

CALGARY BIRD BANDING SOCIETY

1997 ANNUAL TECHNICAL REPORT

Prepared

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Some of the 1997 new bandings. Clockwise from top left: 1. Townsend's Warbler (AHY-M) 2. Savannah Sparrow (HY-U) 3. Veery (SY-U) 4. Nashville Warbler (AHY-M) 5. MacGillivray's Warbler (HY-U). All photos by CBBS.



Some of the 1997 new bandings. From top: 1. Sharp-shinned Hawk 2. Black-throated Green Warbler (HY-M) 3. Yellow-bellied Sapsucker (left) - Red-naped Sapsucker (right) mixed pair. Photos 1 and 3 by Gwen Smiley, photo 2 by CBBS.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	2
FUNDING AND ACKNOWLEDGEMENTS	3
MIGRATION MONITORING	4
Background	4
Methods and Study Site	4
Coverage	6
New Bandings	6
Recaptures	7
References	8
MONITORING AVIAN PRODUCTIVITY AND SURVIVAL (MAPS) ...	28
Background	28
Objectives	29
Methods	29
Coverage	29
Results and Discussion	30
Reference	30
PERSONNEL	33
Banders-in-Charge (BIC)	33
MORTALITIES AND INJURIES	35
EQUIPMENT	37
Mist-nets	37
Net Poles and Re-bar Stakes	37
Banding Equipment	37
Lab Equipment	38
Summary	38

LIST OF TABLES

1. Migration Coverage and Capture Rates - Fall 1997.	10
2. 1997 New Bandings at Inglewood Bird Sanctuary.	13
3. New Bandings at Inglewood Bird Sanctuary.	17
4. Significant Recaptures at Inglewood Bird Sanctuary 1997.	19
5. Migrants at Inglewood Bird Sanctuary - Fall 1997.	21
6. Inglewood Bird Sanctuary MAPs Summary - 1997.	31
7. Inglewood Bird Sanctuary MAPs Summary - 1992-1997.	32
8. Number of days of effort contributed	34

LIST OF FIGURES

1. Topographic maps showing location of Inglewood Bird Sanctuary.	5
2. Schematic of Inglewood Bird Sanctuary migration monitoring station.	9
3. Capture Rates at Inglewood Bird Sanctuary - Fall 1997.	12
4. Migration at Inglewood Bird Sanctuary - Fall 1997.	27

APPENDICES

1. Migration Monitoring Protocol Including Data Forms.
2. Recaptures at Inglewood Bird Sanctuary - Fall 1997.
3. Length of Stay and Physiological Change in Recaptures at IBS - Fall 1997.
4. 1997 Spring Banding.
5. Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997.
6. 1997 Weather During Migration Monitoring.
7. CBBS 1997 Membership List.
8. Dunn *et al.* 1997.
9. Fatal Light Awareness Program (FLAPS) Calgary

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 1997 migration monitoring program follows pilot efforts in 1992 and 1994 and the full fall programs completed in 1995 and 1996. Twelve mist-nets were operated for a minimum of 6 hours per day on 65 of the 77 days between 31 July and 15 October. Volunteers and Banders-in-Charge contributed a total of 202 man-days to the banding projects (i.e. MAPS and migration monitoring). Four Banders-in-Charge, 3 from Edmonton, AB and 1 from Blairmore, AB, provided 32 man-days of supervision to ensure maximum coverage during migration monitoring. A total of 4608 net-hours yielded 1,455 new bandings of 64 species. Ninety-five percent were Neotropical migrants. New bandings were concentrated in August (72%).

Recaptures totalled 392 involving at least 284 different birds of 38 species; including several birds originally banded as early as 1992. Three Swainson's Thrushes banded during fall migration in previous years and recaptured this year provided rare re-encounters of migrants.

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 139 species were detected including 25 species of warbler and vireo.

The MAPS site was operated again in 1997, building on previous data gathered since 1992. A total of 121 birds were captured, of which 90 were new bandings. White-throated Sparrow was documented as a breeder at IBS for the second consecutive year.

Sixteen mortalities occurred during the mist-netting of 2515 birds, 5 of which resulted from predation (1 by a Gray Squirrel, 2 by cats and 2 by Mule Deer). In addition, fifty-eight injuries were recorded, most minor wing abrasions.

CBBS received funding from a wide variety of sources including the Baillie Birdathon which raised approximately \$2850 net to CBBS.

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;
- Promote conservation of Neotropical migratory birds by fostering public awareness and understanding of Neotropical migratory birds; and
- Provide for the recreation of the members and to promote and afford opportunity for friendly and social activities.

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 Survival station was established at IBS in 1992 and continued in 1993,1995,1996 and 1997;
- pilot spring banding was initiated in 1997 at Dunbow Road just south of Calgary; 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.

Additional projects, currently in the formulation stage are anticipated in the next few years.

FUNDING AND ACKNOWLEDGEMENTS

Funding for CBBS migration monitoring at IBS during 1997 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 (\$2,000);
- funds raised by the CBBS through participation in the Baillie Birdathon (approximately \$2850 net) including a \$1,000 gross pledge from Imperial Oil Resources Limited;
- a grant from Canadian Wildlife Service through Loney Dickson (\$2,000);
- a grant from Manning Diversified Forest Products (\$1,000);
- two grants from Alberta Sport, Recreation, Parks and Wildlife to fund production of the 1996 (\$625) and 1997 (\$625) annual technical report; and
- a grant from the Petro Canada Ltd. Volunteer Program (\$300).

Additional contributions in kind were made by Canadian Tire (propane camp stove), Grad and Walker Energy Corporation (a 386 IBM-compatible personal computer), and Calgary Co-operative Association Limited (15 cloth shopping bags suitable for storing mist-nets).

The majority of the funds were used to provide a per diem to Banders-in-Charge brought in from Edmonton, AB, to cover BIC travel costs, and 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 John Pollock's spirit of cooperation in sharing digital copies of these forms for our use.

We are confident that the IBS migration monitoring project will become part of Bird Study Canada's nation-wide system of monitoring sites and thereby qualify for enhanced funding through the Baillie Birdathon.

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 will be a unique and valuable addition to the Canadian Migration Monitoring Network currently being conceived 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 was initiated in 1995.

Methods and Study Site

The fall migration of Neotropical migrants was monitored in 1997 at Inglewood Bird Sanctuary, 35 hectares of mature riverine balsam poplar forest, known for large number so 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 31 July through 15 October. Twelve 12-m 1¼" mist-nets were operated in permanent net lanes for a minimum of 6 hours each day beginning at sunrise. Monitoring songbird population change based on fall mist-netting has been shown to be an effective technique (Dunn *et al.* 1997, Appendix 8).

Spring migration was not monitored due to concerns of the IBS Area Manager regarding potential adverse environmental impact. Spring conditions at the site are wetter than during fall. Nevertheless there is potential to implement spring migration monitoring program in subsequent years.

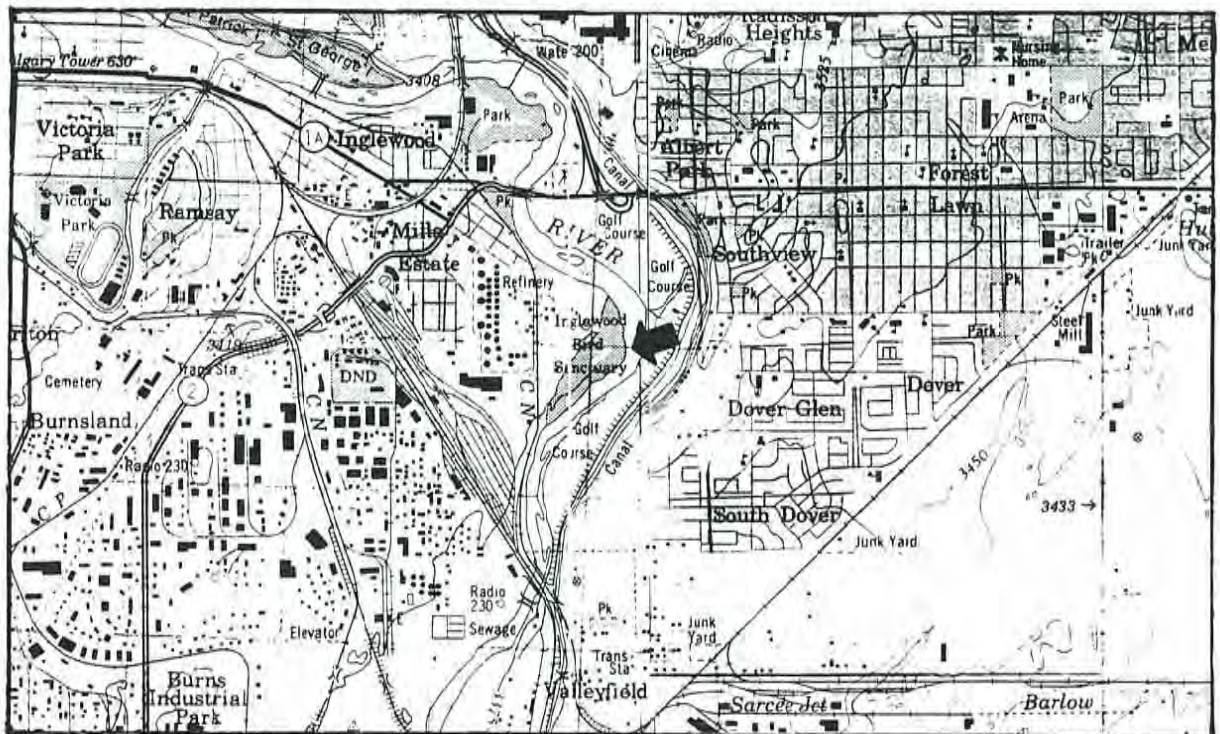
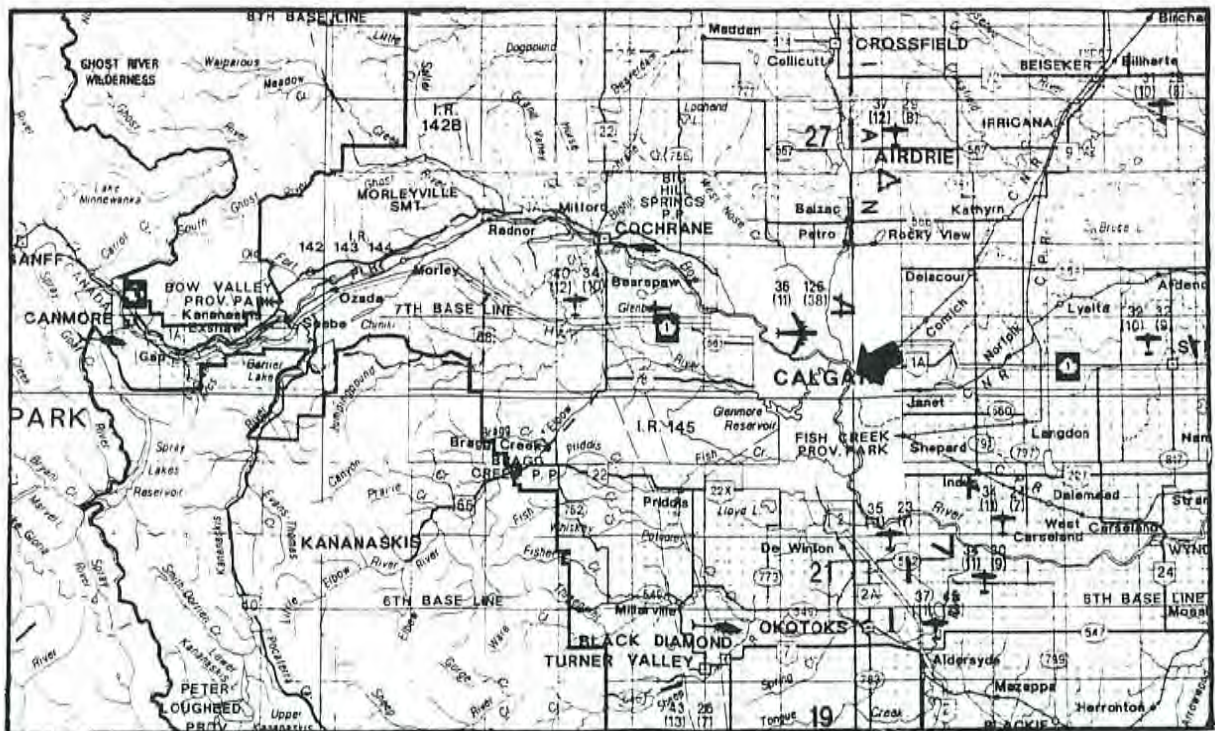


Figure 1. Topographic maps at 1:250,000 (top) and 1:50,000 (bottom) scales showing location of Inglewood Bird Sanctuary in southwestern Alberta. North is up.

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 1). Net locations and the daily census route are shown on Figure 2.

Coverage

Fall migration monitoring at IBS was conducted from 31 July - 15 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 1997, a coverage of 84.4% was achieved. That is, mist-netting occurred on 65 of the 77 target days for a total of 4608.3 net-hours (Table 1, Figure 3). The 12 days missed were due to inclement weather and/or the unavailability of a qualified bander-in-charge resulted in 12 days without banding.

Daily census were obtained on 63 of the 65 days on which mist-netting occurred and 5 of the days on which mist-netting did not occur.

New Bandings

A total of 1,455 new bands were placed on birds of 64 species (Table 2). Of these, 1,376 (95%) were Neotropical migrants (Dobkin 1992). The only days on which 50 or more new bandings occurred were 9-14 August. Approximately 72% of new bandings occurred in August, 26% in September and 1% in each of July and October. A summary of new bandings at IBS from 1992-1997 is presented in Table 3.

Migration monitoring was continued into October but, as in 1996, adverse weather and low capture rates provided little encouragement to include this period in future years.

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 Western (Cordilleran?) Flycatcher on 9 August, Nashville Warblers on 1 and 10 September, and a Black-throated Green Warbler on 14 August provided rare records of these species for IBS. Blue-headed Vireos on 24 August and 11 September were the only representatives of the recently split Solitary Vireo complex. It will be interesting to

see if Cassin's Vireo is detected in the future.

The *Oporornis* warblers are often difficult to detect and identify through conventional bird watching. During 1997 migration monitoring at IBS 1 Connecticut Warbler, 3 Mourning Warblers and 9 MacGillivray's Warblers were banded. Ten Swainson's Thrushes were banded in 1997 compared to 52 in 1996 and 17 in 1995.

Recaptures

Recaptures totalled 392 involving at least 284 different birds of 38 species (Appendix 2). Length of stay and physiological changes (weight change, fat accumulation etc.) vary between individuals, age classes and species (Appendix 3). Of 7 Tennessee Warblers for which age was known, all AHYs (N=4) showed a loss in weight between captures while all HYs (N=3) showed a weight gain. This may result from energy requirements of AHYs who go through a more extensive moult in fall. One Swainson's Thrush remained at IBS for at least 15 days, while 7 Yellow-rumped Warblers were present for a minimum of 12-25 days. Six Northern Waterthrushes that stopped at IBS for at least 3 days showed weight gains from 4.8%-16.6%. Of 4 Clay-coloured Sparrows that lingered at IBS, 3 (all AHYs) lost weight while 1 (an HY) did not change weight.

Recaptures were highest in resident species. For example, the Black-capped Chickadee illustrates this with 21 recaptures compared to 5 new bandings. Some migrant species, like the Chipping Sparrow with 151 new bandings and 6 recaptures, appear to pass through the IBS site very quickly. Significant recaptures (birds originally banded in previous years) at IBS during 1997 are presented in Table 4.

Five of the 21 significant recaptures are of particular interest. Three Swainson's Thrushes banded at IBS on 2 August 1996, 29 August 1996, and 27 August 1994 and recaptured 4 September, 1 August and 27 August 1997 respectively, represent rare re-encounters of migrants. Notably the latter bird was banded as an AHY-U and therefore at least 4-years old in 1997. A House Wren banded at IBS in 1992 and recaptured during 1997 was at least 6-years old. A Cedar Waxwing banded in 1996 at IBS and recaptured in 1997 was a first year-to-year re-encounter of an individual of this species.

Estimated Daily Totals (EDTs)

The estimated daily totals (EDTs) represent the total number of birds, by species, present at IBS site each day. Each EDT incorporates the bird banding 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) (see Appendix 1), give an overall description of bird migration and an integral part of

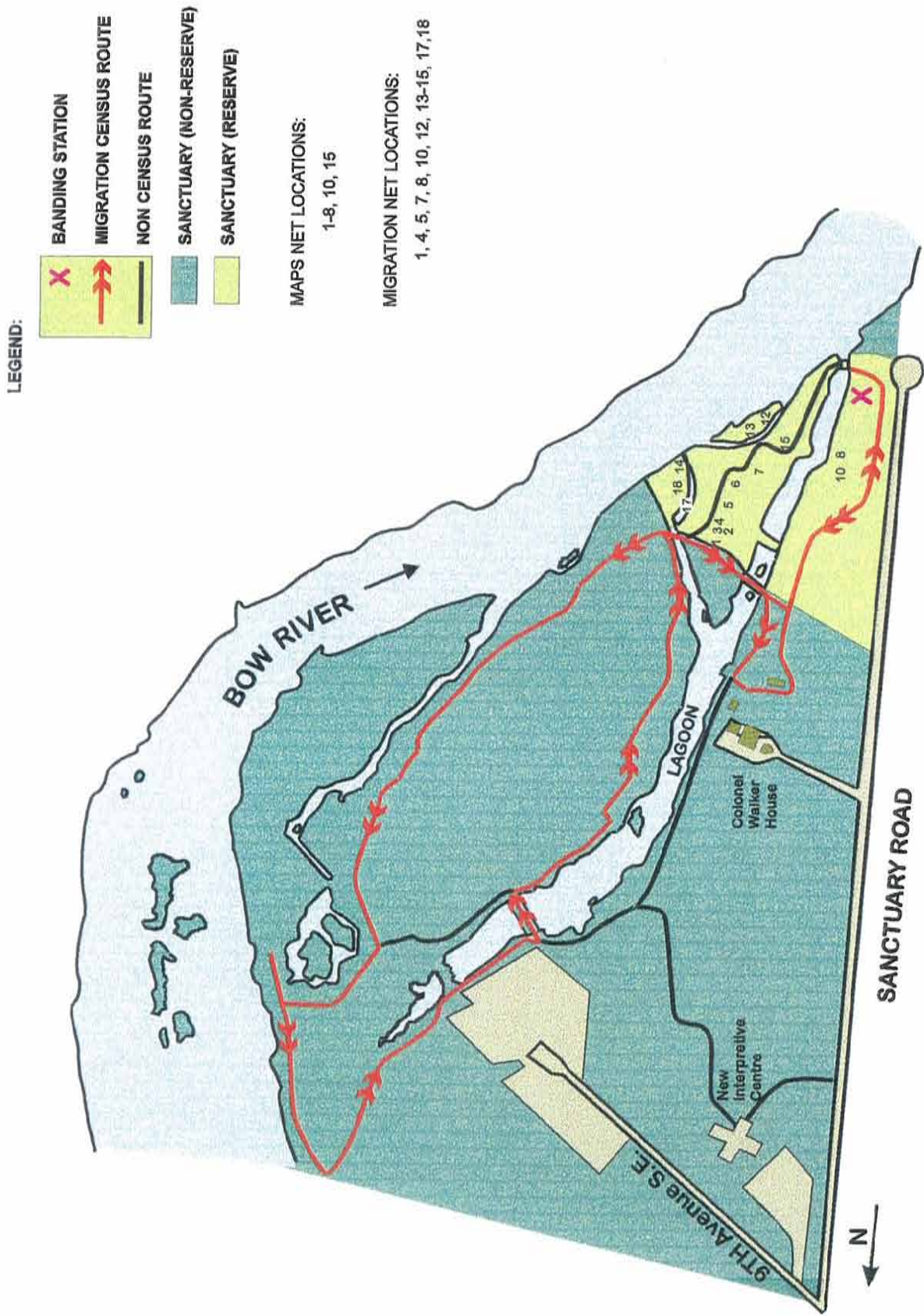


Figure 2. Schematic of Inglewood Bird Sanctuary migration monitoring station

CBBS' migration monitoring project. Tables 5 and Appendix 5 summarize the migrant and PKS components respectively of the EDTs by species and day. Figure 4 is a histogram of the number of birds observed during migration.

