# CALGARY BIRD BANDING SOCIETY

# 2003 ANNUAL TECHNICAL REPORT


Prepared

by

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***Custodire aves***
Keep watch on birds

**SY-U Yellow-throated Vireo banded at Inglewood Bird Sanctuary 2 August 2003**
**First Alberta Record**

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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. IBS has long been known as an important migration site for Neotropical migrants. Located within 80-km of the Rocky Mountains, the site is an integral component of the Canadian Migration Monitoring Network.

During 2003 CBBS received support from the Alberta Gaming and Liquor Commission, Petro-Canada Volunteer Grant Fund, Baillie Birdathon and the Canadian Wildlife Service.

Spring migration monitoring was undertaken at IBS for the second consecutive year. The 2003 fall migration monitoring program follows pilot programs in 1992 and 1994 and full fall programs in 1995 through 2002. Twelve mist-nets were operated for approximately 6 hours on 31of the 38 days between 1 May and 7 June (2138 net-hrs) and 69 of the 71 days between 28 July and 6 October (4928 net-hrs). Total new bandings of 347 and 1452 were achieved for the spring and fall programs respectively. A Yellow-throated Vireo, first Alberta record, was banded on 2 August.

The IBS MAPS site was operated again in 2003, adding to previous data gathered since 1992. New bandings set a new low at 65 with a continued increase in Gray Catbird. Least Flycatchers were notable by their absence.

2003 marked the second year of a pilot migration monitoring program at Las Caletas, Costa Rica on the Osa Peninsula along the Pacific coast. Migration monitoring methods used were similar to those at IBS. Spring migration monitoring was conducted from 15 April – 9 May. Mist-netting occurred on all 25 days for a total of 2123 net-hours. In total, 979 new birds of 80 species were captured (excluding recaptures) of which 778 were new bandings and 201, mostly hummingbirds (185), were released or otherwise unbanded. From a different perspective 518 were resident birds and 461 were migrants. Of the migrants 406 (88%) were Swainson's Thrushes and 34 (7%) were Alder Flycatchers. A full migration monitoring program covering 28 March – 29 April is commencing in 2004.

A Northern Saw-whet Owl program was initiated at a site in the foothills southwest of Calgary. A total of 52 Northern Saw-whet Owls and 4 Boreal Owls were banded on 34 days between 7 October and 18 November. Encouraged by this result CBBS plans to initiate a full Northern Saw-whet Owl monitoring program in fall 2004. Target period will be 15 September – 31 October.

Trend analysis was undertaken on 27 species occurring as migrants at IBS and captured in sufficient quantity to allow analysis. Three species evidenced significant or nearly significant change over the evaluation period:

| | |
|---|---|
| Solitary Sandpiper | - 1.8%/year (p=0.06) |
| Northern Waterthrush | - 1.6%/year (p=0.09) |
| Dark-eyed Junco | - 2.3%/year (p=0.02) |

Trends over the period 1995-2002 were compared to those for the same period for Delta Marsh and Last Mountain Bird Observatories. Swainson's Thrush, Orange-crowned Warbler, Ovenbird, White-throated Sparrow, Dark-eyed Junco and Baltimore Oriole all evidenced significant or nearly significant declines at 2 or more of the three stations.

## 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, other 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 1995-2002;
- spring banding was initiated in 1997 at Dunbow Road approximately 22-km SSE of the City of Calgary and continued in 1998 and 1999;
- spring and fall banding/migration monitoring was initiated at the Cominco Natural Area (CNA) in 2000 with spring banding continued in 2001 (Cominco is still utilized for training);
- colour-banding and relocation of Red-tailed and Swainson's Hawks at Calgary International Airport was initiated in cooperation with the Calgary Airport Authority in 2000 and is ongoing;
- pilot spring migration monitoring was initiated at Las Caletas on the Osa Peninsula, Costa Rica in 2002 and continued in 2003;
- a Northern Saw-whet Owl migration monitoring pilot program was carried out at Inglewood Bird Sanctuary in 2000 and subsequently discontinued; and
- pilot Northern Saw-whet Owl migration monitoring was carried out in 2003 at a location in the foothills southwest of Calgary.

