CALGARY BIRD BANDING SOCIETY

1999 ANNUAL TECHNICAL REPORT

Prepared

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Some of the 1999 new bandings. Clockwise from top left: 1. **MacGillivray's Warbler** (ASY-M 25 May Dunbow) 2. **Yellow-bellied Flycatcher** (HY-U 20 Aug IBS) 3. **American Tree Sparrow** (HY-U 5 Oct IBS) 4. **Common Yellowthroat** (HY-U 24 Sep IBS) 5. **Brown Creeper** (AHY-U 5 Oct IBS) 6. **Townsend's Warbler** (HY-U 19 Aug IBS) 7. **Connecticut Warbler** (HY-U 4 Sep IBS) 8. **Brewer's Sparrow** (HY-U 18 Aug IBS) 9. **Chestnut-sided Warbler** (HY-U 29 Aug IBS). All photos by CBBS

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EXECUTIVE SUMMARY

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

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

The 1999 migration monitoring program follows pilot efforts in 1992 and 1994 and the full fall programs completed in 1995 through 1998. Twelve mist-nets were operated for approximately 6 hours on 68 of the 75 days between 26 July and 8 October. Volunteers and Banders-in-Charge contributed a total of 204 man-days to the banding projects (i.e. MAPS and migration monitoring). A total of 4,426 net-hours yielded 1,276 new bandings of 66 species during fall migration monitoring. Approximately 72% were Neotropical Migrants. New bandings were relatively spread out over the season this year - 45% in August and 47% in September.

Recaptures during fall migration monitoring totalled 303 involving at least 210 different birds of 36 species; including a Black-capped Chickadee originally banded in 1992. An Orange-crowned Warbler banded during fall migration in 1998 and recaptured this year provided yet another apparently rare re-encounter of a migrant. Other recaptures included a 4+ years old eastern Kingbird, a 4+ years old Downy Woodpecker, a 5+ years old Black-capped Chickadee, and a 6+ years old Yellow Warbler. A Swamp Sparrow banded during fall 1998 was killed by a cat near Stony Plain, AB on 10 July 1999, approximately 280-km NNW.

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

The MAPS site was operated again in 1999, building on previous data gathered since 1992. A total of 142 birds were captured, of which 108 were new bandings. Capture of Gray Catbirds confirmed their breeding status for the second consecutive year.

Ten mortalities occurred during the mist-netting of 2109 birds, 4 of which resulted from predation (2 by Black-billed Magpies and 2 by cats). In addition, 35 injuries were recorded.

Spring banding was conducted at Dunbow Road for the third consecutive year. Banding occurred on 22 of 28 days from 8 May - 4 June. A total of 1,596 net-hours resulted in 405 captures of which 245 were new bandings. Interesting captures including single Magnolia, Black-and-white and MacGillivray's Warblers.

During 1999 CBBS received support from the James L. Baillie Memorial Fund, Petro Canada Volunteer Grant Fund, Canadian Wildlife Service, Manning Diversified Forest Products, and Alberta Sport, Recreation, Parks and Wildlife.

INTRODUCTION

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

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

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

- a Monitoring Avian Productivity and Survivorship (MAPS) station was established at IBS in 1992 and continued in 1993 and 1995-1998; and
- spring banding was initiated in 1997 at Dunbow Road just south of Calgary and continued in 1998 and 1999.

Two new initiatives are contemplated for 2000: fall mist-netting of Northern Saw-whet Owls at Inglewood Bird Sanctuary and colour-banding and, relocation of Red-tailed and Swainson's Hawks at Calgary International Airport. The latter project is in cooperation with the Calgary Airport Authority.

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

FUNDING AND ACKNOWLEDGEMENTS

Funding for CBBS migration monitoring at IBS during 1999 was provided by:

- a grant through The James L. Baillie Memorial Fund from a contribution by Environment Canada, supplemented with funds raised through the annual Baillie Birdathon ($500);
- funds raised by the CBBS through participation in the Baillie Birdathon (approximately $2140 net);
- a grant from Canadian Wildlife Service through Mr. Loney Dickson ($2,000);
- a grant from the Petro Canada Volunteer Grant Program ($300);
- an honorarium from the Bow Valley Naturalists for conducting a banding workshop for Canmore/Banff naturalists ($500);
- a grant from Manning Diversified Forest Products ($500); and
- a grant from Alberta Sport, Recreation, Parks and Wildlife to fund production of this 1999 ($780) annual technical report.

An additional contribution in kind was made by Environment Canada - Brenda Dale (bander training workshops). Bird bags were kindly provided by Linda Wiggins and Pat Mitchell.

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

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

MIGRATION MONITORING

Background

Neotropical migrants are birds that breed in the Nearctic biogeographic realm and winter in the Neotropics. The Neotropical migratory bird system involves some 5-10 billion birds of over 150 species (Greenberg 1992). Recent (1978-1988) trends in data from the Breeding Bird Survey indicate that a majority of Neotropical migrants in eastern North America decreased in their population index (Sauer and 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 (Figure 1) and is a unique and valuable addition to the Canadian Migration Monitoring Network coordinated and administered by Bird Studies Canada. IBS is located within Calgary which greatly facilitates the potential for volunteer involvement. Pilot Neotropical migrant monitoring covering only a portion of the fall migration season was undertaken in 1992 and 1994 while full fall migration monitoring has occurred since 1995. Monitoring songbird population change based on fall mist-netting has been shown to be an effective technique (Dunn *et al.* 1997; Appendix 1).

Methods and Study Site

The fall migration of Neotropical migrants was monitored in 1999 at Inglewood Bird Sanctuary (IBS). IBS is comprised of 35 hectares of mature riverine balsam poplar forest known for its large number of songbirds during fall migration. Constant effort mist-netting (i.e. constant number of nets in permanent locations for constant time period each day) and collection of associated morphometric and other data (e.g. age, sex, wing chord, weight, fat reserves, capture net, time of capture) from each bird captured was carried out each day, weather permitting, during fall migration. Nets were operated from 26 July through 8 October. Twelve 12-m 30-mm mist-nets were operated in permanent net lanes for approximately 6 hours each day beginning at sunrise. As spring conditions at the site are wetter than during fall, spring migration is not monitored, by request of the IBS manager, because of concern for adverse environmental impact.

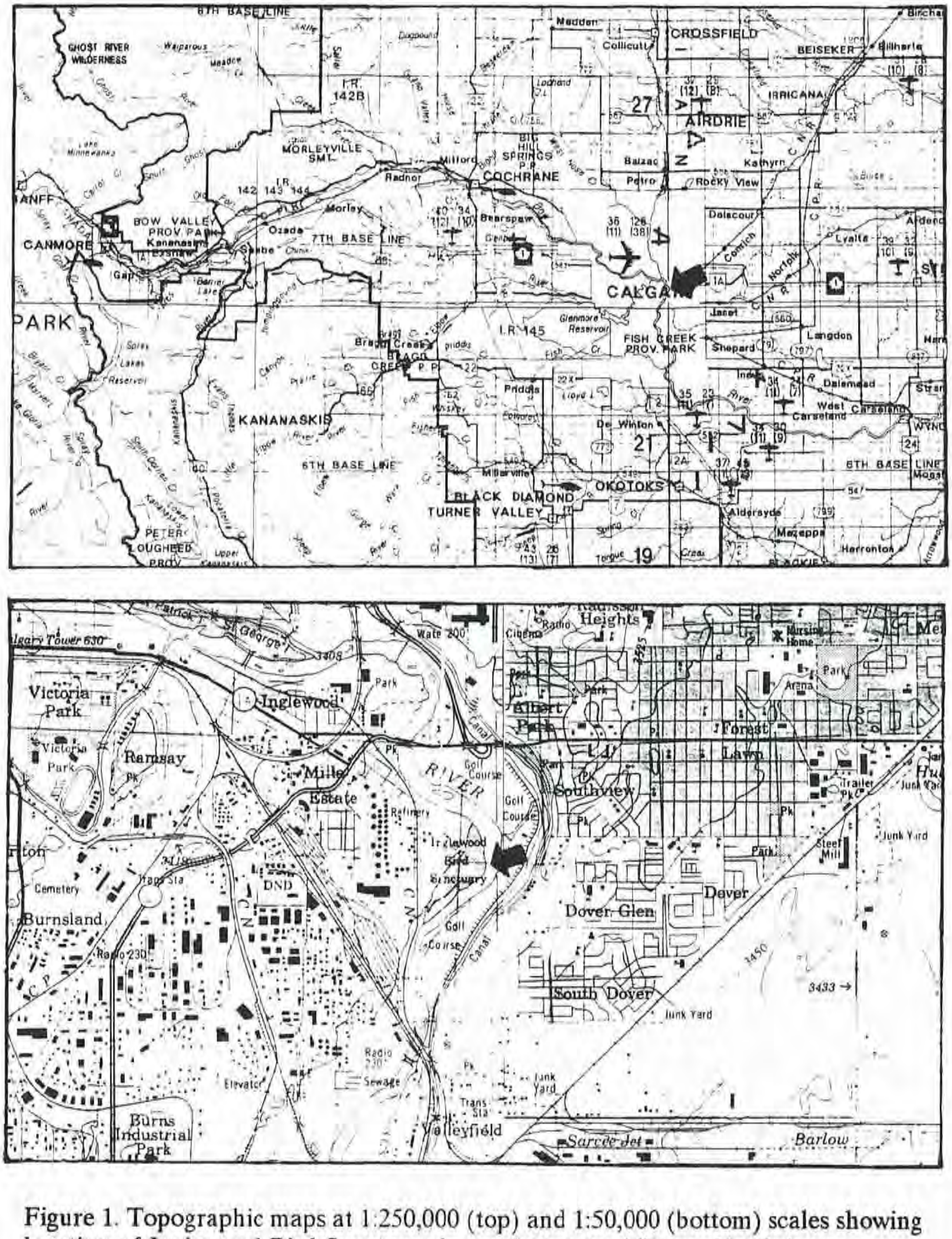

Figure 1. Topographic maps at 1:250,000 (top) and 1:50,000 (bottom) scales showing location of Inglewood Bird Sanctuary in southwestern Alberta. North is up.

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

Monitoring Schedule and Coverage

Fall migration monitoring at IBS was conducted from 26 July to 8 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 1999, a coverage of 90.7% was achieved. That is, mist-netting occurred on 68 of the 75 target days for a total of 4426 net-hours (Table 1, Figure 3). Inclement weather and/or the unavailability of a BIC resulted in 7 days of the monitoring period without banding.

A daily census was obtained on 65 of the 68 days on which mist-netting occurred. A census is not obtained when the number of migrants or personnel shortage would result in unacceptable risk (e.g. excessive holding time) to captured birds.

New Bandings

A total of 1,276 new bands were placed on birds of 66 species (Appendix 3). Of these, 920 or approximately 72% were Neotropical migrants (Finch 1991). Days on which 50 or more new bandings occurred were 9 August and 15 September. Approximately 45% of new bandings occurred in August and 47% in September. Timing of migration varies from year-to-year as illustrated in Appendix 4. A summary of new bandings at IBS from 1992-1999 is presented in Table 3. The top 20 banded species overall and by year are identified in Appendix 5.

As in 1998, fall migration monitoring was initiated during the last week of July. Capture rates on the three July days when banding occurred suggest that starting mist-netting at this time is appropriate. Mist-netting was not extended beyond 8 October based on low capture rates and the lack of BICs.

A banding station adds another dimension to understanding the avifauna at a site as illustrated by IBS. For example, several species were banded that are infrequently reported by bird watchers. A Yellow-bellied Flycatcher on 20 August, a Bohemian Waxwing on 10 August, a Nashville Warbler on 3 September, a Chestnut-sided Warbler on 29 August, a Black-throated Green Warbler on 10 September, a Bay-breasted Warbler on 24 August, and a Brewer's Sparrow on 18 August. In addition,

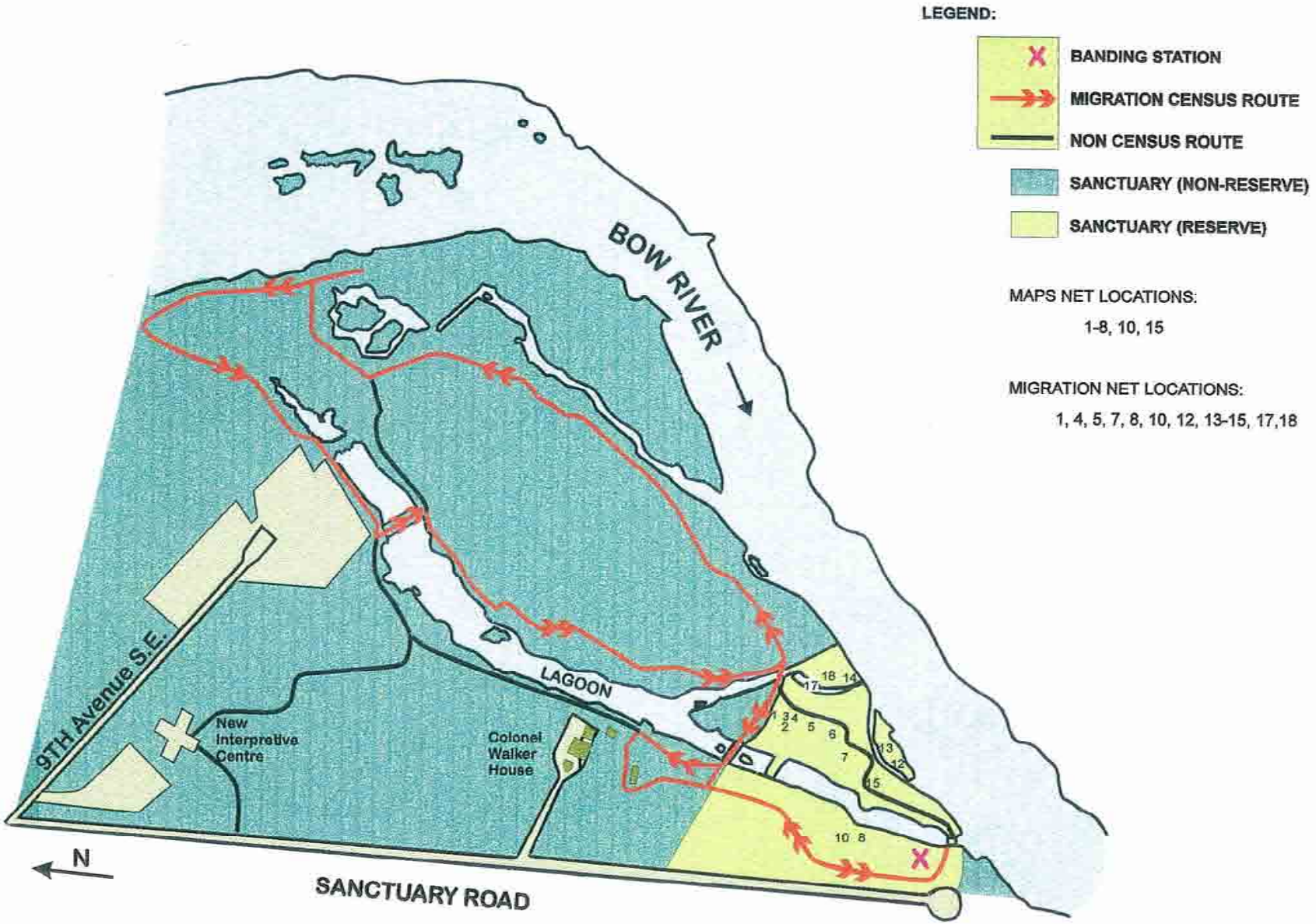

Figure 2. Schematic of Inglewood Bird Sanctuary migration monitoring station

Table 1. Migration Monitoring Dates and Capture Rates - Fall 1999

		Captures					Rate
Date	Net-hours	New Bandings	Recaptures	Escapes	Mortalities	Total	Captures/100 Net-hours
26-Jul	58.5	30	4	0	0	34	58
27-Jul	61.6	8	3	0	0	11	18
28-Jul	59.8	11	2	0	0	13	22
29-Jul							
30-Jul							
31-Jul							
01-Aug	66.4	20	4	3	1	28	42
02-Aug	57.6	19	6	0	0	25	43
03-Aug	71.9	9	1	2	0	12	17
04-Aug	72.5	5	0	0	0	5	7
05-Aug	73.3	16	0	0	0	16	22
06-Aug	70.2	12	3	0	0	15	21
07-Aug	72.4	21	5	0	0	26	36
08-Aug	40.5	12	3	0	0	15	37
09-Aug	59.6	68	10	1	0	79	133
10-Aug	61.9	36	10	0	0	46	74
11-Aug	52.9	43	9	4	0	56	106
12-Aug	42.2	42	9	0	0	51	121
13-Aug	51.3	24	6	2	0	32	62
14-Aug	49.0	25	10	0	0	35	71
15-Aug	60.0	31	6	0	0	37	62
16-Aug	59.8	21	1	0	0	22	37
17-Aug	59.5	15	6	0	0	21	35
18-Aug	60.5	21	6	1	0	28	46
19-Aug	70.7	39	5	0	0	44	62
20-Aug	59.4	20	7	0	0	27	45
21-Aug	60.8	7	1	0	0	8	13
22-Aug	61.1	8	3	0	0	11	18
23-Aug	70.9	5	1	1	0	7	10
24-Aug	74.4	24	1	1	0	26	35
25-Aug	68.7	16	3	1	0	20	29
26-Aug	72.2	7	4	1	1	13	18
27-Aug	60.9	0	3	0	0	3	5
28-Aug	69.3	0	4	0	0	4	6
29-Aug	72.8	7	1	0	0	8	11
30-Aug	69.3	7	3	1	0	11	16
31-Aug							

Table 1. Migration Monitoring Dates and Capture Rates - Fall 1999

		Captures					Rate
Date	Net-hours	New Bandings	Recaptures	Escapes	Mortalities	Total	Captures/100 Net-hours
01-Sep	73.1	13	4	1	0	18	25
02-Sep	72.1	18	5	0	0	23	32
03-Sep	72.1	14	4	0	0	18	25
04-Sep	72.7	15	6	1	0	22	30
05-Sep	70.5	9	2	0	0	11	16
06-Sep	70.2	45	9	4	0	58	83
07-Sep	65.8	7	4	0	0	11	17
08-Sep	70.4	12	3	0	0	15	21
09-Sep	71.1	7	5	0	0	12	17
10-Sep	71.7	20	0	1	0	21	29
11-Sep	71.7	18	3	0	0	21	29
12-Sep	74.9	31	3	0	0	34	45
13-Sep	70.7	11	6	1	0	18	25
14-Sep	68.7	18	2	2	0	22	32
15-Sep	62.2	74	4	1	1	80	129
16-Sep	71.3	24	5	2	0	31	43
17-Sep	72.5	42	9	0	0	51	70
18-Sep	71.5	9	1	1	0	11	15
19-Sep	72.5	42	9	2	0	53	73
20-Sep	70.5	23	3	0	2	28	40
21-Sep	68.8	5	1	2	0	8	12
22-Sep	74.3	47	9	3	0	59	79
23-Sep	72.7	24	12	3	0	39	54
24-Sep	71.7	40	9	1	1	51	71
25-Sep	71.6	5	12	1	0	18	25
26-Sep	72.1	6	7	2	0	15	21
27-Sep	72.5	7	4	1	0	12	17
28-Sep	78.7	5	5	0	1	10	13
29-Sep	60.2	2	3	0	0	5	8
30-Sep	13.8	5	1	0	0	6	43
01-Oct							
02-Oct							
03-Oct	66.4	16	1	0	0	17	26
04-Oct							
05-Oct	63.8	13	8	1	0	22	34
06-Oct	64.9	18	2	0	0	20	31
07-Oct	45.8	0	0	0	0	0	0
08-Oct	40.9	2	2	0	0	4	10
Total	4426.3	1276	303	48	7	1633	36.9

Figure 3. Capture Rates at Inglewood Bird Sanctuary - Fall 1999

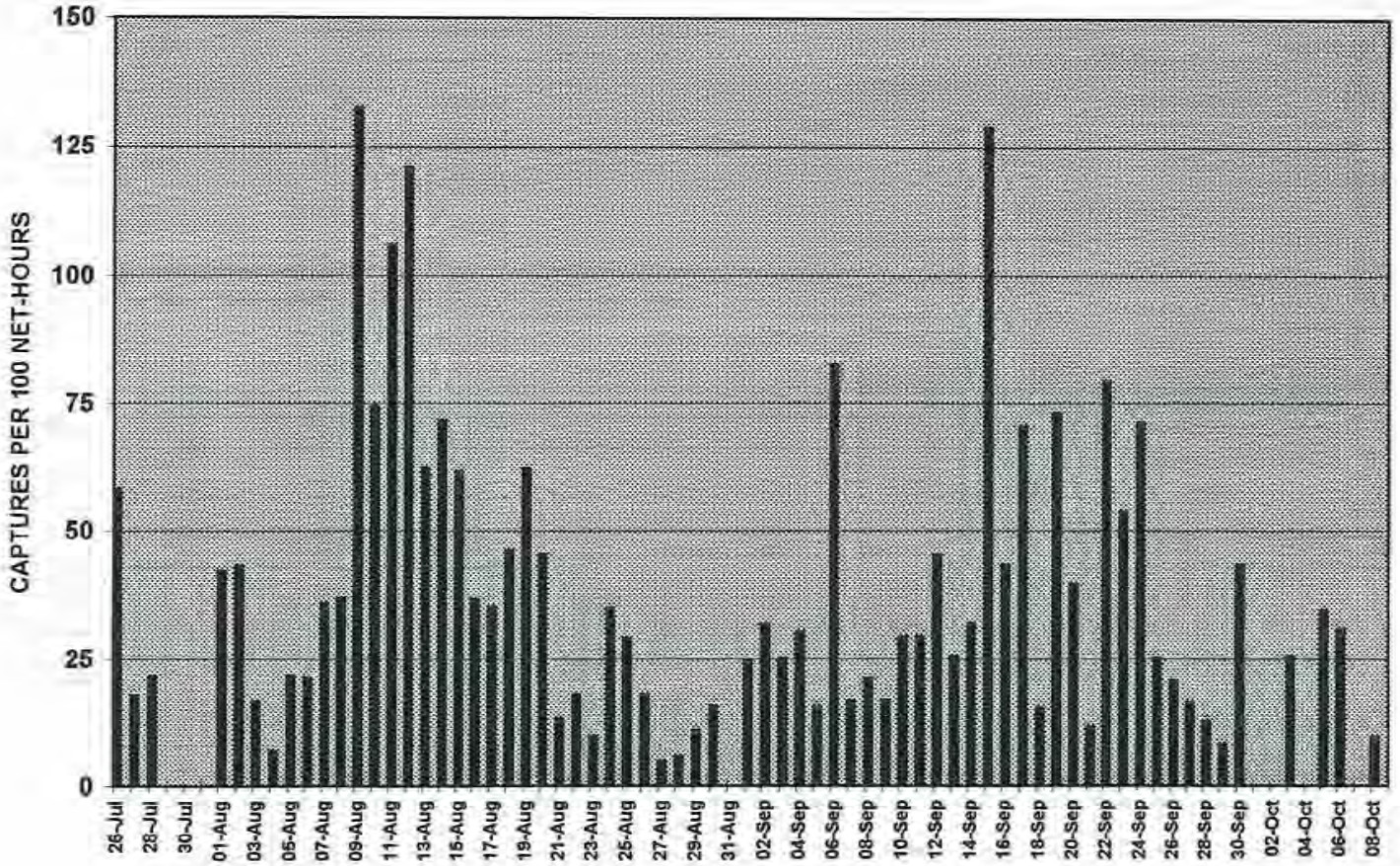

Table 2. New Bandings at Inglewood Bird Sanctuary

Year	1992	1994	1995	1996	1997	1998	1999
Start	03-Aug	18-Aug	01-Aug	31-Jul	31-Jul	25-Jul	26-Jul
Finish	22-Sep	09-Sep	30-Sep	12-Oct	15-Oct	02-Oct	08-Oct
# Days	26	20	54	70	65	61	68
Species							
Wood Duck			1				
Mallard							1
Sharp-shinned Hawk	2	2		1	5	4	3
Cooper's Hawk				1	1		
Northern Goshawk				1			
Broad-winged Hawk						1	
Solitary Sandpiper	3	2	3	14	13	14	2
Spotted Sandpiper		1	2		3	3	2
Belted Kingfisher	2	2	8	8	6	8	10
Yellow-bellied Sapsucker			1				
Downy Woodpecker		1	2	3	5	7	3
Northern Flicker	2	1	4	8	7	3	11
Olive-sided Flycatcher	3		3		5	2	
Western Wood-Pewee	6	4	11	2	33	8	10
Yellow-bellied Flycatcher			1				1
Traill's Flycatcher	24	16	29	25	50	36	24
Least Flycatcher	16	5	16	9	30	14	11
Dusky Flycatcher			2	1			
Pacific-slope Flycatcher			1		1		
Eastern Phoebe		1					
Eastern Kingbird	1	2	7	18	17	19	2
Blue-headed Vireo	1		1	1	2		
Warbling Vireo	8	15	13	18	27	18	8
Philadelphia Vireo	1						
Red-eyed Vireo	3	1	2	4	3	12	2
Blue Jay				1			
Black-billed Magpie			2	1	8	2	2
N Rough-winged Swallow					2		
Black-capped Chickadee	9	12	7	17	5	19	10
Red-breasted Nuthatch		3		2		4	2
White-breasted Nuthatch	1	1	6		4	4	4
Brown Creeper	1						1
House Wren	3	3	50	45	52	49	33
Golden-crowned Kinglet	2		2	1	1	1	2
Ruby-crowned Kinglet	3	1	10	18	20	14	5
Townsend's Solitaire				1			
Veery	2					1	
Gray-cheeked Thrush	1					1	
Swainson's Thrush	34	13	17	52	10	28	19
Hermit Thrush	4		3	14	6	9	9
American Robin	5	11	114	81	81	31	60
Gray Catbird		1		5	7	6	5
Brown Thrasher					3		
European Starling			2				
Bohemian Waxwing							1
Cedar Waxwing	12	1	42	14	67	11	25
Tennessee Warbler	43	5	33	30	52	74	106
Orange-crowned Warbler	24	36	177	116	86	207	91