The EDTs at IBS during the 1997 fall migration documented 139 species seen, heard or captured. This total includes 25 species of warblers and vireos, 8 species of flycatcher and 15 sparrow and other finch species. Of the 139 species, many were single sightings of one individual bird. Some of the more interesting of the 18 bird observations were a Black-crowned Night-Heron on 15 September, a Eurasian Wigeon and a Harlequin Duck on 15 October, a Broad-winged Hawk on 13 September, a Peregrine Falcon on 20 September, a Sabine's Gull on 18 September, a Pileated Woodpecker on 23 September, a Sprague's Pipit on 3 September, a Blackburnian Warbler on 20 August, single Canada Warblers on 20 and 29 August, 2 Swamp Sparrows on 6 October, and a Harris' Sparrow on 15 October.

References

- Dobkin, D.S. 1992. Neotropical migrant landbirds in the northern Rockies and Great Plains. U.S.D.A. Forest Service Northern Region. Publication No. R1-93-34. Missoula, MT.
- Greenberg, R. 1982. The nonbreeding season: Introduction. Pages 175-177 *In* Hagan, J.M. and Johnston, D.W. editors. Ecology and conservation of Neotropical migrant landbirds. Smithsonian Institution Press, Washington. Proceedings of a symposium hosted by Manomet Bird Observatory, 6-9 December, 1989.
- Hagan, J.M., K.A. Hobson, D.J.T. Hussell, N. Nur and C.J. Ralph. 1994. Recommended methods for monitoring bird migration. Draft prepared by the Intensive Sites Technical Committee of the Migration Monitoring Council. 22 pp.
- McCracken, J.D., D.J.T. Hussell, and E. Dunn. 1993. A manual for monitoring bird migration. Long Point Bird Observatory, Port Rowan, Ontario. 65 pp.
- Sauer, J.R. and S. Droege. 1992. Geographic patterns in population trends of Neotropical migrants in North America. Pages 26-42 *In* Hagan, J.M. and Johnston, D.W. editors. Ecology and conservation of Neotropical migrant landbirds. Smithsonian Institution Press, Washington. Proceedings of a symposium hosted by Manomet Bird Observatory, 6-9 December, 1989.

Table 1. Migration Coverage and Capture Rates - Fall 1997

Date	Net-hours	Captures				Total	Captures/100 Net-hour
		New Bandings	Recaptures	Escapes	Mortalities		
31-Jul	63.2	13	5	1	0	19	30
01-Aug	67.2	32	4	4	0	40	60
02-Aug	77.1	24	8	2	0	34	44
03-Aug	74.4	17	6	2	0	25	34
04-Aug	76.0	30	5	2	0	37	49
05-Aug	73.1	40	10	5	0	55	75
06-Aug	74.1	27	8	0	0	35	47
07-Aug	74.0	36	6	0	0	42	57
08-Aug	0.0	0	0	0	0	0	n/a
09-Aug	81.6	83	19	6	3	110	135
10-Aug	82.2	67	5	7	0	79	96
11-Aug	78.2	95	14	3	1	112	143
12-Aug	79.0	57	23	3	1	84	106
13-Aug	79.1	96	16	1	0	113	143
14-Aug	76.9	83	21	1	1	106	138
15-Aug	20.2	6	9	1	0	16	79
16-Aug	56.9	31	19	4	1	55	97
17-Aug	81.2	39	13	1	0	53	65
18-Aug	75.6	27	8	3	0	38	50
19-Aug	74.6	21	9	2	0	32	43
20-Aug	73.2	23	4	2	1	29	40
21-Aug	66.3	42	6	2	0	50	75
22-Aug	61.1	41	14	1	0	56	92
23-Aug	69.4	14	4	0	0	18	26
24-Aug	73.8	24	12	2	0	38	51
25-Aug	75.8	10	15	0	1	26	34
26-Aug	75.2	17	6	1	0	24	32
27-Aug	76.4	5	8	1	0	14	18
28-Aug	74.4	20	8	2	0	30	40
29-Aug	73.8	21	4	1	0	26	35
30-Aug	71.0	5	4	1	0	10	14
31-Aug	69.0	11	3	1	0	15	22
01-Sep	66.7	9	3	0	0	12	18
02-Sep	73.2	7	3	1	0	11	15
03-Sep	71.5	9	1	0	0	10	14
04-Sep	74.9	19	3	3	0	25	33
05-Sep	72.2	17	0	0	0	17	24
06-Sep	71.0	10	1	1	0	12	17
07-Sep	76.6	13	3	0	0	16	21

Table 1. Migration Coverage and Capture Rates - Fall 1997

Date	Net-hours	Captures				Total	Captures/100 Net-hour
		New Bandings	Recaptures	Escapes	Mortalities		
08-Sep	75.1	6	3	0	0	9	12
09-Sep	73.6	4	3	0	0	7	10
10-Sep	72.0	8	0	0	0	8	11
11-Sep	71.2	12	1	1	0	14	20
12-Sep	72.0	32	2	1	0	35	49
13-Sep	74.3	11	4	1	0	16	22
14-Sep	75.3	14	7	0	0	21	28
15-Sep	73.1	12	10	1	1	24	33
16-Sep	73.7	35	9	2	0	46	62
17-Sep	72.8	22	4	1	0	27	37
18-Sep	0.0	0	0	0	0	0	n/a
19-Sep	71.3	7	4	1	0	12	17
20-Sep	69.6	7	4	1	0	12	17
21-Sep	69.0	7	3	0	0	10	14
22-Sep	72.5	28	8	1	0	37	51
23-Sep	72.2	9	1	1	0	11	15
24-Sep	73.9	39	1	0	1	41	55
25-Sep	72.2	5	2	0	0	7	10
26-Sep	51.6	3	0	0	0	3	6
27-Sep	72.5	10	2	0	0	12	17
28-Sep	38.9	2	0	0	0	2	5
29-Sep	75.5	20	1	1	1	23	30
30-Sep	64.6	1	1	0	0	2	3
01-Oct	68.8	6	2	0	0	8	12
02-Oct	0.0	0	0	0	0	0	n/a
03-Oct	0.0	0	0	0	0	0	n/a
04-Oct	70.8	3	0	0	0	3	4
05-Oct	0.0	0	0	0	0	0	n/a
06-Oct	69.3	7	5	0	0	12	17
07-Oct	0.0	0	0	0	0	0	n/a
08-Oct	0.0	0	0	0	0	0	n/a
09-Oct	0.0	0	0	0	0	0	n/a
10-Oct	0.0	0	0	0	0	0	n/a
11-Oct	0.0	0	0	0	0	0	n/a
12-Oct	0.0	0	0	0	0	0	n/a
13-Oct	50.0	1	1	0	0	2	4
14-Oct	0.0	0	0	0	0	0	n/a
15-Oct	82.6	3	4	0	0	7	8
Total	4608.3	1455	392	79	12	1938	42

Figure 3. Capture Rates at Inglewood Bird Sanctuary - Fall 1997

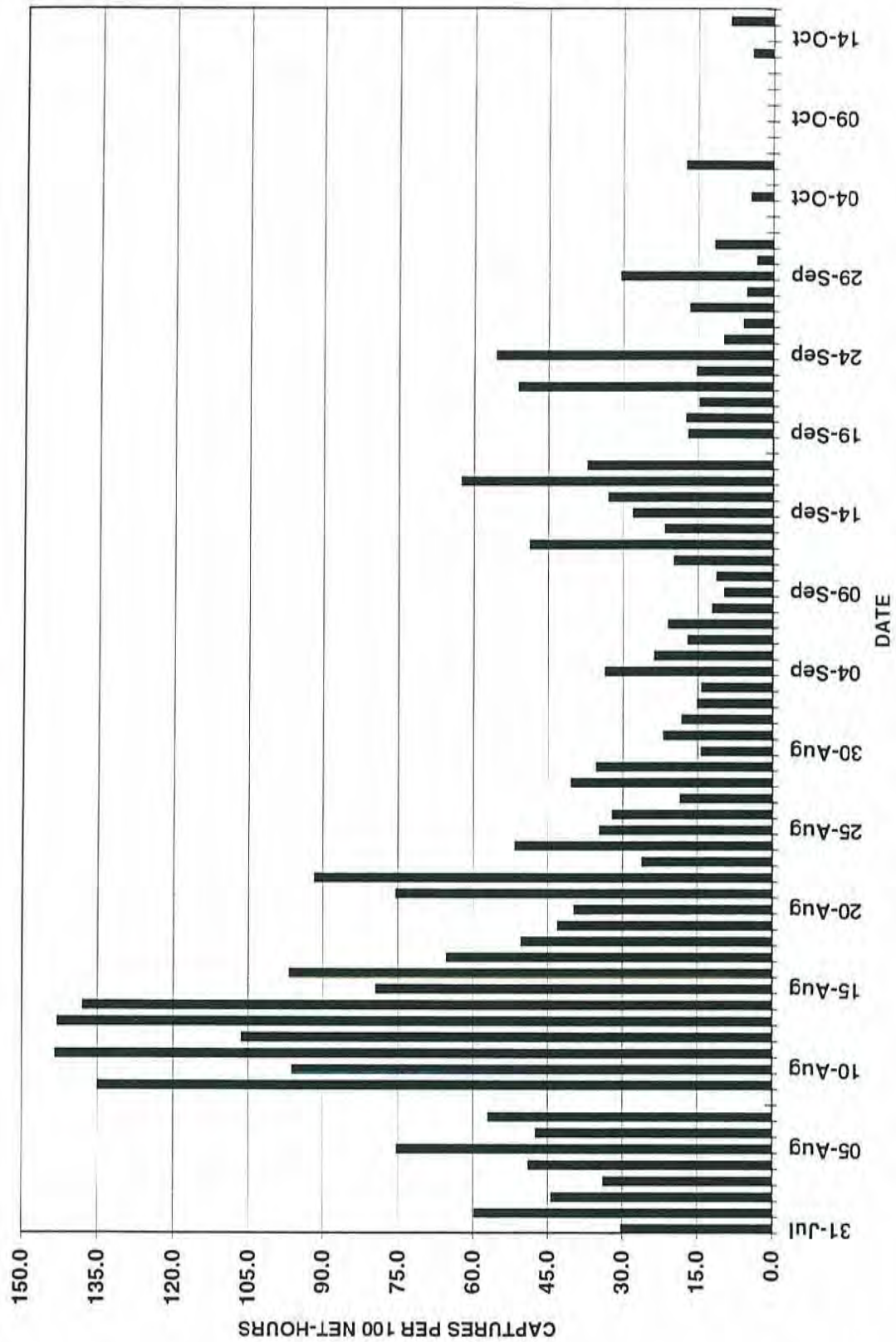


Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1997

	Jul							Aug																		
	31	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19						
Sharp-shinned hawk																										
Cooper's Hawk																										
Solitary Sandpiper		1					1	1		1					2	1		1								
Spotted Sandpiper		1																								
Belted Kingfisher		1																		1						
Downy Woodpecker	2			1																1						
Northern Flicker		2				1						1														
Olive-sided Flycatcher											1				1			1								
Western Wood-Pewee		1			1	1	3	3		4	2	2	3	3			7	1	1							
Trall's Flycatcher				1				1		7	4	1	1		2		2		3	3						
Least Flycatcher	1		1	1			1	1		2		1	3	2	6			3		1						
Western Flycatcher										1																
Eastern Kingbird		1		1	2		1	1		2	1	2		3			1			1						
N Rough-winged Swallow		1	1																							
Black-billed Magpie		1																								
Black-capped Chickadee	1	1																								
White-breasted Nuthatch						1								1			1									
House Wren	4	4	2	3	3	4	2	4		5	3	2	4	1	1	1										
Golden-crowned Kinglet																										
Ruby-crowned Kinglet																										
Swainson's Thrush					1																					
Hermit Thrush																										
American Robin	2	12	10	3	4	6	2	7		7	2	5		3			2			1						
Gray Catbird											1		1	2												
Brown Thrasher																										
Cedar Waxwing		1		1		1		2			8	18	3	14	11			2		2						
Blue-headed Vireo																										
Warbling Vireo			2	1	2					2		1			1		1			2						
Red-eyed Vireo																										
Tennessee Warbler			1		5	2				6	5	2	8	4	3			1		2						
Orange-crowned Warbler																				1						
Nashville Warbler																										
Yellow Warbler		1	1	1	6	10	5	5		24	13	14	9	15	4		5	5		3						
Magnolia Warbler																			1							
Yellow-rumped Warbler		2	5	2			1	1		6	5	16	8	10	7		1	6		3						
Black-throated Green Warbler															1											
Townsend's Warbler																										
Palm Warbler																										
Blackpoll Warbler																										
American Redstart												1								2						
Ovenbird															1					1						
Northern Waterthrush				1				1		1	4	4	4	3	7	3	1	1		5						
Connecticut Warbler																										
Mourning Warbler																		1								
MacGillivray's Warbler															2			1								
Common Yellowthroat																										
Wilson's Warbler											2		1	5	13		1	1	4	6						
Canada Warbler																										
Western Tanager															1			1								
Rose-breasted Grosbeak																										
American Tree Sparrow																										
Chipping Sparrow	1	2		1	5	8	7	5		8	14	24	7	22	17	1	5	13	3	1						
Clay-coloured Sparrow			1		1		1			2	1	1	2	3	4				2							
Savannah Sparrow															1											
Song Sparrow	1					1				2	1	2	2	1						1						
Lincoln's Sparrow	1																									
White-throated Sparrow																		2								
White-crowned Sparrow																										
Dark-eyed Junco																										
Brown-headed Cowbird										1					1											
Baltimore Oriole						5	3	2		1																
Purple Finch								1						1												
Pine Siskin										1																
American Goldfinch								1																		
Total	13	32	24	17	30	40	27	36	0	83	67	95	57	96	83	6	31	39	27	21						

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1997

	Aug											Sep								
	20	21	22	23	24	25	26	27	28	29	30	31	01	02	03	04	05	06	07	08
Sharp-shinned hawk																	1		1	
Cooper's Hawk																		1		
Solitary Sandpiper	1	3																		
Spotted Sandpiper	1	1																		
Belted Kingfisher		1		1		1														
Downy Woodpecker	1																			
Northern Flicker			1																	
Olive-sided Flycatcher			1																	
Western Wood-Pewee				1																
Trail's Flycatcher	4	3	1			1						1	2	1	2	4	3	1		
Least Flycatcher	1						1				1	1	1							1
Western Flycatcher																				
Eastern Kingbird											1									
N Rough-winged Swallow																				
Black-billed Magpie			1														1	2		1
Black-capped Chickadee					1									1	1					
White-breasted Nuthatch			1																	
House Wren		1	2	1		2			1		1							1		
Golden-crowned Kinglet																				
Ruby-crowned Kinglet																				
Swainson's Thrush	1						1									2		1		
Hermit Thrush																				
American Robin		1		2																
Gray Catbird		2	1																	
Brown Thrasher			1	1											1					
Cedar Waxwing		4	1	1																
Blue-headed Vireo						1														
Warbling Vireo	1	1	4	3					1			2								
Red-eyed Vireo									1			1								
Tennessee Warbler	2	2	2		1					1	1		1							1
Orange-crowned Warbler					1					1								1		2
Nashville Warbler													1							
Yellow Warbler		8	1	1	3		2									1				
Magnolia Warbler			1														1			1
Yellow-rumped Warbler	3	1	9		4		1	4	10	1		4				6	8		1	
Black-throated Green Warbler																				
Townsend's Warbler										1										
Palm Warbler																				
Blackpoll Warbler		1				1	1													
American Redstart		1																		
Ovenbird				1					1	2			2		1					
Northern Waterthrush	2	1			1	2						1			1	1				
Connecticut Warbler								1												
Mourning Warbler					2															
MacGillivray's Warbler	1	2					2	1												1
Common Yellowthroat																				1
Wilson's Warbler	4	5	6	1	10	2	5	1	4	14	1		1	3	3	3	2	2	7	1
Canada Warbler										1										
Western Tanager							1													
Rose-breasted Grosbeak		1																		
American Tree Sparrow																				
Chipping Sparrow	1	3	1				2													
Clay-coloured Sparrow			2															1		
Savannah Sparrow														1						
Song Sparrow			1			1														
Lincoln's Sparrow								1		1				1		1				1
White-throated Sparrow													1					1		
White-crowned Sparrow																1				
Dark-eyed Junco																				
Brown-headed Cowbird																				
Baltimore Oriole				1																
Purple Finch																				
Pine Siskin			1																	
American Goldfinch			3																	
Total	23	42	41	14	24	10	17	5	20	21	5	11	9	7	9	19	17	10	13	6

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1997

	Sep																												
	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28									
Sharp-shinned hawk			1													1													
Cooper's Hawk																													
Scitary Sandpiper												1																	
Spotted Sandpiper																													
Belted Kingfisher																													
Downy Woodpecker																													
Northern Flicker			1									1																	
Olive-sided Flycatcher																													
Western Wood-Pewee																													
Trall's Flycatcher				1		1																							
Least Flycatcher									1																				
Western Flycatcher																													
Eastern Kingbird																													
N Rough-winged Swallow																													
Black-billed Magpie								2																					
Black-capped Chickadee																													
White-breasted Nuthatch																													
House Wren																													
Golden-crowned Kinglet																													
Ruby-crowned Kinglet			2	1			1							1			1			4									
Swainson's Thrush				1		1	1	1																					
Hermit Thrush								1																					1
American Robin						1							1		1	5		3											
Gray Catbird																													
Brown Thrasher																													
Cedar Waxwing																													
Blue-headed Vireo			1																										
Warbling Vireo					2								1																
Red-eyed Vireo								1																					
Tennessee Warbler							1	1																					
Orange-crowned Warbler	1	4	2	14		5	4	12	12		3	2	1	8		4	1		2										
Nashville Warbler		1																											
Yellow Warbler																													
Magnolia Warbler																													
Yellow-rumped Warbler		3	4	9	4								3	5		24	1												
Black-throated Green Warbler																													
Townsend's Warbler																													
Palm Warbler									2					1															
Blackpoll Warbler				2							1																		
American Redstart																													
Ovenbird						1					1																		
Northern Waterthrush					1					1																			
Connecticut Warbler																													
Mourning Warbler																													
MacGillivray's Warbler																													
Common Yellowthroat						1		4	2																				
Wilson's Warbler	2			2				2	2							1													
Canada Warbler																													
Western Tanager																													
Rose-breasted Grosbeak																													
American Tree Sparrow																													1
Chipping Sparrow																													
Clay-coloured Sparrow																													
Savannah Sparrow																													
Song Sparrow						1		1																					
Lincoln's Sparrow			1					2	1					1	1	1													
White-throated Sparrow	1			1	2	2	2	7				4		8	4	2	2												
White-crowned Sparrow				1	1		1	3	1		1		1	3	3											1	1		
Dark-eyed Junco										1																			
Brown-headed Cowbird																													
Baltimore Oriole																													
Purple Finch																													
Pine Siskin																													
American Goldfinch																													
Total	4	8	12	32	11	14	12	35	22	0	7	7	7	28	9	39	5	3	10	2									

Table 2. New Bandings at Inglewood Bird Sanctuary - Fall 1997

	Sep		Oct													Total			
	29	30	01	02	03	04	05	06	07	08	09	10	11	12	13		14	15	
Sharp-shinned hawk		1																5	
Cooper's Hawk																		1	
Solitary Sandpiper																		13	
Spotted Sandpiper																		3	
Belted Kingfisher							1											6	
Downy Woodpecker																		5	
Northern Flicker																		7	
Olive-sided Flycatcher																		5	
Western Wood-Pewee																		33	
Trail's Flycatcher																		50	
Least Flycatcher																		30	
Western Flycatcher																		1	
Eastern Kingbird																		17	
N Rough-winged Swallow																		2	
Black-billed Magpie																		8	
Black-capped Chickadee																		5	
White-breasted Nuthatch																		4	
House Wren																		52	
Golden-crowned Kinglet																	1	1	
Ruby-crowned Kinglet	7		2			1												20	
Swainson's Thrush																		10	
Hermit Thrush				1											1		1	6	
American Robin				1														81	
Gray Catbird																		7	
Brown Thrasher																		3	
Cedar Waxwing																		67	
Blue-headed Vireo																		2	
Warbling Vireo																		27	
Red-eyed Vireo																		3	
Tennessee Warbler																		52	
Orange-crowned Warbler	2			1			1											86	
Nashville Warbler																		2	
Yellow Warbler																		137	
Magnolia Warbler																		4	
Yellow-rumped Warbler	7								6									191	
Black-throated Green Warbler																		1	
Townsend's Warbler																		1	
Palm Warbler																		3	
Blackpoll Warbler																		6	
American Redstart																		4	
Ovenbird																		11	
Northern Waterthrush																		46	
Connecticut Warbler																		1	
Mourning Warbler																		3	
MacGillivray's Warbler																		10	
Common Yellowthroat																		8	
Wilson's Warbler		1																119	
Canada Warbler																		1	
Western Tanager																		3	
Rose-breasted Grosbeak																		1	
American Tree Sparrow									1								1	3	
Chipping Sparrow																		151	
Clay-coloured Sparrow																		21	
Savannah Sparrow																		2	
Song Sparrow																		15	
Lincoln's Sparrow																		13	
White-throated Sparrow																		39	
White-crowned Sparrow		3		1														22	
Dark-eyed Junco																		3	
Brown-headed Cowbird																		2	
Baltimore Oriole																		12	
Purple Finch																		2	
Pine Siskin																		2	
American Goldfinch																		4	
Total	20	1	6	0	0	3	0	7	0	0	0	0	0	0	0	1	0	3	1455

Table 3. New Bandings at Inglewood Bird Sanctuary

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

Table 3. New Bandings at Inglewood Bird Sanctuary

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

Table 4. Significant Recaptures at Inglewood Bird Sanctuary 1997.