As of 1998 the Calgary Bird Banding Society's Inglewood Bird Sanctuary site is a fully designated member of the Canadian Migration Monitoring Network (CMMN) coordinated and administered by Bird Studies Canada. Establishment of this formal association of migrant monitoring sites across Canada significantly enhances the value of the work conducted at each site. The Calgary Bird Banding Society and Inglewood Bird Sanctuary hosted the 2003 CMMN national meeting.

## FUNDING AND ACKNOWLEDGEMENTS

Funding proceeds other than membership dues and member donations during 2003 were:

- funds raised by the CBBS through participation in the Baillie Birdathon (approximately $2,915- net – CBBS 50% share);
- a grant from Canadian Wildlife Service through Mr. Loney Dickson ($2,000);
- a grant from the Petro-Canada Volunteer Grant Program ($500); and
- proceeds from running a 2-day casino under authority of the Alberta Gaming and Liquor Commission ($56,000)

Funds were used to provide a per diem to Banders-in-Charge (BICs), cover in-country costs for the Costa Rica pilot project, purchase mist-nets, produce the annual technical report and cover migration monitoring miscellaneous costs (field data sheets, propane, batteries, film and processing etc.).

Data and/or photographs to support our study of Mourning and MacGillivray's Warbler morphometrics at Inglewood Bird Sanctuary were contributed by Mackenzie Bird Observatory and Delta Marsh Bird Observatory.

Sincere appreciation go out to all the volunteers who have helped make 2003 another successful year for CBBS. Many non-members have helped immensely by volunteering at our casino, participating in the Baillie Birdathon and providing expertise such as carpentry etc. Thanks to you all.

## MIGRATION MONITORING AT INGLEWOOD BIRD SANCTUARY

### 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). Trends in data from the Breeding Bird Survey (1978-1988) indicated 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 monitoring covering only a portion of the fall migration season was undertaken in 1992 and 1994. 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).

### Methods and Study Site

Both spring and fall migration of Neotropical migrants was monitored in 2003 at Inglewood Bird Sanctuary (IBS). IBS' 35 hectares includes mature riverine balsam poplar forest known for its number and diversity 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. Twelve 12-m long 30-mm mesh mist-nets were operated in permanent net lanes for approximately 6-hours each day beginning at sunrise. A daily census was obtained when possible. A census was not attempted when the number of migrants or volunteer shortage would result in unacceptable risk to captured birds (e.g. excessive holding time).

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

## Monitoring Schedule and Coverage

### *Spring*

Spring migration monitoring at IBS was conducted from 1 May to 7 June. This was the second full year of spring migration monitoring at IBS. In addition to standardized constant-effort mist-netting, a census route was surveyed 2-3 hours from the start of the netting. Coverage of 82% was achieved. That is, mist-netting occurred on 31 of the 38 target days for a total of 2138 net-hours (Table 1a, Figure 3a). Inclement weather resulted in 7 days of the monitoring period without banding.

### *Fall*

Fall migration monitoring at IBS was conducted from 28 July to 6 October. In addition to standardized constant-effort mist-netting, a census route was surveyed 2-3 hours from the start of the netting. During 2003, coverage of 97% was achieved. That is, mist-netting occurred on 69 of the 71 target days for a total of 4928 net-hours (Table 1b, Figure 3b). Inclement weather resulted in 2 days of the monitoring period without banding.

## New Bandings

### *Spring*

A total of 347 new bands were placed on birds of 36 species (Table 2a, Appendix 1a), a significant decrease from 2002. Days on which 25 or more new bandings occurred were 11, 13, 21, 24 May (Figure 3a). New banding totals by species at IBS are presented in Table 2a. The top 20 banded species are identified in Appendix 2. Species monitored at IBS based on criteria developed by Bird Studies Canada appear in Appendix 3 along with those criteria.

### *Fall*

A total of 1452 new bands were placed on birds of 60 species (Table 2b, Appendix 1b). Days on which 40 or more new bandings occurred were 31 July, 2,3 August and 2,8,10,21 September. Approximately 46% of new bandings occurred in August and 44% in September (Figure 3b). New bandings at IBS from 1992-2003 are presented in Table 2b. The top 20 banded species over all years, and during 2003, are identified in Appendix 2. Species monitored at IBS based on criteria developed by Bird Studies Canada appear in Appendix 3 along with those criteria.