Table 2. New Bandings at Inglewood Bird Sanctuary

Year	1992	1994	1995	1996	1997	1998	1999
Start	03-Aug	18-Aug	01-Aug	31-Jul	31-Jul	25-Jul	26-Jul
Finish	22-Sep	09-Sep	30-Sep	12-Oct	15-Oct	02-Oct	08-Oct
# Days	26	20	54	70	65	61	68
Species							
Nashville Warbler				1	2	1	1
Yellow Warbler	56	19	44	62	137	91	138
Chestnut-sided Warbler	1						1
Magnolia Warbler	9	4	2	2	4	4	2
Yellow-rumped Warbler	293	171	496	92	191	638	195
Black-throated Green Warbler					1	1	1
Townsend's Warbler	1				1	2	3
Palm Warbler		3	7	4	3	8	7
Bay-breasted Warbler			1				1
Blackpoll Warbler	17	5	17	8	6	30	5
Black-and-white Warbler	4	1	1	2		3	
American Redstart	19	4	3	6	4	20	5
Ovenbird	22	6	10	30	11	38	11
Northern Waterthrush	22	8	23	56	46	26	41
Connecticut Warbler	2	2	4	4	1	3	3
Mourning Warbler	4	2	5	10	3	9	1
MacGillivray's Warbler	2		3	8	10	6	2
Common Yellowthroat		1	6	1	8	10	8
Wilson's Warbler	121	68	102	175	119	113	100
Canada Warbler	1			2	1	3	1
Western Tanager	1	1	12	1	3	2	4
American Tree Sparrow			10	3	3	7	2
Chipping Sparrow	4	1	29	14	151	27	83
Clay-coloured Sparrow		1	1	6	21	37	26
Brewer's Sparrow							1
Savannah Sparrow		1			2		
Fox Sparrow	1	1	1			2	1
Song Sparrow		1	9	9	15	18	21
Lincoln's Sparrow	9	7	53	28	13	59	48
Swamp Sparrow				2		7	3
White-throated Sparrow	13	11	73	28	39	77	54
Harris's Sparrow			1				
White-crowned Sparrow	5	4	20	24	22	21	22
Dark-eyed Junco	5	3	15	15	3	10	8
Rose-breasted Grosbeak	6				1	3	2
Red-winged Blackbird			4				2
Common Grackle			3				
Brown-headed Cowbird			1	2	2	1	
Baltimore Oriole	4		21	12	12	8	5
Purple Finch		1			2	1	1
Pine Siskin					2		
American Goldfinch	3			2	4	2	2
Total	**841**	**466**	**1549**	**1121**	**1455**	**1898**	**1276**
Species	**52**	**48**	**61**	**59**	**64**	**64**	**66**
Net-hours	**934**	**1078**	**3456.4**	**4547.2**	**4608.3**	**4371.4**	**4426.3**
Bandings/100 Net-hours	**90.0**	**43.2**	**44.8**	**24.7**	**31.6**	**43.4**	**28.8**

a Golden-crowned Sparrow, captured on 18 September, escaped prior to being banded.

The *Oporornis* warblers are often difficult to detect and identify through conventional bird watching. During 1999 migration monitoring at IBS 3 Connecticut Warblers, 1 Mourning Warbler and 2 MacGillivray's Warblers were banded. A study of differences between Mourning and MacGillivray's Warblers captured at IBS has been underway since 1996. All birds are photographed when initially captured and additional morphometric detail and plumage characteristics documented. It is hoped that control data from other banding stations can be acquired in 2000 to help determine whether *Oporornis* warblers at IBS may be hybrids. DNA analysis offers another potential avenue of investigation into this problem.

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

Species monitored at IBS based on criteria developed by Bird Studies Canada appear in Appendix 7 along with those criteria. Appendix 8 presents a preliminary trend analysis using data from 1995-1999. It is anticipated that a more rigorous analysis will be undertaken by Bird Studies Canada during 2000 and in subsequent years.

Two other areas of research have been identified during 1999. Firstly banding data will be provided to Erica Dunn of CWS as part of a cooperative study on mass gain among migrating songbirds at Canadian stopover sites. It is anticipated that Ms. Dunn's analysis will provide insight into the quality of IBS as a refueling area for Neotropical Migrants. Secondly, preliminary discussions occurred at the Canadian Migration Monitoring Network (CMMN) meeting in September 1999 regarding a cooperative study to identify the geographic origin of birds captured at CMMN sites using stable isotopes. This project offers the possibility of confirming the hypothesis that CMMN sites monitor birds from a wide area north of their respective locations.

Recaptures

Recaptures at IBS totalled 303 involving 210 different birds of 36 species (Appendix 4). Recaptures were highest in resident species: Black-capped Chickadee 47 recaptures compared to 10 new bandings; and House Wren 45 recaptures compared to 33 new bandings. However some resident species evidence a lower recapture rate suggesting that migrants swell the ranks: Yellow Warbler 24 recaptures compared to 137 new bandings. A few species appear to use IBS for moulting or extended pre-

migratory foraging: Northern Waterthrush 24 recaptures compared to 41 new bandings; and White-crowned Sparrow 12 recaptures compared to 22 new bandings. Some species do not appear to linger at IBS: Chipping Sparrow 4 recaptures compared to 83 new bandings; and Yellow-rumped Warbler 4 recaptures compared to 195 new bandings.

Year-to-year recaptures at both Dunbow Road and IBS are presented in Appendix 10. Most year-to-year recaptures occur in the year following banding. However in a few cases birds are recaptured in several subsequent years and occasionally show up for the first time a number of years after banding. We are hopeful that House Wren 1910-52261 will reappear in 2000!

Estimated Daily Totals (EDTs)

The estimated daily totals (EDTs) represent the total number of birds, by species, detected at the IBS migration monitoring site each day. Each EDT incorporates capture data as well as a standardized census and any casual observations made during banding operations. The EDTs, after removal of probable and known stopovers (PKS), give an overall description of bird migration. EDT is secondary to mist-netting at Inglewood, as a monitoring measure. If high capture rates and/or personnel shortage create a risk to the welfare of the birds, a census (and therefore an EDT) is not done. Appendices 11 and 12 summarize the migrant and PKS components respectively of the EDTs by species and day. Figure 4 illustrates the temporal pattern of observed migration during the migration monitoring period while Appendix 4 compares migration phenology 1995-1999.

The EDTs at IBS during the 1999 fall migration documented 128 species seen, heard or captured. This total includes 25 species of warblers and vireos, 6 species of flycatcher and 16 sparrow and other finch species. Of the 128 species, a number were single sightings of one individual bird. Two of the more interesting observations were a Three-toed Woodpecker on 28 July and 2 Sandhill Cranes on 23 August.

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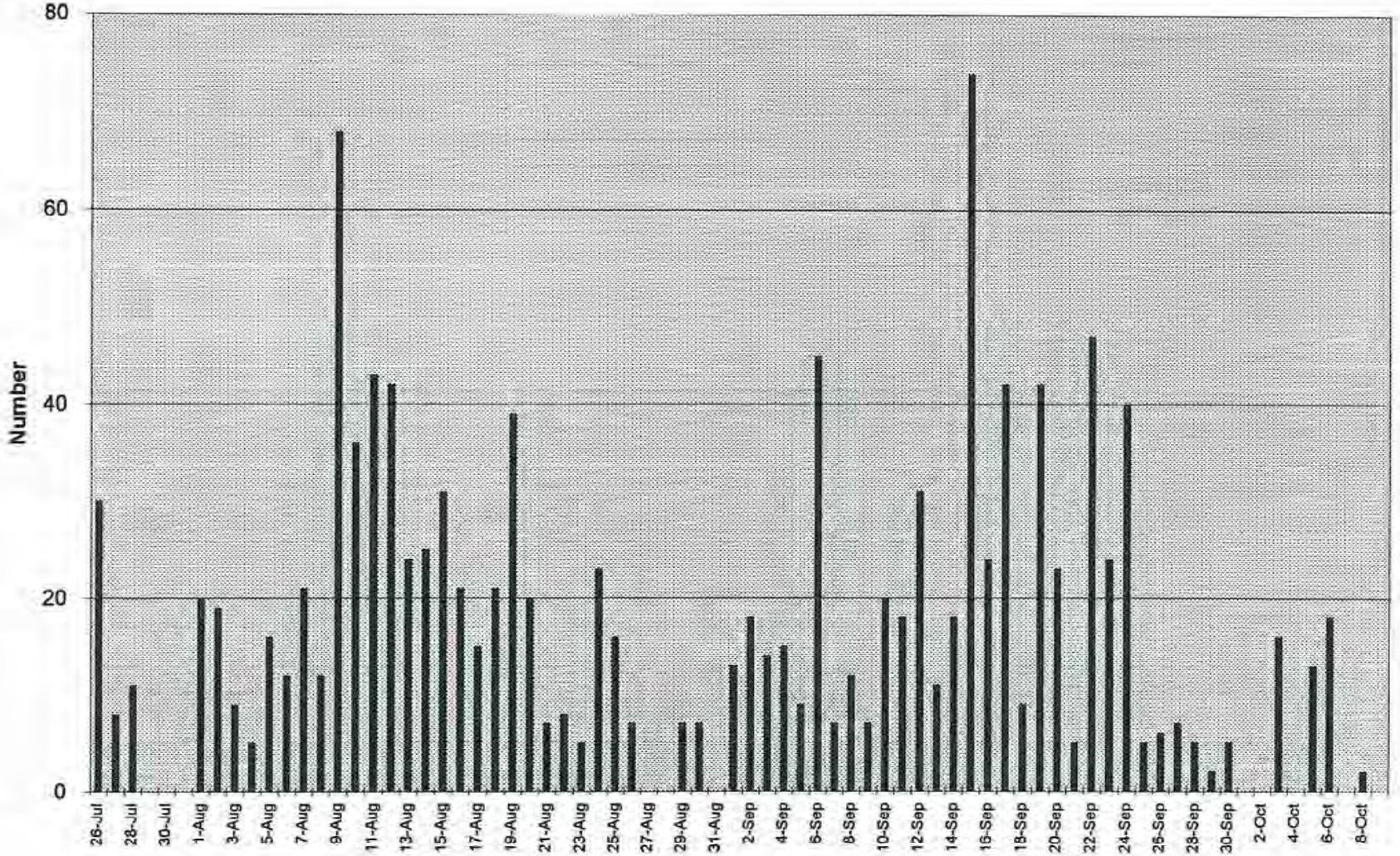
Figure 4. Migrants at Inglewood Bird Sanctuary - Fall 1999



MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS)

Background

The Monitoring Avian Productivity and Survivorship (MAPS) Program is a cooperative effort among public agencies, private organizations, and bird banders of North America. It provides long-term data on population and demographic parameters for target landbird species throughout the continent. The 1999 field season was MAPS 11th 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.

North America 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 North American stations.

Objectives

The overall 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 majority of 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-nests must continue for a minimum of three periods in the adult "super-period" and two periods in the young "super-period". For IBS MAPS initiates during period 4 (31 May - 9 June) and coverage entails 7 of the 10 ten-day periods.

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

MAPS Schedule and Coverage

1999 marked the 7th year of the MAPS project at IBS since 1992. Lack of qualified personnel precluded gathering data in 1994. In 1999 a total of 425.3 net-hours were achieved over 7 periods.

Results

The number of each species captured, by date, during 1999 are summarized in Table 3. The number of each species that were banded, recaptured, or escaped before banding are summarized in Table 4 for 1999 as well as six previous years.

Table 3. Inglewood Bird Sanctuary MAPS Summary - 1999

Date	5 June		16 June		26 June		9 July		17 July		23 July		05-Aug		Total
Species	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	Banded	Other	
Downy Woodpecker				1											1
Northern Flicker	2														2
Traill's Flycatcher													1		1
Least Flycatcher	1								1						2
Eastern Kingbird											3				3
Warbling Vireo			1		1										2
Tree Swallow			2												2
Black-capped Chickadee		1	1	1	1		2	1					1		8
House Wren	3	1	1	2					1	1	4	3			16
Swainson's Thrush	1								3						4
American Robin				1		1	3		2	1			3		11
Gray Catbird	6	1		1			1			1	1				11
Cedar Waxwing	2										1		2		5
Tennessee Warbler									3		1	2			6
Yellow Warbler	2	1	2		2	2				1	5	1	13		29
Northern Waterthrush													1		1
Wilson's Warbler	1														1
Western Tanager											4				4
Clay-colored Sparrow			2		1				10	3	4	3		1	24
Song Sparrow			1			2	2		1						6
Baltimore Oriole			1							1	1				3
Total Birds	18	4	11	6	5	5	8	1	21	8	24	9	21	1	142
Total Species	8	4	8	5	4	3	4	1	7	6	9	4	6	1	21
Net-Hrs	62.8		64.6		60.5		57.1		59.26		60.00		61.06		425.32
Captures/100 Net-Hrs	35.0		26.3		16.5		15.8		48.9		55.0		36.0		33.4

Note: Other = recaptures + escapes

Table 4. Inglewood Bird Sanctuary MAPS Summary

	New Bandings							Recaptures						
	1992	1993	1995	1996	1997	1998	1999	1992	1993	1995	1996	1997	1998	1999
American Kestrel			1											
Downy Woodpecker	1	3	1	5	4	1		2	1		5			1
Hairy Woodpecker	1	1	1			1								
Yellow-shafted Flicker	1	1	1											
Flicker Intergrade			2				2				1			
Northern Flicker				2										
Western Wood-Pewee	6	1	1	1	1	2		2	3				1	
Traill's Flycatcher				3	3		1							
Least Flycatcher	14	8	3	2	3	4	2	9	4	1				
Eastern Kingbird	2	1			3	1	3						1	
Warbling Vireo	7	7	1	4	2		2	1		1		1	3	
Red-eyed Vireo	1													
Black-billed Magpie				1	2									
Tree Swallow	3						2							
Bank Swallow	1													
Black-capped Chickadee	5	7	5	9	2	3	5	3	2	5	1		2	3
White-breasted Nuthatch	3	4		2					1		2			
House Wren	5	11	9	9	13	8	9	1	3	11	7	10	11	6
Veery	2					1		4						
Swainson's Thrush	10	8	6	4	3	1	4	1		2				
American Robin	21	6	26	25	23	10	8					6	2	1
Gray Catbird	3			1	1	4	8	1					2	3
European Starling			1											
Cedar Waxwing	27	8		6	1	9	5	2	3				1	
Tennessee Warbler	1	6		7	1	3	4		1		1		3	2
Orange-crowned Warbler						1								
Yellow Warbler	20	14	7	2	6	9	24	16	16	5	3	2	6	5
Myrtle Warbler	10					2							1	
American Redstart		1												
Ovenbird	3			1		1		1						
Northern Waterthrush						1	1						1	
Mourning Warbler	1													
Wilson's Warbler				2		1	1							
Western Tanager		1	3	1	2		4							
Chipping Sparrow		7			1									
Clay-colored Sparrow		1				6	17							5
Song Sparrow		1		1		1	4							2
Lincoln's Sparrow		3	1	2	5	2			2		1	1		
White-throated Sparrow				2							1			
Rose-breasted Grosbeak				1										
Common Grackle			1		2									
Brown-headed Cowbird	6				3			2	2					
Baltimore Oriole	3	7	2	8	9	1	2		1		4	1		1
Purple Finch		1												
American Goldfinch	2	2		1										
House Sparrow	2					2								
Total	161	110	72	102	90	76	108	45	39	25	26	21	34	28
Species	27	24	18	25	21	24	20	13	12	6	10	6	12	10

Discussion

New banding numbers continue to fluctuate (Table 5). 1999 was the site's best new banding year since 1993. A highlight in 1999 was the continued capture of Gray Catbirds confirming for the second year in a row their breeding status at IBS. Interesting notes are the decline in the number of new bandings of Warbling Vireo and American Robin, and the increase in the number of new bandings of Yellow Warbler and Clay-colored Sparrow. Significant MAPS recaptures can be found in the Significant Recaptures section of this report.

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PERSONNEL

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

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

Banders-in-Charge (BIC)

No salaried staff are involved in any CBBS projects. However, in order to cover as many days as possible during the spring banding and fall migration monitoring projects it continues to be necessary to bring in several Banders-in-Charge (BIC) from outside Calgary. In order to attract out-of-town BICs a daily per diem and travel allowance is offered. This arrangement provides an incentive for qualified individuals to assume the BIC duties and imposes accountability on the BIC to complete field data sheets and input data to computer files. No per diems are paid until all duties of the BIC, including data entry, have been fully discharged. The per diem decided upon by the general membership for the 1999 field season remained unchanged at $100/day for out-of-town BICs and $50/day for local BICs. One exception to the local BIC per diem was approved by the general membership this year. Local BICs were invited to submit proposals to cover extended periods during the fall. A scarcity of out-of-town banders precipitated this approach in 1999.

Table 5. Number of days of effort contributed by various individuals at Inglewood Bird Sanctuary in 1999.

Individual	M Monitoring		MAPS	
	BIC	Vol	BIC	Vol
Grahame Booth	14[3]		4[1]	
Lily Cesh		4		
Doug Collister	6[1]		1[1]	1
Brian Couronne		2		
Ross Dickson	3[2]			
Amy Gemmell		3		
Christina Hall		9		
Garry Hornbeck		5		
Mary Huston		7		
Scott Jubinville		1		
Stefan Jungkind	14[2]			
Janos Kovacs		1		
Dwight Knapik		2		
Steve Lane		8		1
Janice Lorenzana		1		
Shonna McLeod		26		5
Michael Magnan		1		
Greg Meyer	12[2]		1[1]	
Pat Mitchell		3		
El Peterson		6		1
Don Stiles		7		
Alexandra Torn		3		2
Bill Taylor		2		
Catherine Watson		4		
Catherine Watson-McDonald		8		
Linda Wiggins		3		
Bruce Wilson		11		
Scott Wilson	19[2]	1	1[1]	1
Total	68	118	7	11

[1] donated [2] received per diem [3] partially donated

1999 SPRING BANDING

The CBBS initiated a spring banding project in 1997 on private property 22-km SSE of the City of Calgary, approximately 1.5-km south of the Bow River. The site has come to be known as Dunbow Road.

The sampled habitat on the property is comprised of three different vegetation types. A stand of balsam poplar (*Populus balsamifera*) occurs in a ravine with an understory of willow (*Salix* spp.). Ground water from the surrounding area flows north through this area into a small pond before spilling out and flowing ultimately into the Bow River. A series of caragana hedges that had been planted in rows also occurs on the site. The third habitat sampled is a stunted aspen (*Populus tremuloides*) forest with a red-osier dogwood (*Cornus stolonifera*) understory.

Fifteen 30-mm mist-net lanes have been established at this site; five within each of the three habitat types. The capture protocol for the Dunbow site is consistent with the fall migration monitoring protocol developed for Inglewood Bird Sanctuary.

The banding effort during 1999 totalled 1,596 net-hours (Table 6), resulting in a total of 405 captures comprised of 248 new bandings (Table 7), 137 recaptures (92 repeats and 45 returns), 21 escapes and 2 mortalities. Table 6 provides a list of species banded for the three years the station has been operated (1997, 1998 and 1999). Fifteen individuals of 7 species banded in 1997 were recaptured during 1999. Fifteen individuals of 8 species banded during 1998 were recaptured during 1999. See the Significant Recaptures section of this report and Appendix 10 for a summary of these highlights.

Seventeen CBBS members contributed to this project in 1999; five BICs and 11 volunteers (Table 8).

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

Table 6. New Bandings at Dunbow Road 1997-1999

	1997	1998	1999
Start	07-May	09-May	08-May
Finish	05-Jun	03-Jun	04-Jun
Days	24	16	22
Cooper's Hawk	1		
Sharp-shinned Hawk			1
Yellow-bellied Sapsucker	3	1	
Red-naped Sapsucker	1	1	1
Downy Woodpecker	4	2	
Northern Flicker		1	
Western Wood-Pewee	2		2
Traill's Flycatcher	4	2	1
Least Flycatcher	10	9	33
Warbling Vireo	2		1
Red-eyed Vireo			2
Tree Swallow	1	3	2
Black-capped Chickadee	41	11	16
White-breasted Nuthatch			1
House Wren	19	23	21
Golden-crowned Kinglet	2		
Ruby-crowned Kinglet	7		3
Veery	1		
Swainson's Thrush	19	6	10
American Robin	22	10	10
Gray Catbird	1		1
Cedar Waxwing	3	4	
Orange-crowned Warbler	11	9	2
Nashville Warbler	1		
Yellow Warbler	15	23	22
Magnolia Warbler			1
Yellow-rumped Warbler	19	4	8
Townsend's Warbler	2		
Blackpoll Warbler	1		6
Black-and-White Warbler			1
American Redstart	2		1
Northern Waterthrush	3	4	
MacGillivray's Warbler			1
Common Yellowthroat			2
Wilson's Warbler			3
Chipping Sparrow	10	3	5
Clay-colored Sparrow	36	28	53
Vesper Sparrow	2	1	1
Savannah Sparrow			3
Song Sparrow	1		
Lincoln's Sparrow	7	2	8
White-throated Sparrow	2	2	
White-crowned Sparrow	31	4	15
Brown-headed Cowbird	3	3	
Baltimore Oriole	1		3
Pine Siskin	1		
American Goldfinch	8	5	8
Total	299	161	248
Species	37	24	32
Net-hours	2299	1305	1596
Bandings/ 100 Net-hours	13.0	12.3	15.5

Table 7. New Bandings at Dunbow Road - Spring 1999

	May																								June					Total
	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4		
Sharp-shinned Hawk						1																								1
Red-naped Sapsucker											1																			1
Western Wood-Pewee																			1		1									2
Traill's Flycatcher																									1					1
Least Flycatcher													1		4	2	5	3	2	2	2		1	1	5			5		33
Warbling Vireo															1															1
Red-eyed Vireo																								1				1		2
Tree Swallow																				2										2
Black-capped Chickadee	1	2		3	3	2	1						1		1					1				1						16
White-breasted Nuthatch																		1												1
House Wren												1	1		3	1	2	2	1	3			3	1	3					21
Ruby-crowned Kinglet												2			1															3
Swainson's Thrush															2		1		2	1	1		1	2						10
American Robin							1			1			1		1				2				2		2					10
Gray Catbird																					1									1
Orange-crowned Warbler															1						1									2
Yellow Warbler															4	1	4	3			3		1	4	2					22
Magnolia Warbler															1															1
Yellow-rumped Warbler					1				1	1		4	1																	8
Blackpoll Warbler					1										4		1													6
Black-and-white Warbler																	1													1
American Redstart																								1						1
MacGillivray's Warbler																		1												1
Common Yellowthroat															1	1														2
Wilson's Warbler																				1			1	1						3
Chipping Sparrow													1		2	1	1													5
Clay-colored Sparrow				1							2	4	6		14	8	3	2	4	4	1			3	1					53
Vesper Sparrow																		1												1
Savannah Sparrow					1		1		1																					3
Lincoln's Sparrow												2			4	1		1												8
White-crowned Sparrow		1		2					3			1	2		3	2		1												15
Baltimore Oriole																	1			2										3
American Goldfinch																		1		3				1	1			2		8
Total	1	3	0	6	6	3	3	0	5	2	3	14	14	0	47	17	19	16	12	19	10	0	9	16	15	0	0	8	0	248
Species	1	2	0	3	4	2	3	0	3	2	2	6	8	0	16	8	9	10	6	9	7	0	6	10	7	0	0	3	0	33

Table 8. Number of days of effort contributed by various individuals at Dunbow Road in 1998.