Downy Woodpecker 1451-67033 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 29 July 1995. Recaptured there as AHY-M on 23 June and 13 July 1996 and 19 August 1997. 2 years old.

... 1461-02314 Banded as AHY-F by Greg Meyer at Inglewood Bird Sanctuary on 13 July 1996. Recaptured there as AHY-F on 11 August 1997. At least 2 years old.

Eastern Kingbird 1461-63719 Banded as AHY-F by Stefan Jungkind at Inglewood Bird Sanctuary on 13 August 1996. Recaptured there as AHY-M on 1 August 1997. At least 2 years old.

Black-capped Chickadee 1950-45186 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 31 August 1994. Recaptured there as AHY-U on 11 August and 26 September 1995, 4&26 August, 20&30 September and 11 October 1996 as well as 25 August and 11 October 1997. 3 years old.

... 2050-70427 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 31 July 1996. Recaptured there as AHY-U on 5 August and 15 September 1997. 1 year old.

... 1980-79991 Banded as AHY-F by Grahame Booth at Inglewood Bird Sanctuary on 22 July 1995. Recaptured there as AHY-U on 5 August and 11 October 1997. At least 3 years old.

... 1950-45258 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 6 September 1994. Recaptured there as U-U on 11 October 1997. At least 4 years old.

... 2050-70142 Banded as U-U by Grahame Booth at Inglewood Bird Sanctuary on 22 August 1995. Recaptured there as AHY-U on 7 September 1997. At least 2 years old.

... 1950-45786 Banded as SY-U by Doug Collister at Inglewood Bird Sanctuary on 28 July 1996. Recaptured there as AHY-U on 27 September 1997. 2 years old.

House Wren 1910-52261 Banded as AHY-U by Ross Dickson at Inglewood Bird Sanctuary on 21 July 1992. Recaptured there as AHY-M on 31 May 1993, 17 June and 9 September 1995, 16 June, 6 July and 13 July 1996 as well as 31 July 1997. At least 6 years old.

... 1950-45886 Banded as HY-U by Stefan Jungkind at Inglewood Bird Sanctuary on 20 August 1996. Recaptured there as AHY-M on 7 June 1997. 1 year old.

... 1950-45790 Banded as U-U by Doug Collister at Inglewood Bird Sanctuary on 2 August 1996. Recaptured there as U-U on 26 July 1997. At least 1 year old.

Table 4. Significant Recaptures at Inglewood Bird Sanctuary 1997

Swainson's Thrush 1461-69595 Banded as SY-M by Doug Collister at Inglewood Bird Sanctuary on 2 August 1996. Recaptured there as AHY-U on 7 September 1996 as well as 29 August and 4 September 1997. 2 years old.

... 1461-63741 Banded as AHY-F by Doug Collister at Inglewood Bird Sanctuary on 29 August 1996. Recaptured there as AHY-U on 1 August 1997. At least 2 years old.

... 1461-63692 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 27 August 1994. Recaptured there as AHY-U on 27 August 1997. At least 4 years old.

American Robin 0962-90991 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 18 August 1995. Recaptured there as AHY-F on 6 August 1997. 2 years old.

... 0972-30466 Banded as AHY-U by Rainer Ebel at Inglewood Bird Sanctuary on 25 September 1995. Recaptured there as ASY-M on 12 July 1997. At least 3 years old.

Cedar Waxwing 1461-63733 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 19 August 1996. Recaptured there as U-M on 11 August 1997. 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 as AHY-U on 11 August and 4 September 1996 as well as 21 June 1997. At least 4 years old.

Yellow Warbler 1980-79983 Banded as ASY-M by Grahame Booth at Inglewood Bird Sanctuary on 7 July 1995. Recaptured there as AHY-M on 13 July 1996 as well as 7 June and 13 August 1997. At least 3 years old.

... 1950-45878 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 19 August 1996. Recaptured there as AHY-M on 13 August 1997. 1 year old.

Table 5. Migrants at Inglewood Bird Sanctuary - Fall 1997

Species	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	
Common Loon																												
Red-necked Grebe																												
Black-crowned Night-Heron																												
Eurasian Wigeon																												
Redhead																												
Harlequin Duck																												
Hooded Merganser																												
Red-breasted Merganser																												
Sharp-shinned Hawk																												
Copper's Hawk																												
Northern Goshawk																												
Accipiter spp.																												
Broad-winged Hawk																												
Screech Owl																												
Killdeer																												
Greater Yellowlegs																												
Lesser Yellowlegs																												
Yellowlegs spp.																												
Solitary Sandpiper																												
Spotted Sandpiper																												
Sandpiper spp.																												
Common Snipe																												
Herring Gull																												
Sabine's Gull																												
Mourning Dove																												
Common Nighthawk																												
Rufous Hummingbird																												
Hummingbird spp.																												
Belted Kingfisher																												
Olive-sided Flycatcher																												
Western Wood-pewee																												
Trail's Flycatcher																												
Least Flycatcher																												
Western Flycatcher																												
Flycatcher spp.																												
Eastern Phoebe																												
Say's Phoebe																												
Eastern Kingbird																												
Tree Swallow																												
N Rough-winged Swallow																												
Bank Swallow																												
Barn Swallow																												
Swallow spp.																												
Blue Jay																												
Red-breasted Nuthatch																												
Brown Creeper																												
House Wren																												
Golden-crowned Kinglet																												
Ruby-crowned Kinglet																												
Swainson's Thrush																												
Hermit Thrush																												
American Robin																												
Gray Catbird																												
Brown Thrasher																												
Sprague's Pipit																												

Table 5. Migrants at Inglewood Bird Sanctuary - Fall 1997

Species	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	28-Aug	
Cedar Waxwing	20	16	6	10	15	16	7	15	7	6	25	16	10	10	10	9	14	12	12	14	13	10	9	7				1	
Northern Shrike																													
Shrike spp.																													
Blue-headed Vireo																													
Warbling Vireo	4	4	4	2	5	12	4	2	2	2	1	2	1	2	10	6	12	2	2	4	5	1	1	1	1	1	1	2	
Red-eyed Vireo	1	1	1	2	5	2																							
Tennessee Warbler																													
Nashville Warbler																													
Orange-crowned Warbler																													
Nashville Warbler																													
Yellow Warbler	6	3	5	21	23	12	11	15	24	22	13	13	13	13	13	6	6	5	2	10	6	12	2	2	5	1	2	4	
Magnolia Warbler																													
Yellow-crowned Warbler	4	14	14	2		4	3	1	7	5	16	13	13	13	3	1	6	4	7	7	2	22	3	8	12	1	1		
Townsend's Warbler																													
Black-throated Green Warbler																													
Blackburnian Warbler																													
Palm Warbler																													
Blackpoll Warbler																													
Black-and-white Warbler																													
American Redstart																													
Ovenbird																													
Northern Waterthrush																													
Connecticut Warbler																													
Mourning Warbler																													
MacGillivray's Warbler																													
Common Yellowthroat																													
Wilson's Warbler																													
Canada Warbler																													
Warbler spp.																													
Western Tanager																													
Rose-breasted Grosbeak																													
American Tree Sparrow	1	2	16	2	15	20	17	11	3	9	14	26	19	8	16	10	33	6	10	6	8	7	2	2	8	2	2	8	
Chipping Sparrow	1	1	1	2	2	4	4	2	1	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
Clay-coloured Sparrow																													
Savannah Sparrow																													
Song Sparrow	2	2	9	2	5																								
Lincoln's Sparrow	1																												
Swamp Sparrow																													
White-throated Sparrow	1																												
White-crowned Sparrow																													
Harris' Sparrow																													
Sparrow spp.																													
Dark-eyed Junco																													
Rusty Blackbird																													
Brewer's Blackbird																													
Blackbird spp.																													
Common Grackle	2	8	1	7	8	13	6	6	1	2	3	9	9	9	4	5	1	8	6	5	3	5	3	3	3	3	3	1	
Baltimore Oriole																													
Purple Finch																													
Pine Siskin																													
American Goldfinch	8	3	6	5	9	5	11																						
Total Birds	118	124	158	187	237	233	158	216	223	124	123	151	170	0	0	101	88	177	162	118	118	107	118	61	72	55	36		
Total Species	19	16	23	22	29	24	23	22	14	24	19	23	27	0	0	20	18	25	25	21	31	26	26	16	26	16	20	20	

Table 5. Migrants at Inglewood Bird Sanctuary - Fall 1997

Species	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep
Common Loon																										
Red-necked Grebe																										
Black-crowned Night-Heron																										
Eurasian Wigeon																										
Redhead																										
Harlequin Duck																										
Hooded Merganser																										
Red-breasted Merganser																										
Sharp-shinned Hawk																										
Cooper's Hawk																										
Northern Goshawk																										
Accipiter spp.																										
Broad-winged Hawk																										
Sora																										
Killdeer																										
Greater Yellowlegs																										
Lesser Yellowlegs																										
Yellowlegs spp.																										
Solitary Sandpiper																										
Willet																										
Spotted Sandpiper																										
Sandpiper spp.																										
Common Snipe																										
Herring Gull																										
Sabine's Gull																										
Mourning Dove																										
Common Nighthawk																										
Rufous Hummingbird																										
Hummingbird spp.																										
Belted Kingfisher																										
Olive-sided Flycatcher																										
Western Wood-Pewee																										
Western Flycatcher																										
Least Flycatcher																										
Western Flycatcher																										
Flycatcher spp.																										
Eastern Phoebe																										
Say's Phoebe																										
Eastern Kingbird																										
Tree Swallow																										
Rough-winged Swallow																										
Bank Swallow																										
Barn Swallow																										
Swallow spp.																										
Blue Jay																										
Red-breasted Nuthatch																										
Brown Creeper																										
House Wren																										
Golden-crowned Kinglet																										
Ruby-crowned Kinglet																										
Swainson's Thrush																										
Hermit Thrush																										
American Robin																										
Gray Catbird																										
Brown Thrasher																										
Sprague's Pipit																										

Table 5. Migrants at Ingleswood Bird Sanctuary - Fall 1997

Species	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep		
Cedar Waxwing																												
Northern Shrike																												
Shrike spp.																												
Blue-headed Vireo																												
Warbling Vireo																												
Red-eyed Vireo																												
Tennessee Warbler																												
Nashville Warbler																												
Orange-crowned Warbler																												
Nashville Warbler																												
Yellow Warbler																												
Magnolia Warbler																												
Yellow-rumped Warbler																												
Townsend's Warbler																												
Black-throated Green Warbler																												
Blackburnian Warbler																												
Palm Warbler																												
Blackpoll Warbler																												
Black-and-white Warbler																												
American Redstart																												
Ovenbird																												
Northern Waterthrush																												
Connecticut Warbler																												
Mourning Warbler																												
MacGillivray's Warbler																												
Common Yellowthroat																												
Wilson's Warbler																												
Canada Warbler																												
Warbler spp.																												
Western Tanager																												
Rose-breasted Grosbeak																												
American Tree Sparrow																												
Chipping Sparrow																												
Clay-coloured Sparrow																												
Savannah Sparrow																												
Song Sparrow																												
Lincoln's Sparrow																												
Swamp Sparrow																												
White-throated Sparrow																												
White-crowned Sparrow																												
Harris' Sparrow																												
Sparrow spp.																												
Dark-eyed Junco																												
Rusty Blackbird																												
Brewer's Blackbird																												
Blackbird spp.																												
Common Grackle																												
Baltimore Oriole																												
Purple Finch																												
Pine Siskin																												
American Goldfinch																												
Total Birds	52	131	66	46	30	20	70	61	84	86	57	81	62	32	127	60	107	69	109	95	74	106	8	125	16	36	35	
Total Species	14	25	20	20	15	13	20	21	22	22	20	23	15	15	18	14	21	16	16	12	16	16	3	16	8	8	9	

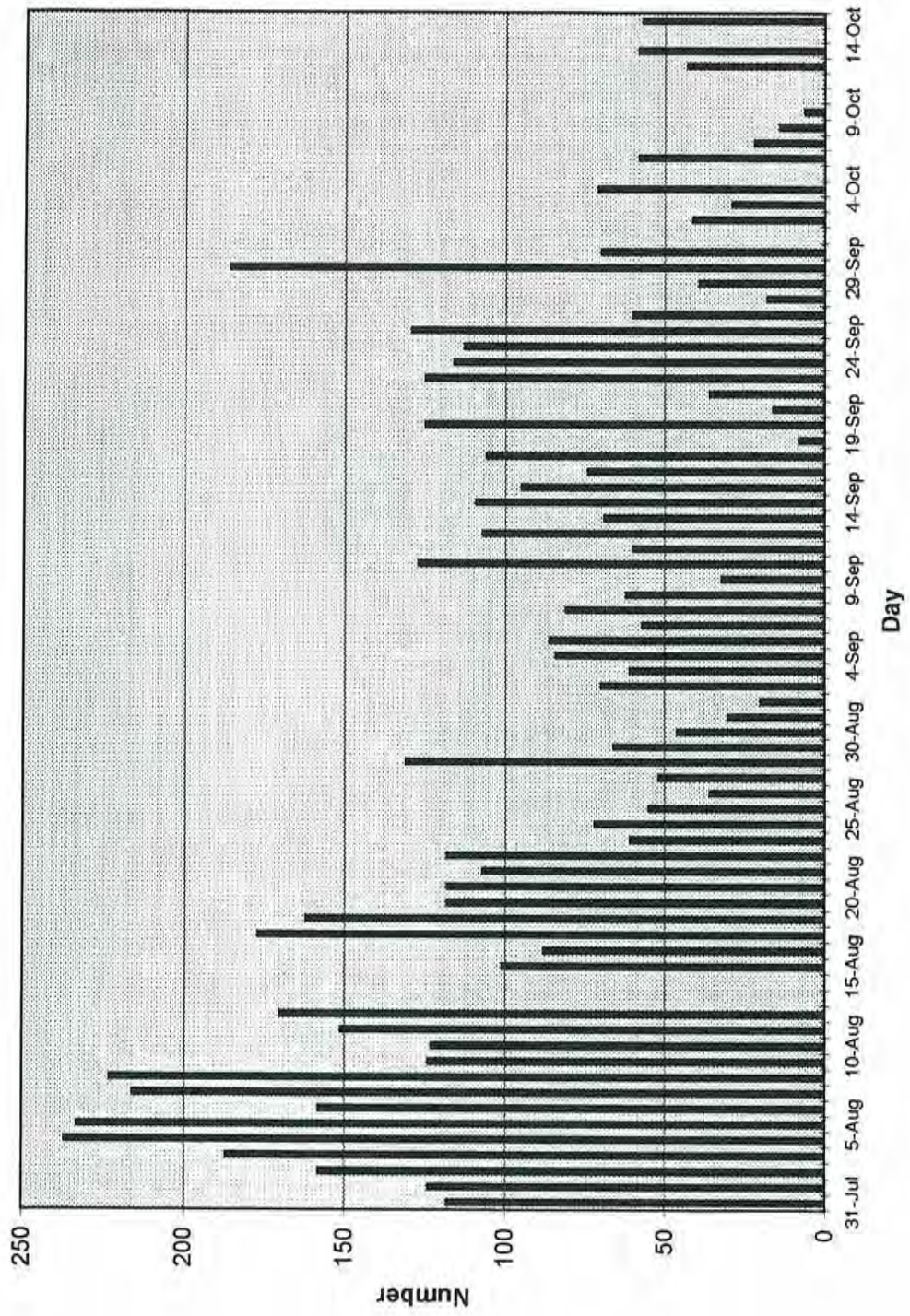
Table 5. Migrants at Inglewood Bird Sanctuary - Fall 1997

Species	Date	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	1-Oct	2-Oct	3-Oct	4-Oct	5-Oct	6-Oct	7-Oct	8-Oct	9-Oct	10-Oct	11-Oct	12-Oct	13-Oct	14-Oct	15-Oct	Tot. Ave	Freq	
Common Loon		1	1																						21	15	
Red-necked Grebe			1																							1	1
Black-crowned Night-Heron																										1	1
Eurasian Wigeon																										1	1
Redhead																										4	4
Harlequin Duck																										1	1
Hooded Merganser																										21	9
Red-breasted Merganser																										2	2
Sharp-shinned Hawk																										16	15
Cooper's Hawk																										11	9
Northern Goshawk																										2	1
Accipiter spp.																										1	1
Broad-winged Hawk																										1	1
Sora																										1	1
Killdeer																										1	1
Greater Yellowlegs																										32	14
Lesser Yellowlegs																										9	2
Yellowlegs spp.																										6	2
Solitary Sandpiper																										93	32
Willet																										1	1
Spotted Sandpiper																										7	1
Sandpiper spp.																										42	24
Common Snipe																										15	2
Herring Gull																										34	5
Sabine's Gull																										10	3
Mourning Dove																										4	1
Common Nighthawk																										2	1
Rufous Hummingbird																										1	1
Hummingbird spp.																										1	1
Balded Kingfisher																										2	1
Olive-sided Flycatcher																										90	52
Western Wood-Pewee																										11	1
Traill's Flycatcher																										88	4
Least Flycatcher																										47	2
Western Flycatcher																										38	2
Flycatcher spp.																										41	1
Eastern Phoebe																										5	1
Say's Phoebe																										1	1
Tree Swallow																										518	17
N Rough-winged Swallow																										15	3
Barn Swallow																										63	7
Barn Swallow																										9	2
Swallow spp.																										7	2
Blue Jay																										5	1
Red-breasted Nuthatch																										28	2
Brown Creeper																										1	1
House Wren																										169	5
Golden-crowned Kinglet																										1	1
Ruby-crowned Kinglet																										45	2
Swainson's Thrush																										21	2
Hermil Thrush																										1	1
American Robin																										10	13
Gray Catbird																										1370	21
Brown Thrasher																										33	1
Sprague's Pipit																										17	2
																										1	1

