9	0		0	15	0		0	22	0		0
29 Aug	10.5	0		0	16	2	NW	0	26	0		0
30 Aug												
31 Aug	9	0		0	19	0		0	23	2	E	0
1 Sep	8	0		0	18	0		2	22	0		0
2 Sep	12	0		0	20	1		0	30	2		0
3 Sep	13	0		0					25	4	S	0
4 Sep	11	3	NW	0	20	2	W	0	24	0		0
5 Sep	6	0		0					25	0		0

Weather Conditions at Inglewood Bird Sanctuary - 1998 Fall Migration

Date	Nets Opened			Midpoint			Nets Closed					
	Temp deg C	Wind		Sky	Temp deg C	Wind		Sky	Temp deg C	Wind		Sky
		Beaufort	Direction			Beaufort	Direction			Beaufort	Direction	
6 Sep	8	0		1					24	2	S	1
7 Sep	12	0		0	30	0		0	34	0		0
8 Sep	15	1	WNW	1	18.2	2	WNW	0	24.3	2	W	0
9 Sep	10			1	15.5	1	NW	2				
10 Sep	5.7	0		4	16	1	N	0	21	0		0
11 Sep	7			2	15			2	23	2	NW	2
12 Sep	6.5			0	17			0	22			2
13 Sep	6			1	13	2	W	1	22			0
14 Sep	6			2	16	1	NW	1	18	2	SE	1
15 Sep	6				18							
16 Sep	16			2					22			0
17 Sep	7	0		0	11	0		0	15.5	2	NW	2
18 Sep	9			2	13			2.4	14			8
19 Sep	8	1		5	6	2	NW	5	7	2	NW	2
20 Sep	8	1		2	9	0		2	13	2	SW	1
21 Sep	3	0		1					20	2	NW	1
22 Sep	5	0		0					20	2	NW	1
23 Sep	9	0		0	15	2		0	19	0		0
24 Sep	8	2	NW	2	12	1	NW	2	18	1	NW	2
25 Sep	9	0		2	11	0		2	9	3	NW	8
26 Sep	0	0		0	10	3	S	0	15	2	S	0
27 Sep	5			0	17			0	25			0
28 Sep	7			2	12	1	NW	2	20.5	1	NW	0
29 Sep	8			2	8			2	8			5
30 Sep	4	1	E	0	12.4	2	S	1	15	2	S	0
1 Oct	0.5			0	9			0		2	W	1
2 Oct	7			2	8			5	8.5			5

Beaufort Wind Scale		
force		kph
0	smoke rises straight	0 to 2
1	smoke drifts, but no wind vane movement	3 to 5
2	wind felt on face, leaves rustle	6 to 11
3	leaves and small twigs in constant motion, wind extends light flag	12 to 20
4	dust and loose paper raised, small branches moved	21 to 29
5	small trees in leaf begin to sway	30 to 39
6	large branches in motion, whistling wires	40 to 50
7	whole trees in motion	51 to 61

Sky Conditions	
0	clear or a few clouds
1	partly cloudy (scattered) or variable
2	cloudy (broken) or overcast
4	fog or smoke
5	drizzle
7	snow
8	showers

APPENDIX 9

Monitored Species at Inglewood Bird Sanctuary

Species	1995-1998		Group
	Yearly Mean		
	Number	Frequency	
Solitary Sandpiper	11	9	
Western Wood-Pewee	14	8	A
Traill's Flycatcher	35	21	A
Least Flycatcher	17	15	A
Eastern Kingbird	15	12	C
Warbling Vireo	19	13	A
House Wren	49	24	C
Ruby-crowned Kinglet	16	11	B
Swainson's Thrush	27	18	A
American Robin	77	25	B
Cedar Waxwing	34	11	B
Tennessee Warbler	47	22	A
Orange-crowned Warbler	147	30	A
Yellow Warbler	84	23	A
Yellow-rumped Warbler	354	38	B
Blackpoll Warbler	15	9	A
Ovenbird	22	15	A
Northern Waterthrush	38	19	A
Wilson's Warbler	127	34	A
Chipping Sparrow	55	15	B
Clay-coloured Sparrow	16	10	A
Song Sparrow	13	12	B
Lincoln's Sparrow	38	23	B
White-throated Sparrow	54	20	B
White-crowned Sparrow	22	13	B
Dark-eyed Junco	11	7	B
Baltimore Oriole	13	5	C
Group A		13	
Group B		10	
Group C		3	
Other		1	
Total		27	

Criteria Used to Define and Priorize Monitored Species

Monitored Species

Mean number banded each year ≥ 10 and mean number of days each year on which individuals banded ≥ 5