Individual	Spring Banding	
	BIC	Vol
Grahame Booth	3[1]	
Lily Cesh		1
Doug Collister	6[1]	
Garry Hornbeck		4
Dwight Knapik		1
Janice Lorenzana		1
Shonna McLeod		6
Greg Meyer	5[2]	
Pat Mitchell		2
Dale Paton	4[2]	
El Peterson		3
Catherine Watson		5
Catherine Watson-McDonald		7
Linda Wiggins		1
Bruce Wilson		3
Scott Wilson	4[1]	
Total	22	34

[1] donated [2] received per diem [3] partially donated

SIGNIFICANT RECAPTURES

All recaptures of birds banded in previous years are listed below. Five of these significant recaptures are of particular interest. An IBS Eastern Kingbird banded in 1996 was recaptured in 1999 making it at least 4 years old. Although all encounters with this bird have occurred during fall migration monitoring it is very likely an IBS resident. An American Robin banded as a fledgling at IBS in 1995 during MAPS was found dead 2.6-km away in 1999, apparently exhibiting fidelity to its natal area. A Yellow Warbler banded in 1995 was recaptured in 1999 making it at least 6 years old.

An Orange-crowned Warbler banded during fall migration in 1998 was recaptured during fall migration 1999. This is the 8th instance at IBS of a rare recapture of a migrant at the same site year-to-year. This phenomena occurred at IBS in 1998 (2 Swainson's Thrushes), 1997 (3 Swainson's Thrushes), 1996 (1 Swainson's Thrush) and 1993 (1 Yellow-rumped Warbler).

The recovery of the year, a Swamp Sparrow banded as HY-U during fall migration 1998 at IBS was killed by a cat during the 1999 breeding season at Stoney Plain, AB approximately 280-km NNW. This recovery suggests that indeed IBS samples migration from a significant distance north.

An IBS House Wren originally banded in 1992 and recaptured in 1998 as at least a 7-year old did not reappear during 1999. We are hopeful that it simply avoided capture and will be re-encountered in 2000 or subsequent years.

Red-naped Sapsucker 8041-54901 Banded as AHY-M by Dale Paton at Dunbow Road on 21 May 1998. Recaptured there on 31 May 1999. At least 2 years old.

Eastern Kingbird 1461-63719 banded as AHY-F by Doug Collister at Inglewood Bird Sanctuary on 13 August 1996. Recaptured there on 1 August 1997 and 7 August 1999. At least 4 years old.

... 1461-63750 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 1 August 1997. Recaptured there on 4 August 1998 and 2 & 20 August 1999. At least 3 years old.

Downy Woodpecker 1461-02314 Banded as AHY-F by Greg Meyer at Inglewood Bird Sanctuary on 13 July 1996. Recaptured there once in 1997, twice in 1998 and as ATY-F on 16 June 1999. At least 4 years old.

... 1461-05307 Banded as AHY-M by Rainer Ebel at Dunbow Road on 10 May 1997. Recaptured there on 20 May 1999. At least 4 years old.

Least Flycatcher 2020-70767 Banded as AHY-U by Grahame Booth at Dunbow Road on 23 May 1997. Recaptured there on 23 May 1999. At least 3 years old.

Black-capped Chickadee 1950-45254 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 6 September 1994. Recaptured there on 17 June and 17 September 1995, 21 September 1996 and 5 June and 24-25 & 30 September 1999. 5 years old.

... 1980-79991 Banded as AHY-F by Grahame Booth at Inglewood Bird Sanctuary on 22 July 1995. Recaptured there 6 times in 1996, twice in 1997, on 9 September 1998 and on 19 & 30 August as well as 5 October 1999. At least 5 years old.

... 1990-57154 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 1 August 1997. Recaptured there on 20 August and 15 September 1998 and 28 September 1999. 2 years old.

... 2120-00102 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there on 12 May 1998 and 8 & 12 May and 4 June 1999. At least 3 years old.

... 2120-00105 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there as ASY-M on 10, 14, 21, 27 & 31 May 1998 and 13 May 1999. At least 3 years old.

... 2120-00107 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there on 9 May 1998 and 14 & 17 May 1999. At least 3 years old.

... 2120-00109 Banded as AHY-M by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there on 10, 12, 14, 18, 21, 24 & 30 May 1998 and 12, 13 & 16 May 1999. At least 3 years old.

... 2120-00117 Banded as AHY-F by Rainer Ebel at Dunbow Road on 7 May 1997. Recaptured there on 10, 14 & 27 May 1998 and 14, 16 & 30 May 1999. At least 3 years old.

... 2120-00124 Banded as AHY-M by Rainer Ebel at Dunbow Road on 8 May 1997. Recaptured there on 9 May 1999. At least 3 years old.

... 2160-18030 Banded as ASY-F by Greg Meyer at Dunbow Road on 17 & 27 May 1998. Recaptured there on 14 May 1999. At least 2 years old.

... 2160-18085 Banded as ASY-F by Greg Meyer at Dunbow Road on 27 May 1998. Recaptured there on 30 May 1999. At least 3 years old.

... 2160-18180 Banded as AHY-U by Greg Meyer at Inglewood Bird Sanctuary on 16 August 1998. Recaptured there on 16 June 1999. At least 2 years old.

... 2160-18704 Banded as U-U by Greg Meyer at Inglewood Bird Sanctuary on 21 September 1998. Recaptured there on 1 September 1999. At least 1 year old.

... 2160-19095 Banded as HY-U by Doug Collister at Inglewood Bird Sanctuary on 21 August 1998. Recaptured there on 12,14,28 September and 2 October 1998, and as AHY-U on 26 August, 6, 26 September and 5 October 1999. 1 year old.

... 2160-19120 Banded as AHY-U by Doug Collister at Inglewood Bird Sanctuary on 6 August 1998. Recaptured there on 14 August, and 1,14,19 September 1998, and as AHY-U on 7, 22 August, and 6, 29 September 1999. At least 2 years old.

... 2160-19174 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 11 August 1998. Recaptured there on 2 October 1998, and 1 September 1999. 1 year old.

... 3500-89670 Banded as AHY-U by Greg Meyer at Dunbow Road on 28 May 1997. Recaptured there on 10 May 1998 and 12 May 1999. At least 3 years old.

White-breasted Nuthatch 1461-31479 Banded as AHY-M by Greg Meyer at Inglewood Bird Sanctuary on 16 August 1998. Recaptured there on 26 July 1999. At least 3 years old.

House Wren 2160-18063 Banded as AHY-U by Dale Paton at Dunbow Road on 21 May 1998. Recaptured there on 26 & 28 May 1999. At least 2 years old.

... 2160-18082 Banded as ASY-U by Greg Meyer at Dunbow Road on 27 May 1998. Recaptured there on 22 & 31 May 1999. At least 3 years old.

... 2160-19002 Banded as AHY-M by Grahame Booth at Dunbow Road on 31 May 1998. Recaptured there on 30 May 1999. At least 2 years old.

American Robin 0962-90966 Banded as HY-U by Grahame Booth at Inglewood Bird Sanctuary on 11 August 1995. Found dead 2.6-km NE of there on 12 April 1999. 4 years old.

... 1152-38740 Banded as AHY-F by Stefan Jungkind at Inglewood Bird Sanctuary on 18 August 1998. Recaptured there on 26 June 1999. At least 2 years old.

Orange-crowned Warbler 2160-18542 banded as AHY-U by Ross Dickson on 28 August 1998. Recaptured there as AHY-M on 9 September 1999. At least 2 years old.

Yellow Warbler 1980-79983 Banded as ASY-M by Grahame Booth at Inglewood Bird Sanctuary on 7 July 1995. Recaptured there once in 1996, twice in 1997, 7 July and 22 August 1998 and 26 June 1999. At least 6 years old.

... 2160-18045 Banded as AHY-M by Doug Collister at Dunbow Road on 20 May 1998. Recaptured there on 22, 23, 25 & 27 May 1999. At least 2 years old.

... 2160-18068 Banded as ASY-M by Grahame Booth at Dunbow Road on 24 May 1998. Recaptured there on 25 & 30 May 1999. At least 2 years old.

... 2160-18077 Banded as ASY-F by Greg Meyer at Dunbow Road on 27 May 1998. Recaptured there on 24 May 1999. At least 3 years old.

... 3500-89677 Banded as SY-M by Greg Meyer at Dunbow Road on 28 May 1997. Recaptured there on 25 & 30 May and 4 June 1999. 3 years old.

Clay-coloured Sparrow 2050-70675 Banded as U-M by Greg Meyer at Dunbow Road on 28 May and 4 June 1997. Recaptured there as AHY-M on 31 May 1999. At least 2 years old.

... 2120-00157 Banded as AHY-M by Rainer Ebel at Dunbow Road on 14 May 1997. Recaptured there on 13 May 1998 and 20, 24 May and 1 June 1999. At least 3 years old.

... 2120-00170 Banded as AHY-M by Rainer Ebel at Dunbow Road on 16 May 1997. Recaptured there on 18 May 1999. At least 3 years old.

... 2160-18022 Banded as ASY-U by Greg Meyer at Dunbow Road on 16 May 1997. Recaptured there on 20 May 1999. At least 4 years old.

... 2160-18028 Banded as ASY-M by Greg Meyer at Dunbow Road on 17 May 1997. Recaptured there on 25 & 27 May 1999. At least 4 years old.

Vesper Sparrow 1461-31412 Banded as AHY-F by Dale Paton at Dunbow Road on 14 May 1998. Recaptured there on 24 May 1999. At least 2 years old.

Swamp Sparrow 3101-89952 banded as HY-U by Rainer Ebel at Inglewood Bird Sanctuary on 16 September 1998. Killed by cat near Stony Plain, AB (279-km NNW) on 10 July 1999. 1 year old.

Brown-headed Cowbird 1461-31414 Banded as ASY-F by Grahame Booth at Dunbow Road on 24 May 1998. Recaptured there on 1 June 1998 and 24 May and 1 June 1999. At least 4 years old.

Baltimore Oriole 8041-54908 Banded as AHY-F by Doug Collister on 27 July 1998. Recaptured there on 16 July 1999. At least 2 years old.

American Goldfinch 2120-00188 Banded as SY-M by Stefan Jungkind at Dunbow Road on 30 May 1997. Recaptured there on 25 May 1999. 3 years old.

MORTALITIES AND INJURIES

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

Table 9 presents all 1999 casualties during the spring banding, MAPS and migration monitoring projects combined. Note that the number captured, by species, is only given where that species experienced injury or mortality.

Mortality rates for all CBBS banding projects have remained at acceptable levels (Figure 5). The injury rate in 1999 was 1.66% compared to the 5-year average of 1.43%. Increases through 1997 were in part due to an increased awareness of banding personal to record even slight abrasions. In spite of apparent improvement the CBBS continues to review each casualty to determine potential for reduction or avoidance of similar occurrences in the future.

Figure 5. Casualty Rates for CBBS Banding Projects

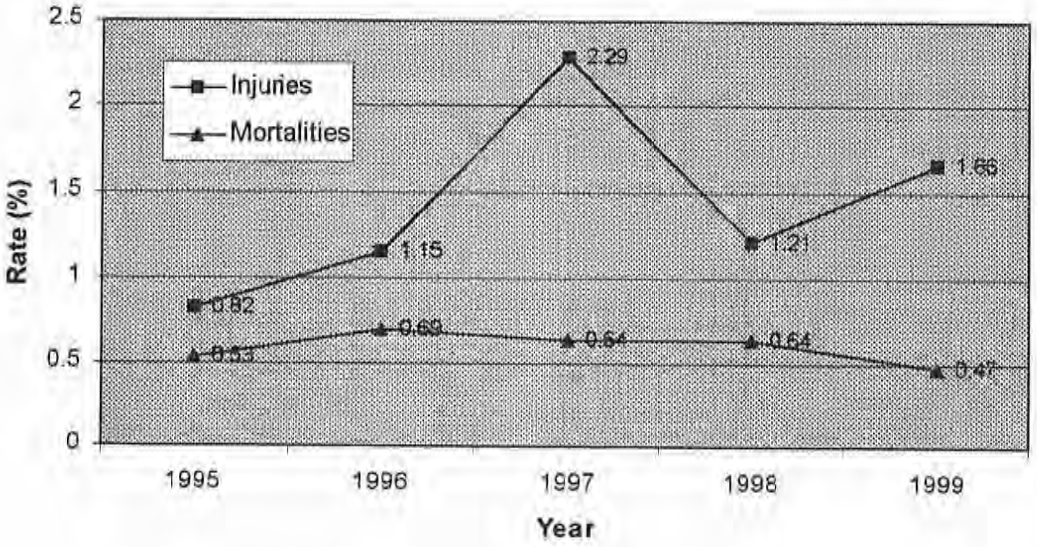

Table 9. Casualties During 1999 Banding Projects

Species	Number Captured	Injuries		Mortalities	
		Number	Type	Number	Cause
Belted Kingfisher	12	1	wing abrasion		
Western Wood-Pewee	13	1	leg abrasion		
Traill's Flycatcher	28	1	leg abrasion		
Black-capped Chickadee	108	2	leg abrasion		
House Wren	139	3	treated for shock	2	cat predation
		2	cut foot	1	found dead in net
		2	leg abrasion		
Swainson's Thrush	40	1	wing abrasion		
American Robin	87	6	wing abrasion	1	caught by tongue
		1	cut tongue		
		1	leg abrasion		
Cedar Waxwing	33	1	cut foot		
Tennessee Warbler	129	2	cut foot		
Yellow Warbler	242	2	cut foot		
		1	broken leg		
Yellow-rumped Warbler	210			2	BBMA predation
				1	broken lower mandible
Common Yellowthroat	17			1	BBMA predation
Wilson's Warbler	112	1	wing abrasion		
Western Tanager	9	1	wing abrasion		
Lincoln's Sparrow					
American Tree Sparrow	2	1	neck abrasion		
Clay-colored Sparrow	131			1	found dead in net
Lincoln's Sparrow	74	3	leg abrasion		
		1	cut tongue		
White-throated Sparrow	76	1	broken leg	1	shock during handling
Total	**2109**	**35**	**(1.66%)**	**10**	**(0.47%)**

EQUIPMENT AND SUPPLIES

Mist-nets

At the end of the 1999 banding season the mist-net inventory consisted of 28 12-m x 30-mm nets. Of these, 17 are new or in near-new condition and 11 are useable but worn and in some cases in need of repair. The 11 "used" nets will be assessed and repaired if possible during 2000 spring banding at Dunbow Road.

Additionally, CBBS has ten 12-m x 38-mm mist-nets donated by Loney Dickson of the Canadian Wildlife Service, all currently in serviceable condition. These nets are used to conduct pilot banding and will likely be used for Northern Saw-whet Owl banding in fall 2000.

Net Poles and Re-bar Stakes

At present a sufficient supply of useable poles and stakes exists to carry CBBS through the 2000 banding season.

Banding Equipment

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

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

APPENDIX 1

MONITORING SONGBIRD POPULATION CHANGE WITH AUTUMN MIST NETTING

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Abstract: Counts of migrating birds potentially could be used to detect population change. This technique would be especially valuable for tracking species poorly monitored by breeding and wintering season counts, such as boreal-nesting songbirds that winter in the tropics. Numbers of migrants counted vary with weather and other factors, however, and we need to demonstrate that migration counts give accurate results. Population trends for 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.

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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 Hussell 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 Hussell 1995), among which weather is perhaps the most important (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 (Hussell 1981, Hagan et al. 1992, Hussell 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 Hussell 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 netting sites (star) and areas of BBS coverage for Michigan (lined 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 unsuited to monitoring population change.

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

We thank the Kalamazoo Nature Center banders and BBS volunteers who collected data. J. Sauer and N. Nur reviewed the manuscript. This is Ontario Ministry of Natural Resources contribution No. 95-03.

METHODS

Study Areas

Data in this paper are for 1979–91, from 2 netting sites at the Kalamazoo Nature Center in Kalamazoo, Michigan (42.2°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 no. 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 magnolia*), yellow-rumped warbler (*D. coronata*), black-throated green warbler (*D. virens*), bay-breasted warbler (*D. castanea*), Canada warbler (*Wilsonia canadensis*), dark-eyed junco (*Junco hyemalis*), and white-throated sparrow (*Zonotrichia albicollis*). For 2 of these species (bay-breasted and Tennessee warblers), there were insufficient BBS data from Michigan to compare with trends in Kalamazoo banding totals.

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

Statistical analyses

Justification of Analytical Approach.—We calculated annual indices of abundance using a modification of the regression model described by Hussell et al. (1992). In broad terms, this is an ANCOVA model that assigns variability in log-transformed daily counts to year, day within the season, moon phase and weather. For example, daily counts are highly skewed (many low counts, a few high ones; Fig. 2), to allow use of standard statistical programs, daily counts were log-transformed to improve normality of distribution and change multiplicative effects to additive ones. In addition, there is a seasonal pattern to migration such that more birds were expected in the middle of the season than at the beginning or end. By adjusting for seasonal pattern, the analysis determines whether a given day's count is lower or higher than expected for its date.

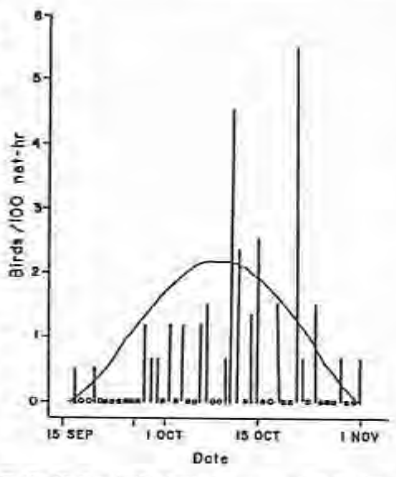

Fig. 2. Number of white-throated sparrows captured per 100 net-hours in 1990 (both areas combined). Curved line shows long-term average (average daily capture over all yrs), squares indicate days with no captures, circles show days with no mist-netting.

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 day^2 as independent variables, to describe a simple pattern of bird abundance through the season (*day* = 0 for a day near the center of the species-specific migration window). The aim of the preliminary run was to identify and remove cases that had low predicted values and were major contributors to a poor distribution of residuals, in violation of the assumptions of the regression model (Hussell 1981). Cases that had predicted values less than 0 birds in the preliminary run were excluded from the second regression analysis. This exclusion had the effect of narrowing the migration window for inclusion of data in the analysis (equally for all yrs) by removing cases at the start and/or end of the season.

The full regression (with the reduced dataset) included the following independent variables: dummy variables for each year except for one reference year (e.g., *Y80* = 1 if year = 1980, otherwise *Y80* = 0), first- through sixth-order *date* (day-of-the-year) terms, *moon phase* (days from nearest new moon and its square), and 13 weather variables. The first- through sixth-order *date* terms allowed description of a relatively complex seasonal pattern of abundance while avoiding overfit that might result from inclusion of additional higher order terms. The weather variables were constructed from data provided by the U.S. National Oceanic and Atmospheric Administration from Lansing, Michigan (precipitation) and from Grand Rapids, Michigan (all other weather data). *Precipitation* was the daily accumulated amount from midnight to noon. Other variables were means of the hourly values at 1300, 1600, 1900, and 2200 hours from the previous day and at 0100, 0400, 0700, and 1000 hours of the current day. These variables were: *cloud cover* (in tenths), square root of horizontal *visibility* distance, and first- and second-order terms for *temperature difference from normal* and for 4 *wind speed/direction* terms. Normal temperature was calculated from a fourth power polynomial regression of mean temperature on day for all dates 1 July–30 November, 1970–91. Mean daily wind speed was the mean of the every-third-hour wind 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 daily counts normalizes the distribution of the residuals in the regression, then the adjusted mean transformed count will provide an estimate of the median count in the original scale (not the mean). To obtain an estimate of the mean count in the original scale, we add one-half the estimated error variance of the regression to the adjusted mean transformed count (Finney 1941, 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

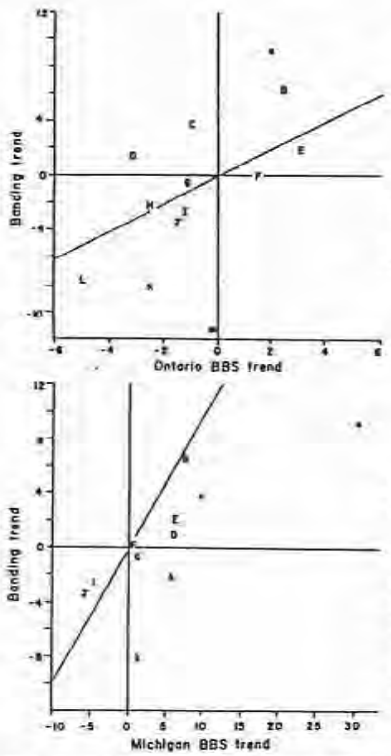

Fig. 3. Trends in Michigan banding totals (2 sites combined) compared with BBS trends for Ontario (top) and Michigan (bottom). Diagonal lines represent equality of trends from the 2 sources. Letters represent species as follows (lower case indicates BBS sample size of 10–15 routes, upper case indicates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

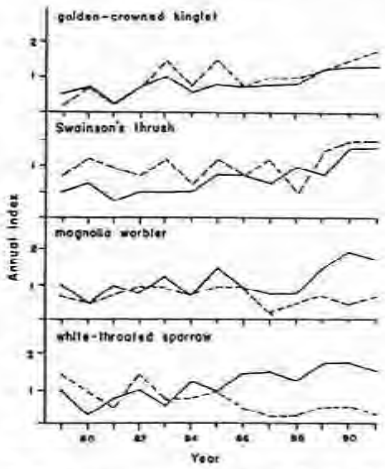

Fig. 4. Comparison of annual indices from the 2 netting sites for a sample of species. Solid line = River, dashed line = Marsh.

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 ($r = 0.783$, $P = 0.02$, $n = 8$). 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.

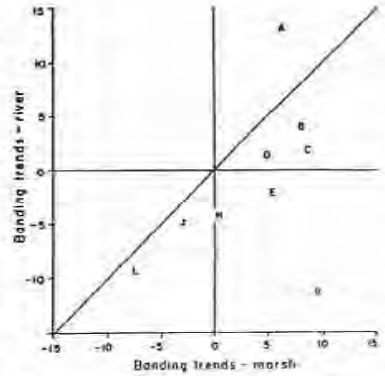

Fig. 5. Comparison of banding trends from River and Marsh. Species codes and diagonal line as for Fig. 3.

ized conditions of date, moon phase and weather.

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

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

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

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

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

Netting site	No. of species[2]	r_s[1] Ontario[3]	Michigan
River	9	0.52† (0.56*)	0.92***
Marsh	9	0.52† (0.65*)	0.57+
Combined	11	0.69** (0.59*)	0.84***

[1] Spearman rank correlation coefficients r_s, 1-tailed significance: *** = $P \leq 0.001$, ** = $P \leq 0.01$, * = $P \leq 0.05$, † = $0.05 \leq P \leq 0.1$.
[2] Sample size at River alone insufficient for dark-eyed junco, at Marsh for Canada warbler, and at both sites for black-throated green warbler.
[3] No. in parentheses show r_s when analysis includes Tennessee warbler (all 3 comparisons) and bay-breasted warbler (combined area only).

RESULTS

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

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

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

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

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

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

We observed divergence in trends from the River and Marsh sites (Fig. 5), even though they are only 0.75 km apart. Differences were small in most species, but significant in white-throated sparrow, and the River site had generally more negative trends. The most likely cause of these discrepancies is differential growth in vegetation. Migrants are selective in foraging habitat (Hutto 1985, Moore and Simons 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, trends for individual species can differ (Fig. 3). They can even differ between nearby stations with the same monitoring technique, as did white-throated sparrow in this study (Fig. 5). In deciding how much reliance to place on a given trend, consideration should be given to sample size, significance level and limitations of the particular monitoring program or migration site. Independent corroboration is always desirable.