Table 5. Migrants at Inglewood Bird Sanctuary - Fall 1997

Species	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	1-Oct	2-Oct	3-Oct	4-Oct	5-Oct	6-Oct	7-Oct	8-Oct	9-Oct	10-Oct	11-Oct	12-Oct	13-Oct	14-Oct	15-Oct	Total	Avg	FW			
Cedar Waxwing						2																				329	8	42		
Northern Shrike																											2	1	2	
Shrike spp.																											1	1	1	
Blue-headed Vireo																											5	1	5	
Warbling Vireo																											72	3	24	
Red-eyed Vireo																											10	1	10	
Tennessee Warbler																											54	3	21	
Nashville Warbler																											2	1	2	
Orange-crowned Warbler	12	1	4	1	2	7																				110	4	26		
Nashville Warbler																											241	9	28	
Yellow Warbler																											5	1	5	
Magnolia Warbler																											5	1	5	
Yellow-rumped Warbler																											5	1	5	
Towhees	45	35	47	21	6																					5	871	13	62	
Black-throated Green Warbler																											4	1	3	
Blackburnian Warbler																											6	2	4	
Palm Warbler	1																										26	2	16	
Blackpoll Warbler	2	1																									5	1	4	
Black-and-white Warbler																											14	1	11	
American Redstart																											44	2	20	
Orenbird																											3	1	3	
Northern Waterthrush																											4	1	3	
Connecticut Warbler																											13	2	8	
Mourning Warbler																											9	2	4	
MacGillivray's Warbler																											149	4	35	
Common Yellowthroat																											147	10	15	
Wilson's Warbler																											2	1	2	
Canada Warbler																											2	1	2	
Warbler spp.																											3	2	2	
Western Tanager																											8	23	4	6
Rose-breasted Grosbeak																											294	9	32	
American Tree Sparrow																											27	2	13	
Chipping Sparrow																											1	1	1	
Clay-colored Sparrow																											51	1	21	
Savannah Sparrow																											25	2	15	
Song Sparrow																											2	2	1	
Lincoln's Sparrow	1	1	1																								2	1	2	
Swamp Sparrow																											2	1	2	
White-throated Sparrow	19	12	3	20	2																						2	2	1	
White-crowned Sparrow	3	15	4	9	2	1																					2	2	1	
Harris' Sparrow																											2	125	6	22
Sparrow spp.																											1	1	1	
Dark-eyed Junco																											113	8	14	
Rusty Blackbird																											34	3	11	
Brewer's Blackbird																											2	32	8	4
Blackbird spp.																											13	3	5	
Common Grackle	2																										16	2	4	
Baltimore Oriole																											75	6	13	
Purple Finch																											97	5	20	
Pine Siskin	1	3																									5	2	3	
American Goldfinch																											26	3	10	
Total Birds	125	116	113	129	60	18	39	186	70	0	41	29	71	0	58	23	14	6	0	0	43	58	0	57	6500	84				
Total Species	16	14	11	10	13	9	15	15	12	0	10	6	13	0	13	9	5	4	0	0	10	10	0	15						

Figure 4. Migrants at Inglewood Bird Sanctuary - Fall 1997



MONITORING AVIAN PRODUCTIVITY AND SURVIVAL (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 1997 field season was MAPS ninth 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 at least 6 of the 10 periods. For IBS the start period is period 4 (31 May - 9 June). At IBS our MAPS coverage entails 7 of the 10 ten-day periods.

An additional requirement of MAPS is to record the type and distribution of vegetation present at the 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 US Vegetation Cover Classification System.

Coverage

1997 marked the fifth year of the MAPS project at IBS with total effort of 434.5 net-hours over the 7 periods. Further, following the completion of the upgrades to the IBS grounds, a revised station map was produced and the defined habitat areas coded and proportions established.

Results and Discussion

The number of each species captured, by date, during 1997 are summarized in Table 6. The number of each species banded, recaptured, or escaped before banding are summarized in Table 7 for 1997 as well as the four previous years.

The number of migrants detected during MAPS continues to vary from year to year, apparently affected by weather conditions. In 1993 and 1996 several migrant sparrows and warblers were captured. During both of these years cold temperatures and snowfalls persisted well into May.

During 1997 the number of new bandings decreased slightly compared to 1996. White-throated Sparrows, for the second year in a row, bred within IBS. Gray Catbirds and Common Grackles continue to increase in numbers at IBS indicating probable breeding.

Because the MAPS project has been operated at IBS for 5 years, birds banded in previous years were recaptured. A 4-year old Warbling Vireo is notable. Additionally, we recaptured our first American Robin, banded as an adult in September 1995 and recaptured in July 1997 and Baltimore Oriole, banded as an adult in July 1996 and recaptured in August 1997. Details regarding these and other significant recaptures can be found in Table 4.

Reference

- DeSante, D.F. and K.M. Burton. 1997. 1997 M.A.P.S. Manual - Instructions For The Establishment And Operation Of Stations As Part Of The Monitoring Avian Productivity and Survivorship Program.
- DeSante, D.F., K.M. Burton, D.R. O'Grady. 1996. The Monitoring Avian productivity and Survivorship (MAPS) Program Fourth and Fifth Annual Report (1993 and 1994). *Bird Populations* 3:67-120.
- DeSante, D.F. and K.M. Burton. 1994. The Monitoring Avian Productivity and Survivorship (MAPS) Program Third Annual Report (1992). *Bird Populations* 2:62-89.

Table 7. Inglewood Bird Sanctuary MAPS Summary - 1992-1997

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

Table 6. Inglewood Bird Sanctuary MAPS Summary - 1997

	7 June		14 June		21 June		4 July		12 & 13 July		26 July		31 July		Total
	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	
Rufous Hummingbird													1		1
Downy Woodpecker							1					2			6
Western Wood-Pewee									1						1
Trail's Flycatcher	1										2				3
Least Flycatcher							1		1		1				4
Eastern Kingbird							3								3
Black-billed Magpie							2								2
Black-capped Chickadee							1								2
House Wren		1		2		1					9		5	4	27
Swainson's Thrush										1					3
American Robin	4	2	2	2	1	1	4	1	10	1	1				29
Gray Catbird			1												1
Cedar Waxwing									1						1
Warbling Vireo							1				1				3
Tennessee Warbler														1	1
Yellow Warbler		1	2	1	1		1				2				8
Western Tanager											2				2
Chipping Sparrow														1	1
Lincoln's Sparrow	3	1	1												6
Common Grackle										2					2
Brown-headed Cowbird	1		2												3
Baltimore Oriole					3	1	2			1	4				12
Total Birds	9	5	8	5	6	3	16	1	15	3	26	9	10	5	121
Total Species	4	4	5	3	4	3	9	1	5	3	10	4	7	1	22
Net-Hrs	57		60		63		63		62		70		60		435
Captures/100 Net-Hrs	24		22		14		27		29		50		25		28

Note: Other = recaptures + escapes

PERSONNEL

Volunteer participation in both the MAPS and migration monitoring 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 10 who donated approximately 8 hours on each day indicated.

Additionally, Brian Couronne provided an initial draft of Appendix 9 and Garry Hornbeck thoroughly edited an earlier version of this report.

Banders-in-Charge (BICs)

No salaried staff are involved in any CBBS projects. However, in order to attract out-of-town Banders-in-Charge (BIC), a daily per diem is offered during migration monitoring. 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 and ensure accuracy. In order to cover as many days as possible during the migration monitoring season it has been necessary to bring in several BICs from outside Calgary. The per diem decided upon by the general membership for the 1997 migration monitoring field season was \$90/day, conditional upon availability of funds. No per diems are paid until all duties of the BIC duties, including data entry to a database, have been fully discharged.

Table 8. Number of days of effort contributed by various individuals at Inglewood Bird Sanctuary in 1997.

Individual	MMonitoring		MAPS	
	BIC	Vol	BIC	Vol
Grahame Booth	10 ¹	1	4 ¹	
Michelle Boutin		3		1
Bill Brown		4		
Doug Collister	10 ¹	2		
Brian Couronne		6		1
Ross Dickson	14 ³			
Dick Graham		3		1
George Halmazna		2		
Garry Hornbeck		5		1
Clive Jackson		2		1
Barb Johnston				1
Stefan Jungkind	4 ²			
Dwight Knapik		4		1
Janos Kovacs	6 ²			
Steve Lane		6		2
Shonna MacLeod		22		1
Arlette Malcolm		4		
Greg Meyer	13 ³	3	3 ¹	
Pat Mitchell		13		2
Dale Paton	8 ²			
El Peterson		5		
Gwen Smiley		6		
Cyndi Smith		3		1
Don Stiles		7		1
Michael Vassal		2		
Catherine Watson-McDonald		1		
Linda Wiggins		2		
Bruce Wilson		5		
Scott Wilson		5		
Total	65	116	7	14

¹ donated ² received per diem ³ partially donated

MORTALITIES AND INJURIES

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

The following list represents all casualties during the spring banding, MAPS and migration monitoring projects combined. Note that the number captured, by species, is only given for species experiencing injury or mortality.

In 1995, 1996, and 1997 the mortality rates for all banding projects performed by the CBBS were 0.53%, 0.69%, and 0.64%, respectively. Injury rates for 1995, 1996, and 1997 were 0.82%, 1.15%, and 2.29%, respectively. The apparent increase may be due to the increased awareness of banding personnel to note even slight abrasions. CBBS members are expected to report all injuries, however minor. Nevertheless we are constantly reviewing protocol and procedures to determine the potential to reduce injuries. We are particularly interested in methods to establish mitigating measures for abrasions which, during 1997, accounting for 69% of all non-fatal injuries.

Species	Number Captured	Injuries		Mortalities	
		Number	Type	Number	Cause
Solitary Sandpiper	14	1	leg strain		
		2	wing abrasion		
		1	leg abrasion		
Spotted Sandpiper	4			1	shock
Belted Kingfisher	6	1	wing abrasion		
Black-billed Magpie	11	1	cut tongue		
Black-capped Chickadee	125	3	cut foot	2	shock
House Wren	155	4	wing abrasion	1	shock
		1	leg strain		
		1	treated for stress		
Golden-crowned Kinglet	4			1	predation by Mule Deer
Swainson's Thrush	40	3	wing abrasion		
American Robin	160	5	cut tongue	1	probable cat predation
		1	cut under left wing pit	2	shock
		2	leg abrasion		
		14	wing abrasion		
Gray Catbird	16	1	wing abrasion		
Brown Thrasher	3	1	wing abrasion		
Cedar Waxwing	78			1	shock

Warbling Vireo	42	1	wing abrasion		
Tennessee Warbler	74			1	broken neck
Yellow Warbler	211	1	wing abrasion	1	shock
				1	predation by Mule Deer
Yellow-rumped Warbler	269	5	wing abrasion		
		1	treated for stress		
Northern Waterthrush	73	1	blood near ear		
Connecticut Warbler	2			1	shock
Common Yellowthroat	12	1	shock		
Wilson's Warbler	158	1	cut toe	1	shock
		1	cut tongue		
		1	treated for stress		
Rose-breasted Grosbeak	1	1	wing abrasion		
Chipping Sparrow	174	1	wing abrasion		
Clay-coloured Sparrow	77			1	probable cat predation
Song Sparrow	26	1	wing abrasion		
White-crowned Sparrow	64	1	wing abrasion	1	probable squirrel predation
Total	2515	58	(2.29%)	16	(0.64%)

EQUIPMENT

Mist-nets

At the beginning of the 1997 banding season the mist-net inventory consisted of 22 30-mm nets. Fifteen of these were from AVINET, Inc. while 7 remained from the Spider Technologies supply. Nets that were damaged beyond reasonable repair during the 1996 banding season were sold to master and sub-permittees. The funds were placed into the CBBS general account.

During spring banding at Dunbow Road, the bottom trammel lines on several of the new AVINET, Inc. nets stretched and or snapped. Poor quality trammel line was suspected, and 6 nets were returned to AVINET, Inc. for inspection and possible repair. AVINET, Inc. suggested that we are perhaps tying the nets to taught, resulting in excessive strain on the lines. The 6 nets were repaired by replacing the trammel line with a stronger breaking strain line. Upgrading the trammel lines on any new nets purchased through AVINET, Inc. may be an option.

Only a Spider Technologies net was seriously damaged this year. Of the remaining 21 nets, all are in good condition, with 2 requiring minor repair.

Additionally CBBS has ten 12-m x 38-mm mist-nets donated by Loney Dickson of the Canadian Wildlife Service.

Net Poles and Re-bar Stakes

Several new sets of net poles and re-bar were purchased during 1997 to replace damaged stock and to supply the Dunbow Road site. At present a sufficient supply of useable poles and stakes exists to carry CBBS through the 1998 banding season.

Banding Equipment

Each BIC was once again responsible for providing his/her own banding pliers, circlip pliers, wing rule, etc. This system has worked well for CBBS.

Lab Equipment

Space in the Colonel Walker House is a future possibility for indoor lab facilities. During 1997 we continued use of a table, 3 chairs, and a tarp located in the field. Room has been made available in the Colonel Walker House for a computer to facilitate data entry.

The AC/DC powered weigh scale, Canon EOS Rebel G camera, and optical devices for aiding in skulling, acquired during 1996, proved invaluable over the course of our banding season. We again acknowledge those agencies that provided funding.

Grad & Walker Energy Corporation donated a 386 IBM-compatible personal computer, which is now equipped with Windows 3.1 software donated by Telus Communications Inc.

A dual burner Coleman stove was donated by Canadian Tire. Hot cereals and drinks on cold mornings kept the banding personnel warm and in good spirits.

Summary

CBBS's equipment for the 1998 banding season is in good order. Only small purchases may be necessary for repair or replacement. However, consideration should be given to the purchase of 4-6 more mist-nets as the Spider Technologies nets will be seeing their fourth season and are unlikely to last much longer.

APPENDIX 1

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 (Figure 2). 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;
- *Incidental Observations* - this form is intended for any incidental observations made during the day. The data recorded will include species, number seen, time of day and as well as additional comments such as location, direction of flight, behaviour etc;
- *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.

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.

References

- Hagan, J.M., K.A. Hobson, D.J.T. Hussell, N. Nur and C.J. Ralph. 1994. Recommended methods for monitoring bird migration. Draft prepared by the Intensive Sites Technical Committee of the Migration Monitoring Council. 22 pp.
- Hussell, D.J.T. and C.J. Ralph. 1996. Recommended methods for monitoring bird populations by counting and capture of migrants. Report of the Intensive Sites Technical Committee of the Migration Monitoring Council. 13 pp.
- McCracken, J.D., D.J.T. Hussell, and E. Dunn. 1993. A manual for monitoring bird migration. Long Point Bird Observatory, Port Rowan, Ontario. 65 pp.
- Pyle, P. 1997. Identification Guide to North American Birds - Part I *Columbidae* to *Ploceidae*. Slate Creek Press, Bolinas, CA. 732 pp.

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 2

Recaptures at Inglewood Bird Sanctuary - Fall 1997

	Jul		Aug																											
	31	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
Solitary Sandpiper																														
Spotted Sandpiper												1								1										
Downy Woodpecker			1			2		2				2		1	1	2			1	1										
Olive-sided Flycatcher																		2												
Western Wood-Pewee								1														1	1							
Trail's Flycatcher									2								1													
Least Flycatcher			1						1								2	1												
Eastern Kingbird																														
Black-capped Chickadee						2																					1			
House Wren	5	1	2	2	1	1	3		2		1	2	3	3	3	1	3	1	1	1	1	1	1	2	4					
Ruby-crowned Kinglet																														
Swainson's Thrush			1																	1										
Hermit Thrush																														
American Robin			1	1			2		1													1								
Gray Catbird																1	1													
Cedar Waxwing			1	1								1			1															
Warbling Vireo													2	1	1				1						1	1	1			
Tennessee Warbler												4			7										1	1	1			
Orange-crowned Warbler																														
Yellow Warbler			1	1	1	3	1	1	7		6	5	4	3	1	2	1													
Magnolia Warbler																										1				
Yellow-rumped Warbler			1								2	1	8	2	3	3	2	1	3	1	1	3	3	3	3	1	1			
Blackpoll Warbler																									1	1				
American Redstart																														
Ovenbird																														
Northern Waterthrush											2	1	1	1	1	2	2	2	1	2					1	1	1			
Mourning Warbler																	1		2											
MacGillivray's Warbler																														
Common Yellowthroat																														
Wilson's Warbler																2	1			2						4	4			
Chipping Sparrow						1					1	1	1	2																
Clay-coloured Sparrow			1	1								1			3										1	1				
Song Sparrow																														
White-throated Sparrow																														
White-crowned Sparrow																														
Common Grackle																														
Baltimore Oriole																	1													
American Goldfinch																														
Total	5	4	8	6	5	10	8	6	0	19	5	14	23	16	21	9	19	13	8	9	4	6	14	4	12	15				

Recaptures at Inglewood Bird Sanctuary - Fall 1997

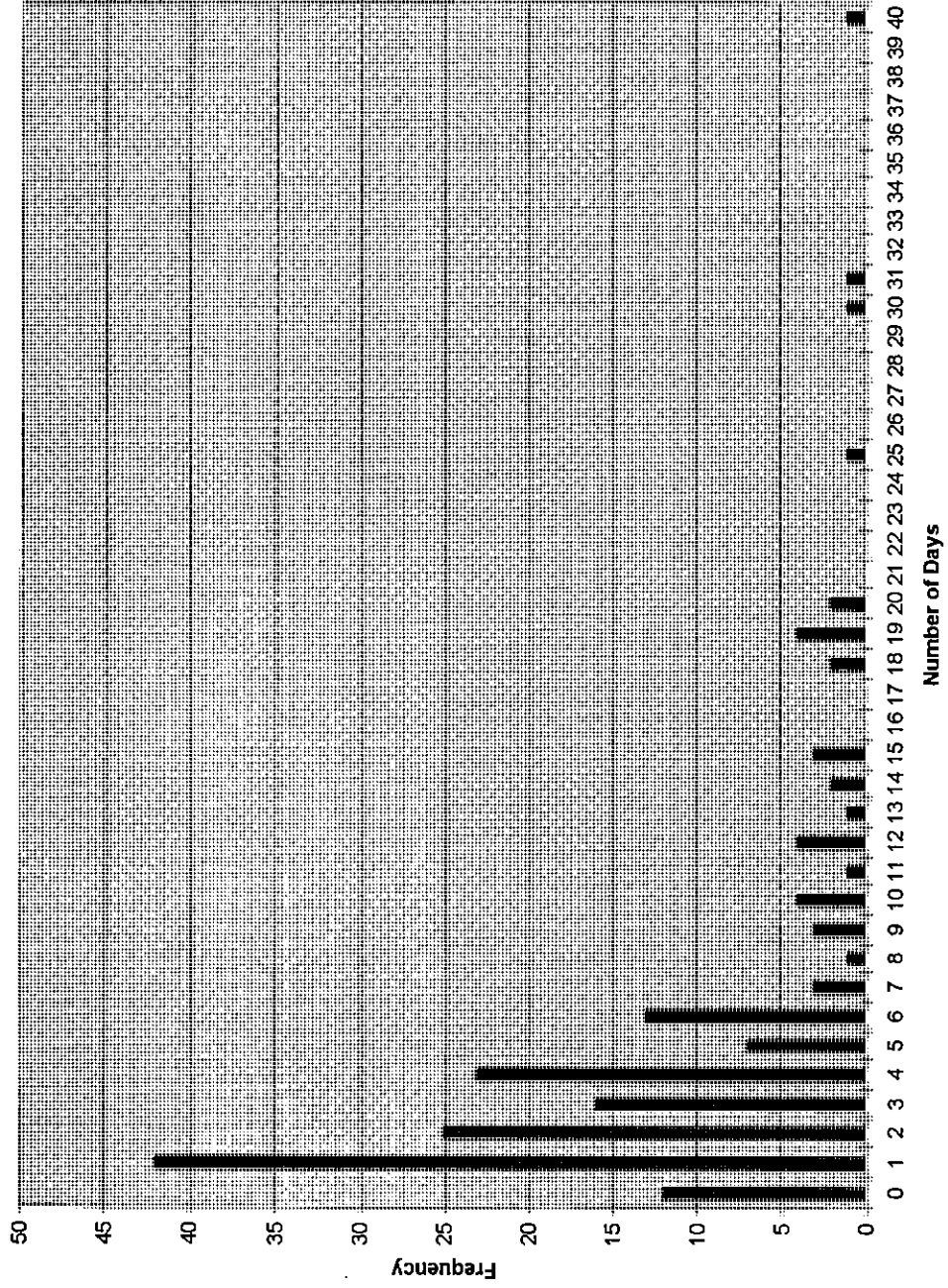
	Aug												Sep														
	26	27	28	29	30	31	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	
Solitary Sandpiper																											
Spotted Sandpiper																											
Downy Woodpecker																											
Olive-sided Flycatcher																											
Western Wood-Pewee																											
Traill's Flycatcher																											
Least Flycatcher																											
Eastern Kingbird																											
Black-capped Chickadee																											
House Wren																											
Ruby-crowned Kinglet																											
Swainson's Thrush																											
Hermit Thrush																											
American Robin																											
Gray Catbird																											
Cedar Waxwing																											
Warbling Vireo																											
Tennessee Warbler																											
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Yellow Warbler																											
Magnolia Warbler																											
Yellow-rumped Warbler																											
Blackpoll Warbler																											
American Redstart																											
Ovenbird																											
Northern Waterthrush																											
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MacGillivray's Warbler																											
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Chipping Sparrow																											
Clay-coloured Sparrow																											
Song Sparrow																											
White-throated Sparrow																											
White-crowned Sparrow																											
Common Grackle																											
Baltimore Oriole																											
American Goldfinch																											
Total	6	8	8	4	4	4	3	3	3	1	3	0	1	3	3	0	1	2	4	7	10	9	4	0	4	4	