Priority for Migration Monitoring

- A** those species that have $< 50\%$ of Canadian breeding range covered by the Breeding Bird Survey and $> 50\%$ of winter range south of the United States, thereby not covered by the Christmas Bird Count
- B** those species that have $< 50\%$ of Canadian breeding range covered by the Breeding Bird Survey but $> 50\%$ of winter range within the United States, thereby covered by the Christmas Bird Count
- C** those species with $> 50\%$ coverage of Canadian breeding range by the Breeding Bird Survey and that have a wintering range largely south of the United States

APPENDIX 10

Top 20 New Bandings at Inglewood Bird Sanctuary

	Total		1998		1997		1996		1995	
	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number
Yellow-rumped Warbler	1	1417	1	638	1	191	3	92	1	496
Orange-crowned Warbler	2	586	2	207	5	86	2	116	2	177
Wilson's Warbler	3	509	3	113	4	119	1	175	4	102
Yellow Warbler	4	334	4	91	3	137	5	62	5	44
American Robin	5	307	12	31	6	81	4	81	3	114
Chipping Sparrow	6	221	15	27	2	151	20	14	12	29
White-throated Sparrow	7	217	5	77	12	39	11	28	5	73
House Wren	8	196	8	49	9	52	8	45	7	50
Tennessee Warbler	9	189	6	74	8	52	9	30	10	33
Lincoln's Sparrow	10	153	7	59		13	12	28	6	53
Northern Waterthrush	11	151	16	26	11	46	6	56	13	23
Trail's Flycatcher	12	140	11	36	10	50	13	25	11	29
Cedar Waxwing	13	134		11	7	67		14	9	42
Swainson's Thrush	14	107	14	28		10	7	52	15	17
Ovenbird	15	89	9	38		11	10	30		10
White-crowned Sparrow	16	87	17	21	16	22	14	24	15	20
Warbling Vireo	17	76		18	15	27	15	18	20	13
Least Flycatcher	18	69		14	14	30		9	18	16
Clay-coloured Sparrow	19	65	10	37	17	21		6		1
Ruby-crowned Kinglet	20	62		14	18	20	16	18		10
Blackpoll Warbler		61	13	30		6		8	17	17
Eastern Kingbird		61	19	19	19	17	17	18		7
Western Wood-Pewee		54		8	13	33		2		11
Baltimore Oriole		53		8		12		12	14	21
Song Sparrow		51		18	20	15		9		9
Black-capped Chickadee		48	20	19		5	18	17		7
Solitary Sandpiper		44		14		13		14		3
Dark-eyed Junco		43		10		3	19	15	19	15
American Redstart		33	18	20		4		6		3

APPENDIX 11

**Ranger Creek, Banff National Park
Pilot MAPS 18-19 July 1998**

A MAPS (Monitoring Avian Productivity and Survivorship) station was investigated along Ranger Creek, approximately 17 km west of Banff, Alberta, adjacent to the Bow Valley Parkway (Highway 1A). The sponsoring organization is the Bow Valley Naturalists (BVN), and the MAPS Coordinator is CBBS member Cyndi Smith. Registration, to join the network of MAPS stations in North America, has been submitted to The Institute for Bird Populations in Point Reyes, California. This project is anticipated to provide long-term information on the status of migratory songbirds in the montane wetland of Banff National Park, through standardized constant-effort mist-netting. The work was conducted under Parks Canada Research/Collection Permit No. C98-15. Until local banders are trained, banding expertise and support will be provided by members of the Calgary Bird Banding Society (CBBS).

The habitat is classified as a VL3 (Vermilion Lakes 3) ecosite within the Ecological Land Classification of Banff National Park. This ecosite is characterised by wet white spruce forest grading to wet shrubby meadow and wet shrub thicket. One side it is bordered by a small dry meadow with some shrubs, and the other side has a series of beaver ponds on Ranger Creek. Under the MAPS protocol the site's primary habitat is "shrubland," and the secondary habitat is "grassland" and "evergreen". The overall successional stage is "primarily mature".

The site was visited on 18 July 1998 by Cyndi Smith, Mike McIvor, Diane McIvor, Greg Meyers, and Shonna McLeod. Nine net lanes were chosen and prepared by placing rebar pegs for the poles, and tying back and trimming vegetation. On the morning of 19 July nine nets were operated for six hours from 0630 to 1230. Twenty-three individuals of 11 species were captured and banded and two individuals were later recaptured.

Traill's Flycatcher (TRFL)	2
Black-Capped Chickadee (BCCH)	1
Swainson's Thrush (SWTH)	1
American Robin (AMRO)	2
Yellow Warbler (YWAR)	2
Yellow-Rumped Warbler (AUWA)	3
Northern Waterthrush (NOWA)	3
Common Yellowthroat (COYE)	3
Fox Sparrow (FOSP)	1
Lincoln's Sparrow (LISP)	3
White-Winged Crossbill (WWCR)	2