***General***

Mist-netting can add another dimension to understanding the avifauna at a site particularly in detection of rare or elusive species. As in past years several species were banded at Inglewood that are infrequently reported by bird watchers: a Yellow-throated Vireo on 2 August was a first Alberta record; a Chestnut-sided Warbler on 4 September; single Cape May Warblers on 3 and 18 August; and a Bay-breasted Warbler on 2 August. A Calliope Hummingbird was captured and released unbanded on 7 August.

The *Oporornis* warblers are often difficult to detect and identify by bird watching with binoculars. During 2003 migration monitoring at IBS 10 Mourning Warblers and 5MacGillivray'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. Data from Mackenzie Bird Observatory was again obtained in 2003 to help investigate whether *Oporornis* warblers at IBS may be hybrids. Delta Marsh Bird Observatory supplied data in support of this collaborative project for the first time. The cooperation of other migration monitoring sites in our study is greatly appreciated and CBBS looks forward to additional data and further insight in future years.

Other areas of research have involved, or have the potential to involve, data from IBS. Banding data were provided to Erica Dunn of CWS as part of a cooperative study on mass gain among migrating songbirds at Canadian stopover sites. Ms. Dunn's analysis provides insight into the quality of IBS as a refueling stop for Neotropical migrants. A copy of her paper appears in Appendix 4. Based on that work IBS appears to be an important refueling stop for migrating Neotropical migrants.

Techniques are being developed 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. Preliminary results involving 1999 samples from Delta Marsh Bird Observatory and Atlantic Bird Observatory indeed indicated that CMMN stations are capturing birds from a broad area, not simply from a small region close to the station. Feather material was collected from 54 resident and migrant birds at IBS during 2003. Analysis is currently underway and results will be published in the 2004 ATR.

## Recaptures

Recaptures at IBS during migration monitoring totaled 585 of 407 different birds of 40 species. Recapture rates were highest (>100%) in resident species (e.g. House Wren, Black-capped Chickadee, Downy Woodpecker, Gray Catbird). However some resident species evidenced a relatively low recapture rate suggesting that migrants swell the ranks (e.g. Yellow Warbler, American Robin). A few migrant species appear to use IBS for moulting or extended pre-migratory foraging as evidenced by high recapture rates (e.g. Mourning Warbler, Tennessee Warbler).

| Species Recaptured at Inglewood Bird Sanctuary during MM 2003 | | | | | |
|---|---|---|---|---|---|
| Species | Recap | Banded | Species | Recap | Banded |
| Belted Kingfisher | 1 | 6 | Yellow Warbler | 37 | 102 |
| Downy Woodpecker | 17 | 13 | Magnolia Warbler | 3 | 6 |
| Northern Flicker | 4 | 7 | Yellow-rumped Warbler | 61 | 323 |
| Western Wood-Pewee | 1 | 12 | Blackpoll Warbler | 1 | 9 |
| Traill's Flycatcher | 2 | 36 | Black-and-white Warbler | 2 | 3 |
| Least Flycatcher | 6 | 15 | American Redstart | 6 | 19 |
| Eastern Kingbird | 4 | 18 | Ovenbird | 6 | 18 |
| Warbling Vireo | 1 | 19 | Northern Waterthrush | 11 | 32 |
| Red-eyed Vireo | 1 | 5 | Mourning Warbler | 10 | 10 |
| Tree Swallow | 3 | 6 | MacGillivray's Warbler | 1 | 5 |
| Black-capped Chickadee | 50 | 19 | Common Yellowthroat | 8 | 15 |
| White-breasted Nuthatch | 2 | 7 | Wilson's Warbler | 75 | 225 |
| House Wren | 72 | 73 | Clay-colored Sparrow | 4 | 15 |
| Ruby-crowned Kinglet | 5 | 26 | Lincoln's Sparrow | 21 | 74 |
| Swainson's Thrush | 10 | 57 | White-throated Sparrow | 5 | 27 |
| Hermit Thrush | 4 | 7 | White-crowned Sparrow | 4 | 25 |
| American Robin | 16 | 124 | Rose-breasted Grosbeak | 2 | 7 |
| Gray Catbird | 36 | 32 | Brown-headed Cowbird | 3 | 4 |
| Tennessee Warbler | 61 | 147 | Baltimore Oriole | 5 | 27 |
| Orange-crowned Warbler | 22 | 121 | American Goldfinch | 2 | 4 |

Fourty-four birds banded in previous years were recaptured in 2003. All year-to-year recaptures from 1992-2003 are presented in Appendix 5. 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 re-appear a number of years after banding. Of note are:

- Black-capped Chickadees banded in 1998 and 1999 and recaptured every year since;
- A Gray Catbird banded in 1998, recaptured for the first time in 2001 and then recaptured again in 2003; and
- A White-throated Sparrow banded in 2002 and recaptured this year (this is not a

breeding species at IBS – this record may be a rare example of migration stopover site fidelity).