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APPENDIX 2

MIGRATION MONITORING PROTOCOL

Inglewood Bird Sanctuary

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

Goals and Objectives

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

Definition of Monitored Area

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

Definition of Count Period

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

Personnel Requirements

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

Migration Count Methods

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

Daily Census

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

Mist-Netting

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

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

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

Incidental Observations

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

Probable and Known Stopovers (PKS)

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

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

A number of species at IBS are both resident in small numbers and occur as migrants to a greater or lesser degree. Other species are migrants but use IBS as a roosting or loafing area. In both these cases differentiating PKS from migrants on any given day is problematic. Further compounding this uncertainty is the fact that contract banders, lacking intimate knowledge of IBS and its avifauna, may 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
Double-crested Cormorant
Great Blue Heron
Canada Goose
Wood Duck
Mallard
Gadwall
American Wigeon
Common Goldeneye
Common Merganser
Osprey
Swainson's Hawk
Red-tailed Hawk
American Kestrel
Merlin
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 casualy observed;
- run down the list on the log sheet asking for other observations. Some judgements must be made and can include good estimates but <u>not</u> 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 neccessary for each new banding, recapture, escape and mortality;**

- *Net Log* - this form contains columns for the opening and closing times for each net, total amount of time each net is up, as well as space to record brief weather data at specific times during the day;

- *Estimated Daily Totals* - this form is the end result of each day's effort from all personnel involved at the migration monitoring station. It contains columns for each species of bird likely to occur during fall migration at IBS. Next to the species names are columns for numbers of newly banded birds, repeat captures, census tally and casual observations. Casual observations may be recorded in the appropriate area on the 2nd side of this EDT form. From this data and discussion amongst the day's participants, a daily estimated daily total is arrived at for each species.

Knowledge, Skills and Experience Required

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

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

Potential Habitat Changes

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

Site-specific Field Procedures

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

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

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

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Daily Log

Calgary Bird Banding Society

Date	
Location	
Bander-in-Charge	
Volunteer	
Volunteer	

Narrative

Bird Migration

Bird Injuries and Mortalities

Non-avian Fauna and Flora

Management of the Station

Signed (BIC)

Net Log

Calgary Bird Banding Society

A.M.

net #	times open open-close	hours min.	hours tenths
1	: - :		.
2	: - :		.
3	: - :		.
4	: - :		.
5	: - :		.
6	: - :		.
7	: - :		.
8	: - :		.
9	: - :		.
10	: - :		.
11	: - :		.
12	: - :		.
13	: - :		.
14	: - :		.
15	: - :		.
16	: - :		.
17	: - :		.
18	: - :		.
19	: - :		.
20	: - :		.
	: - :		.
	: - :		.
	: - :		.
	: - :		.
	: - :		.
		Total	.

Weather				
	temp.	wind	direction	sky condition
opening				
midpoint				
close				

Signed (BIC)

Location _____

Date _____

NOTES:

P.M.

net #	times open open-close	hours min.	hours tenths
1	: - :		.
2	: - :		.
3	: - :		.
4	: - :		.
5	: - :		.
6	: - :		.
7	: - :		.
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9	: - :		.
10	: - :		.
11	: - :		.
12	: - :		.
13	: - :		.
14	: - :		.
15	: - :		.
16	: - :		.
17	: - :		.
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20	: - :		.
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	: - :		.
		Total	.

Weather				
	temp.	wind	direction	sky condition
opening				
midpoint				
close				

Signed (BIC)

Calgary Bird Banding Society - Inglewood Bird Sanctuary

Estimated Daily Totals

Bander-in-Charge_____ DATE_____

	new	repeats				EDT	
	bandings	total	same day	census	casual	Migrants	PKS
Common Loon							
American White Pelican							
Double-cr. Cormorant							
Great Blue Heron							
Canada Goose							
Wood Duck							
Gadwall							
Mallard							
American Wigeon							
Common Goldeneye							
Common Merganser							
Osprey							
Sharp-shinned Hawk							
Cooper's Hawk							
Northern Goshawk							
Swainson's Hawk							
Red-tailed Hawk							
American Kestrel							
Merlin							
Ring-necked Pheasant							
Killdeer							
Greater Yellowlegs							
Lesser Yellowlegs							
Solitary Sandpiper							
Spotted Sandpiper							
Sandpiper spp.							
Common Snipe							
Franklin's Gull							
Ring-billed Gull							
California Gull							
Herring Gull							
Gull spp.							
Rock Dove							
Great Horned Owl							
Belted Kingfisher							
Yellow-be. Sapsucker							
Downy Woodpecker							
Hairy Woodpecker							
Northern Flicker							

	new	repeats				EDT	
	bandings	total	same day	census	casual	Migrants	PKS
Olive-sided Flycatcher							
Western Wood-Pewee							
Trail's Flycatcher							
Least Flycatcher							
Empidonax spp.							
Flycatcher spp.							
Eastern Kingbird							
Blue-headed Vireo							
Cassin's Vireo							
Warbling Vireo							
Red-eyed Vireo							
Vireo spp.							
Blue Jay							
Black-billed Magpie							
American Crow							
Common Raven							
Tree Swallow							
N Rough-winged Swallow							
Bank Swallow							
Cliff Swallow							
Barn Swallow							
Swallow spp.							
Black-capped Chickadee							
Red-breasted Nuthatch							
White-breasted Nuthatch							
Nuthatch spp.							
House Wren							
Golden-crowned Kinglet							
Ruby-crowned Kinglet							
Swainson's Thrush							
Hermit Thrush							
American Robin							
Gray Catbird							
Brown Thrasher							
European Starling							
Cedar Waxwing							
Tennessee Warbler							
Orange-crowned Warbler							
Nashville Warbler							

	new	repeats				EDT	
	bandings	total	same day	census	casual	Migrants	PKS
Yellow Warbler							
Magnolia Warbler							
Yellow-rumped Warbler							
Townsend's 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							
American Tree Sparrow							
Chipping Sparrow							
Clay-colored Sparrow							
Song Sparrow							
Lincoln's Sparrow							
White-throated Sparrow							
White-crowned Sparrow							
Dark-eyed Junco							
Sparrow spp.							
Rose-breasted Grosbeak							
Red-winged Blackbird							
Rusty Blackbird							
Brewer's Blackbird							
Common Grackle							
Brown-headed Cowbird							
Blackbird spp.							
Baltimore Oriole							
Purple Finch							
Pine Siskin							
American Goldfinch							
House Sparrow							

Casual Observations (other than census)

Time	Species	Number	Notes (location, direction of flight etc.)

Band Size__________ Location:________________________ BIC: ________________________________

D	Band Number	Species Code	Age	How	Sex	How	Wing mm	Mass gm	Skull	Primary Molt											Fat	CP	BP	Date	time banded	trap type	trap #	bander	comments
										1	2	3	4	5	6	7	8	9	10	11									
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APPENDIX 3

New Bandings at Inglewood Bird Sanctuary - Fall 1999

	July						August																		
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mallard															1											
Sharp-shinned Hawk																										
Solitary Sandpiper							1																			
Spotted Sandpiper										1													1			
Belted Kingfisher	1														1									1		
Downy Woodpecker	1											1						1								
Northern Flicker																							1			
Western Wood-Pewee	1	1					2	1	2	1			1													
Yellow-bellied Flycatcher																										1
Traill's Flycatcher		1											1		1	1	2	3		1	1	2	1		3	
Least Flycatcher														1			3	2				1	1			
Eastern Kingbird	1												1													
Warbling Vireo							1	2							1	1							1			
Red-eyed Vireo																							1			
Black-billed Magpie																										
Black-capped Chickadee	1										1	1											1			
Red-breasted Nuthatch																										
White-breasted Nuthatch																1	1									
Brown Creeper																										
House Wren	4	2					3	2									2	3		2	1	1				2
Golden-crowned Kinglet																										
Ruby-crowned Kinglet																										
Swainson's Thrush		1																								1
Hermit Thrush																										
American Robin	9	1	7				6	5		1	2	1	1			2	2		3	1	1			1		
Gray Catbird	1																				1					
Bohemian Waxwing																1										
Cedar Waxwing	1						1									8	1	6	7		1					
Tennessee Warbler								1				1	1		15	13	16	7	2	12	7	4	1	1	7	6
Orange-crowned Warbler																										
Nashville Warbler																										
Yellow Warbler	2						4	6	5	1	12	3	12	9	16	6	7	10	5	9	5	2	1	4	8	2
Chestnut-sided Warbler																										
Magnolia Warbler																										
Yellow-rumped Warbler																			1						1	
Black-throated Green Warbler																										

New Bandings at Inglewood Bird Sanctuary - Fall 1999

	July						August																			
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Townsend's Warbler																									1	
Palm Warbler																										
Bay-breasted Warbler																										
Blackpoll Warbler																										
American Redstart																										
Ovenbird																					1					
Northern Waterthrush											1	2		1	8	2	5	1				1	1	4	1	
Connecticut Warbler																										
Mourning Warbler																										
MacGillivray's Warbler																										
Common Yellowthroat																										
Wilson's Warbler															1						1	4	1			2
Canada Warbler																			1							
Western Tanager	3		1																							
American Tree Sparrow																										
Chipping Sparrow	2								2			1	3		19	1	2	5	4		4		3	8	17	6
Clay-colored Sparrow	2	2								1		1			1		1				7	1	1	1	1	
Brewer's Sparrow																								1		
Fox Sparrow																										
Song Sparrow			3										1	1	2		1	1			1	2				
Lincoln's Sparrow	1											1						1								
Swamp Sparrow																										
White-throated Sparrow																										
White-crowned Sparrow																										
Dark-eyed Junco																										
Rose-breasted Grosbeak							1	1																		
Red-winged Blackbird																						2				
Baltimore Oriole							1	1										2	1							
Puple Finch																						1				
American Goldfinch															2											
	30	8	11	0	0	0	20	19	9	5	16	12	21	12	68	36	43	42	24	25	31	21	15	21	39	20

New Bandings at Inglewood Bird Sanctuary - Fall 1999

	August											September													
	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mallard																										
Sharp-shinned Hawk						1											1									
Solitary Sandpiper														1												
Spotted Sandpiper																										
Belted Kingfisher														1		1						1		1	1	1
Downy Woodpecker																										
Northern Flicker																1				1			2			3
Western Wood-Pewee													1													
Yellow-bellied Flycatcher																										
Traill's Flycatcher			1						1				2	1	1							1				
Least Flycatcher		1										1						1								
Eastern Kingbird																										
Warbling Vireo		1	1																							
Red-eyed Vireo														1												
Black-billed Magpie																			2							
Black-capped Chickadee																										
Red-breasted Nuthatch																	1									
White-breasted Nuthatch																										1
Brown Creeper																										
House Wren	2					2						1	1	1			1									
Golden-crowned Kinglet																										
Ruby-crowned Kinglet																										
Swainson's Thrush												1											1	1	1	
Hermit Thrush																										
American Robin		1			1																					1
Gray Catbird	1					1													1							
Bohemian Waxwing																										
Cedar Waxwing																										
Tennessee Warbler	1	1		3						1		2						1							1	1
Orange-crowned Warbler										1			1				3	1		1	2	2	2	1	5	6
Nashville Warbler														1												
Yellow Warbler				1	1	1			2	1		1		1							1					
Chestnut-sided Warbler									1																	
Magnolia Warbler									1			1														
Yellow-rumped Warbler	2		1	9	6					1			1			1	2			1	7		6			52
Black-throated Green Warbler																					1					

New Bandings at Inglewood Bird Sanctuary - Fall 1999

	August											September													
	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Townsend's Warbler					1													1								
Palm Warbler																				1						1
Bay-breasted Warbler				1																						
Blackpoll Warbler													1			2							1			
American Redstart				1					1			1		1											1	
Ovenbird				3		1			1			1		1	1											
Northern Waterthrush	1	1	1							1				2	3							1	1	2		
Connecticut Warbler															1	1						1				
Mourning Warbler													1													
MacGillivray's Warbler						1						1														
Common Yellowthroat															1	1						1				1
Wilson's Warbler				3	2					1		1	4	1	4	1	34	3	6	2	4	6	4	1	3	
Canada Warbler																										
Western Tanager																										
American Tree Sparrow																										
Chipping Sparrow		2	1														2			1						
Clay-colored Sparrow		1		1	1								1		1							1				
Brewer's Sparrow																										
Fox Sparrow																										
Song Sparrow				2	2								1	1										1		1
Lincoln's Sparrow					2					1		2	1	1	3	1			2		1		3	1	1	3
Swamp Sparrow																						1				
White-throated Sparrow													3						1		2	3	7			1
White-crowned Sparrow																	1				1		4	3	5	2
Dark-eyed Junco																					1					
Rose-breasted Grosbeak																										
Red-winged Blackbird																										
Baltimore Oriole																										
Puple Finch																										
American Goldfinch																										
	7	8	5	24	16	7	0	0	7	7	0	13	18	14	15	9	45	7	12	7	20	18	31	11	18	74

New Bandings at Inglewood Bird Sanctuary - Fall 1999

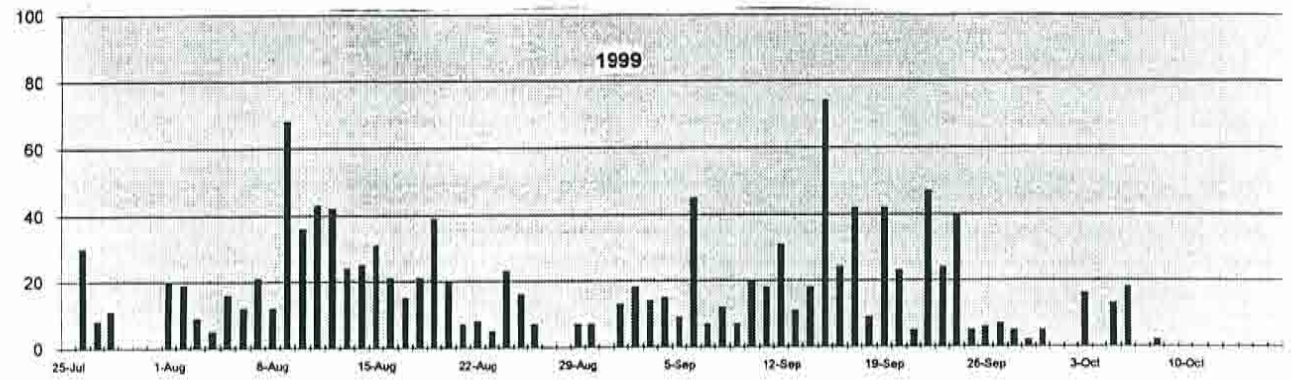
	September															October									Total
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8		
Mallard																									1
Sharp-shinned Hawk			1																						3
Solitary Sandpiper																									2
Spotted Sandpiper																									2
Belted Kingfisher	1																								10
Downy Woodpecker																									3
Northern Flicker			1		2																				11
Western Wood-Pewee																									10
Yellow-bellied Flycatcher																									1
Traill's Flycatcher																									24
Least Flycatcher																									11
Eastern Kingbird																									2
Warbling Vireo																									8
Red-eyed Vireo																									2
Black-billed Magpie																									2
Black-capped Chickadee				1					1			3									1				10
Red-breasted Nuthatch																		1							2
White-breasted Nuthatch																		1							4
Brown Creeper																				1					1
House Wren				1	1		1																		33
Golden-crowned Kinglet										1	1														2
Ruby-crowned Kinglet									2			1			1			1							5
Swainson's Thrush	1	2	1	9																					19
Hermit Thrush		1				1	2	1				1	1		2										9
American Robin		2		2	8		1	1																	60
Gray Catbird																									5
Bohemian Waxwing																									1
Cedar Waxwing																									25
Tennessee Warbler				1																					106
Orange-crowned Warbler	5	14	3	9	3	1	9	5	11			1	2		1			2							91
Nashville Warbler																									1
Yellow Warbler																									138
Chestnut-sided Warbler																									1
Magnolia Warbler																									2
Yellow-rumped Warbler	13	4	1	5	5		22	6	19		1			2				1		8	17				195
Black-throated Green Warbler																									1

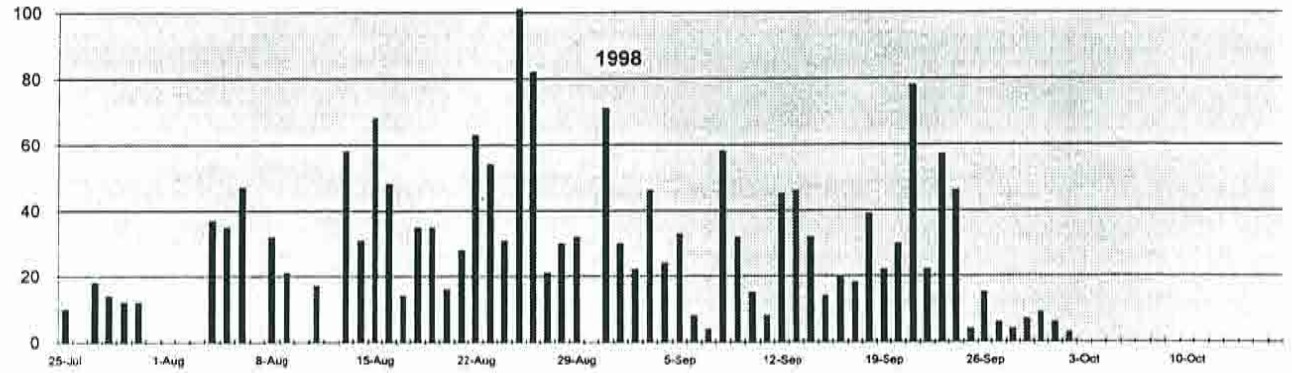
New Bandings at Inglewood Bird Sanctuary - Fall 1999

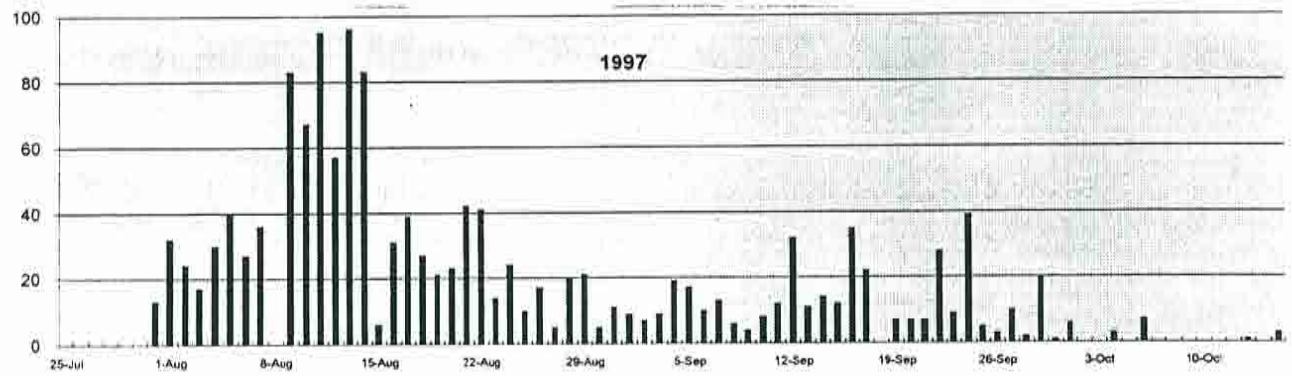
	September															October									Total
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8		
Townsend's Warbler																									3
Palm Warbler		1					3		1																7
Bay-breasted Warbler																									1
Blackpoll Warbler		1																							5
American Redstart																									5
Ovenbird		1		1																					11
Northern Waterthrush		1																							41
Connecticut Warbler																									3
Mourning Warbler																									1
MacGillivray's Warbler																									2
Common Yellowthroat	2	1						1																	8
Wilson's Warbler	1	2	1	1	2			1		2								1							100
Canada Warbler																									1
Western Tanager																									4
American Tree Sparrow															1					1					2
Chipping Sparrow																									83
Clay-colored Sparrow				1																					26
Brewer's Sparrow																									1
Fox Sparrow						1																			1
Song Sparrow									1																21
Lincoln's Sparrow		3	1	4		1	3	3	2	1		1	2					2							48
Swamp Sparrow								1										1							3
White-throated Sparrow		6		6	2	1	4	5	3	1	3							6							54
White-crowned Sparrow	1	2					2				1														22
Dark-eyed Junco		1		1																3			2		8
Rose-breasted Grosbeak																									2
Red-winged Blackbird																									2
Baltimore Oriole																									5
Puple Finch																									1
American Goldfinch																									2
	24	42	9	42	23	5	47	24	40	5	6	7	5	2	5	0	0	16	0	13	18	0	2		1276

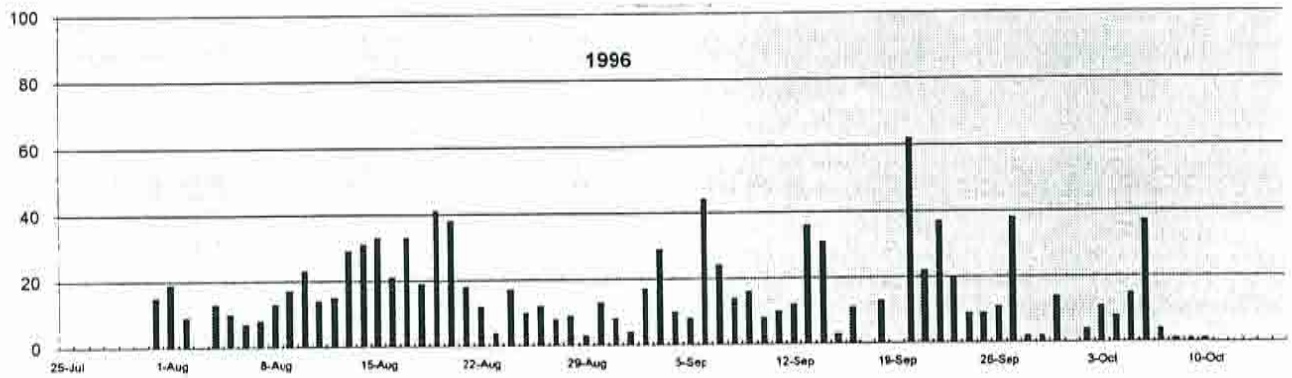
APPENDIX 4

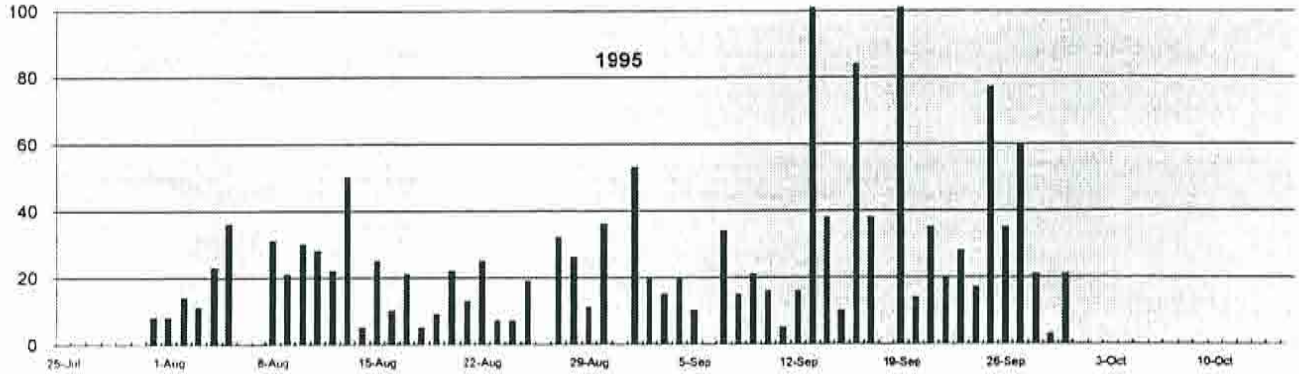
Fall Migration Phenology at Inglewood Bird Sanctuary Based on New Bandings