Recaptures at Inglewood Bird Sanctuary - Fall 1997

	Sep										Oct					Total										
	21	22	23	24	25	26	27	28	29	30	01	02	03	04	05		06	07	08	09	10	11	12	13	14	15
Solitary Sandpiper																										1
Spotted Sandpiper																										1
Downy Woodpecker																										14
Olive-sided Flycatcher																										1
Western Wood-Pewee																										3
Trail's Flycatcher																										8
Least Flycatcher																										6
Eastern Kingbird																										4
Black-capped Chickadee							2																1			21
House Wren										2																39
Ruby-crowned Kinglet								1	1																	2
Swainson's Thrush																										7
Hermit Thrush																								2		2
American Robin																										5
Gray Catbird																										6
Cedar Waxwing																										5
Warbling Vireo																										6
Tennessee Warbler																										5
Orange-crowned Warbler	1	3																								10
Yellow Warbler																										21
Magnolia Warbler																										24
Yellow-rumped Warbler																										39
Blackpoll Warbler																										2
American Redstart																										4
Ovenbird	1																									1
Northern Waterthrush	1	1																								4
Mourning Warbler																										24
MacGillivray's Warbler																										3
Common Yellowthroat																										6
Wilson's Warbler																										4
Chipping Sparrow																										31
Clay-coloured Sparrow																										6
Song Sparrow																										9
White-throated Sparrow																										12
White-crowned Sparrow																										3
Common Grackle																										1
Baltimore Oriole																										5
American Goldfinch																										1
Total	3	8	1	1	2	0	2	0	1	1	2	0	0	0	0	5	0	0	0	0	0	0	1	0	4	392

APPENDIX 3

Frequency of Interval Between Recaptures at Inglewood Bird Sanctuary - Fall 1997



**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)			
Solitary Sandpiper 807155879	U	U	Aug-15	4	58.6	-4.6	-7.8			
			Aug-19		54.0					
Western Wood-Pewee 199057146	AHY	U	Aug-01	6	14.0	-0.2	-1.4			
			Aug-07		13.8					
Western Wood-Pewee 207042893	HY	F	Aug-13	4	12.9	0.3	2.3			
			Aug-17		13.2					
Western Wood-Pewee 212005808	HY	U	Aug-16	1	14.2	0.3	2.1			
			Aug-17		14.5					
Traill's Flycatcher 195048616	HY	U	Sep-14	1	14.2	0.2	1.4			
			Sep-15		14.4					
Traill's Flycatcher 199057366	HY	U	Aug-31	1	12.4	1.1	8.9			
			Sep-01		13.5					
Traill's Flycatcher 205070850	HY	U	Sep-03	1	13.3	-0.1	-0.8			
			Sep-04		13.2					
Traill's Flycatcher 212041214	HY	U	Aug-22	0	13.6	-0.2	-1.5			
			Aug-22		13.4					
Traill's Flycatcher 351063507	HY	U	Aug-19	2	12.6	0.7	5.6			
			Aug-21		13.3					
Least Flycatcher 207042927	U	U	Aug-14	2	10.3	0.2	1.9			
			Aug-16		10.5					
Least Flycatcher 212005845	HY	U	Aug-26	2	11.1	-0.2	-1.8			
			Aug-28		10.9					
Eastern Kingbird 145193670	AHY	M	Aug-03	13	36.7	1.0	2.7			
			Aug-16		37.7					
House Wren 199057186	HY	U	Aug-05	2	10.6	0.6	5.7			
			Aug-07		11.2					
			Aug-11		4			11.7	0.5	4.5
			Aug-25		14			11.9	0.2	1.7
				Total	20	1.3	12.3			
House Wren 199057190	HY	U	Aug-05	7	10.7	0.3	2.8			
			Aug-12		11.0					

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
House Wren 199057204	HY	U	Aug-06		11.5		
			Aug-20	14	12.7	1.2	10.4
			Aug-25	5	11.7	-1.0	-7.9
			Aug-25	0	11.8	0.1	0.9
			Total	19		0.3	2.6
House Wren 205070683	HY	U	Jul-31		10.2		
			Aug-04	4	10.3	0.1	1.0
House Wren 205070688	HY	U	Aug-06		11.1		
			Aug-25	19	11.1	0.0	0.0
House Wren 205070790	HY	U	Aug-02		10.2		
			Aug-07	5	10.7	0.5	4.9
House Wren 207042705	HY	U	Aug-10		10.8		
			Aug-16	6	10.6	-0.2	-1.9
House Wren 207042719	AHY	U	Aug-10		10.4		
			Aug-14	4	10.7	0.3	2.9
House Wren 207042758	AHY	U	Aug-11		10.4		
			Aug-17	6	11.1	0.7	6.7
House Wren 350089674	HY	U	Jul-31		10.9		
			Aug-09	9	11.6	0.7	6.4
House Wren 350089675	AHY	U	Jul-31		10.4		
			Aug-19	19	11.1	0.7	6.7
House Wren 199057155	HY	U	Aug-01		10.9		
			Aug-05	4	11.0	0.1	0.9
House Wren 199057158	HY	U	Aug-04		10.8		
			Aug-07	3	10.7	-0.1	-0.9
			Aug-13	6	10.5	-0.2	-1.9
			Aug-14	1	12.1	1.6	15.2
			Total	10		1.3	12.0
Ruby-crowned Kinglet 206028313	HY	U	Sep-29		6.3		
			Sep-29	0	6.5	0.2	3.2
Ruby-crowned Kinglet 206028316	HY	M	Sep-29		6.8		
			Sep-30	1	6.5	-0.3	-4.4
Swainson's Thrush 145169595	AHY	U	Aug-29		32.4		
			Sep-04	6	35.9	3.5	10.8

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Swainson's Thrush 146163752	AHY	U	Aug-04 Aug-19	15	30.8 30.8	0.0	0.0
Swainson's Thrush 146184517	HY	U	Sep-14 Sep-15	1	37.1 36.7	-0.4	-1.1
Swainson's Thrush 146184524	U	U	Sep-16 Sep-19	3	34.4 33.2	-1.2	-3.5
American Robin 114249064	HY	U	Jul-31 Aug-06	6	83.1 86.0	2.9	3.5
Gray Catbird 807164408	HY	U	Aug-13 Aug-16 Aug-27 Sep-01 Total	3 11 5 19	38.7 38.7 41.6 42.3	0.0 2.9 0.7 3.6	0.0 7.5 1.7 9.3
Gray Catbird 807164409	HY	U	Aug-13 Aug-17	4	38.6 37.8	-0.8	-2.1
Cedar Waxwing 145186421	HY	F	Aug-10 Aug-14	4	29.6 29.5	-0.1	-0.3
Cedar Waxwing 145193669	HY	U	Aug-03 Aug-04	1	30.5 29.1	-1.4	-4.6
Warbling Vireo 199057347	HY	U	Aug-23 Aug-24	1	12.7 12.9	0.2	1.6
Warbling Vireo 211133519	AHY	U	Aug-16 Aug-25 Sep-15 Total	9 21 30	13.2 13.2 13.3	0.0 0.1 0.1	0.0 0.8 0.8
Warbling Vireo 310189661	U	U	Aug-14 Aug-18	4	11.6 12.4	0.8	6.9
Tennessee Warbler 195048611	HY	F	Sep-14 Sep-16	2	9.4 9.5	0.1	1.1
Tennessee Warbler 199057197	HY	U	Aug-07 Aug-12	5	7.4 8.0	0.6	8.1
Tennessee Warbler 205070869	AHY	U	Sep-07 Sep-08	1	10.0 9.4	-0.6	-6.0

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Tennessee Warbler 206029225	AHY	M	Aug-02		10.3		
			Aug-20	18	10.1	-0.2	-1.9
Tennessee Warbler 207042857	AHY	F	Aug-12		10.0		
			Aug-14	2	9.8	-0.2	-2.0
Tennessee Warbler 350089676	AHY	U	Jul-31		10.3		
			Aug-06	6	10.3	0.0	0.0
			Aug-21	15	10.2	-0.1	-1.0
			Aug-31	10	9.6	-0.6	-5.9
			Total	31		-0.7	-6.8
Tennessee Warbler 350089694	HY	U	Aug-18		9.4		
			Aug-22	4	10.3	0.9	9.6
Tennessee Warbler 351063538	U	U	Aug-21		9.3		
			Aug-25	4	9.4	0.1	1.1
Orange-crowned Warbler 195048571	HY	U	Sep-11		9.2		
			Sep-11	0	9.2	0.0	0.0
Orange-crowned Warbler 195048583	HY	U	Sep-12		9.2		
			Sep-12	0	9.0	-0.2	-2.2
			Sep-13	1	8.8	-0.2	-2.2
			Total	1		-0.4	-4.3
Orange-crowned Warbler 195048585	HY	U	Sep-12		9.2		
			Sep-13	1	9.0	-0.2	-2.2
Orange-crowned Warbler 195048589	HY	U	Sep-12		9.5		
			Sep-16	4	10.7	1.2	12.6
Orange-crowned Warbler 195048591	HY	U	Sep-12		8.9		
			Sep-15	3	8.7	-0.2	-2.2
Orange-crowned Warbler 195048592	HY	U	Sep-12		9.4		
			Sep-14	2	10.1	0.7	7.4
Orange-crowned Warbler 195048608	HY	M	Sep-14		10.4		
			Sep-16	2	10.7	0.3	2.9
Orange-crowned Warbler 195048612	HY	U	Sep-14		9.0		
			Sep-14	0	9.0	0.0	0.0
			Sep-15	1	8.6	-0.4	-4.4
			Total	1		-0.4	-4.4
Orange-crowned Warbler 195048615	HY	U	Sep-14		9.6		
			Sep-16	2	8.7	-0.9	-9.4

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Orange-crowned Warbler 195048617	HY	U	Sep-15 Sep-16	1	10.2 10.7	0.5	4.9
Orange-crowned Warbler 195048619	HY	U	Sep-15 Sep-15 Sep-16 Total	0 1 1	8.9 8.9 8.4	0.0 -0.5	0.0 -5.6 -0.5 -5.6
Orange-crowned Warbler 195048623	HY	U	Sep-16 Sep-16	0	9.4 9.5	0.1	1.1
Orange-crowned Warbler 195048639	HY	M	Sep-17 Sep-17	0	10.2 10.1	-0.1	-1.0
Orange-crowned Warbler 199057428	HY	U	Oct-04 Oct-06	2	9.3 10.2	0.9	9.7
Orange-crowned Warbler 205070866	HY	U	Sep-07 Sep-07	0	9.5 9.7	0.2	2.1
Yellow Warbler 199057149	HY	U	Aug-01 Aug-11	10	9.2 10.1	0.9	9.8
Yellow Warbler 199057175	HY	M	Aug-04 Aug-05	1	9.7 9.8	0.1	1.0
Yellow Warbler 199057191	HY	F	Aug-05 Aug-06	1	10.0 9.9	-0.1	-1.0
Yellow Warbler 199057211	HY	U	Aug-06 Aug-07	1	10.3 10.0	-0.3	-2.9
Yellow Warbler 199057231	HY	U	Aug-07 Aug-09	2	9.4 9.8	0.4	4.3
Yellow Warbler 199057237	HY	F	Aug-07 Aug-09	2	9.8 8.5	-1.3	-13.3
Yellow Warbler 199057242	U	F	Aug-07 Aug-11	4	9.7 10.2	0.5	5.2
Yellow Warbler 205070691	AHY	F	Aug-17 Aug-20	3	10.0 9.9	-0.1	-1.0
Yellow Warbler 205070786	HY	U	Aug-02 Aug-04	2	9.6 9.8	0.2	2.1

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Yellow Warbler 207042703	AHY	M	Aug-10 Aug-11	1	9.8 9.7	-0.1	-1.0
Yellow Warbler 207042736	U	M	Aug-10 Aug-11 Aug-12 Total	1 1 2	10.0 10.5 10.0	0.5 -0.5 0.0	5.0 -4.8 0.0
Yellow Warbler 207042747	U	U	Aug-11 Aug-12	1	9.3 9.3	0.0	0.0
Yellow Warbler 207042772	U	U	Aug-11 Aug-12	1	10.0 10.4	0.4	4.0
Yellow Warbler 207042816	AHY	M	Aug-12 Aug-14	2	8.9 10.4	1.5	16.9
Magnolia Warbler 351063553	U	U	Aug-22 Aug-24	2	8.7 9.5	0.8	9.2
Yellow-rumped Warbler 199057219	AHY	F	Aug-06 Aug-24	18	11.6 12.1	0.5	4.3
Yellow-rumped Warbler 199057312	AHY	U	Aug-12 Aug-15	3	13.1 13.2	0.1	0.8
Yellow-rumped Warbler 205070796	U	U	Aug-03 Aug-10 Aug-12 Aug-28 Total	7 2 16 25	12.5 12.4 11.5 11.9	-0.1 -0.9 0.4 -0.6	-0.8 -7.3 3.5 -4.8
Yellow-rumped Warbler 205070800	AHY	U	Aug-15 Aug-24	9	12.9 11.1	-1.8	-14.0
Yellow-rumped Warbler 205070819	HY	U	Aug-27 Aug-28	1	11.7 11.8	0.1	0.9
Yellow-rumped Warbler 205070833	HY	U	Aug-28 Aug-30	2	12.0 11.4	-0.6	-5.0
Yellow-rumped Warbler 207042840	HY	M	Aug-14 Aug-18 Aug-22 Total	4 4 4 8	13.1 14.1 13.7	1.0 -0.4 0.6	7.6 -2.8 4.6
Yellow-rumped Warbler 207042853	U	U	Aug-12 Aug-18	6	11.5 12.5	1.0	8.7

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Yellow-rumped Warbler 207042943	U	U	Aug-14 Aug-26	12	12.1 13.4	1.3	10.7
Yellow-rumped Warbler 351063515	HY	M	Aug-20 Aug-21	1	12.7 13.1	0.4	3.1
Yellow-rumped Warbler 199057253	HY	U	Aug-09 Aug-12	3	12.1 12.0	-0.1	-0.8
Yellow-rumped Warbler 199057342	U	U	Aug-17 Aug-31	14	12.3 11.6	-0.7	-5.7
Yellow-rumped Warbler 207042706	HY	U	Aug-10 Aug-22	12	12.7 13.2	0.5	3.9
Yellow-rumped Warbler 207042707	AHY	U	Aug-10 Aug-21	11	12.7 12.7	0.0	0.0
Yellow-rumped Warbler 207042717	HY	U	Aug-10 Aug-25	15	11.8 12.1	0.3	2.5
Yellow-rumped Warbler 207042718	HY	U	Aug-18 Aug-24	6	12.1 13.5	1.4	11.6
Yellow-rumped Warbler 207042751	HY	U	Aug-11 Aug-12	1	12.7 13.0	0.3	2.4
Yellow-rumped Warbler 207042755	HY	U	Aug-11 Aug-12	1	13.3 13.4	0.1	0.8
Yellow-rumped Warbler 207042762	AHY	M	Aug-11 Aug-14	3	12.8 13.0	0.2	1.6
Yellow-rumped Warbler 207042765	U	U	Aug-11 Aug-12	1	11.7 11.9	0.2	1.7
Yellow-rumped Warbler 207042767	HY	F	Aug-11 Aug-16	5	11.7 12.1	0.4	3.4
Yellow-rumped Warbler 207042828	HY	M	Aug-12 Aug-12	0	13.2 11.0	-2.2	-16.7
Yellow-rumped Warbler 207042836	U	U	Aug-16 Aug-21	5	11.6 12.2	0.6	5.2
Yellow-rumped Warbler 207042853	U	U	Aug-12 Aug-18	6	11.5 12.5	1.0	8.7

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Yellow-rumped Warbler 207042943	U	U	Aug-14		12.3		
			Aug-26	12	13.4	1.1	8.9
Yellow-rumped Warbler 207042963	U	U	Aug-14		12.5		
			Aug-17	3	10.9	-1.6	-12.8
Blackpoll Warbler 195048587	HY	F	Sep-12		10.7		
			Sep-14	2	11.2	0.5	4.7
Blackpoll Warbler 351063546	HY	F	Aug-21		12.0		
			Aug-22	1	12.2	0.2	1.7
			Aug-23	1	11.8	-0.4	-3.3
			Aug-24	1	11.6	-0.2	-1.7
			Total	3		-0.4	-3.4
Ovenbird 211133529	HY	U	Aug-13		18.9		
			Aug-22	9	19.2	0.3	1.6
Ovenbird 310189666	HY	U	Aug-23		18.4		
			Aug-30	7	19.5	1.1	6.0
Northern Waterthrush 209155634	U	U	Aug-09		17.5		
			Aug-10	1	17.4	-0.1	-0.6
Northern Waterthrush 211133516	AHY	U	Aug-11		16.3		
			Aug-11	0	16.1	-0.2	-1.2
			Aug-16	5	19.0	2.9	18.0
			Total	5		2.7	16.6
Northern Waterthrush 211133518	AHY	F	Aug-11		15.5		
			Aug-12	1	16.1	0.6	3.9
Northern Waterthrush 211133523	U	U	Aug-12		15.8		
			Aug-15	3	17.2	1.4	8.9
			Aug-16	1	17.3	0.1	0.6
			Total	4		1.5	9.5
Northern Waterthrush 211133531	U	U	Aug-14		18.3		
			Aug-17	3	20.6	2.3	12.6
Northern Waterthrush 211133533	HY	U	Aug-14		18.7		
			Aug-17	3	20.8	2.1	11.2
			Aug-19	2	21.7	0.9	4.3
			Total	5		3.0	16.0
Northern Waterthrush 211133540	HY	U	Aug-25		15.6		
			Aug-26	1	16.5	0.9	5.8
			Aug-27	1	16.3	-0.2	-1.2
			Total	2		0.7	4.5