**Daily Estimated Totals (DETs)**

The daily estimated totals (DETs) represent the total number of birds, by species, detected at the IBS migration monitoring site each day. Each DET incorporates capture data as well as a standardized census and any casual observations made during banding operations. The DETs, after removal of probable and known stopovers (PKS), give an overall description of bird migration. DET is secondary, and inferior to, mist-netting as a monitoring measure at IBS. If high capture rates and/or personnel shortage create a risk to the welfare of the birds, a census (and therefore a DET) is not done.

## 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 2003 field season was MAPS 15th 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-crownedWarbler
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 over 500 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". At IBS, MAPS initiates during period 4 (31 May - 9 June) and coverage entails 7 of the 10 ten-day periods. In recent years period 10 has been operated during fall migration monitoring. During 2003 period 9 was also operated during fall migration monitoring.

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 habitat is assessed every 5 years.

## MAPS Schedule and Coverage

2003 marked the 11th year of the MAPS project at IBS since 1992. Unavailability of qualified personnel precluded gathering data in 1994. In 2003 a total of 424 net-hours were achieved over 7 periods. Although period 4 is no longer required at stations at the latitude of IBS we have continued with it in most years out of tradition.

## Results

The number of each species banded, by date, during 2003 are summarized in Table 3. The number of each species that were banded is summarized in Table 4 and Figure 5 for 2003 as well as the 10 previous years.

## Discussion

The number of new bandings has fluctuated from year to year but has generally trended downward. New lows were set in 2003 for number of birds and species. Noteworthy in 2003 was no Least Flycatchers for the first time and a continued increase in Gray Catbirds. One possible factor in the decline of MAPS bandings is a reduction in the quality of habitat at IBS over time. Certainly some ecological processes essential for a healthy riparian ecosystem have been attenuated (e.g. seasonal flooding, balsam poplar regeneration). Very few migrants were detected in 2003 which also contributed to the overall decrease in birds and species.

## MIGRATION MONITORING AT LAS CALETAS, COSTA RICA

### Introduction

A migration monitoring site on the Osa Peninsula on the Pacific coast of Costa Rica was identified in 1998 and pilot migration monitoring was initiated in 2002 and continued in 2003 (Figure 4). CBBS is interested in the potential to monitor Neotropical migrants on their northward migration through Central America as a complement to the migration monitoring carried out at IBS. The purpose of the pilot program was to see whether in fact there is a significant movement of Neotropical migrants through the site and, if so, the optimum temporal window to monitor the migration using standardized mist-netting.

### Study Site

The potential migration monitoring site is located on the Pacific coast of southwest Costa Rica on the Osa Peninsula just north of Corcovado National Park in the vicinity of the Las Caletas ecotourism lodge. Las Caletas is located on the south coast of Drake Bay, a few kilometres southwest of the small village of Agujitas and is accessed by a 2 hour boat trip from the town of Sierpe, down the Sierpe River and southwest across Drake Bay. The lodge is on a hill looking north over the Pacific Ocean. The monitoring station is 200 metres further uphill south of the lodge.

### Methods

Migration monitoring methods used during spring 2003 were similar to those at IBS. Constant effort mist-netting 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 on each day, weather permitting. Nineteen different net lanes were tried with a maximum of 16 in operation on any given day. The 12-m x 30-mm mesh mist-nets were operated for approximately 6 hours each day beginning at sunrise (~ 0530 to 1130). USFWS aluminum bands were applied to migrants while CBBS-purchased bands were applied to species resident in the area. Hummingbirds, captured incidentally, were released unbanded.

### Monitoring Schedule and Coverage

Spring migration monitoring was conducted from 15 April – 9 May. Mist-netting occurred on all 25 days for a total of 2123 net-hours (Table 5).