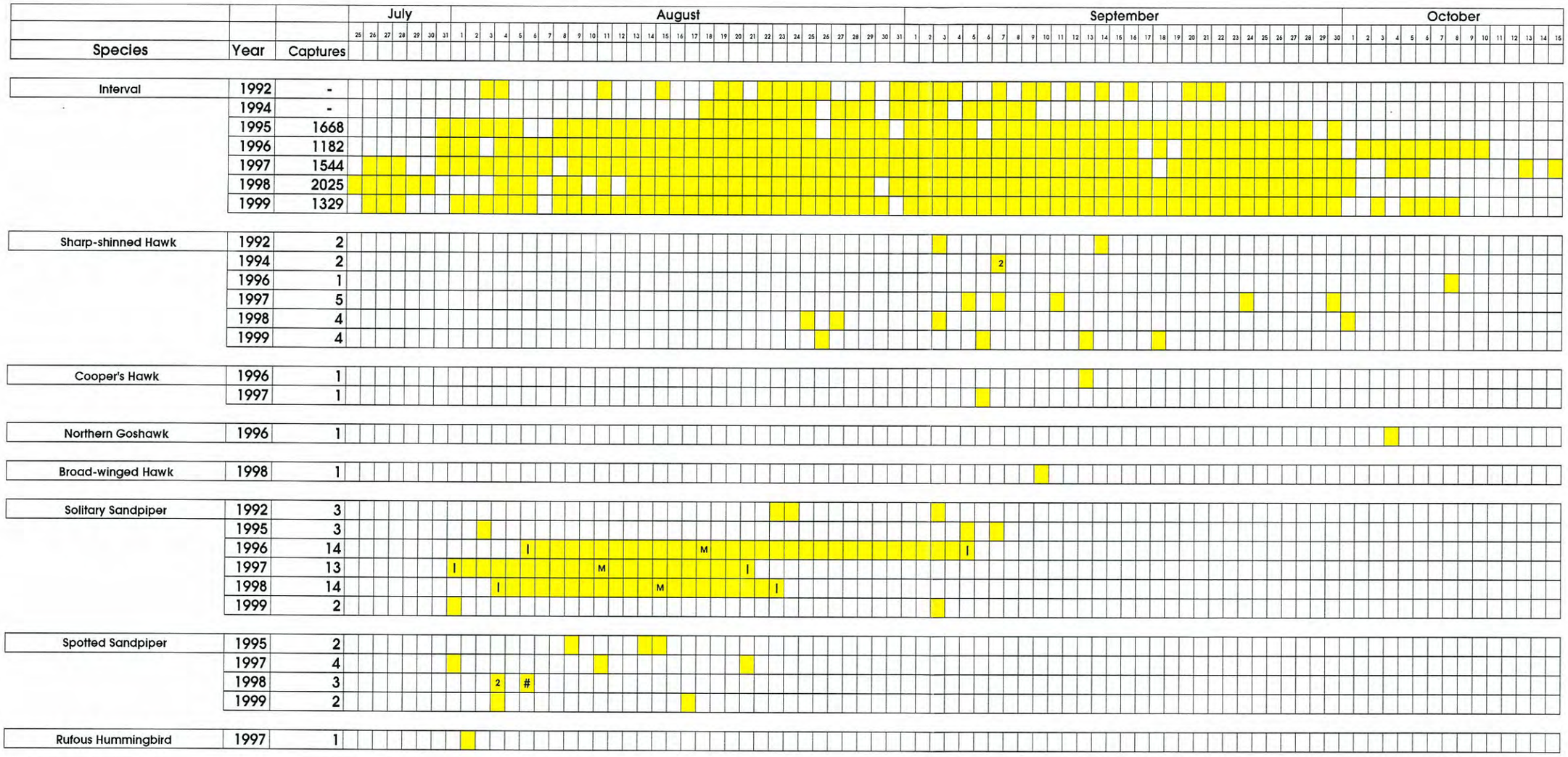
APPENDIX 5

Top 20 New Bandings at Inglewood Bird Sanctuary

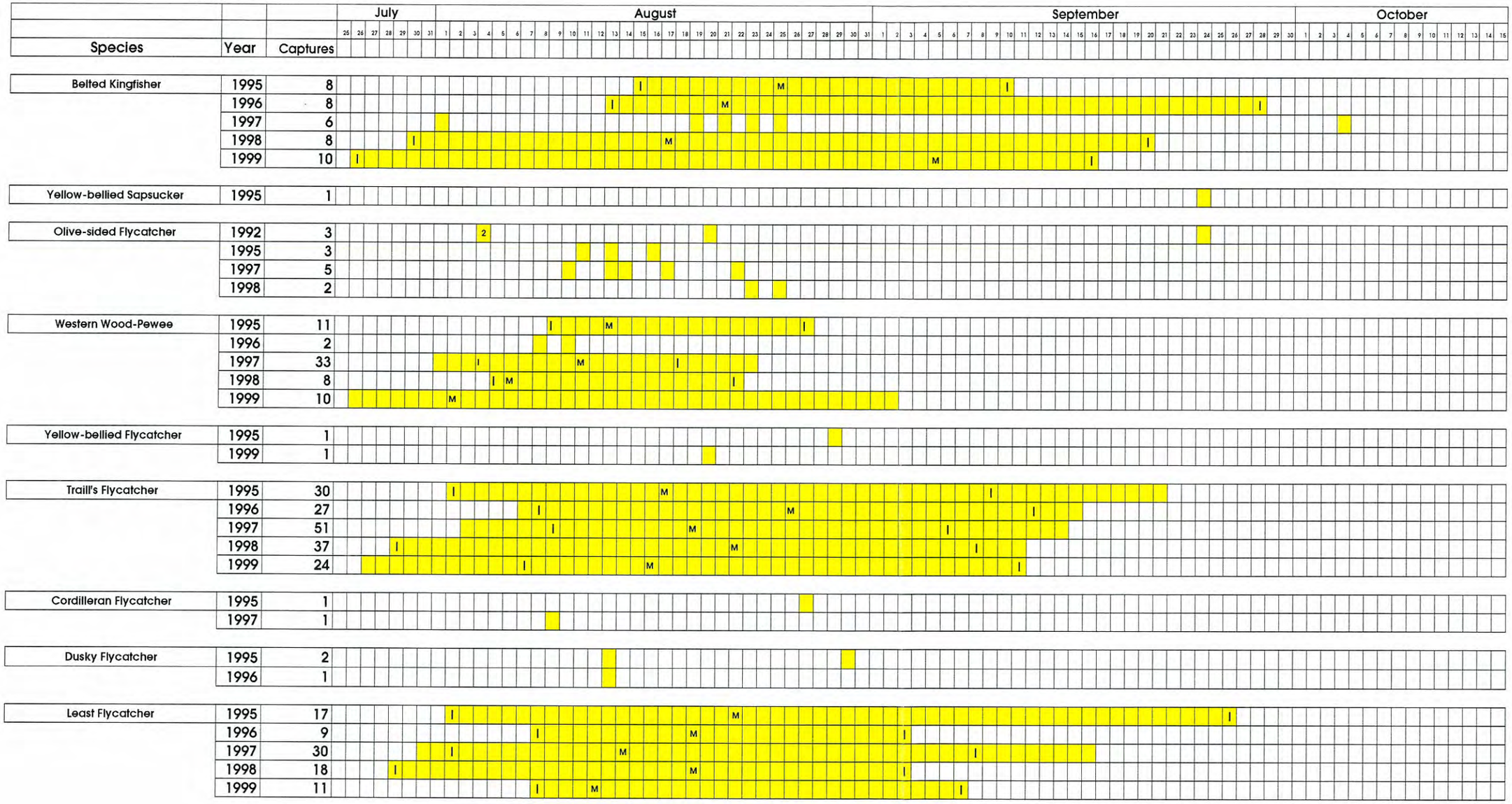
	Total		1999		1998		1997		1996		1995	
	Rank	Number			Rank	Number	Rank	Number	Rank	Number	Rank	Number
Yellow-rumped Warbler	1	1612	1	195	1	638	1	191	3	92	1	496
Orange-crowned Warbler	2	586	5	91	2	207	5	86	2	116	2	177
Wilson's Warbler	3	509	4	100	3	113	4	119	1	175	4	102
Yellow Warbler	4	334	2	138	4	91	3	137	5	62	8	44
American Robin	5	307	7	60	12	31	6	81	4	81	3	114
Chipping Sparrow	6	221	6	83	15	27	2	151	20	14	12	29
White-throated Sparrow	7	217	8	54	5	77	12	39	11	28	5	73
House Wren	8	196	11	33	8	49	9	52	8	45	7	50
Tennessee Warbler	9	189	3	106	6	74	8	52	9	30	10	33
Lincoln's Sparrow	10	153	9	48	7	59		13	12	28	6	53
Northern Waterthrush	11	151	10	41	16	26	11	46	6	56	13	23
Traill's Flycatcher	12	140	14	24	11	36	10	50	13	25	11	29
Cedar Waxwing	13	134	13	25		11	7	67		14	9	42
Swainson's Thrush	14	107	17	19	14	28		10	7	52	16	17
Ovenbird	15	89	20	11	9	38		11	10	30		10
White-crowned Sparrow	16	87	15	22	17	21	16	22	14	24	15	20
Warbling Vireo	17	76		8		18	15	27	15	18	20	13
Least Flycatcher	18	69	19	11		14	14	30		9	18	16
Clay-colored Sparrow	19	65	12	26	10	37	17	21		6		1
Ruby-crowned Kinglet	20	62		5		14	18	20	16	18		10
Blackpoll Warbler		61		5	13	30		6		8	17	17
Eastern Kingbird		61		2	19	19	19	17	17	18		7
Western Wood-Pewee		54		10		8	13	33		2		11
Baltimore Oriole		53		5		8		12		12	14	21
Song Sparrow		51	16	21		18	20	15		9		9
Black-capped Chickadee		48		10	20	19		5	18	17		7
Solitary Sandpiper		44		2		14		13		14		3
Dark-eyed Junco		43		8		10		3	19	15	19	15
American Redstart		33		5	18	20		4		6		3
Northern Flicker		22	18	11		3		7		8		4

APPENDIX 6

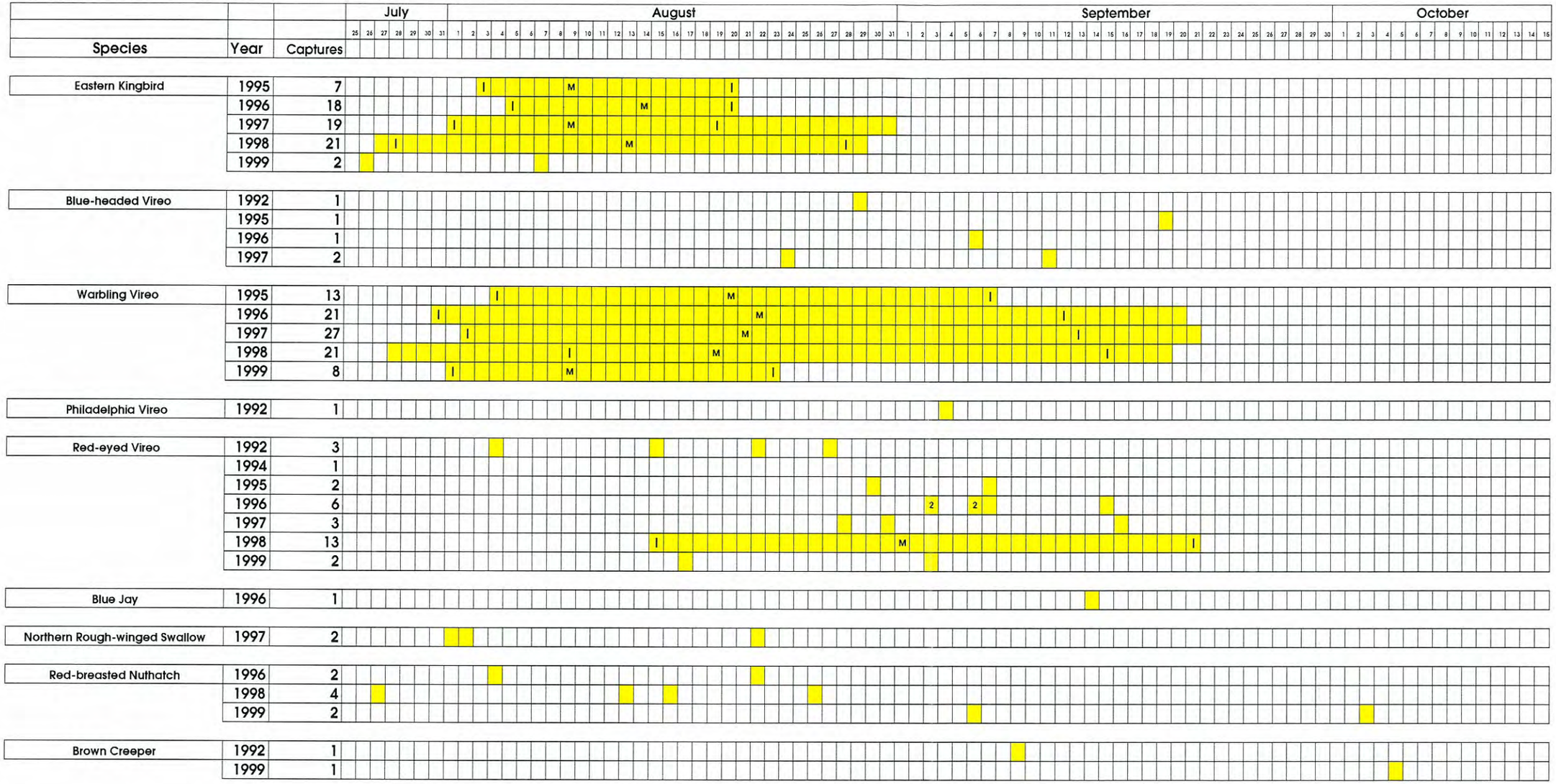
Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



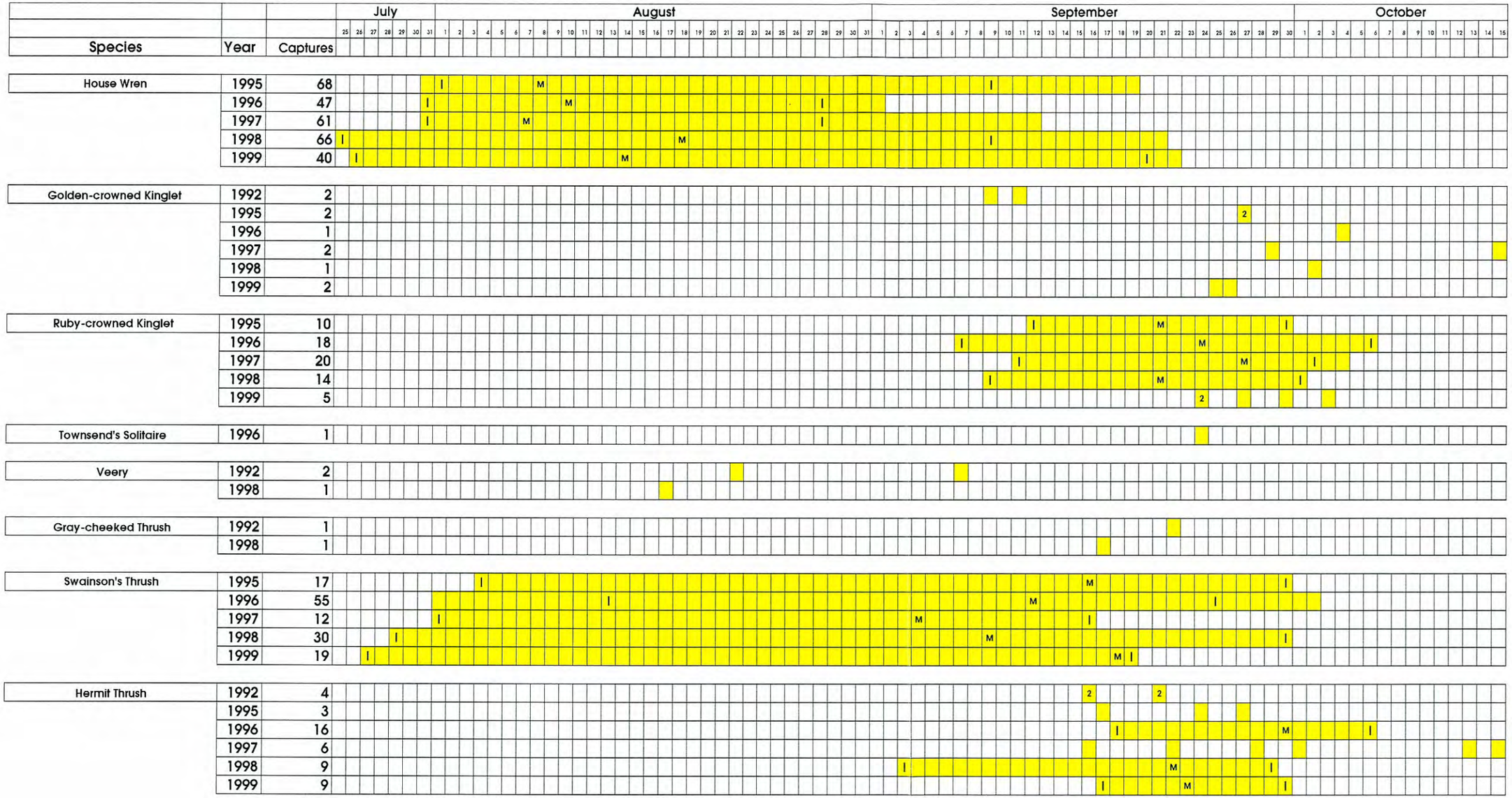
Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



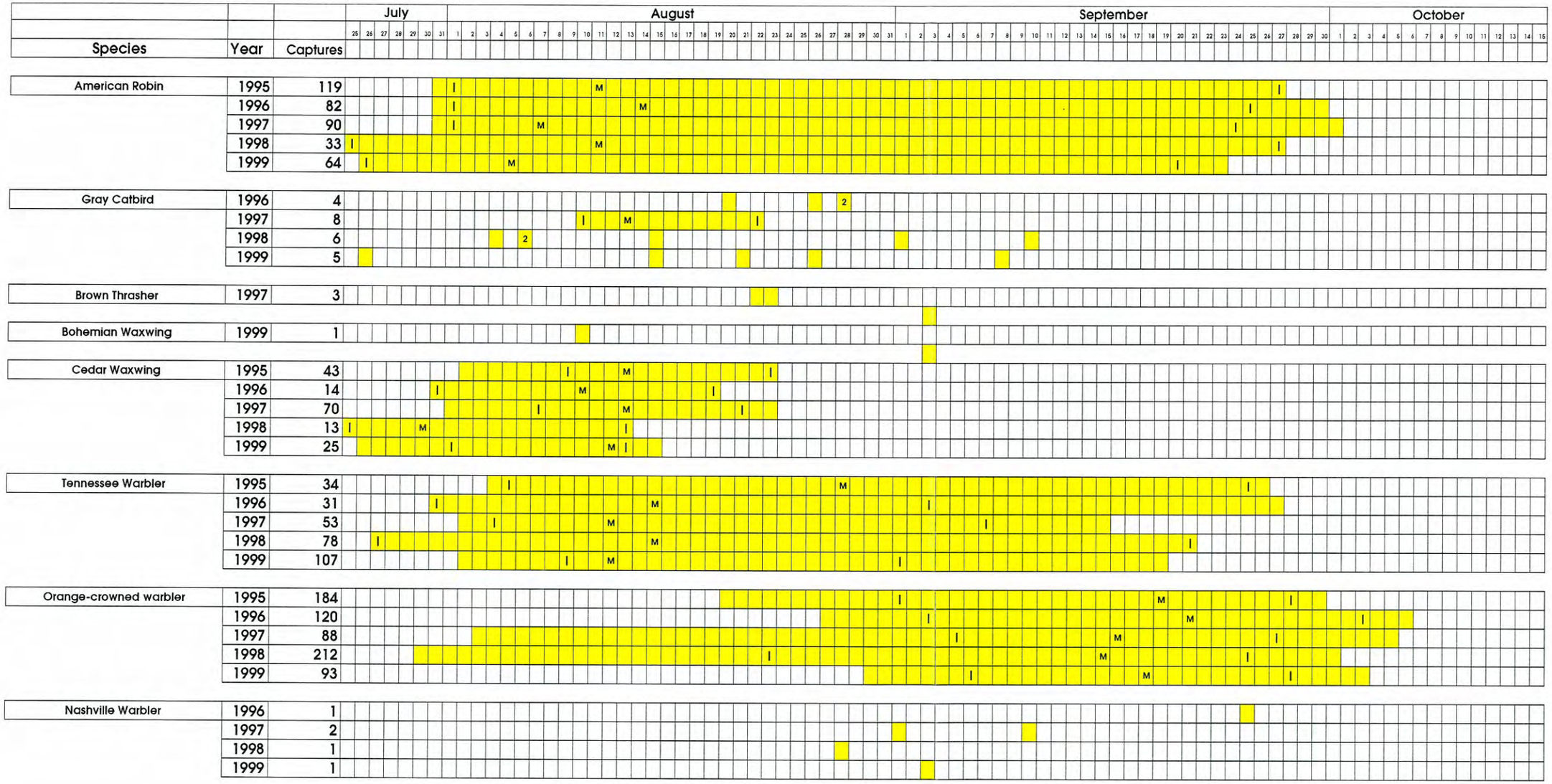
Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



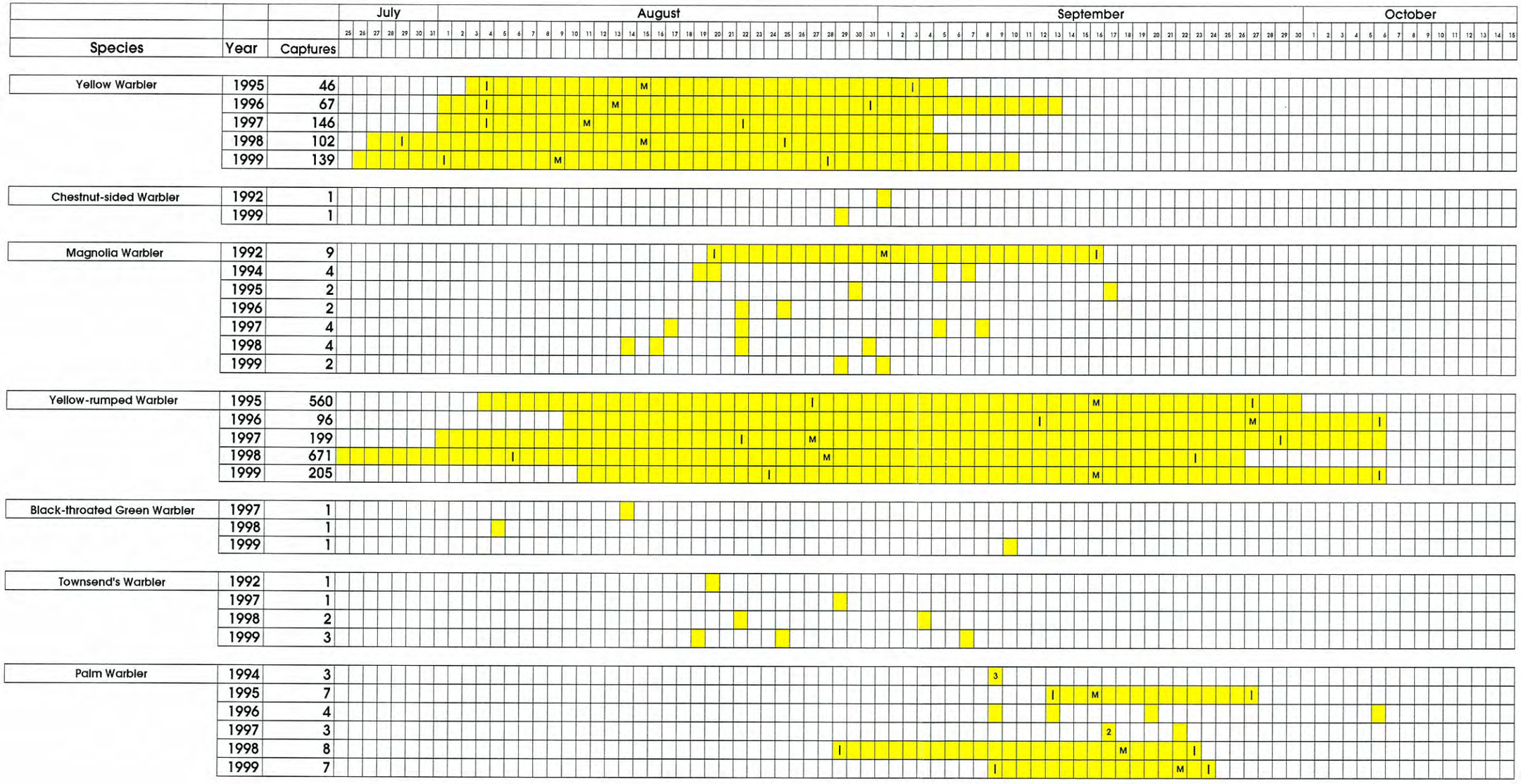
Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