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Northern Waterthrush 219145648	U	U	Aug-15		18.6		
			Aug-23	8	19.7	1.1	5.9
			Aug-25	2	19.5	-0.2	-1.0
			Total	10		0.9	4.8
Northern Waterthrush 219145649	AHY	U	Aug-15		18.8		
			Aug-15	0	18.4	-0.4	-2.1
Northern Waterthrush 219145654	HY	U	Aug-18		14.9		
			Aug-18	0	14.7	-0.2	-1.3
Northern Waterthrush 310189810	HY	U	Sep-17		16.2		
			Sep-17	0	16.7	0.5	3.1
			Sep-19	2	17.1	0.4	2.4
			Sep-22	3	18.1	1.0	5.8
			Sep-24	2	18.3	0.2	1.1
Total	7		2.1	13.0			
Mourning Warbler 199057354	U	U	Aug-24		11.5		
			Aug-25	1	11.8	0.3	2.6
MacGillivray's Warbler 207042950	U	U	Aug-14		11.0		
			Aug-16	2	10.9	-0.1	-0.9
			Aug-18	2	11.5	0.6	5.5
			Total	4		0.5	4.5
MacGillivray's Warbler 212005835	HY	U	Aug-26		11.6		
			Aug-27	1	12.1	0.5	4.3
MacGillivray's Warbler 212005846	U	U	Aug-26		12.4		
			Aug-28	2	12.2	-0.2	-1.6
			Aug-30	2	12.9	0.7	5.7
			Total	4		0.5	4.0
Common Yellowthroat 195048625	HY	M	Aug-16		10.8		
			Aug-16	0	10.6	-0.2	-1.9
			Aug-17	1	10.5	-0.1	-0.9
			Total	1		-0.3	-2.8
Common Yellowthroat 195048626	HY	M	Sep-16		10.8		
			Sep-19	3	10.7	-0.1	-0.9
Wilson's Warbler 195048559	HY	M	Sep-09		8.5		
			Sep-09	0	8.0	-0.5	-5.9
Wilson's Warbler 205070826	HY	M	Aug-28		7.8		
			Aug-28	0	8.0	0.2	2.6

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Wilson's Warbler 206028169	HY	M	Aug-24		7.5		
			Aug-25	1	7.6	0.1	1.3
Wilson's Warbler 206028170	U	F	Aug-24		8.1		
			Aug-25	1	8.2	0.1	1.2
Wilson's Warbler 206028172	U	M	Aug-24		7.9		
			Aug-25	1	8.1	0.2	2.5
Wilson's Warbler 206028177	HY	M	Aug-24		8.1		
			Aug-25	1	8.3	0.2	2.5
Wilson's Warbler 206029226	AHY	M	Aug-27		7.9		
			Aug-28	1	8.3	0.4	5.1
Wilson's Warbler 206029242	HY	F	Sep-07		7.4		
			Sep-08	1	7.5	0.1	1.4
			Sep-09	1	7.5	0.0	0.0
			Total	2		0.1	1.4
Wilson's Warbler 206029246	HY	M	Sep-07		7.8		
			Sep-09	2	8.0	0.2	2.6
Wilson's Warbler 207042935	U	U	Aug-14		7.6		
			Aug-15	1	7.3	-0.3	-3.9
Wilson's Warbler 212005809	U	U	Aug-16		7.9		
			Aug-16	0	8.0	0.1	1.3
Wilson's Warbler 212005838	U	U	Aug-26		7.5		
			Aug-27	1	7.7	0.2	2.7
Wilson's Warbler 351063512	HY	M	Aug-20		8.0		
			Aug-22	2	7.9	-0.1	-1.3
Wilson's Warbler 351063517	HY	M	Aug-20		8.4		
			Aug-27	7	7.2	-1.2	-14.3
			Sep-01	5	8.4	1.2	16.7
			Total	12		0.0	0.0
Wilson's Warbler 351063554	HY	F	Aug-22		7.6		
			Aug-24	2	7.3	-0.3	-3.9
			Aug-26	2	7.2	-0.1	-1.4
			Aug-28	2	7.3	0.1	1.4
			Total	6		-0.3	-3.9

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Wilson's Warbler 351063555	U	M	Aug-22		8.1		
			Aug-24	2	7.9	-0.2	-2.5
Wilson's Warbler 351063557	HY	F	Aug-22		7.6		
			Aug-24	2	7.4	-0.2	-2.6
			Aug-26	2	7.3	-0.1	-1.4
			Total	4		-0.3	-3.9
Wilson's Warbler 351063571	U	F	Aug-29		7.0		
			Aug-29	0	7.0	0.0	0.0
			Sep-02	4	7.3	0.3	4.3
			Total	4		0.3	4.3
Chipping Sparrow 199057164	HY	U	Aug-04 Aug-05	1	11.9 11.9	0.0	0.0
Chipping Sparrow 199057187	HY	U	Aug-05 Aug-11	6	11.7 11.9	0.2	1.7
Chipping Sparrow 199057213	HY	U	Aug-06 Aug-10	4	12.2 11.7	-0.5	-4.1
Chipping Sparrow 207042714	AHY	U	Aug-10 Aug-12	2	10.8 10.0	-0.8	-7.4
Chipping Sparrow 207042780	HY	U	Aug-11 Aug-13	2	11.6 12.7	1.1	9.5
Chipping Sparrow 207042852	HY	U	Aug-12 Aug-13	1	12.0 13.1	1.1	9.2
Clay-coloured Sparrow 205070782	AHY	U	Aug-02		10.0		
			Aug-03	1	10.1	0.1	1.0
			Aug-06	3	9.9	-0.2	-2.0
			Total	4		-0.1	-1.0
Clay-coloured Sparrow 207042843	AHY	U	Aug-12 Aug-16	4	12.0 11.8	-0.2	-1.7
Clay-coloured Sparrow 207042858	HY	U	Aug-13 Aug-16	3	10.8 10.8	0.0	0.0
Clay-coloured Sparrow 207042926	AHY	U	Aug-14 Aug-24	10	13.1 12.8	-0.3	-2.3
Song Sparrow 145186481	U	U	Aug-11		19.5		
			Aug-14	3	20.7	1.2	6.2

**Length of Stay and Physiological Change in Recaptures
at Inglewood Bird Sanctuary - Fall 1997**

Species Code Band Number	Age	Sex	Capture Date	Interval (days)	Weight (g)	Change (g)	Change (%)
Song Sparrow 145186495	U	U	Aug-25		21.6		
			Aug-30	5	21.5	-0.1	-0.5
			Aug-31	1	21.1	-0.4	-1.9
			Total	6		-0.5	-2.3
Song Sparrow 146163755	HY	U	Aug-05		19.7		
			Aug-06	1	19.3	-0.4	-2.0
Song Sparrow 146163764	AHY	U	Aug-13		18.4		
			Aug-17	4	18.4	0.0	0.0
			Sep-22	36	19.5	1.1	6.0
			Total	40		1.1	6.0
White-throated Sparrow 146163779	AHY	U	Sep-22		24.3		
			Sep-25	3	23.6	-0.7	-2.9
White-throated Sparrow 146163795	HY	U	Sep-24		22.6		
			Sep-25	1	22.9	0.3	1.3
White-throated Sparrow 146184509	HY	U	Sep-09		23.5		
			Sep-13	4	24.2	0.7	3.0
White-throated Sparrow 146184511	U	U	Sep-12		26.2		
			Sep-15	3	25.0	-1.2	-4.6
White-throated Sparrow 146184514	HY	M	Sep-13		26.8		
			Sep-16	3	25.8	-1.0	-3.7
White-throated Sparrow 146184522	HY	U	Sep-15		27.6		
			Sep-20	5	27.5	-0.1	-0.4
White-throated Sparrow 146184531	U	U	Sep-16		26.4		
			Sep-20	4	23.5	-2.9	-11.0
White-crowned Sparrow 146184513	HY	U	Sep-13		27.0		
			Sep-15	2	26.4	-0.6	-2.2
White-crowned Sparrow 146184525	AHY	M	Sep-16		25.4		
			Sep-22	6	27.2	1.8	7.1
White-crowned Sparrow 146163783	AHY	U	Sep-22		23.3		
			Sep-23	1	22.7	-0.6	-2.6
White-crowned Sparrow 146184525	AHY	U	Sep-16		25.4		
			Sep-22	6	27.2	1.8	7.1
American Goldfinch 199057226	ASY	M	Aug-07		12.2		
			Aug-22	15	12.9	0.7	5.7

APPENDIX 4

1997 SPRING BANDING

A 30-day spring banding project was initiated in 1997 on private property 22-km SSE of the city of Calgary, approximately 1.5-km S of the Bow River (Dunbow Road). The habitat on the property sampled by mist-netting is comprised of 3 different vegetation types.

One 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. A 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. Tables A4.1, A4.2, and A4.3 summarize our banding efforts.

Of the 30 days of coverage planned from May 7 through June 5, banding occurred on 24 days. A late May snowstorm resulted in the loss of 6 days. Our banding effort of 2298.7 net-hours resulted in a total of 411 birds captured (Table A4.1). This total is comprised of 299 new bandings (Table A4.2), 98 recaptures, 10 escapes, and 4 mortalities (included in the mortality and injury summary section in the main body of this report). All of the recaptures were of birds banded during this project.

Various individuals who contributed volunteer effort to this project (Table A4.3), are gratefully acknowledged for their time in cutting net lanes and supporting the BICs. Similar to fall migration at IBS, per diems were paid to out-of-town BICs to ensure adequate coverage.

Special thanks to Norma Jensen, who graciously has allowed us the use of her property to initiate this project. The CBBS plans to continue this project in 1998, although likely for a shorter period.

Table A4-1. Coverage and Capture Rate during spring banding at Dunbow Road - 1997

	Net-hours	Captures				Total	Captures/100 Net-hour
		New Bandings	Recaptures	Escapes	Mortalities		
07-May	94.0	25	8	0	1	34	36
08-May	119.7	7	4	1	0	12	10
09-May	112.6	11	7	0	0	18	16
10-May	120.0	14	2	0	0	16	13
11-May	115.5	17	3	1	0	21	18
12-May	116.7	17	4	0	1	22	19
13-May	113.2	8	4	0	0	12	11
14-May	118.1	10	2	0	0	12	10
15-May	116.7	8	4	1	0	13	11
16-May	120.4	6	1	1	0	8	7
17-May	45.0	8	1	0	0	9	20
18-May	83.4	8	8	0	0	16	19
19-May	94.5	2	3	1	0	6	6
20-May	0.0	0	0	0	0	0	n/a
21-May	0.0	0	0	0	0	0	n/a
22-May	98.5	26	3	0	0	29	29
23-May	67.9	18	2	0	0	20	29
24-May	0.0	0	0	0	0	0	n/a
25-May	0.0	0	0	0	0	0	n/a
26-May	0.0	0	0	0	0	0	n/a
27-May	0.0	0	0	0	0	0	n/a
28-May	96.1	20	2	2	0	24	25
29-May	85.5	11	4	0	0	15	18
30-May	79.8	11	2	0	1	14	18
31-May	86.4	13	4	1	1	19	22
01-Jun	94.2	8	7	1	0	16	17
02-Jun	90.0	14	8	0	0	22	24
03-Jun	90.0	18	6	1	0	25	28
04-Jun	92.5	15	9	0	0	24	26
05-Jun	48.0	4	0	0	0	4	8
Total	2298.7	299	98	10	4	411	18

Table A4-3. Number of days of effort contributed by various individuals during spring banding at Dunbow Road in 1997.

Individual	BIC	Vol
Grahame Booth	3 ¹	
Michelle Boutin		1
Doug Collister	1 ¹	1
Brian Couronne		2
Rainer Ebel	10 ²	
Dick Graham		1
Garry Hornbeck		1
Clive Jackson		1
Stefan Jungkin	6 ²	
Dwight Knapik		4
Jennifer Lane		2
Shonna MacLeod		6
Greg Meyer	1 ¹	
Pat Mitchell		2
Dale Paton	3 ²	
El Peterson		7
Gwen Smiley		3
Don Stiles		2
Michael Vassal		1
Catherine Watson-McDonald		3
Linda Wiggins		2
Total	24	39

¹ donated

² received per diem

APPENDIX 5

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	
American White Pelican	2																					
Double-crested Cormorant	1	1	1	6	1	3	2	2														
Great Blue Heron		1		1	2	1																
Canada Goose	15	16	1	17	6	10	13	7	13	4	7	10	11									
Wood Duck	16	16	11	17	6	10	13	7	13	4	7	10	11									
Mallard	20	14	29	36	31	14	40	29	38	8	16	30	52									
Blue-winged Teal																						
Gadwall																						
American Wigeon																						
Common Goldeneye	12			20	7	10	14	18	10	7	15	7	22									
Hooded Merganser																						
Common Merganser	16	4	2	23	17	24	13	4	5	8	9	16										
Duck spp.																						
Osprey	1				1	1																
Northern Harrier																						
Swainson's Hawk	1			1																		
Red-tailed Hawk	1																					
Buteo spp.																						
American Kestrel				1	1	1	1	1	1	1	2	3										
Merlin																						
Peregrine Falcon																						
Gray Partridge					1																	
Ring-necked Pheasant	1	1	1	1	1	2	1	1	1	1	1	1										
American Coot																						
Solitary Sandpiper																						
Spotted Sandpiper																						
Franklin's Gull																						
Ring-billed Gull	385	160	100	150		250	500	200	50	50	189	285	360									
California Gull	3	1	1	1		1	1	1	20	50			4									
Gull spp.	10	2	25	7	14	40	5	7														
Rock Dove																						
Great Horned Owl																						
Downy Woodpecker	3	2	1	3	3	6	3	3	1	2	6	1										
Hairy Woodpecker																						
Northern Flicker	1	9	3	5	11	6	5	5	3	1	5	5										
Pileated Woodpecker																						
Western Wood-Pewee																						
Least Flycatcher																						
Trail's Flycatcher																						
Eastern Kingbird																						
Black-billed Magpie	5	7	19	14	10	7	4	2	2	4	6	7										
American Crow	2	7	7	1	8	2	1	1	2	2	1	11										

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	Date	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	
Common Raven						1																	
Black-capped Chickadee		12	2	7	8	13	10	13	8	1	4	2	8	4	no data	no data	8	22		4	2		
White-breasted Nuthatch					1	1	3	1	2	1					no data	no data	2	1	1	14	7	9	
House Wren		1		2	1	1	1	1	3	2			1	2	no data	no data	1	3					
Ruby-crowned Kinglet															no data	no data							
Swainson's Thrush		1													no data	no data							
American Robin								2			1				no data	no data		1					
Gray Catbird															no data	no data							
Cedar Waxwing						1							1		no data	no data							
European Starling		100	120	53	250	200	70	150	250	420	118		110	70	no data	no data	70	11	20	45	30	25	
Warbling Vireo							1	1	1	1	1			4	no data	no data				1			
Tennessee Warbler															no data	no data							
Orange-crowned Warbler															no data	no data							
Yellow Warbler				1	1	1	3	1	1	3		6	5		no data	no data	1	2	1				
Magnolia Warbler															no data	no data							
Yellow-rumped Warbler				1								2	7		no data	no data	3	2	1	3	1		
Blackpoll Warbler															no data	no data							
Ovenbird															no data	no data							
Northern Waterthrush												1	1		no data	no data	1	2	2				
Mourning Warbler															no data	no data							
MacGillivray's Warbler															no data	no data		1		1			
Common Yellowthroat															no data	no data							
Wilson's Warbler															no data	no data							
Chipping Sparrow							1	1	1			1	1		no data	no data							
Clay-coloured Sparrow					1								1		no data	no data		3					
Song Sparrow									2						no data	no data			1				
White-throated Sparrow															no data	no data							
White-crowned Sparrow															no data	no data							
Red-winged Blackbird		5				2		1							no data	no data							
Common Grackle															no data	no data							
Brown-headed Cowbird										3					no data	no data							
Baltimore Oriole															no data	no data							
American Goldfinch										2					no data	no data							
House Sparrow				1	2	1	5	2	10			3	2		no data	no data	10			15	6		
Total Birds		613	355	295	539	560	487	787	575	564	269	250	504	603	0	0	404	149	311	538	429	952	
Total Species		22	14	25	21	25	25	28	26	13	19	16	22	25	0	0	25	22	22	25	21	22	

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep
American White Pelican	1	3			2					1					1	1				
Double-crested Cormorant	4	10	9	14	8	2	2	5	3	8	5	6	5		11	14	11	8	10	2
Great Blue Heron	1			2						1		2							1	1
Canada Goose	9	3	8	3	8	9	6	15	45	21	16	23	40	10	7	2	17	13	24	36
Wood Duck	8	6	6	6	15	9	29	16	6	10	11	16	30	20	12	15	21	20	17	5
Mallard	55	40	64	64	36	42	47	54	33	55	37	77	56	41	35	40	55	25	33	30
Blue-winged Teal																			3	
Gadwall																				
American Wigeon											1									
Common Goldeneye	12	12	2	3	7	1	4	2	3		1	3	2			2	2	2	2	1
Hooded Merganser																				
Common Merganser	9	10	6	11	16		2	22	6	7	2	8	16	13	20	18	2	8	32	22
Duck spp.																			18	
Osprey	1			1				4							1	1	1	1	2	2
Northern Harrier				2																
Swainson's Hawk			1	1				1		1			1		1					2
Red-tailed Hawk	1	1	1											1						
Buteo spp.												2	2	2	2				1	
American Kestrel				1						1			1		1					1
Merlin	1	1	1	1			1	1		1		2	2	2	1				1	
Peregrine Falcon																				
Gray Partridge																				
Ring-necked Pheasant	2	1	1	1	1	1	1	1	1	1	1				1					1
American Coot																				
Solitary Sandpiper					2															
Spotted Sandpiper																				
Franklin's Gull	2																			
Ring-billed Gull	400	600	140	104	206	320	370	200	162	200	250	110	730	49	350	112	170	398	158	350
California Gull																		1		
Gull spp.								11				18								
Rock Dove	5	18	10	10	6	5	5	19	4	5	11		16	10	26	4	15	19	7	9
Great Horned Owl																				
Downy Woodpecker	3	2		3	1	2	1	2	2				2	1	1	1	2	1	2	2
Hairy Woodpecker	1	1					1												2	
Northern Flicker	3	4	7		5	1	2	3	4	3	1		7	2	6	2	2		3	8
Pileated Woodpecker																				
Western Wood-Pewee																				
Least Flycatcher								1					1							
Trail's Flycatcher																1				
Eastern Kingbird									3											
Black-billed Magpie	9	10	4	6	26	7	16	13	14	52	13	19	55	10	34	10	20	22	15	48
American Crow	1	4	1	1	4	1	1	6	8	3	3	11	18	3	1	3	2	3	6	3

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	
Common Raven							1														
Black-capped Chickadee	10	8	6	5	8	12	9	15	10	10	3	9	1	8	10	12	19	16	13	8	
White-breasted Nuthatch	1	1					1	2	1						1	2				1	1
House Wren		1	2		4																1
Ruby-crowned Kinglet																					
Swainson's Thrush							1		1						1						
American Robin						1	1													2	
Gray Catbird																				1	
Cedar Waxwing																					
European Starling	54	50	10	18	27	10	28	18	10	16	6	26	20	21	80	160	32	20	12	40	
Warbling Vireo					1		1														
Tennessee Warbler	1	1			1						1										1
Orange-crowned Warbler																					
Yellow Warbler							1														
Magnolia Warbler					1																
Yellow-rumped Warbler	3	3		3	1	2		2	1	1	1				1						
Blackpoll Warbler		1	1	1																	
Ovenbird		1						1		1				1							
Northern Waterthrush				1	1	1	1														
Mourning Warbler	1																				
MacGillivray's Warbler							1	1		1											
Common Yellowthroat																					
Wilson's Warbler					3	4	2	2	2	2	1	1						1	1	2	
Chipping Sparrow																					
Clay-coloured Sparrow					1																
Song Sparrow									1	1	1										
White-throated Sparrow																	1				
White-crowned Sparrow																					
Red-winged Blackbird																					
Common Grackle																					
Brown-headed Cowbird							1														
Baltimore Oriole																					
American Goldfinch																					
House Sparrow														3							
Total Birds	585	807	276	261	380	429	538	418	318	401	365	333	1012	193	602	401	374	584	343	573	
Total Species	22	28	20	23	21	19	28	26	20	22	19	16	23	17	21	19	18	21	21	21	21