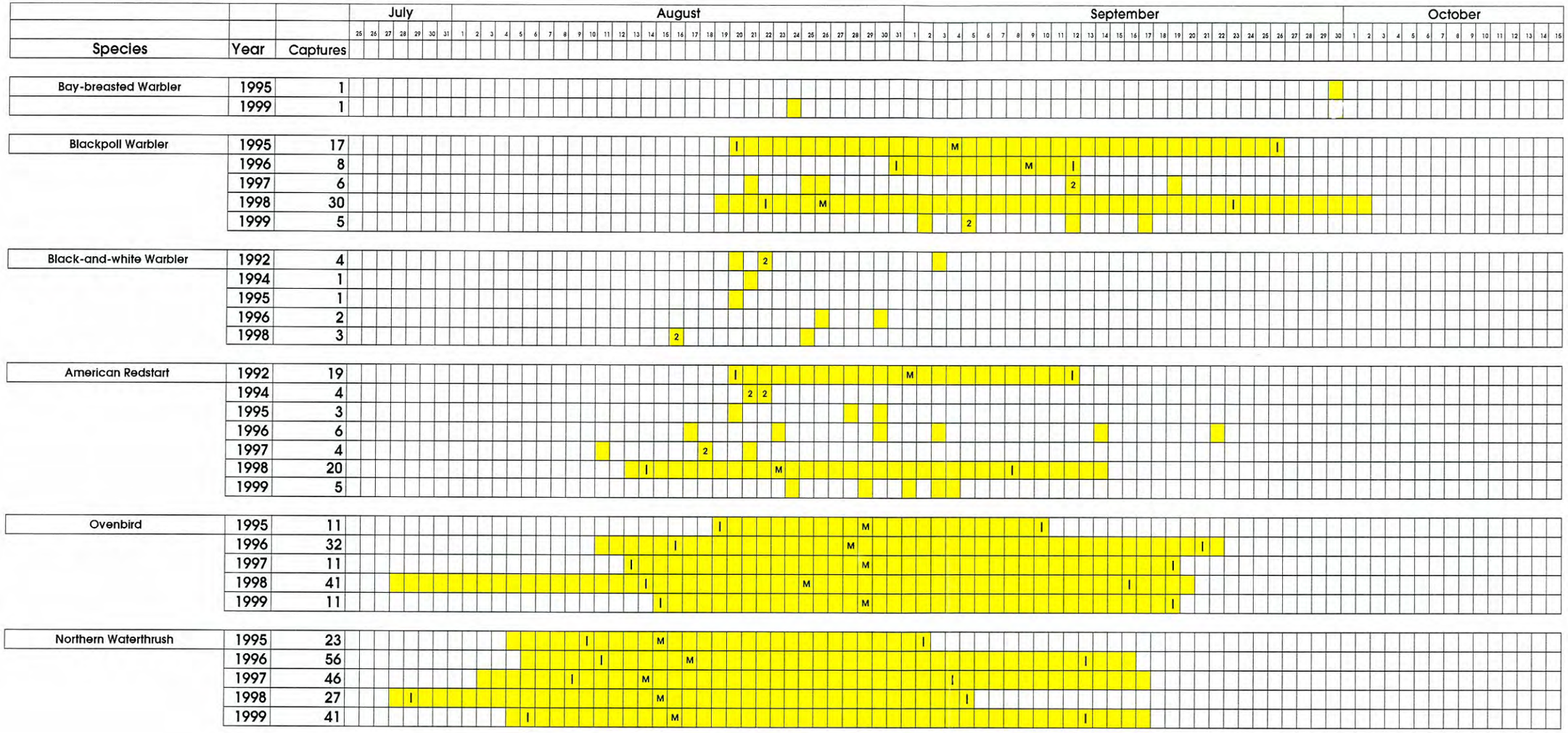
Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures

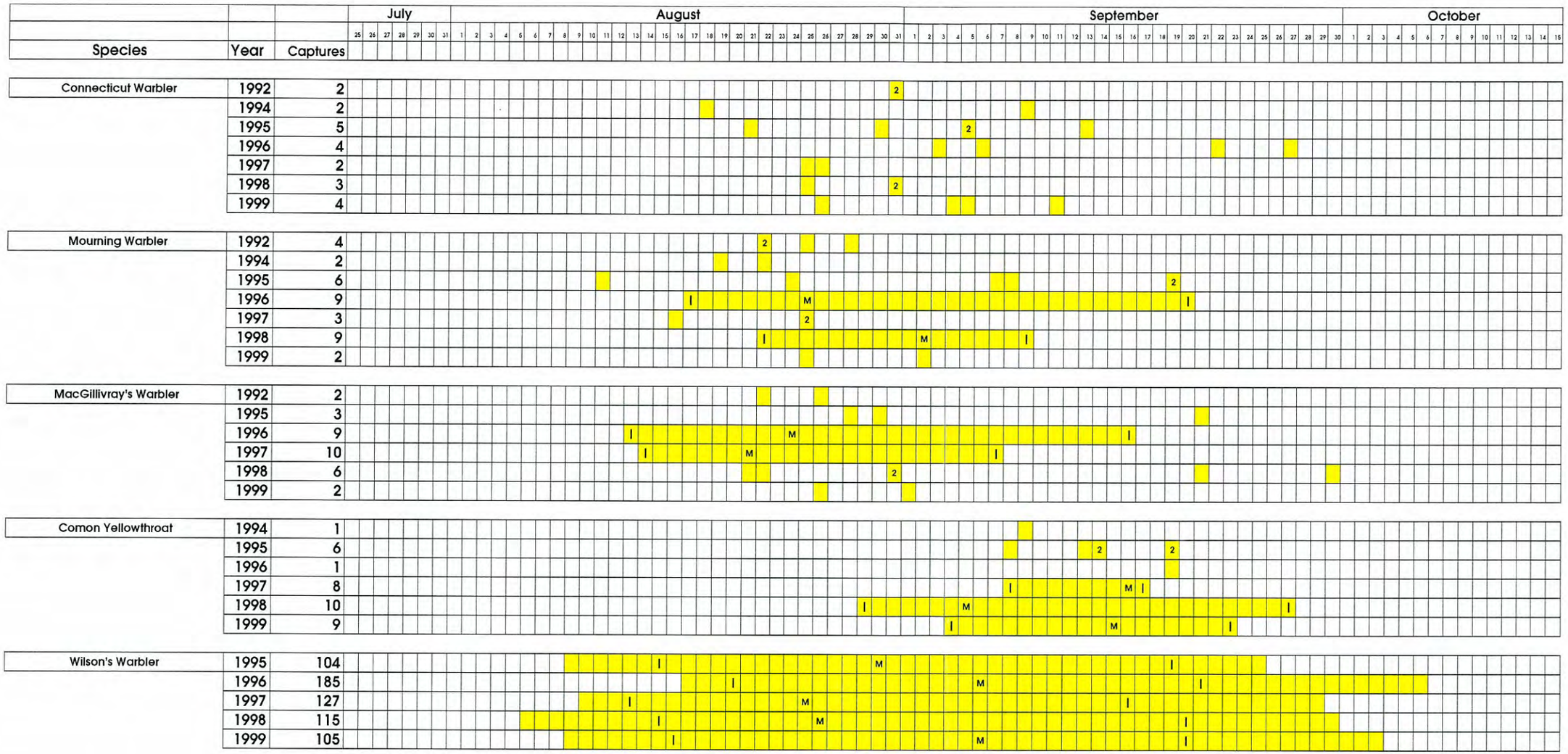


Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures

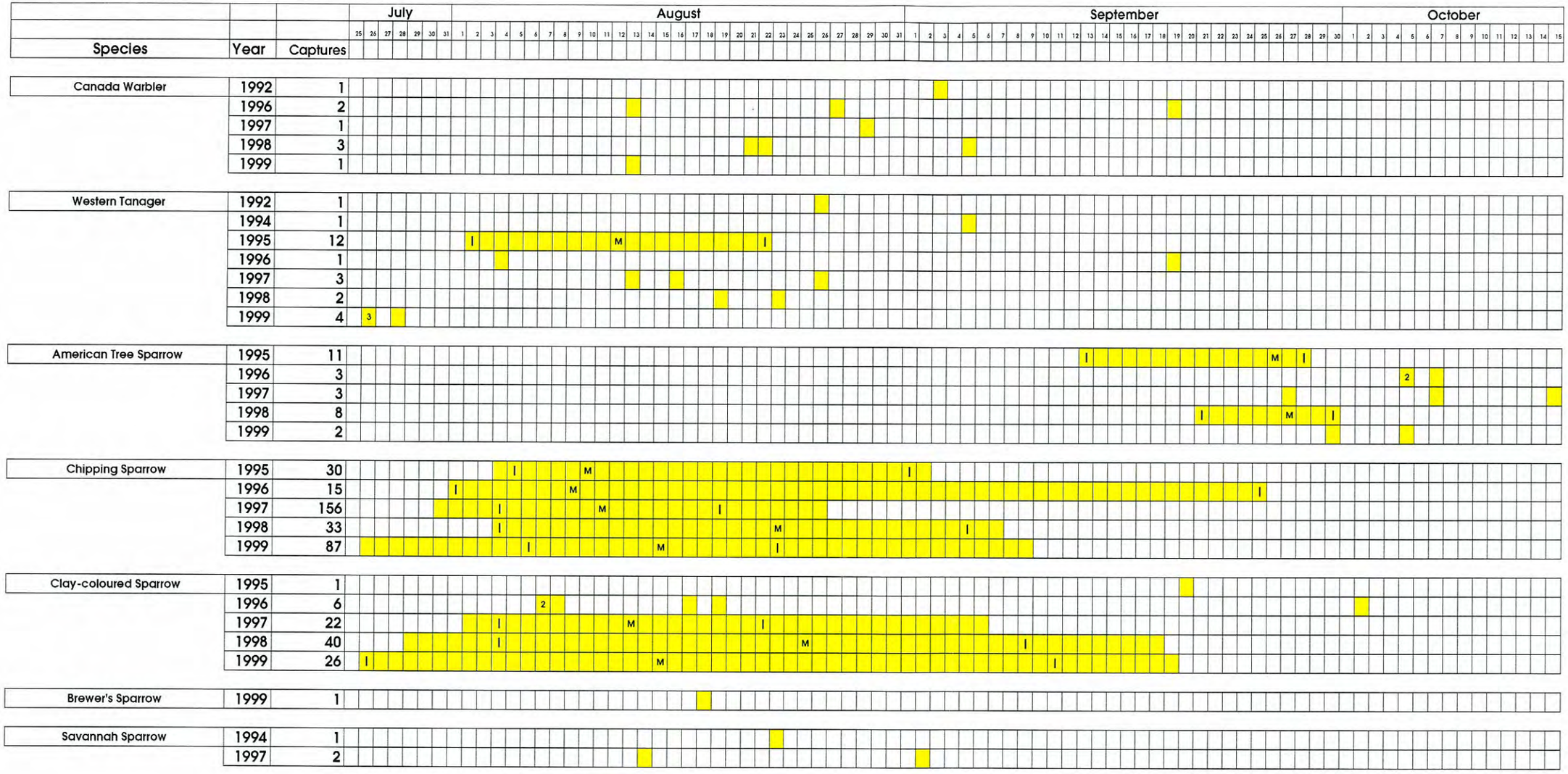


Species	Year	Captures
Bay-breasted Warbler	1995	1
	1999	1
Blackpoll Warbler	1995	17
	1996	8
	1997	6
	1998	30
	1999	5
Black-and-white Warbler	1992	4
	1994	1
	1995	1
	1996	2
	1998	3
American Redstart	1992	19
	1994	4
	1995	3
	1996	6
	1997	4
	1998	20
	1999	5
Ovenbird	1995	11
	1996	32
	1997	11
	1998	41
	1999	11
Northern Waterthrush	1995	23
	1996	56
	1997	46
	1998	27
	1999	41

Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures

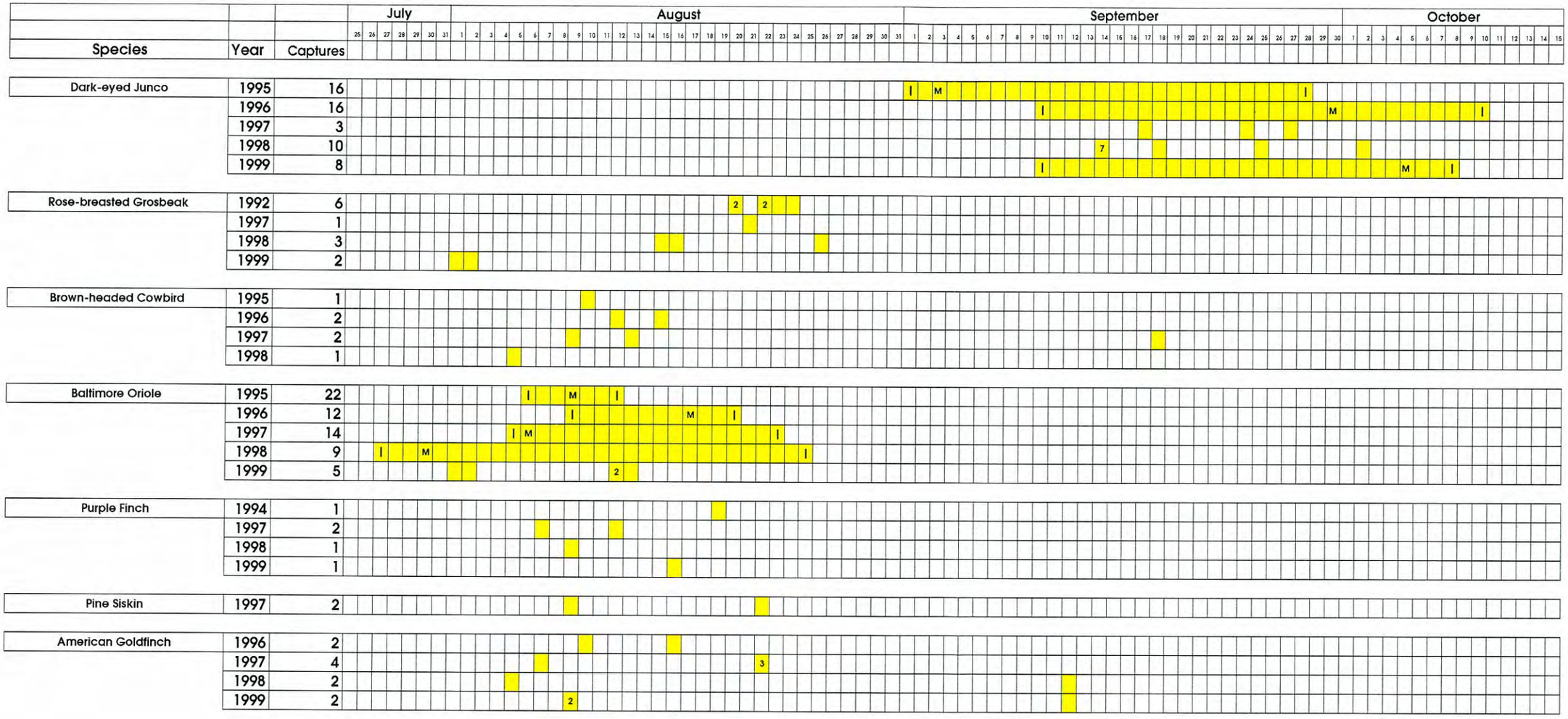


Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures

Fall Migration Phenology at Inglewood Bird Sanctuary - Based on New Captures



APPENDIX 7

Monitored Species at Inglewood Bird Sanctuary

	1995-1999			
	Multi-year Mean		Group	
	Number	Frequency	BSC	Baillie
Species				
Solitary Sandpiper	9	7		
Western Wood-Pewee	13	8	A	3
Traill's Flycatcher	33	20	A	1
Least Flycatcher	16	13	A	1
Eastern Kingbird	13	10	C	
Warbling Vireo	17	12	A	
House Wren	46	23	C	
Ruby-crowned Kinglet	13	10	B	2
Swainson's Thrush	25	17	A	1
American Robin	73	24	B	4
Cedar Waxwing	32	10	B	
Tennesee Warbler	59	22	A	1
Orange-crowned Warbler	135	28	A	1
Yellow Warbler	94	24	A	3
Yellow-rumped Warbler	322	35	B	2
Blackpoll Warbler	13	8	A	1
Ovenbird	20	13	A	3
Northern Waterthrush	38	19	A	1
Wilson's Warbler	122	33	A	1
Chipping Sparrow	61	16	B	4
Clay-colored Sparrow	18	11	A	
Song Sparrow	14	13	B	4
Lincoln's Sparrow	40	23	B	3
White-throated Sparrow	54	19	B	2
White-crowned Sparrow	22	12	B	2
Dark-eyed Junco	10	6	B	4
Baltimore Oriole	12	5	C	
Group A	13			
Group B	10			
Group C	3			
Other	1			
Total	27			

Criteria Used to Define and Priorize Monitored Species (From Bird Studies Canada)

Monitored Species

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

Priority for Migration Monitoring

A Those species that have $<50\%$ of Canadian breeding range covered by the Breeding Bird Survey and $>50\%$ of winter range south of the United States, thereby not covered by the Christmas Bird Count

B Those species that have $<50\%$ of Canadian breeding range covered by the Breeding Bird Survey but $>50\%$ of winter range within the United States, thereby covered by the Christmas Bird Count

C Those species with $>50\%$ coverage of Canadian breeding range by the Breeding Bird Survey and that have a wintering range largely south of the United States

APPENDIX 8

Preliminary Trend Analysis

Tabulated below is the result of a preliminary trend analysis on those species which are monitored according to the criteria developed by Bird Studies Canada (Appendix 7). Trend analysis is based on total captures from 1995-1999 and represents the results of simple linear regression within Microsoft EXCEL. Daily captures were log-transformed, summed and normalized by dividing by the number of monitoring days that encompassed the species' "window" of migration. Two sub-analasyses were undertaken. In the first, captures on days when banding did not occur were left as 0. In the second, captures on days when banding did not occur were estimated based on the previous and following days. Confidence level (P) is indicated as highly significant *** ($P<0.01$), significant ** ($P<0.05$) or almost significant * ($P<0.10$). Note that due to net-lane inconsistencies several species could only be analyzed over 1996-1998 and another, Clay-colored Sparrow, was analyzed over 1997-1999 to account for dramatic habitat effects from 1996 to 1997. It is imperative to keep in mind that these trends are based on very low sample sizes and do not take into account other factors, such as weather, which could have significant influence on results.

Preliminary Trend Analysis of Monitored Species at Inglewood Bird Sanctuary

Species	Analysis Interval	Trend (% per year)		P	
		1	2	1	2
Solitary Sandpiper	1996-1998	+1.8	+4.3		
Western Wood-Pewee	1995-1999	-0.2	+1.2		
Traill's Flycatcher	1995-1999	-0.3	-0.8		
Least Flycatcher	1995-1999	-0.3	+0.5		
Eastern Kingbird	1996-1998	-1.1	+7.4		*
Warbling Vireo	1996-1998	-1.4	-1.4		
House Wren	1995-1999	-4.4	-5.0		
Ruby-crowned Kinglet	1995-1999	-2.2	-2.2		
Swainson's Thrush	1995-1999	-2.3	-3.7		
American Robin	1995-1999	-9.9	-9.8	*	**
Cedar Waxwing	1995-1999	-4.9	-4.3		
Tenessee Warbler	1995-1999	+6.9	+6.6	**	
Orange-crowned Warbler	1995-1999	-1.5	-4.4		
Yellow Warbler	1995-1999	+10.6	+14.2	*	**
Yellow-rumped Warbler	1995-1999	+1.4	-0.1		
Blackpoll Warbler	1995-1999	-0.9	-1.8		
Ovenbird	1995-1999	+0.1	-0.3		
Northern Waterthrush	1995-1999	+0.8	+0.8		
Wilson's Warbler	1995-1999	-0.3	-2.6		
Chipping Sparrow	1995-1999	+7.3	+7.2		
Clay-colored Sparrow	1997-1999	-0.5	-1.3		
Song Sparrow	1995-1999	+2.2	+3.2	***	*
Lincoln's Sparrow	1995-1999	+1.3	+0.3		
White-throated Sparrow	1995-1999	+1.9	+0.5		
White-crowned Sparrow	1995-1999	-0.2	-2.6		**
Dark-eyed Junco	1995-1999	-3.0	-3.3		
Baltimore Oriole	1995-1999	-4.2	-5.6	*	*

APPENDIX 9

Recaptures at Inglewood Bird Sanctuary - Fall 1999

	July						August																								
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Belted Kingfisher																															
Downy Woodpecker															1																
Northern Flicker																															1
Western Wood-Pewee																				1											
Traill's Flycatcher																															
Eastern Kingbird								1					1													1					
Black-capped Chickadee													1				1								1			2			
White-breasted Nuthatch	1																		1												
Brown Creeper																															
House Wren		2					3	4	1				1		2			1		3	2		2	2	1			1	1		1
Golden-crowned Kinglet																															
Ruby-crowned Kinglet																															
Swainson's Thrush																								1	1						
Hermit Thrush																															
American Robin																				1											
Gray Catbird																															
Cedar Waxwing			1																		1	1									
Tennessee Warbler																3	4	2	3	1	1		3								
Orange-crowned Warbler																															
Yellow Warbler	1											1	2	3	1	6		1	2	1					1	4	1				
Yellow-rumped Warbler																														1	
Palm Warbler																															
Blackpoll Warbler																															
Ovenbird																							1			1					
Northern Waterthrush												2			2	1	4	4		2				1		1					
Mourning Warbler																															
Common Yellowthroat																															
Wilson's Warbler															1																
Western Tanager								1																							
Chipping Sparrow															2									1							
Clay-colored Sparrow	1	1																													
Song Sparrow			1				1								1					1	1			1	1						1
Lincoln's Sparrow	1																	1			1										
Swamp Sparrow																															
White-throated Sparrow																															
White-crowned Sparrow																															
Totals	4	3	2	0	0	0	4	6	1	0	0	3	5	3	10	10	9	9	6	10	6	1	6	6	5	7	1	3	1	1	3

Recaptures at Inglewood Bird Sanctuary - Fall 1999

	August						September																								
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Belted Kingfisher																					1									1	
Downy Woodpecker																															
Northern Flicker															1											1					
Western Wood-Pewee																															
Traill's Flycatcher								2																							
Eastern Kingbird																															
Black-capped Chickadee	1		2		3		3	1				5		1	2				1				1							1	2
White-breasted Nuthatch																															
Brown Creeper																															
House Wren	1		1				1		3	1	1	3	3					1	1									1			1
Golden-crowned Kinglet																															1
Ruby-crowned Kinglet																															
Swainson's Thrush		1								1									1			1									
Hermit Thrush																															
American Robin																															
Gray Catbird	1																														
Cedar Waxwing																															
Tennessee Warbler																															
Orange-crowned Warbler															1			1		1			2		3			1	2	5	2
Yellow Warbler																															
Yellow-rumped Warbler		1																												1	
Palm Warbler																															1
Blackpoll Warbler										1																					
Ovenbird				1					1	2																					
Northern Waterthrush		1									1						1		2			1			1						
Mourning Warbler								1																							
Common Yellowthroat										1													2								1
Wilson's Warbler	1							1				1	1				1											1			1
Western Tanager																															
Chipping Sparrow															1																
Clay-colored Sparrow																															
Song Sparrow														2							1				1						
Lincoln's Sparrow			1															1			1	1	3		1			3		1	
Swamp Sparrow																															1
White-throated Sparrow																	1								2		1	2	10		2
White-crowned Sparrow																			1	1	1	2	1	1	1	2		1			
Totals	4	3	4	1	3	0	4	5	4	6	2	9	4	3	5	0	3	3	6	2	4	5	9	1	9	3	1	9	12	9	12

Recaptures at Inglewood Bird Sanctuary - Fall 1999

	September					Oct									Total
	26	27	28	29	30	1	2	3	4	5	6	7	8		
Belted Kingfisher															2
Downy Woodpecker															1
Northern Flicker															3
Western Wood-Pewee															1
Traill's Flycatcher															2
Eastern Kingbird															3
Black-capped Chickadee	3	2	2	1	1					6	2		2		47
White-breasted Nuthatch															2
Brown Creeper										1					1
House Wren															45
Golden-crowned Kinglet	1														2
Ruby-crowned Kinglet		1													1
Swainson's Thrush															6
Hermit Thrush		1													1
American Robin															1
Gray Catbird															1
Cedar Waxwing															3
Tennessee Warbler															17
Orange-crowned Warbler								1							19
Yellow Warbler															24
Yellow-rumped Warbler										1					4
Palm Warbler															1
Blackpoll Warbler															1
Ovenbird															6
Northern Waterthrush															24
Mourning Warbler															1
Common Yellowthroat			1												5
Wilson's Warbler															8
Western Tanager															1
Chipping Sparrow															4
Clay-colored Sparrow															2
Song Sparrow				1											13
Lincoln's Sparrow			1												16
Swamp Sparrow															1
White-throated Sparrow	3		1												22
White-crowned Sparrow				1											12
Totals	7	4	5	3	1	0	0	1	0	8	2	0	2		303