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep
American White Pelican																			
Double-crested Cormorant	5	11	8	5	22	9	10	12	1	2	2		3	4	5	10	9	11	7
Great Blue Heron				1		1													3
Canada Goose	21	33	93	200	56	100	26	90	70	105	10	10	50	76	65	112	39	77	40
Wood Duck	16	20	19	16	14	36	38	33	32	35	26	26	18	34	54	41	50	64	38
Mallard	21	40	51	90	51	11	59	68	18	35	60	60	19	71	44	55	60	106	66
Blue-winged Teal																			121
Gadwall	1			2														2	
American Wigeon	1			2	1	5											1		
Common Goldeneye		1	1	2	5	3			12	1	25				1	2			
Hooded Merganser																			
Common Merganser	23	13	11	19	7	5	2	2		8	8	28	45	22	35	33	52	29	14
Duck spp.				18															
Osprey											1								
Northern Harrier																			
Swainson's Hawk	1					1													
Red-tailed Hawk	1																		
Buteo spp.																			
American Kestrel		1															1		
Merlin					1							1							1
Peregrine Falcon												1							
Gray Partridge																			
Ring-necked Pheasant		1	1							1									
American Coot																			
Solitary Sandpiper																			
Spotted Sandpiper																			
Franklin's Gull																			1
Ring-billed Gull	250	490	440	200	180	100	123	245	520	450	250	250	526	55	180	560	625	290	630
California Gull				1				3											
Gull spp.																			
Rock Dove	20	7	10	8	11	12	5	9		4			3		2	15	16	11	12
Great Horned Owl				1		1													
Downy Woodpecker	1	1	2	2	1	2	2	1	1	2	1	1	1		1	1	3	1	1
Hairy Woodpecker																			
Northern Flicker	3	9	2	2	1	5	1	3	1	5	1	9	4	2	2	6	4	2	3
Pileated Woodpecker																			
Western Wood-Pewee															1				
Least Flycatcher																			
Trail's Flycatcher						1													
Eastern Kingbird																			
Black-billed Magpie	26	11	35	20	28	25	12	23	3	22	57	9	21	10	30	32	15		8
American Crow	13	10		5	8	8		5		2	2	6	7	10	9	5		5	5

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	
Common Raven	1																			
Black-capped Chickadee	6	5	4	8	10	11	7	13	1											
White-breasted Nuthatch	2	1	3	2	1	3	1	1												
House Wren																				
Ruby-crowned Kinglet																				
Swainson's Thrush																				
American Robin																				
Gray Catbird																				
Cedar Waxwing																				
European Starling	50	43	60	80	80	57	75	37	28	2	100	15	17	6	36	35	35	55	31	30
Warbling Vireo							2													
Tennessee Warbler								1												
Orange-crowned Warbler				2	1	2	5					1	1	2						
Yellow Warbler																				
Magnolia Warbler																				
Yellow-rumped Warbler																				
Blackpoll Warbler						1														
Ovenbird																				
Northern Waterthrush																				
Mourning Warbler																				
MacGillivray's Warbler																				
Common Yellowthroat																				
Wilson's Warbler																				
Chipping Sparrow																				
Clay-coloured Sparrow																				
Song Sparrow																				
White-throated Sparrow				1			1	1												
White-crowned Sparrow																				
Red-winged Blackbird																				
Common Grackle																				
Brown-headed Cowbird																				
Baltimore Oriole																				
American Goldfinch																				
House Sparrow				15																
Total Birds	462	697	744	701	462	416	331	535	662	795	456	708	336	439	925	935	696	875	605	
Total Species	19	17	17	24	21	24	17	16	10	19	18	19	16	16	17	18	15	13	16	

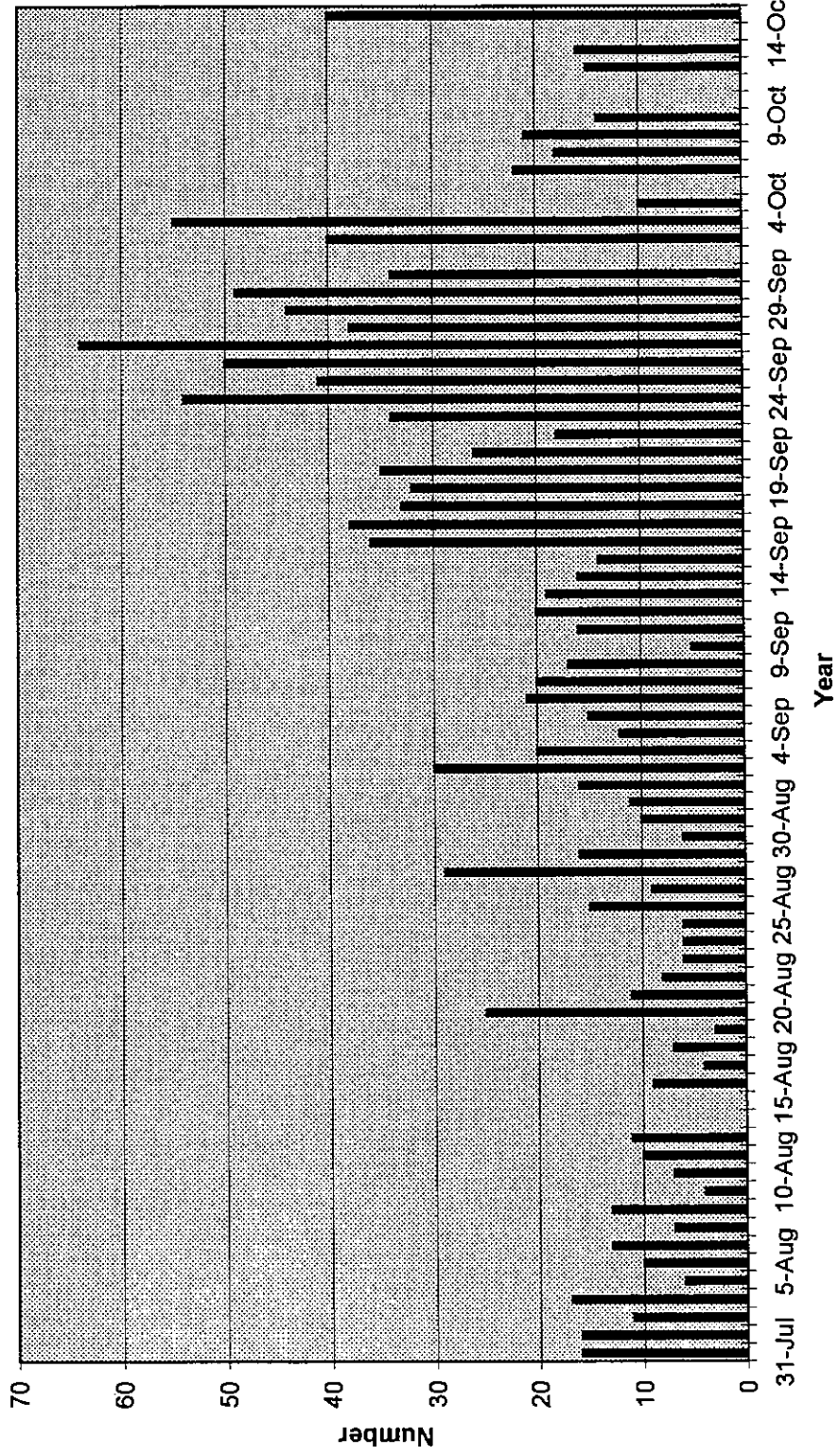
Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	Date	29-Sep	30-Sep	1-Oct	2-Oct	3-Oct	4-Oct	5-Oct	6-Oct	7-Oct	8-Oct	9-Oct	10-Oct	11-Oct	12-Oct	13-Oct	14-Oct	15-Oct	Avg	Freq
American White Pelican																				
Double-crested Cormorant		4	6																2	12
Great Blue Heron					5														6	55
Canada Goose	104	76	40	133	160	29	1	2							3	1			1	17
Wood Duck	49	34	40	55	22	18	21	14							125	135		250	48	59
Mallard	67	96	32	40	28	80	11	102	35						15	16		40	21	70
Blue-winged Teal															26	150		120	48	70
Gadwall																3			3	2
American Wigeon																			2	4
Common Goldeneye																			1	2
Hooded Merganser																			3	7
Common Merganser	39	52	28	58	24	1													7	1
Duck spp.																			2	7
Osprey																			10	16
Northern Harrier																			18	2
Swainson's Hawk																			1	15
Red-tailed Hawk																			2	1
Buteo spp.																			1	15
American Kestrel																			1	9
Merlin	1																		2	4
Peregrine Falcon																			1	21
Gray Partridge																			1	17
Ring-necked Pheasant																			1	1
American Coot																			1	1
Solitary Sandpiper																			2	2
Spotted Sandpiper																			2	2
Franklin's Gull																			1	1
Ring-billed Gull	220	335	500	600	400	320	650	400	503										4	4
California Gull																			250	309
Gull spp.																			100	69
Rock Dove	22	2	5	2	32	10													6	45
Great Horned Owl	1																		3	6
Downy Woodpecker	2	2	1	2	3														1	5
Hairy Woodpecker	1		1	1	2														4	3
Northern Flicker																			1	20
Pileated Woodpecker																			4	2
Western Wood-Pewee																			2	4
Least Flycatcher																			1	1
Trail's Flycatcher																			1	2
Eastern Kingbird																			1	5
Black-billed Magpie	40	22	5	7	32	7	14	10											11	10
American Crow	12	1	2	2	4	20	1	1											1	1

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1997

Species	Date	29-Sep	30-Sep	1-Oct	2-Oct	3-Oct	4-Oct	5-Oct	6-Oct	7-Oct	8-Oct	9-Oct	10-Oct	11-Oct	12-Oct	13-Oct	14-Oct	15-Oct	Ave	Freq		
Common Raven																				2	11	
Black-capped Chickadee		14	10																	20	9	66
White-breasted Nuthatch		1	1																	2	1	43
House Wren																					2	15
Ruby-crowned Kinglet																					1	1
Swainson's Thrush																					1	6
American Robin																					2	3
Gray Catbird																					1	5
Cedar Waxwing																					1	2
European Starling		50	69		30		10		100		40	20			25	12		20		59	67	
Warbling Vireo																					1	6
Tennessee Warbler																					1	10
Orange-crowned Warbler									1												2	8
Yellow Warbler																					2	13
Magnolia Warbler																					2	17
Yellow-rumped Warbler																					1	4
Blackpoll Warbler																					1	5
Ovenbird																					1	14
Northern Waterthrush																					1	1
Mourning Warbler																					1	1
MacGillivray's Warbler																					1	5
Common Yellowthroat																					1	1
Wilson's Warbler																					2	13
Chipping Sparrow																					1	4
Clay-coloured Sparrow																					1	5
Song Sparrow																					1	6
White-throated Sparrow																					1	3
White-crowned Sparrow																					3	3
Red-winged Blackbird																					1	1
Common Grackle																					2	3
Brown-headed Cowbird																					2	3
Baltimore Oriole																					2	1
American Goldfinch																					2	1
House Sparrow																					5	18
Total Birds		627	709	0	630	776	706	0	798	725	591	606	0	0	583	818	0	1176		606		
Total Species		16	16	0	12	10	13	0	17	8	10	14	0	0	17	22	0	19		18		

Wood Ducks at Inglewood Bird Sanctuary - Fall 1997



APPENDIX 6

Weather Conditions at Inglewood Bird Sanctuary - 1997 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	
31 Jul	14	0		1	20	0		0	24	0		0
1 Aug	13	0		1	20	1		0	24	0		0
2 Aug	11	0		1	16	1		2	25	2		1
3 Aug	10	0		0		0		0	22	2		0
4 Aug	15	0		0	22			0	27	0		0
5 Aug	17	0		0	22	1	E	1	27	1	E	1
6 Aug	15	0		0	18	1	SSW	0	25	1	SSW	0
7 Aug	16	0		1	18	0			21	1	E	2
8 Aug				8								
9 Aug	12	0		1	14	3	W	2	16	0		1
10 Aug	2	0		0	12	0		0	19	1		0
11 Aug	12	2	NE	0	18	2	NE	2	21	2	NE	2
12 Aug	12	0		0					20		W	2
13 Aug	12	0		0	16			2	18			8
14 Aug	10	0		1	10	0		1				8
15 Aug	13	5	N	8	10	3	N	2	10	3	N	8
16 Aug	8	3	NW	4					12	3	NW	2
17 Aug	6	1	E	4	11	0		2	18	0		0
18 Aug	8	0		2		0		1		0		1
19 Aug	9	0		0	12	0		1	15	1	W	1
20 Aug	8	0		0	13	1	N		18	4	N	0
21 Aug	12	0		2	15	0		5	22	1	W	1
22 Aug	11	0		0	18	0		1	25	0		1
23 Aug	8	0		0	17	0		0	24	3	SW	0
24 Aug	12	0		2	18	0		2	18	0		2
25 Aug	12	0		0	15	0		1	17	0		0
26 Aug	10	0		0					23	0		0
27 Aug	13	0		1	18	1		1	24.5	5	WSW	1
28 Aug	11	0		1	19	1		1	19.5	1		2
29 Aug	7	0		1	15	2	NW	1	22	2	NW	0
30 Aug	11	0		0	12	0		0	16	0		0
31 Aug	10	3	NW	1	11	4	NW	2	13	2	NW	2
1 Sep	10.5	3	SE	1	15	5	SE	0	18.5	5	SE	0
2 Sep	7.5	0		0	18.5	0		0	24.5	0		0
3 Sep	16	0		2	18.5	4	NW	2	24	4	NW	1
4 Sep	13.5	0		2	16.5	2	N	1	18	4	N	1
5 Sep	7	0		0	12	0		0	19	1	N	0
6 Sep	9.5	0		0	15.5	2	N	0	16.5	2	N	0
7 Sep	5	0		0	13.5	2	NW	1	18	0		1
8 Sep	2	0		0	15	2	SW	0	18	3	S	0
9 Sep	3	0		1	15	0		0	20	0		0
10 Sep	4.5	0		1	17	0		1	21	0		1
11 Sep	7	0		1	15	0		1	23	3	W	1
12 Sep	9	0		5	12	0		2	14	0		2
13 Sep	3	0		0	9	2	N	2	11	2	N	2
14 Sep	5	1	S	2	5	2	N	2	9	2	N	2
15 Sep	8	0		2		2	W	2	18	2	W	1

Weather Conditions at Inglewood Bird Sanctuary - 1997 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	
16 Sep	4	0		2	6	0		2	11	0		1
17 Sep	5	0		2	6	1	NW	2	7.5	0		2
18 Sep	1	4		5								
19 Sep	-2	0		0	1	0		0	14	0		0
20 Sep	6	0		0	15	0		0	19	0		1
21 Sep	5	0		0	14	0		0	19	0		0
22 Sep	5	0		0	14	0		0	20	0		0
23 Sep	5	0		0	13	0		0	24	0		0
24 Sep	8	0		0	16	0		0	25	0		0
25 Sep	4	0		0	17	0		0	26	3	W	0
26 Sep	11	3	SW	2	19	6	SW	1	23	3	SW	0
27 Sep	6	1	W	2	9	1	W	1	19	6	W	0
28 Sep	7	0		0	16	5	W	0	20	5	W	0
29 Sep	4	0		0	9	0		1	21	1	W	1
30 Sep	7	0		1	8	0		1	23	5	S	
1 Oct	5	1	S	1	11	3	S	2	14	4	S	2
2 Oct												
3 Oct												
4 Oct	1	0		1	9	0		1	16	0		1
5 Oct												
6 Oct	0	0		0	6	2	N	2	12	1	N	2
7 Oct	-1	3	N	7								
8 Oct												
9 Oct												
10 Oct												
11 Oct												
12 Oct					0	1		7				
13 Oct	0	1	NW		2				8	2	W	1
14 Oct												
15 Oct	4	0		1	8	2	W	2				

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 7

**CALGARY BIRD BANDING SOCIETY
1997 MEMBERSHIP LIST**

Grahame Booth
Michelle Boutin
Bill Brown
Doug Collister
Brian Couronne
Rainer Ebel
Dick Graham
George Halmazna
Garry Hornbeck
Clive Jackson
Barb Johnston
Stefan Jungkind
Dwight Knapik
Stephen Lane
Diane McIvor
Shonna McLeod
Arlette Malcolm
Pat Mitchell
Greg Meyer
Dale Paton
El Peterson
John Pollock
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

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 1979-91 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, songbird, 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 Husell 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 Husell 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 (Husell 1981, Hagan et al. 1992, Husell 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 Husell 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

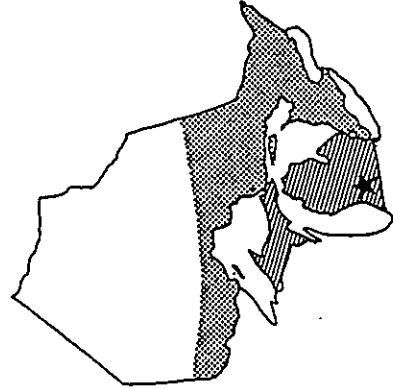


Fig. 1. Location of mist-netting sites (star) and areas of BBS coverage for Michigan (hatched shading) and Ontario (stippled shading). Although the Michigan BBS region covers the entire state, none of the species analyzed breeds as far south as Kalamazoo.

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 unsuitable 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 Husell 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.

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METHODS

Study Areas

Data in this paper are for 1979-91, from 2 netting sites at the Kalamazoo Nature Center in Kalamazoo, Michigan (49.2°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 15-20 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 site and for the 2 sites combined: within the 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. castaneus*), Canada warbler (*Wilsonia canadensis*), dark-eyed junco (*Junco hiemalis*), 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 abundances 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

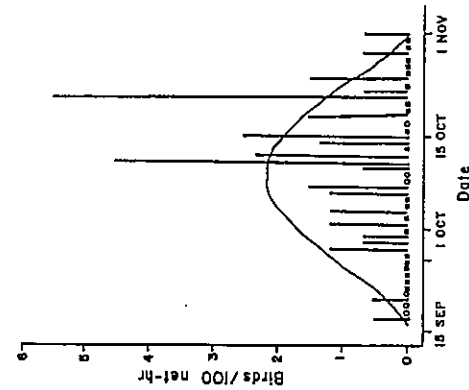


Fig. 2. Number of white-throated sparrows captured per 100 net-hours in 1980 (both areas combined). Curved line shows long-term average (average daily capture over all yrs); squares indicate days with no captures; circles show days with no migration.

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 analysts 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., $Y_{80} = 1$ if year = 1980, otherwise $Y_{80} = 0$), 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 speeds, 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 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; Baskerville 1972; Sprugel 1983), before converting to 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-

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.

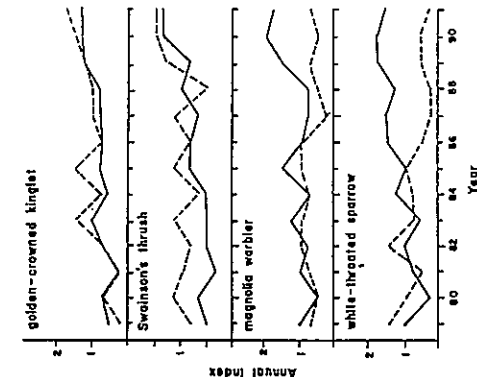


Fig. 4. Comparison of annual indices from the 2 netting sites for a sample of species. Solid line = River, dashed line = Marsh.

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.

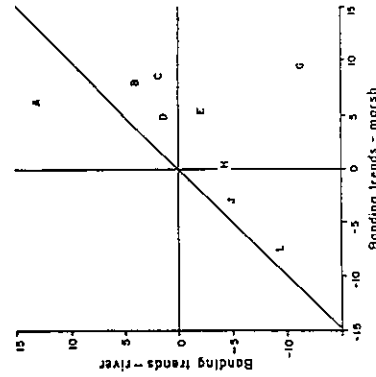


Fig. 5. Comparison of banding trends from River and Marsh. Species codes and diagonal line as for Fig. 3.