APPENDIX 10

Year-to-Year Recaptures at Inglewood Bird Sanctuary and Dunbow Road

Species	Band	Location	1992	1993	1994	1995	1996	1997	1998	1999
Belted Kingfisher	1363-70918	IBS			B	r				
Yellow-bellied Sapsucker	8051-65119	Dunbow						B	r	
Red-naped Sapsucker	8041-54901	Dunbow							B	r
Downy Woodpecker	1451-67033	IBS				B	r	r		
Downy Woodpecker	1461-02314	IBS					B	r	r	r
Downy Woodpecker	1461-05307	Dunbow						B		r
Downy Woodpecker	1461-63690	IBS			B	r				
Northern Flicker	1453-31301	IBS				B	r			
Least Flycatcher	2050-70767	Dunbow						B		r
Eastern Kingbird	1451-38640	IBS	B			r				
Eastern Kingbird	1461-63719	IBS					B	r		r
Eastern Kingbird	1461-63750	IBS						B	r	r
Warbling Vireo	1910-52290	IBS	B			r	r			
Warbling Vireo	1950-45045	IBS			B	r				
Warbling Vireo	1950-45076	IBS			B		r	r	r	
Warbling Vireo	1950-48110	IBS		B		r				
Warbling Vireo	2050-70837	IBS						B	r	
Warbling Vireo	2050-70961	IBS					B		r	
Warbling Vireo	2161-14605	IBS				B			r	
Black-capped Chickadee	1950-45065	IBS			B	r				
Black-capped Chickadee	1950-45186	IBS			B	r	r	r		
Black-capped Chickadee	1950-45254	IBS			B	r	r			r
Black-capped Chickadee	1950-45256	IBS			B	r	r			
Black-capped Chickadee	1950-45258	IBS			B	r	r	r	r	
Black-capped Chickadee	1950-45786	IBS					B	r		
Black-capped Chickadee	1980-79991	IBS				B	r	r	r	r
Black-capped Chickadee	1990-57154	IBS						B	r	
Black-capped Chickadee	2050-70142	IBS				B		r		
Black-capped Chickadee	2050-70427	IBS					B	r		
Black-capped Chickadee	2050-70849	IBS						B	r	
Black-capped Chickadee	2120-00102	Dunbow						B	r	r
Black-capped Chickadee	2120-00103	Dunbow						B	r	
Black-capped Chickadee	2120-00105	Dunbow						B	r	r
Black-capped Chickadee	2120-00107	Dunbow						B	r	r
Black-capped Chickadee	2120-00109	Dunbow						B	r	r
Black-capped Chickadee	2120-00110	Dunbow						B	r	
Black-capped Chickadee	2120-00113	Dunbow						B	r	
Black-capped Chickadee	2120-00114	Dunbow						B	r	
Black-capped Chickadee	2120-00117	Dunbow						B	r	r
Black-capped Chickadee	2120-00124	Dunbow						B		r
Black-capped Chickadee	2120-00125	Dunbow						B	r	
Black-capped Chickadee	2120-00128	Dunbow						B	r	
Black-capped Chickadee	2120-00197	Dunbow						B	r	
Black-capped Chickadee	2160-18085	Dunbow							B	r
Black-capped Chickadee	2160-18180	IBS						B	r	
Black-capped Chickadee	2160-18704	IBS							B	r

Year-to-Year Recaptures at Inglewood Bird Sanctuary and Dunbow Road

Species	Band	Location	1992	1993	1994	1995	1996	1997	1998	1999
Black-capped Chickadee	2160-19059	IBS							B	r
Black-capped Chickadee	2160-19120	IBS							B	r
Black-capped Chickadee	2160-19174	IBS							B	r
Black-capped Chickadee	3500-89670	Dunbow						B	r	r
White-breasted Nuthatch	1461-31479	IBS							B	r
White-breasted Nuthatch	1461-84757	IBS				B	r		r	
House Wren	1910-52261	IBS	B	r		r	r	r	r	
House Wren	1950-45790	IBS					B	r		
House Wren	1950-45886	IBS					B	r		
House Wren	1950-48126	IBS		B		r				
House Wren	2060-28447	IBS						B	r	
House Wren	2160-18063	Dunbow							B	r
House Wren	2160-18082	Dunbow							B	r
House Wren	2160-19002	Dunbow							B	r
Swainson's Thrush	1451-67159	IBS					B		r	
Swainson's Thrush	1461-63572	IBS						B	r	
Swainson's Thrush	1461-63682	IBS			B		r			
Swainson's Thrush	1461-63692	IBS			B			r		
Swainson's Thrush	1461-63741	IBS					B	r		
Swainson's Thrush	1461-69595	IBS					B	r		
American Robin	0962-90991	IBS				B		r		
American Robin	0972-30466	IBS				B		r		
American Robin	1142-49046	IBS						B	r	
American Robin	1142-49201	Dunbow						B	r	
American Robin	1142-49212	Dunbow						B		r
American Robin	1142-49217	Dunbow						B	r	
American Robin	1142-49221	Dunbow						B	r	
American Robin	1152-38703	Dunbow							B	r
American Robin	1152-38740	IBS							B	r
Gray Catbird	8041-54948	IBS							B	r
Cedar Waxwing	1461-63733	IBS					B	r		
Orange-crowned Warbler	2160-18542	IBS							B	r
Yellow Warbler	1910-52230	IBS	B			r				
Yellow Warbler	1950-45519	IBS				B	r		r	
Yellow Warbler	1950-45878	IBS					B	r	r	
Yellow Warbler	1950-48086	IBS		B		r				
Yellow Warbler	1950-48129	IBS		B		r	r			
Yellow Warbler	1950-48133	IBS		B		r				
Yellow Warbler	1980-79983	IBS				B	r	r	r	r
Yellow Warbler	1990-57104	Dunbow						B	r	
Yellow Warbler	2050-70144	IBS				B	r			
Yellow Warbler	2070-42756	IBS						B	r	
Yellow Warbler	2120-00181	Dunbow						B	r	
Yellow Warbler	2160-19158	IBS							B	r
Yellow Warbler	2160-18045	Dunbow							B	r
Yellow Warbler	2160-18068	Dunbow							B	r

Year-to-Year Recaptures at Inglewood Bird Sanctuary and Dunbow Road

Species	Band	Location	1992	1993	1994	1995	1996	1997	1998	1999
Yellow Warbler	2160-18077	Dunbow							B	r
Yellow Warbler	2160-19059	IBS							B	r
Yellow Warbler	3500-89667	Dunbow						B		r
Clay-colored Sparrow	2050-70675	Dunbow						B		r
Clay-colored Sparrow	2120-00157	Dunbow						B	r	r
Clay-colored Sparrow	2120-00170	Dunbow						B		r
Clay-colored Sparrow	2120-00176	Dunbow						B	r	
Clay-colored Sparrow	2160-18022	Dunbow							B	r
Clay-colored Sparrow	2160-18028	Dunbow							B	r
Clay-colored Sparrow	2160-18030	Dunbow							B	r
Vesper Sparrow	1461-05331	Dunbow						B	r	
Vesper Sparrow	1461-31412	Dunbow							B	r
Lincoln's Sparrow	2161-14607	IBS				B	r			
Brown-headed Cowbird	1461-05333	Dunbow						B	r	
Brown-headed Cowbird	1461-31414	Dunbow							B	r
Baltimore Oriole	8041-54908	IBS							B	r
Baltimore Oriole	8051-65131	IBS						B	r	
American Goldfinch	2120-00188	Dunbow						B		r

B year banded
r recaptured

APPENDIX 11

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Sharp-shinned Hawk		-			-	-	-			1																		
Cooper's Hawk		-			-	-	-				1																	
Broad-winged Hawk		-			-	-	-																					
Accipiter spp.		-			-	-	-																					
Sandhill Crane		-			-	-	-																					
Killdeer		-			-	-	-													1						1	1	
Greater Yellowlegs		-			-	-	-																					
Lesser Yellowlegs		-			-	-	-																					
Solitary Sandpiper		-			-	-	-	1	2		2			1		1					1							
Spotted Sandpiper		-	1	1	-	-	-	2	1	2		2	2	2	2	2			2		2	4	3	5	1	1	2	
Sandpiper spp.	1	-			-	-	-	1				1						2		2								
Common Snipe		-			-	-	-																					
Herring Gull		-			-	-	-																					
Hummingbird spp.		-			-	-	-																	1				
Belted Kingfisher	3	-	1	1	-	-	-		2	1	2	1	2	1	1	1	2	2		2		1	1		1		1	
Yellow-bellied Sapsucker		-			-	-	-															1						
Yellow-bellied Flycatcher		-			-	-	-																				1	
Olive-sided Flycatcher		-			-	-	-																	2				
Western Wood-Pewee	6	-	6	3	-	-	-	7	6	6	10	4	10	8	10	6	6	10	7	17	8	10	5	5	3	5		
Traill's Flycatcher		-			-	-	-					1		1		1	1	3	3		1	1	3	1	1	5		
Least Flycatcher		-			-	-	-								3			3	5	1			1	4	1		2	
Flycatcher spp.		-	1		-	-	-			2						7	2	1				2	4	2				
Eastern Kingbird	24	-	15	14	-	-	-	15	17	19	24	19	24	19	11	19	23	20	18	16	11	13	16	21	24	28	11	
Northern Shrike		-			-	-	-																					
Blue-headed Vireo		-			-	-	-																				1	
Warbling Vireo	2	-	2		-	-	-	2	5	1	2	2	4	1	2	3	1		1	2	1			4			2	
Red-eyed Vireo		-			-	-	-																	1				
Vireo spp.		-			-	-	-																			1	3	
Blue Jay		-			-	-	-						1												1		1	
Tree Swallow	5	-	2	6	-	-	-	5	2																			
N Rough-winged Swallow		-			-	-	-	1	1	1	1		1			2	1		3	1								
Barn Swallow		-			-	-	-															1						
Swallow spp.		-			-	-	-	3			4		4			1	3			5								
Red-breasted Nuthatch	1	-			-	-	-																		1			

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	August											September															
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sharp-shinned Hawk	1					1					-					1	1	3	2	1				1		1	
Cooper's Hawk											-														1		
Broad-winged Hawk										1	-																
Accipiter spp.						1					-							1									
Sandhill Crane			2								-																
Killdeer					1						-																1
Greater Yellowlegs											-																
Lesser Yellowlegs											-						3									3	
Solitary Sandpiper					1						-			1													
Spotted Sandpiper	2	2	1	2					1		-		1	1	1	2	1			1							
Sandpiper spp.											-				1												2
Common Snipe											-																
Herring Gull	1										-											1					
Hummingbird spp.											-																
Belted Kingfisher		2	1	2	1			1	2		-			1	1	2			2	2	1	3	2	4	1	1	2
Yellow-bellied Sapsucker											-																
Yellow-bellied Flycatcher											-																
Olive-sided Flycatcher											-				1												
Western Wood-Pewee		1	2	4	2	1		1			-		1									1					
Traill's Flycatcher			1						1		-		2	1	1							1					
Least Flycatcher		1									-	1						1				1					
Flycatcher spp.				3	1						-			1			2										
Eastern Kingbird	20	12	5	19	21	3	7	4	3	5	-	3		1	7	5			2	3							
Northern Shrike											-																
Blue-headed Vireo											-					1											
Warbling Vireo		1	5			3		2	1		-	1	2														
Red-eyed Vireo											-			1													
Vireo spp.					1		1				-												1				
Blue Jay										1	-			1													
Tree Swallow				1						2	-																
N Rough-winged Swallow											-																
Barn Swallow											-																
Swallow spp.					5						-										5						
Red-breasted Nuthatch	1			1							-						2	1		1				1	1	1	1

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	September														October										
Species	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	Tot	Mean	Freq
Sharp-shinned Hawk		2	1						2						-	-		-		-	1	-	19	1	14
Cooper's Hawk									1			1			-	-		-		-		-	4	1	4
Broad-winged Hawk															-	-		-		-		-	1	1	1
Accipiter spp.															-	-		-		-		-	2	1	2
Sandhill Crane															-	-		-		-		-	2	2	1
Killdeer				1	1										-	-		-	1	-		-	8	1	8
Greater Yellowlegs					2			3	2		3	1	4		-	-		-		-		-	15	3	6
Lesser Yellowlegs							3				5				-	-		-	1	-		-	15	3	5
Solitary Sandpiper															-	-		-		-	1	-	11	1	9
Spotted Sandpiper															-	-		-		-		-	52	2	29
Sandpiper spp.															-	-		-		-		-	10	1	7
Common Snipe					1										-	-		-		-		-	1	1	1
Herring Gull						50							2		-	-	4	-	1	-	10	-	69	10	7
Hummingbird spp.															-	-		-		-		-	1	1	1
Belted Kingfisher	3	4	4	2	1	2	2	2	3	1	3				-	-		-	1	-		-	85	2	48
Yellow-bellied Sapsucker							1				2				-	-		-		-		-	4	1	3
Yellow-bellied Flycatcher															-	-		-		-		-	1	1	1
Olive-sided Flycatcher															-	-		-		-		-	3	2	2
Western Wood-Pewee															-	-		-		-		-	171	6	30
Traill's Flycatcher															-	-		-		-		-	29	2	18
Least Flycatcher															-	-		-		-		-	24	2	12
Flycatcher spp.															-	-		-		-		-	28	2	12
Eastern Kingbird															-	-		-		-		-	541	14	39
Northern Shrike											1		1		-	-		-		-		-	2	1	2
Blue-headed Vireo															-	-		-		-		-	2	1	2
Warbling Vireo															-	-		-		-		-	52	2	24
Red-eyed Vireo															-	-		-		-		-	2	1	2
Vireo spp.															-	-		-		-		-	7	1	5
Blue Jay		1													-	-		-		-	1	-	7	1	7
Tree Swallow															-	-		-		-		-	23	3	7
N Rough-winged Swallow															-	-		-		-		-	12	1	9
Barn Swallow															-	-		-		-		-	1	1	1
Swallow spp.															-	-		-		-		-	30	4	8
Red-breasted Nuthatch								1							-	-	1	-		-		-	14	1	13

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuthatch spp.		-			-	-	-																				
Brown Creeper		-			-	-	-																				
House Wren	10	-	2	6	-	-	-	6	6	2	4	1	5	6	9	3	3	3	8	3	11	5	7	2	1	6	4
Golden-crowned Kinglet		-			-	-	-																				
Ruby-crowned Kinglet		-			-	-	-																				
Swainson's Thrush		-	1		-	-	-						1				1										1
Hermit Thrush		-			-	-	-																				
American Robin	49	-	12	50	-	-	-	40	41	24	17	40	19	20	17	18	33	26	47	24	14	13	6	9	30	15	16
Gray Catbird	2	-		1	-	-	-	5	2	2	5	1	2	1	2	1	2			2			1		2	1	2
Brown Thrasher		-			-	-	-														2						
American Pipit		-			-	-	-																				
Bohemian Waxwing		-			-	-	-										1										
Cedar Waxwing	8	-	7	7	-	-	-	11	17	16	32	10	6	9	30	16	20	36	45	57	50	26	16	8	21	12	2
Tennessee Warbler		-			-	-	-		1		1		1	1	2	16	30	20	10	12	13	8	12	4	5	10	6
Orange-crowned Warbler		-			-	-	-					1							2								1
Nashville Warbler		-			-	-	-																				
Yellow Warbler	6	-	8	8	-	-	-	7	14	16	20	37	20	26	28	28	22	22	27	32	12	16	16	4	26	66	12
Chestnut-sided Warbler		-			-	-	-																				
Magnolia Warbler		-			-	-	-																				
Yellow-rumped Warbler	3	-	2		-	-	-				1		2			2	1	4		2		1	4			14	7
Black-throated Green Warbler		-			-	-	-																				
Townsend's Warbler		-			-	-	-																			1	
Palm Warbler		-			-	-	-													2							
Bay-breasted Warbler		-			-	-	-																				
Blackpoll Warbler		-			-	-	-																				
Black-and-white Warbler		-			-	-	-																				
American Redstart		-			-	-	-																				1
Ovenbird		-			-	-	-															1		1	2	1	
Northern Waterthrush		-			-	-	-					2	5		3	9	8	10	6	9	4	2	3	1	4	2	4
Connecticut Warbler		-			-	-	-																				
Mourning Warbler		-			-	-	-																				1
MacGillivary's Warbler		-			-	-	-																				
Oporornis warbler spp.		-			-	-	-																				
Common Yellowthroat		-	1		-	-	-							1													

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	August											September															
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nuthatch spp.											-						1										
Brown Creeper											-																
House Wren	2		4	6	6	15	3			2	-	2	4	2	4	2	2	2		4				2	1		1
Golden-crowned Kinglet											-																
Ruby-crowned Kinglet											-												1				
Swainson's Thrush	1								1		-	1											2	1	1		1
Hermit Thrush											-																
American Robin	5	11	19	16	21	7	12	9	15	13	-	2	18	9	9	65	19	26	3	13	10	5	8	17	12	10	20
Gray Catbird	1	1	1	2	2	3	3	3	2		-	2	1	3	3	2	1	1	1	1	1			2			
Brown Thrasher											-																
American Pipit											-																
Bohemian Waxwing											-		1														
Cedar Waxwing	16	21		6	4	8		27	10	2	-	3	4	8	6	9		4	2	6	6	5		3	7	8	5
Tennessee Warbler	3	1		4						1	-	2	1		1			1						1	1	1	5
Orange-crowned Warbler										1	-		2	3			5	5	1	4	2	4	2	7	6	6	5
Nashville Warbler											-		1	1													
Yellow Warbler	6			3	5	2	2		2	1	-	1	2	1	2						2			6			
Chestnut-sided Warbler								1	1		-																
Magnolia Warbler									1		-	1	2														
Yellow-rumped Warbler	3	2	8	21	13	20	1	4	6	1	-	12	38	7	4	10	9	8	1	4	20	5	11	17	6	92	16
Black-throated Green Warbler											-										1						
Townsend's Warbler					1						-		1					1									
Palm Warbler											-									1						1	
Bay-breasted Warbler				1				1			-																
Blackpoll Warbler											-		1		1	2							1				
Black-and-white Warbler			1								-																
American Redstart				1				2	1		-	1	1	1													
Ovenbird				6		2			2		-	1		1	1	1							1		1		
Northern Waterthrush	1	2	1							1	-			2	3							1	2	4			1
Connecticut Warbler						1					-				1	1						1					
Mourning Warbler					1						-		1														
MacGillivary's Warbler						2					-	1															
Oporornis warbler spp.											-	3													2		
Common Yellowthroat											-				3	1						1				2	2

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	September														October								Tot	Mean	Freq
Species	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8			
Nuthatch spp.			2		1										-	-		-		-		-	4	1	3
Brown Creeper															-	-		-	1	-		-	1	1	1
House Wren	1	1	2	5	2	1			1	1				1	-	-		-		-		-	192	4	50
Golden-crowned Kinglet									1	1					-	-		-		-		-	2	1	2
Ruby-crowned Kinglet					3			2						1	-	-	1	-		-		-	8	2	5
Swainson's Thrush	3	2	10	1									1		-	-		-		-		-	29	2	16
Hermit Thrush					1	2	1				1	1			-	-		-		-		-	6	1	5
American Robin	49	19	77	45	22	25	18	11	16	10	24	4	50	5	-	-	8	-	33	-	10	-	1380	21	66
Gray Catbird				1	1										-	-		-		-		-	72	2	39
Brown Thrasher															-	-		-		-		-	2	2	1
American Pipit				2											-	-		-		-		-	2	2	1
Bohemian Waxwing															-	-		-		-		-	2	1	2
Cedar Waxwing	2					2			4						-	-		-		-		-	640	13	48
Tennessee Warbler	2		1												-	-		-		-		-	177	6	31
Orange-crowned Warbler	23	7	10	4	2	11	10	14	1	1	8	2			-	-	4	-		-		-	154	5	30
Nashville Warbler															-	-		-		-		-	2	1	2
Yellow Warbler															-	-		-		-		-	508	14	36
Chestnut-sided Warbler															-	-		-		-		-	2	1	2
Magnolia Warbler															-	-		-		-		-	4	1	3
Yellow-rumped Warbler	46	48	27	58	51	40	80	49	7	8	46	2	12	2	-	-	5	-	11	-	13	-	887	16	55
Black-throated Green Warbler															-	-		-		-		-	1	1	1
Townsend's Warbler															-	-		-		-		-	4	1	4
Palm Warbler	1				2	3		9							-	-		-		-		-	19	3	7
Bay-breasted Warbler															-	-		-		-		-	2	1	2
Blackpoll Warbler	1														-	-		-		-		-	6	1	5
Black-and-white Warbler															-	-		-		-		-	1	1	1
American Redstart															-	-		-		-		-	8	1	7
Ovenbird	1		1												-	-		-		-		-	23	2	15
Northern Waterthrush	1														-	-		-		-		-	91	4	26
Connecticut Warbler															-	-		-		-		-	4	1	4
Mourning Warbler															-	-		-		-		-	3	1	3
MacGillivary's Warbler															-	-		-		-		-	3	2	2
Oporornis warbler spp.															-	-		-		-		-	5	3	2
Common Yellowthroat	1						1					1			-	-		-		-		-	14	1	10

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Wilson's Warbler		-			-	-	-									1						1	4	2			2
Canada Warbler		-			-	-	-													1							
Warbler spp.		-			-	-	-					1				15	8	11	30	50	3		3		14		12
Western Tanager	4	-		1	-	-	-		1	1																	
American Tree Sparrow		-			-	-	-																				
Chipping Sparrow	9	-	5	3	-	-	-			6		2	7	11		21	6	9	40	46		42	21	64	42	48	43
Clay-colored Sparrow	8	-	4		-	-	-	2		1	3	2	2	1		1	9	1	2	1		7	3	1	4	1	
Brewer's Sparrow		-			-	-	-																		1		
Fox Sparrow		-			-	-	-																				
Song Sparrow	2	-	4	5	-	-	-	5	4	3	5	3	6	3	6	6	2	5	4	5	2	3	4			1	6
Lincoln's Sparrow	2	-			-	-	-				1		1						2			1					
Swamp Sparrow		-			-	-	-																				
White-throated Sparrow		-			-	-	-													3							
White-crowned Sparrow		-			-	-	-																				
Golden-crowned Sparrow		-			-	-	-																				
Dark-eyed Junco		-			-	-	-																		1		
Sparrow spp.		-		6	-	-	-						7			4	1	13		5	1		5		1		
Rose-breasted Grosbeak		-			-	-	-	1	1			1											1	1		1	
Brewer's Blackbird	6	-			-	-	-			3	3	1															
Common Grackle		-			-	-	-																				
Blackbird spp.		-			-	-	-					16		2			1										
Baltimore Oriole	1	-	2		-	-	-	3	6	2	2	3	3	3		3	4	5	4	8	2	4	3	2	1	2	3
Purple Finch		-			-	-	-																1				
Pine Siskin		-			-	-	-						2									2					3
American Goldfinch	6	-	6	6	-	-	-	2	4	2	5	3	5	6		6	5	4	6	7	12	12	1	6	12	10	3
Evening Grosbeak		-			-	-	-																3				
Finch spp.		-			-	-	-																1				
Total Birds	158	-	82	118	-	-	-	119	133	111	145	154	142	123	126	193	196	210	272	316	150	177	148	151	200	232	154
Total Species	21	-	19	15	-	-	-	19	19	20	21	23	25	20	14	26	26	21	21	27	18	24	27	23	24	22	29

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	August											September															
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Wilson's Warbler				3	2	6				1	-	1	5	2	10	1	50	9	9	5	4	7	4	5	4		1
Canada Warbler											-																
Warbler spp.					12						-		120		3	2	1	15	12	8	7	9	1	13	1		
Western Tanager			1								-																
American Tree Sparrow											-																
Chipping Sparrow	36	5	1	11	12	2	7				-		2				5			13	2						
Clay-colored Sparrow	5	7		1	5		5		5		-	1	1		1							1					
Brewer's Sparrow											-																
Fox Sparrow											-																
Song Sparrow	1	2	3	6		1	2	1		1	-		1	1										1		2	
Lincoln's Sparrow				1	2					2	-	2	1	1	4	1			2	2	2		3	1	2	3	1
Swamp Sparrow											-											1					
White-throated Sparrow				1						1	-		3						1		4	3	21			1	
White-crowned Sparrow									1		-						5				1		4	12	9	2	1
Golden-crowned Sparrow											-																
Dark-eyed Junco											-							1			3						3
Sparrow spp.	2		2	7	7	2	1				-		10		3	1		1			1	10	7	21	8		
Rose-breasted Grosbeak											-																
Brewer's Blackbird											-																
Common Grackle											-				2	7											
Blackbird spp.						10					-						10				50						
Baltimore Oriole	3	2									-																
Purple Finch								1	1		-																
Pine Siskin				6							-					2											
American Goldfinch	6	7	2	7	10	10		1	2	2	-	3	5	7	2	3	1		2		4		2	2	2		
Evening Grosbeak											-																
Finch spp.											-																
Total Birds	116	80	60	140	136	100	44	58	58	38	-	44	232	57	75	121	118	80	40	69	126	60	73	121	66	134	68
Total Species	20	17	18	26	23	20	11	14	19	17	-	20	28	23	25	21	17	16	13	16	19	18	17	20	18	15	17