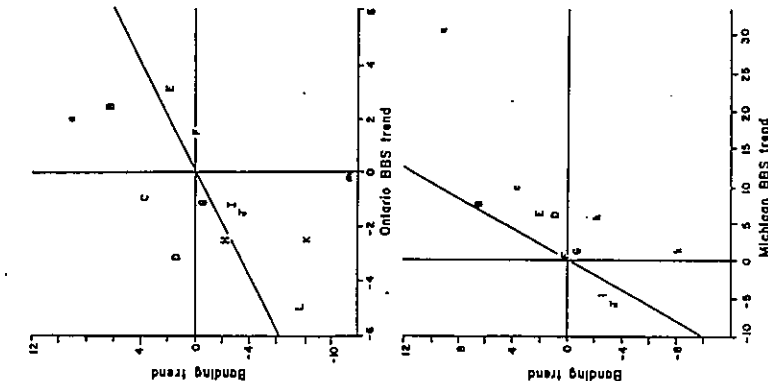


Fig. 3. Trends in Michigan banding totals (2 sites combined) compared with BBS trends for Ontario (top) and Michigan (bottom). Diagonal lines represent equality of trends from the 2 sources. Letters represent species as follows (lower case indicates BBS sample size of 10-15 routes, upper case indicates >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.

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

Netting site	No. of species ²	Ontario ¹	Michigan
River	9	0.521 (0.56)*	0.92***
Marsh	8	0.591 (0.65)*	0.57+
Combined	11	0.69** (0.58)	0.84***

¹ Spearman rank correlation coefficient. ² Initial significance: *** $P \leq 0.001$, ** $P \leq 0.01$, * $P \leq 0.05$, + $P \leq 0.05$.
³ Sample size at River alone insufficient for dark-eyed junco, at Marsh for Canada warbler, and at both sites for black-throated green warbler.
⁴ r in parentheses show r , when analysis includes Tennessee warbler (at 3 comparisons) and bay-breasted warbler (combined sites 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 , 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 , 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

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 trends in 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 doubled 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 divergences 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 1992), 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 1995).

Finally, despite overall agreement between trends from independent monitoring programs, 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.

LITERATURE CITED

BASKEVILLE, C. L. 1972. Use of logarithmic regression in estimation of plant biomass. *Can. J. For. Res.* 2:49-53.

DARBY, K. V. 1985. Migration counts and local weather at British bird observatories: an examination by linear discriminant analysis. Pages 37-64 in B. J. T. Morgan and P. M. North, eds. *Lecture notes in statistics* 28. Springer-Verlag, Berlin, Germany.

DUNN, E. H. 1996. The Canadian Migration Monitoring Network. Ring 17:311-37.

_____, AND D. J. T. HUSSELL. 1995. Using migration counts to monitor landbird populations: review and evaluation of current status. Pages 43-88 in D. M. Power, ed. *Current ornithology*. XII. Plenum Press, New York, N.Y.

FINNEY, D. J. 1941. On the distribution of a variable whose logarithm is normally distributed. *R. Stat. Soc. Ser. Suppl.* 7:155-161.

HAGAN, J. M., III, T. L. LLOYD-EVANS, J. L. ATWOOD, AND D. S. WOOD. 1992. Long-term changes in migratory landbirds in the northeastern United States: evidence from migration capture data. Pages 115-130 in J. M. Hagan III and D. W. Johnston, eds. *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Inst. Press, Washington, D.C.

HUSSELL, D. J. T. 1981. The use of migration counts for detecting population levels. Pages 92-102 in C. J. Ralph and J. M. Scott, eds. *Estimating numbers of terrestrial birds*. Stud. Avian Biol. 6.

_____, M. H. MATHER, AND P. H. SINGLAH. 1992. Trends in numbers of tropical- and temperate-

wintering migrant landbirds in migration at Long Point, Ontario, 1961-1988. Pages 101-114 in J. M. Hagan III and D. W. Johnston, eds. *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Inst. Press, Washington, D. C.

_____, AND C. J. RALPH. 1995. Recommended methods for monitoring bird populations by counting and capture of migrants. North American Migration Monitoring Council. Canadian Wildl. Serv., Ottawa and U. S. Geol. Surv., Laurel, Md.

HUTTO, R. L. 1985. Seasonal changes in the habitat distribution of transient insectivorous birds in southeastern Arizona: competition mediated? *Auk* 102:120-132.

LINK, W. A., AND J. R. SAUER. 1994. Estimating equations estimates of trends. *Bird Populations* 2:23-32.

MARCHANT, J. H. 1962. Recent trends in breeding populations of some common trans-Saharan migrant birds in northern Europe. *Ibis* 134 Suppl. 1:113-119.

MOORE, F. R., AND T. R. SIMONS. 1992. Habitat suitability and stopover ecology of neotropical landbird migrants. Pages 345-355 in J. M. Hagan III and D. W. Johnston, eds. *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Inst. Press, Washington, D. C.

PETERJOHN, B. C. 1994. The North American breeding bird survey. *Birding* 95:366-398.

_____, AND J. R. SAUER. 1994. Population trends of woodland birds from the North American breeding bird survey. *Wildl. Soc. Bull.* 22:155-164.

PLYE, E., N. NUR, R. P. HENDERSON, AND D. F. DESANTE. 1993. The effects of weather and lunar cycle on nocturnal migration of landbirds at Southeast Farallon Island, California. *Condor* 95:343-361.

_____, AND D. F. DESANTE. 1994. Trends in nocturnal migrant landbird populations at Southeast Farallon Island, California, 1968-1992. *Stud. Avian Biol.* 15:58-74.

RICHARDSON, W. J. 1978. Timing and amount of bird migration in relation to weather: a review. *Oikos* 30:229-272.

SPRUGEL, D. C. 1983. Correcting for bias in log-transformed allometric equations. *Ecology* 64:209-210.

SVENSSON, S. E. 1978. Efficiency of two methods for monitoring bird population levels: breeding bird censuses versus counts of migrating birds. *Oikos* 30:373-386.

TTUS, K., AND M. R. FULLER. 1990. Recent trends in counts of migrant hawks from northeastern North America. *J. Wildl. Manage.* 54:403-470

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APPENDIX 9

FATAL LIGHT AWARENESS PROGRAM (FLAPS) CALGARY

Window predation rates high among the list of threats that are often overlooked, by man, as simply just a cost of doing business. The city downtown skyline is a master of seduction. Prey is drawn to its glowing towers and mirrored finishes only to find a false promise of comfort followed by death as many crash in mid-flight against the beckoning windows of office buildings.

As in the last two years, FLAPS Calgary has compiled information during 1997. Some interesting trends during the 3 years of data are evident. Details of all recorded collisions are given in Table A9-1 while summaries by building and species are presented in Tables A9-2 and A9-3 respectively. During 1997 only 143 birds found compared to the 1996 total of 236. Of the 143, 10 were rescued and released. Perhaps early migration and good weather conditions account for fewer mortalities in 1997. Most of the migratory birds pushed through early. This along with a large portion of the nights with little cloud cover, resulted in the migrants flying over the downtown section. The banding station which is 6-km from the downtown core, found similar results.

Again the most frequent species for 1997 was the Chipping Sparrow at 47% of the collisions followed by the Red-breasted Nuthatch at 10%. Notable species were 3 Mallards, 2 American Kestrels, 2 Ring-necked Pheasants and 1 Great Horned Owl. We were successful in rescuing 1 American Kestrel, a female Ring-necked Pheasant and the Great Horned Owl.

For 1998, we will again encourage the building owners to extinguish the lights during migration periods and ask for their help in the rescue of casualties. Also for the 1998 season, we plan to follow the example of the Toronto FLAPS program and photograph the offending buildings that are leaving lights on during the migration periods.

Table A9-1. 1997 Bird Collisions with Buildings in Downtown Calgary

Date	Time	Species	Building	Face	Mirrored	Conditions
31-Jan	1000	Rock Dove *	Altus Centre	east		sun -30
15-Feb	1330	Rock Dove	Altus Centre	east		sun -25
25-Mar	1430	Rock Dove	Amoco Building	west		cloud/sun +15
27-Mar	1400	House Sparrow	Fifth Avenue Place	west	Y	sun +18
15-Apr	700	Mallard	Norcen Tower	north		sun +10
21-Apr	700	American Robin	Fifth Avenue Place	east	Y	sun/cloud +10
22-Apr		Mountain Bluebird	ERCB	east	Y	sun +10
22-Apr		Rock Dove	Gulf Canada Square	south	Y	
25-Apr	1000	House Sparrow	Western Canadian Place	east	Y	sun/cloud +10
25-Apr	1000	House Sparrow	Fifth Avenue Place	west	Y	sun/cloud +10
30-Apr	700	American Robin	Elveden Centre	north		sun/cloud +10
1-May	1000	Brewer's Blackbird	Gulf Canada Square	south	Y	cloud/rain+3
5-May	700	Rock Dove	Energy Plaza	south	Y	sun/cloud +16
6-May	1100	Savannah Sparrow	Canterra Tower	south	Y	sun/cloud +14
6-May	0700	Brown-headed Cowbird	Gulf Canada Square	west	Y	sun/cloud+14
13-May	700	Ring-necked Pheasant	Shaw Court	west	Y	sun +24
13-May	1030	Mallard	Western Canadian Place	north	Y	sun +24
13-May	1430	Ring-necked Pheasant*	Norcen Tower	north		sun +24
21-May	1000	Olive-sided Flycatcher	Western Canadian Place	west	Y	snow
22-May	700	Orange-crowned Warbler	Fifth Avenue Place	east	Y	cloud +2
22-May	1000	Chipping Sparrow	Fifth Avenue Place	south	Y	cloud +2
22-May	1100	Chipping Sparrow	Fifth Avenue Place	west	Y	sun +24
23-May	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	cloud +2
28-May	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +18
28-May	1000	Yellow Warbler	Energy Plaza	north	Y	sun/cloud +18
28-May	1000	Yellow-rumped Warbler	Stock Exchange Tower	north	Y	sun/cloud +18
28-May	1800	Mallard	Fifth Avenue Place	north	Y	sun/cloud +18
6-Jun	1000	House Sparrow	Fifth Avenue Place	east	Y	cloud/rain +9
6-Jun	1100	Wilson's Warbler	Fifth Avenue Place	north	Y	cloud/rain +9
20-Jun		House Sparrow	Fifth Avenue Place	north	Y	sun
21-Jun	800	Red-breasted Nuthatch *	Fifth Avenue Place	north	Y	cloud +16
14-Jul	1100	Red-breasted Nuthatch	Fifth Avenue Place	south	Y	cloud/rain +9
15-Jul	1000	Sparrow spp.	Elveden Centre	south		cloud +26
19-Jul	900	House Sparrow	Western Canadian Place	east	Y	cloud+20
19-Jul	1800	Wilson's Warbler	Western Canadian Place	east	Y	cloud+24
29-Jul	700	Say's Phoebe	Bankers Hall	east		sun/cloud +30
30-Jul	1030	House Sparrow	Fifth Avenue Place	north	Y	sun +25
31-Jul	700	Chipping Sparrow *	Fifth Avenue Place	east	Y	sun +25
31-Jul	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +25
31-Jul	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +25
31-Jul	700	Clay-coloured Sparrow	Fifth Avenue Place	north	Y	sun +25
31-Jul	700	Clay-coloured Sparrow	Fifth Avenue Place	north	Y	sun +25
1-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud+22
1-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +22
1-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +22
5-Aug	800	Chipping Sparrow	Western Canadian Place	east	Y	sun +32
5-Aug	800	Chipping Sparrow	Western Canadian Place	east	Y	sun +32
5-Aug	800	Chipping Sparrow	Western Canadian Place	east	Y	sun +32
5-Aug	1200	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +32

Table A9-1. 1997 Bird Collisions with Buildings in Downtown Calgary

Date	Time	Species	Building	Face	Mirrored	Conditions
7-Aug	1100	Wilson's Warbler	Petro Canada Centre	north		sun +27
7-Aug	1300	Least Flycatcher	Elveden Centre	north		sun +24
7-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun +24
7-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun +24
7-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun +24
7-Aug	700	Tree Swallow	Western Canadian Place	east	Y	sun +24
11-Aug	800	Song Sparrow	Western Canadian Place	southeast	Y	sun/cloud +20
11-Aug	800	Song Sparrow	Western Canadian Place	south	Y	sun/cloud +20
11-Aug	900	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +20
12-Aug	700	Chipping Sparrow	Western Canadian Place	south	Y	sun +24
12-Aug	700	Chipping Sparrow	Western Canadian Place	south	Y	sun +24
12-Aug	700	Chipping Sparrow	Western Canadian Place	south	Y	sun +24
12-Aug	700	Chipping Sparrow	Western Canadian Place	south	Y	sun +24
12-Aug	800	Chipping Sparrow	Fifth Avenue Place	south	Y	sun +24
12-Aug	800	Chipping Sparrow *	Fifth Avenue Place	south	Y	sun +24
13-Aug	1030	Red-breasted Nuthatch *	Fifth Avenue Place	east	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	southeast	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun+20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun+20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	east	Y	sun +20
14-Aug	1000	Chipping Sparrow	Fifth Avenue Place	north	Y	sun+20
14-Aug	1300	Red-breasted Nuthatch *	Trimac Place	east	Y	sun/cloud +20
14-Aug	1300	Red-breasted Nuthatch	Trimac Place	east	Y	sun/cloud +20
14-Aug	1000	Red-breasted Nuthatch	Fifth Avenue Place	east	Y	sun/cloud +20
14-Aug	700	Red-breasted Nuthatch	Western Canadian Place	north	Y	sun/cloud +20
22-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun/ cloud +25
22-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun/cloud+25
22-Aug	700	Chipping Sparrow	Western Canadian Place	north	Y	sun/cloud +25
22-Aug	1000	Common Raven	Gulf Canada Square	north	Y	sun/cloud +25
22-Aug	1000	Chipping Sparrow	Gulf Canada Square	north	Y	sun/cloud +25
22-Aug	1000	Chipping Sparrow	Gulf Canada Square	north	Y	sun/cloud +25
22-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +25
22-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +25
22-Aug	700	Chipping Sparrow	Fifth Avenue Place	east	Y	sun/cloud +25
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +24
25-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun/cloud +21
25-Aug	1100	Red-breasted Nuthatch	Bankers Hall	east		sun/cloud +25
25-Aug	1100	Red-breasted Nuthatch	Bankers Hall	east		sun/cloud +25
25-Aug	900	Wilson's Warbler	Bankers Hall	north		sun/cloud +25
26-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun +25

Table A9-1. 1997 Bird Collisions with Buildings in Downtown Calgary

Date	Time	Species	Building	Face	Mirrored	Conditions
26-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun +25
26-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun +25
26-Aug	830	Red-breasted Nuthatch	Energy Plaza	north	Y	sun +25
26-Aug	700	Least Flycatcher	Energy Plaza	north	Y	sun +25
26-Aug	700	Wilson's Warbler	Energy Plaza	north	Y	sun +25
27-Aug	700	Yellow Warbler	Western Canadian Place	east	Y	sun +25
27-Aug	800	Song Sparrow *	Energy Plaza	east	Y	sun +25
27-Aug	700	Chipping Sparrow	Fifth Avenue Place	west	Y	sun +25
27-Aug	700	Chipping Sparrow	Fifth Avenue Place	west	Y	sun +25
27-Aug	700	Chipping Sparrow	Fifth Avenue Place	west	Y	sun +25
27-Aug	700	Chipping Sparrow	Fifth Avenue Place	west	Y	sun +25
27-Aug	1200	Townsend's Warbler	Fifth Avenue Place	east	Y	sun +25
27-Aug	800	American Kestrel	Gulf Canada Square	north	Y	sun +25
28-Aug	700	Clay-coloured Sparrow	Fifth Avenue Place	south	Y	sun +25
28-Aug	700	Clay-coloured Sparrow	Fifth Avenue Place	south	Y	sun +25
28-Aug	700	Chipping Sparrow	Fifth Avenue Place	north	Y	sun +25
28-Aug	2030	Chipping Sparrow	Fifth Avenue Place	north	Y	sun +25
28-Aug	0700	Alder Flycatcher	Fifth Avenue Place	north	Y	sun +25
2-Sep		House sparrow	Gulf Canada Square	west	Y	sun/cloud +24
2-Sep		Chipping Sparrow	Fifth Avenue Place	west	Y	sun cloud +24
2-Sep		Chipping Sparrow	Fifth Avenue Place	west	Y	sun/cloud +24
2-Sep		Chipping Sparrow	Fifth Avenue Place	west	Y	sun/cloud +24
3-Sep	1200	Red-breasted Nuthatch	Gulf Canada Square	south	Y	sun/cloud +24
8-Sep	1100	American Kestrel *	Amoco Building	south	Y	cloud +18
8-Sep	700	Chipping Sparrow	Fifth Avenue Place	north	Y	cloud +18
8-Sep	700	Chipping Sparrow	Fifth Avenue Place	north	Y	cloud +18
8-Sep	700	Chipping Sparrow	Fifth Avenue Place	north	Y	cloud +18
9-Sep	1200	Townsend's Solitaire	Fifth Avenue Place	north	Y	cloud
9-Sep	700	Chipping Sparrow	Fifth Avenue Place	east	Y	cloud
9-Sep	700	Chipping Sparrow	Fifth Avenue Place	north	Y	cloud
9-Sep		Red-breasted Nuthatch	Fifth Avenue Place	north	Y	cloud
10-Sep	900	Orange-crowned Warbler	Energy Plaza	north	Y	cloud+15
12-Sep	700	Chipping Sparrow	Energy Plaza	north	Y	cloud +15
13-Sep	1200	Red-breasted Nuthatch	Fifth Avenue Place	north	Y	cloud/rain +12
13-Sep	1200	Red-breasted Nuthatch	Fifth Avenue Place	north	Y	cloud/rain+12
17-Sep	700	Chipping Sparrow	Elveden Centre	north		cloud
20-Sep	730	Orange-crowned Warbler	Canterra Tower	north	Y	sun/cloud
25-Sep	1800	Great Horned Owl *	Elveden Centre	north		sun cloud +18
2-Oct	2000	Brewer's Blackbird	Canterra Tower	west	Y	sun/cloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	north	Y	sun/cloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	north	Y	sun/cloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	south	Y	sun/cloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	south	Y	suncloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	inside	Y	sun/cloud
2-Oct	2000	Brewer's Blackbird	Canterra Tower	east	Y	sun/cloud

* birds rescued and released alive

Table A9-2. Bird Collisions by Building in Downtown Calgary - 1997

Building	Birds
Fifth Avenue Place	73
Western Canadian Place	23
Canterra Tower	9
Gulf Canada Square	9
Energy Plaza	8
Eiveden Centre	5
Bankers Hall	4
Altus Centre	2
Amoco Building	2
Norcen Tower	2
Trimac Place	2
ERCB	1
Petro Canada Centre	1
Shaw Court	1
Stock Exchange Tower	1

Table A9-3. Bird Collisions by Species in Downtown Calgary - 1997

Species	Number	Species	Number
Chipping Sparrow	67	Yellow Warbler	2
Red-breasted Nuthatch	14	Alder Flycatcher	1
Brewer's Blackbird	8	Brown-headed Cowbird	1
House Sparrow	8	Common Raven	1
Rock Dove	5	Great Horned Owl	1
Wilson's Warbler	5	Mountain Bluebird	1
Clay-coloured Sparrow	4	Olive-sided Flycatcher	1
Mallard	3	Savannah Sparrow	1
Orange-crowned Warbler	3	Say's Phoebe	1
Song Sparrow	3	Sparrow spp.	1
American Kestrel	2	Townsend's Solitaire	1
American Robin	2	Townsend's Warbler	1
Least Flycatcher	2	Tree Swallow	1
Ring-necked Pheasant	2	Yellow-rumped Warbler	1