Migrants at Inglewood Bird Sanctuary - Fall 1999

Date	September														October									Tot	Mean	Freq
Species	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8				
Wilson's Warbler		1	3	2			1		2		3				-	-	1	-		-		-		152	5	31
Canada Warbler															-	-		-		-		-		1	1	1
Warbler spp.	4	3	3	6	5					7				5	-	-		-		-		-		384	13	30
Western Tanager															-	-		-		-		-		8	2	5
American Tree Sparrow														1	-	-	1	-	3	-		-		5	2	3
Chipping Sparrow		6													-	-		-		-		-		527	18	30
Clay-colored Sparrow			1					1							-	-		-		-		-		87	3	30
Brewer's Sparrow															-	-		-		-		-		1	1	1
Fox Sparrow	1				1										-	-		-		-		-		2	1	2
Song Sparrow						1	1	1							-	-		-		-		-		109	3	36
Lincoln's Sparrow	3	2	3	1	3	3	3	5	2		2	2			-	-	3	-		-		-		69	2	33
Swamp Sparrow							1								-	-	1	-		-		-		3	1	3
White-throated Sparrow	47	5	42	22	26	23	13	9	16	7	13	1	10		-	-	25	-	4	-	7	-		308	12	25
White-crowned Sparrow	3	26	8	8	2	2	4	3		3	2				-	-		-	9	-	4	-		109	5	20
Golden-crowned Sparrow		1													-	-		-		-		-		1	1	1
Dark-eyed Junco	1		2	3			6				2				-	-	2	-	6	-	2	-		32	3	12
Sparrow spp.		15		2					12	14	35	2			-	-		-		-		-		206	7	30
Rose-breasted Grosbeak															-	-		-		-		-		6	1	6
Brewer's Blackbird															-	-		-		-		-		13	3	4
Common Grackle			3												-	-		-		-		-		12	4	3
Blackbird spp.			8												-	-		-		-		-		97	14	7
Baltimore Oriole															-	-		-		-		-		71	3	23
Purple Finch															-	-		-		-		-		3	1	3
Pine Siskin					2	2									-	-		-		-		-		19	3	7
American Goldfinch				4		2	6	2	3						-	-		-		-		-		226	5	47
Evening Grosbeak															-	-		-		-		-		3	3	1
Finch spp.															-	-		-		-		-		1	1	1
Total Birds	193	143	208	167	129	169	151	112	73	53	150	17	80	15	-	-	56	-	71	-	49	-		7960	121	66
Total Species	19	16	19	17	19	15	16	14	15	10	15	10	7	6	-	-	12	-	11	-	9	-			19	

APPENDIX 12

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Pied-billed Grebe	-				-	-	-				23																
American White Pelican	-			3	-	-	-	1																			
Double-crested Cormorant	-	4	2	4	-	-	-	2	18	6		9	6	6	8	6	9	5	10	5	2	3	10	1	5	13	1
Great Blue Heron	-	1			-	-	-		1											1							
Canada Goose	-	4	12	15	-	-	-	17	4	9	2	5	13	5	12	4		2		11		1	1	8		4	18
Wood Duck	-	14	15	6	-	-	-	4	3	9	17	5	10	8	13	12	21	16	21	11	10	15	3	21	7	32	17
Gadwall	-				-	-	-																		3		
Mallard	-	60	50	30	-	-	-	52	65	36	40	47	26	28	47	44	63	40	31	54	33	10	30	30	32	51	13
Blue-winged Teal	-				-	-	-																				
American Wigeon	-	8	1		-	-	-																				
Northern Pintail	-				-	-	-																				
Green-winged Teal	-				-	-	-																				
Redhead	-				-	-	-																				
Bufflehead	-				-	-	-																	1			
Common Goldeneye	-	2			-	-	-	2			2			1	3	5	2		2	1							1
Hooded Merganser	-				-	-	-								1				1				4			1	
Common Merganser	-	7		10	-	-	-	2	11	4	4	8	4	3	10	6	5	9	11	7	5	5	13	10	2	2	3
Osprey	-				-	-	-		1		1							1						1			1
Bald Eagle	-				-	-	-																				
Northern Harrier																											
Swainson's Hawk	-	1	1	1	-	-	-	1	1			1	1	1		1			1	2	1	1			2	1	3
Red-tailed Hawk	-			2	-	-	-	1					1										1				
Buteo spp.	-				-	-	-				1						1										
American Kestrel	-	1	3		-	-	-	1	1	2			2								1						
Merlin	-				-	-	-	1																			1
Falcon spp.	-				-	-	-																1				
Peregrine Falcon	-				-	-	-															1					
Hawk spp.	-				-	-	-																	1			
Ring-necked Pheasant	-	2	2	2	-	-	-		1	1	2	1	1		1	1	1		1		1		1		2		
Franklin's Gull	-	1	4	1	-	-	-		1																		

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	August											September														
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pied-billed Grebe											-													1	1	
American White Pelican											-						1									
Double-crested Cormorant	6	12	2	3		2	3		3	10	-	5	2	2	4	6	1	4	2	8	2	7	5	6	3	
Great Blue Heron										1	-	1	1	1						1				1		
Canada Goose	5			22			5	16	7	15	-	10	24	8	7	15	12	7	49	49	33	46	24	10	3	28
Wood Duck	15	25	32	14	18	17	10	8	12	26	-	30	8	8	12	12	15	19	7	51	17	40	32	35	30	20
Gadwall											-		1													
Mallard	7	44	53	43	35	49	31	41	51	21	-	53	49	23	20	30	6	54	45	31	66	45	45	26	25	
Blue-winged Teal					1						-													3		
American Wigeon											-							2								
Northern Pintail											-															
Green-winged Teal											-											4				
Redhead								1			-															
Bufflehead											-											1				
Common Goldeneye	1		1				24	2	1	1	-	1			5	2		2	2		1	1		15	1	
Hooded Merganser	1	1	2			2				2	-									1		3		1		
Common Merganser	2		1	6	2	1	1	7	10	13	-	4	11	6	16	5	4	9	4	7	2	4	10		30	9
Osprey		1			1	1	1		1	1	-						1			1			1			
Bald Eagle											-															
Northern Harrier																1										
Swainson's Hawk			1							1	-	1	3	1	2			1					1			
Red-tailed Hawk										1	-			1	1				2				1			1
Buteo spp.								1		1	-											1				
American Kestrel				1		2					-				1						2					
Merlin	1										-															
Falcon spp.	1										-															
Peregrine Falcon											-															
Hawk spp.											-															
Ring-necked Pheasant		1				1					-															
Franklin's Gull											-															

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	September															October										
Species	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8		Mean	Freq
Pied-billed Grebe	1			1	1	1		1						1	1	-	-		-		-		-		3	10
American White Pelican																-	-		-		-		-		2	3
Double-crested Cormorant	4	35	8	2	20	5	4	8	12	10	4	24	2	19	5	-	-	6	-	4	-	4	-		7	62
Great Blue Heron			1										1			-	-	1	-		-		-		1	12
Canada Goose	3	38	21	27	21	14	30	25		39	71	35	18	52	12	-	-	25	-	42	-	37	-		18	57
Wood Duck	35	29	23	31	10	35	25	50	38		54	35	35	56	40	-	-	25	-	42	-	50	-		22	65
Gadwall																-	-		-		-		-		2	2
Mallard	5	20	10	39	25	37	45	54	20	19	21	35	46	53	6	-	-	170	-	147	-	90	-		41	65
Blue-winged Teal																-	-		-		-		-		2	2
American Wigeon								1								-	-		-		-		-		3	4
Northern Pintail											1					-	-		-		-		-		1	1
Green-winged Teal																-	-		-		-		-		4	1
Redhead																-	-		-		-		-		1	1
Bufflehead																-	-		-		-		-		1	2
Common Goldeneye				1	13		5									-	-		-		-		-		4	28
Hooded Merganser					1			1				1				-	-	1	-		-		-		2	16
Common Merganser	5	19	1	19		3		12	9	16	13	16	5	11	1	-	-	30	-	6	-	4	-		8	61
Osprey																-	-		-		-		-		1	14
Bald Eagle														1		-	-		-		-		-		1	1
Northern Harrier																										
Swainson's Hawk			1		1			1				1				-	-		-		-		-		1	28
Red-tailed Hawk			1													-	-		-		-		-		1	11
Buteo spp.																-	-		-		-		-		1	5
American Kestrel				1	1											-	-		-		-		-		1	13
Merlin							1									-	-		-		-		-		1	4
Falcon spp.																-	-		-		-		-		1	2
Peregrine Falcon																-	-		-		-		-		1	1
Hawk spp.																-	-		-		-		-		1	1
Ring-necked Pheasant						1										-	-		-	1	-		-		1	19
Franklin's Gull																-	-		-		-		-		2	4

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ring-billed Gull	-				-	-	-	10	100	3	6	9									4	4		2		50	
California Gull	-			1	-	-	-	2											4								
Gull spp.	-	8	12	20	-	-	-	35		165	68	175	103	54	70	7		12		8			14		3	6	4
Rock Dove	-		3	12	-	-	-	33	3		32			5		20	10	32	10	4			9	2	6	9	
Mourning Dove	-				-	-	-													1			1				
Great Horned Owl	-				-	-	-																				
Belted Kingfisher	-				-	-	-																				
Downy Woodpecker	-	3		1	-	-	-	3	3	2	3	3	4	3	1	5		5	4	4		7	2	1	2	2	5
Hairy Woodpecker	-				-	-	-	1		1		2							1	1			1				1
Three-toed Woodpecker	-			1	-	-	-																				
Northern Flicker	-	4	13	4	-	-	-	2	9	5	10	8	3	5	4	4	4	3	7	14	3	2	8	6	12	5	3
Woodpecker spp.	-				-	-	-																				
Western Wood-Pewee	-				-	-	-														1						
Eastern Kingbird	-				-	-	-		1					1													1
Black-billed Magpie	-	4	18	11	-	-	-	8	5	6	3	4	7	2		7	1	6	15	12	2	4		12	10	3	1
American Crow	-	6	12	16	-	-	-	7	35	4	4	24	3	6	9	250	3	9	16	14	10	4	9	6	4	8	3
Common Raven	-	3		8	-	-	-																		1		
Black-capped Chickadee	-	9	5	12	-	-	-	11	17	21	23	8	20	14	16	11	19	8	16	13	5	7	13	20	14	8	10
White-breasted Nuthatch	-	1	1	1	-	-	-	1	1	2	2		1	1	1	1	2	2	1	3		1	1	2	2		3
Nuthatch spp.	-				-	-	-																				
House Wren	-		2		-	-	-	3	4	1				1		1			1		3	2		2	2	1	
Ruby-crowned Kinglet	-				-	-	-																				
Swainson's Thrush	-				-	-	-																		1	1	
American Robin	-				-	-	-														1						
Gray Catbird	-				-	-	-																				
European Starling	-	110	70	70	-	-	-	74	229	60	142	225	56	48	47	170	230	175	325	268	59	30	77	96		120	45
Cedar Waxwing	-			1	-	-	-															1					
Tennessee Warbler	-				-	-	-											3	2	4	1	1	1	3			
Orange-crowned Warbler	-				-	-	-																				
Yellow Warbler	-				-	-	-								2	1	6		1	2	1					1	4

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	August											September														
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ring-billed Gull		4	25		1	75		17	1	26	-	104	100	108			8	235		400				305	481	25
California Gull									49		-							2								
Gull spp.	5	1		81	80	1	15			2	-		37	3	41	130	4	12	161	54	303	860	210			
Rock Dove	3		9	3	13		3	1		13	-	2	12	7	1	8	7	6		8	1	3				
Mourning Dove				1	1						-															
Great Horned Owl						5					-					1		1	1							
Belted Kingfisher						1					-		1													1
Downy Woodpecker	1	2	4	5	4	1	1		3	1	-			1	1		1			1		2	1	1		
Hairy Woodpecker	2	1	1			1			1		-		1		1					1						
Three-toed Woodpecker											-															
Northern Flicker	4	1	1	3	4	3	1	3		5	-	1	8	4	5	8	4	6	6	11	2	4	5	4	3	4
Woodpecker spp.											-		1		1	1										
Western Wood-Pewee											-															
Eastern Kingbird											-		1													
Black-billed Magpie	5			14	4	3	7	7		2	-	4	3	20	27	27	5	11	13	16	6	25	12	48	15	4
American Crow	3	1	6	1	11	2	5	2	2		-	5	2	2	1	4	7	4	1	13	3	4	3	5	9	5
Common Raven										2	-													2		
Black-capped Chickadee	5	20	18	10	11	14	11	15	7	9	-	15	26	9	22	6	12	17	18	25	22	9	8	10	10	7
White-breasted Nuthatch	1	2	3	2	1		1		1		-		2	1	2							3	1	2		1
Nuthatch spp.											-					1										
House Wren		1	1		1	1					-	1		3	1	1	2	3						1		
Ruby-crowned Kinglet											-															
Swainson's Thrush											-				1									1		
American Robin											-															
Gray Catbird						1					-		1													
European Starling	35	107	50	36	40	20	29	1	8	25	-	14	3	6	40	28	15	6	25	100	16	15	15	95	29	
Cedar Waxwing											-															
Tennessee Warbler											-															
Orange-crowned Warbler											-									1						
Yellow Warbler	1										-															

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	September															October										
Species	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8		Mean	Freq
Ring-billed Gull		468		300	200	770	75	300				200	456	480	200	-	-	400	-	225	-	500	-		176	38
California Gull																-	-	3	-		-		-		10	6
Gull spp.	125		53	13		100	35		124	256	540	20				-	-	60	-		-	6	-		89	46
Rock Dove			1		7	12			5		6	12		19	3	-	-		-	6	-	16	-		9	42
Mourning Dove																-	-		-		-		-		1	4
Great Horned Owl									1					1		-	-		-		-		-		2	6
Belted Kingfisher									1					2		-	-		-		-	1	-		1	6
Downy Woodpecker	2			1	1		2		3			3				-	-	2	-	2	-	1	-		2	45
Hairy Woodpecker	1		1		1			1			3	1				-	-		-		-		-		1	21
Three-toed Woodpecker																-	-		-		-		-		1	1
Northern Flicker	4	12	10	3	8	1	4	4	3	4		4		2		-	-	5	-	2	-	1	-		5	62
Woodpecker spp.																-	-		-		-		-		1	3
Western Wood-Pewee																-	-		-		-		-		1	1
Eastern Kingbird																-	-		-		-		-		1	4
Black-billed Magpie	9	15	11	8	4	14	11	6	4	15	12	8	8	20	3	-	-	24	-	17	-	22	-		10	61
American Crow	4	2	2	4	8	12	20	6	3	3	3	8	2	18		-	-	4	-	10	-		-		11	63
Common Raven				1												-	-		-		-	11	-		4	7
Black-capped Chickadee	5	8	13	35	2	4	8	10	28	8	15	26	8	12	5	-	-	13	-	10	-	7	-		13	66
White-breasted Nuthatch	2	1			2	1	1	3	3		1	1		2		-	-	2	-	3	-	2	-		2	47
Nuthatch spp.																-	-		-		-		-		1	1
House Wren							1			1						-	-		-		-		-		2	25
Ruby-crowned Kinglet												1				-	-		-		-		-		1	1
Swainson's Thrush																-	-		-		-		-		1	4
American Robin																-	-		-		-	16	-		9	2
Gray Catbird																-	-		-		-		-		1	2
European Starling	39	42	34	34		60	40	160	87	52	6	87	46	120	50	-	-	100	-	95	-	105	-		74	63
Cedar Waxwing																-	-		-		-		-		1	2
Tennessee Warbler																-	-		-		-		-		2	7
Orange-crowned Warbler				2			1	1	3	2						-	-	1	-		-		-		2	7
Yellow Warbler																-	-		-		-		-		2	9

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	July							August																				
Species	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Yellow-rumped Warbler	-				-	-	-																				
Palm Warbler	-				-	-	-																				
Ovenbird	-				-	-	-																	1			1
Northern Waterthrush	-				-	-	-						1			1	1	3	3		2				1		1
Common Yellowthroat	-				-	-	-																				
Wilson's Warbler	-				-	-	-																				
Chipping Sparrow	-				-	-	-																		2		
Clay-colored Sparrow	-		1		-	-	-																				
Song Sparrow	-				-	-	-														1	1			1	1	
Lincoln's Sparrow	-				-	-	-															1					
Swamp Sparrow	-				-	-	-																				
White-throated Sparrow	-				-	-	-																				
White-crowned Sparrow	-				-	-	-																				
Red-winged Blackbird	-		1		-	-	-																10				
Brown-headed Cowbird	-				-	-	-															1					
House Sparrow	-	2			-	-	-				2						7			1						1	
Total Birds	-	255	228	232	-	-	-	274	514	337	387	534	262	192	245	557	385	331	484	441	146	102	210	226	114	320	140
Total Species	-	22	20	23	-	-	-	24	22	18	20	16	18	18	16	20	17	17	22	22	20	21	21	20	21	21	22

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	August											September														
Species	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Yellow-rumped Warbler				1							-															
Palm Warbler											-															
Ovenbird											-			1	2											
Northern Waterthrush											-					1								2		
Common Yellowthroat											-															
Wilson's Warbler						1					-															
Chipping Sparrow											-															
Clay-colored Sparrow											-															
Song Sparrow					1						-								1							1
Lincoln's Sparrow								1			-															1
Swamp Sparrow											-															
White-throated Sparrow											-															
White-crowned Sparrow											-													1	1	1
Red-winged Blackbird											-															
Brown-headed Cowbird											-															
House Sparrow							2				-									2				2		
Total Birds	104	224	210	246	229	204	150	123	157	178	-	251	297	215	214	287	105	401	337	781	476	1077	374	577	641	108
Total Species	20	16	17	17	18	22	17	15	15	21	-	16	22	20	23	19	17	19	15	20	14	19	16	23	14	14

Probable and Known Stopovers at Inglewood Bird Sanctuary - Fall 1999

Date	September															October										
Species	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8		Mean	Freq
Yellow-rumped Warbler										1			1			-	-		-	1	-		-		1	4
Palm Warbler										1						-	-		-		-		-		1	1
Ovenbird																-	-		-		-		-		1	4
Northern Waterthrush				1												-	-		-		-		-		2	11
Common Yellowthroat										1						-	-		-		-		-		1	1
Wilson's Warbler							1									-	-		-		-		-		1	2
Chipping Sparrow																-	-		-		-		-		2	1
Clay-colored Sparrow																-	-		-		-		-		1	1
Song Sparrow				1										1		-	-		-		-		-		1	9
Lincoln's Sparrow	1	2					3		1							-	-		-		-		-		1	7
Swamp Sparrow										1						-	-		-		-		-		1	1
White-throated Sparrow				1		1	2	7		2	3		1			-	-		-		-		-		2	7
White-crowned Sparrow	2	1	1	1	2									1		-	-		-		-		-		1	9
Red-winged Blackbird																-	-		-		-		-		6	2
Brown-headed Cowbird																-	-		-		-		-		1	1
House Sparrow											2					-	-		-		-		-		2	9
Total Birds	247	692	192	526	328	1071	314	651	345	431	755	518	629	871	326	-	-	872	-	613	-	873	-		368	
Total Species	17	14	17	22	19	17	20	19	17	17	16	19	13	19	11	-	-	18	-	16	-	17	-		18	

APPENDIX 13

Weather Conditions at Inglewood Bird Sanctuary - 1999 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	
26 Jul	6	0		0					20	1	SW	1
27 Jul	10	0		0					25	2	SW	0
28 Jul	10	0		0					30	1	W	1
29 Jul												
30 Jul												
31 Jul	6	0		5								
1 Aug	8			0	11			2	14	3	SE	2
2 Aug	7			1				1	20	2		0
3 Aug	9			0	20			0	23	2		0
4 Aug	11.5			1	22	2	SE	1	22.5	3	SE	1
5 Aug	15			0	16			8	18			0
6 Aug	10			0	19.5	2		0	22.5	2		1
7 Aug	14	0		2					20	2	SE	1
8 Aug	16	0		2					22	0		8
9 Aug	11			1	20			1	23			1
10 Aug	13.5	4	N	2		3	N	2	17.5	3	N	2
11 Aug	13			8	14	2		1	14	2	E	2
12 Aug	12	2		8	13	2		8	14	3		2
13 Aug	9.5	0		4	11.5	0		1	18	0		1
14 Aug	12.5	0		2	16	1	SW	1	18	0		2
15 Aug	8	0		1	15	1	SW	2	22	0		2
16 Aug	12	0		2	15	2	SW	1	22	2	SW	1
17 Aug	12	0		0	18	0		0	19.5	1	SW	0
18 Aug	7	0		0	10	0		1	25	0		1
19 Aug	14	1	S	8	18	0		2	23	1	S	1
20 Aug	11	0		0	18	0		0	23	1	SSE	0
21 Aug	10	0		0	17	1	SW	1	24	2	SW	1
22 Aug	7	0		0	14	2	SW	0	19	1	SW	0
23 Aug	6	0		0	15	1	SW	0	21	2	SW	0
24 Aug	13	2	W	0	18	1	W	0	22	1	W	0
25 Aug	14	0		1	18.5	1	SE	0	27	4	SE	0
26 Aug	7	0		0	14	1	E	0	19	2	E	0
27 Aug	11	1	W	1	13.5	2	NW	2	18	2	NW	1
28 Aug	10	0		2	14	2	S	2	19	1	S	2
29 Aug	15	3	SE	2	18	2	SE	1	24	2	SE	1
30 Aug	13	3	SW	2	12	3	SW	2	12	3	NW	2
31 Aug												
1 Sep	4	0		2	8	0		1	13	1	W	2
2 Sep	3	0		1	9	0		1	12	0		1
3 Sep	0	0		1	8	2	S	1	15	2	S	0
4 Sep	2	0		0	9	0		0	16	1	S	0
5 Sep	4	0		0	20	2	S	1	16	1	S	2
6 Sep	12	2	SW	2	14	3	W	2	11	1	W	8
7 Sep	8	3	W	2	11	2	NW	2	13	5	N	2
8 Sep	3	0		0	12	0		0	15	1	W	0
9 Sep	3	0		0	10	2	SE	0	17	2	S	0

Weather Conditions at Inglewood Bird Sanctuary - 1999 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	
10 Sep	7	1	N	0	10	2	N	2	13	1	N	2
11 Sep	4	3	NW	0		5	NW	0	12	5	NW	1
12 Sep	1			0		2		0	19	2	SW	0
13 Sep	7	1	NW	0	16	1	W	0	18	1	W	0
14 Sep	3	0		0	10	1	S	0	19	2	S	0
15 Sep	4	0		0	15	2	N	0				
16 Sep	7	0		0	17	2	N	0	22	2	N	0
17 Sep	10	2	N	1	15	0		1	17	1	N	0
18 Sep	8	2	W	2	15	1	W	0	16	2	NW	1
19 Sep	1	0		0	9	3	S	0	19	0		0
20 Sep	6	0		0	16	3	W	0	26	2	W	0
21 Sep	5	0		0	16	1	S	0	25	0		0
22 Sep	8	0		1	13	0		1	22	2	S	0
23 Sep	6	0		0	16	1	SW	1	24	3	S	0
24 Sep	1.5	0		0	6.5	0		0	14	1	S	0
25 Sep	7	0		2	10			1	10	1	NE	2
26 Sep	2	2	NNW	1	7	4	NNW	1	12	5	NNW	1
27 Sep	1	0		2				7	10	4	S	2
28 Sep	-2	0		0					9	1	SE	2
29 Sep	8	4	NNW	1	11	4	W	2	12	5	W	5
30 Sep	0	2	NE	7	1	4	N	7				
1 Oct												
2 Oct												
3 Oct	-1	0		0					10	1	W	0
4 Oct												
5 Oct	0	0		2	4	1	S	2	7	2	S	2
6 Oct	1	0		1	10	0		1	16	2	S	1
7 Oct	7	2	SW	2					14	5	SW	2
8 Oct	6	3	N	2	7	0		5				

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

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

APPENDIX 14

CALGARY BIRD BANDING SOCIETY
1999 MEMBERSHIP LIST

Grahame Booth
Bill Brown
Lily Cesh
Doug Collister
Brian Couronne
Amy Gemmel
Dick Graham
Christina Hall
Garry Hornbeck
Mary Huston
Brian Isaac
Clive Jackson
Scott Jubinville
Stefan Jungkind
Dwight Knapik
Stephen Lane
Janice Lorenzana
Michael Magnan
Arlette Malcolm
Shonna McLeod
Greg Meyer
Pat Mitchell
Dale Paton
El Peterson
Mike Preston
Gwen Smiley
Cyndi Smith
Don Stiles
Ken Symington
Bill Taylor
Alexandra Torn
Barry Trakalo
Mike Vassal
James Walcott
Jean Wallace
Catherine Watson
Catherine Watson-McDonald
Linda Wiggins
Bruce Wilson
Scott Wilson

Executive

President - El Peterson
Vice President - Shonna McLeod
Treasurer - Dwight Knapik
Secretary - Garry Hornbeck
Annual Report - Doug Collister