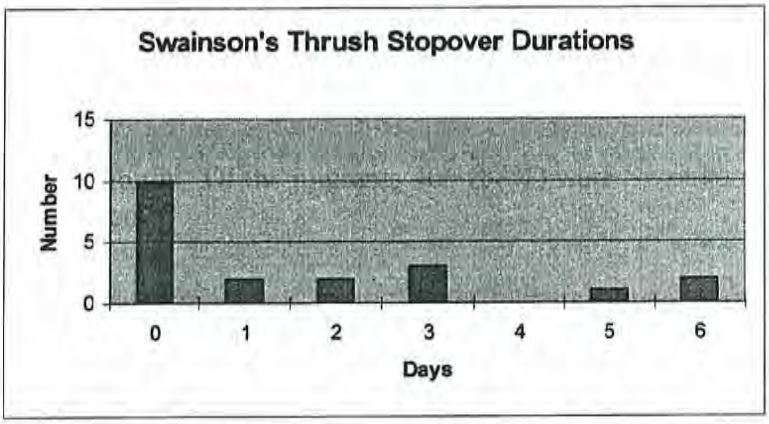
### New Bandings and Captures

In total, 979 birds of 80 species were captured (excluding recaptures) of which 778 (79%) were new bandings and 201 (21%) released or otherwise unbanded (Appendix 6). From a different perspective 518 (53%) were resident birds and 461 (47%) were migrants. Of the resident birds

185 (36%) were hummingbirds. Of the migrants 406 (88%) were Swainson's Thrushes and 34 (7%) were Alder Flycatchers.

**Recaptures**

A total of 330 recaptures were recorded, primarily (94%) resident birds (42 species). Twenty Swainson's Thrushes were recaptured, 10 (50%) same day and the rest up to 6 days post-banding. Although this species appears to be moving through the Las Caletas area with purpose at least a few birds are lingering to forage prior to continuing their northward migration.




None of the 34 Alder Flycatchers, 10 Yellow-green Vireos, 6 Red-eyed Vireos, 3 Willow Flycatchers or 1 Northern Waterthrush banded was recaptured. The capture and recapture of several warblers in 2002 was not experienced in 2003 perhaps suggesting that winter residents had already moved out of the area prior to initiation of the 2003 program. On the other hand a Yellow-bellied Flycatcher (the only one banded in 2002) was recaptured in 2003 documenting winter territory fidelity in this species.

Recapture of resident birds allows quantification of year-to-year survivorship. Although only one year of data is in so far we are already seeing indications of the relatively high survivorship that neotropical resident birds exhibit. The table below documents survival rates from 2002 to 2003 of 14% to 100%. It should be kept in mind that many of these survival rates are based on small sample sizes. Data from future years of monitoring will increase sample sizes and refine survivorship rates.

| Species | 2002 bandings | % recaptured in 2003 |
|---|---|---|
| Olivaceous Piculet | 3 | 66.7% |
| Buff-throated Foliage-gleaner | 4 | 50.0% |
| Plain Xenops | 5 | 60.0% |
| Tawny-winged Woodcreeper | 6 | 50.0% |
| Wedge-billed Woodcreeper | 16 | 37.5% |
| Black-hooded Antshrike | 8 | 50.0% |
| Streak-headed Woodcreeper | 4 | 25.0% |
| Chestnut-backed Antbird | 8 | 37.5% |
| Bicolored Antbird | 2 | 50.0% |
| Ochre-bellied Flycatcher | 21 | 28.6% |
| Northern Bentbill | 4 | 25.0% |
| Ruddy-tailed Flycatcher | 2 | 100.0% |
| Orange-collared Manakin | 26 | 30.8% |
| Blue-crowned Manakin | 7 | 14.3% |
| Tawny-crowned Greenlet | 2 | 50.0% |
| Red-capped Manakin | 21 | 19.0% |
| Long-billed Gnatwren | 12 | 25.0% |
| Bananaquit | 9 | 33.3% |
| Gray-headed Tanager | 4 | 50.0% |
| White-shouldered Tanager | 4 | 25.0% |
| Black-cheeked Ant-Tanager | 5 | 20.0% |
| Scarlet-rumped Tanager | 7 | 14.3% |
| Orange-billed Sparrow | 12 | 58.3% |

## Discussion

Pilot migration monitoring during 2002 and 2003 has documented a significant movement of Swainson's Thrushes through the Las Caletas area along with smaller numbers of several other Neotropical migrants. Figure 6 presents the daily captures of all migrants including Swainson's Thrushes over the entire migration period as covered in 2002 and 2003. Based on this profile CBBS intends to initiate full standardized migration monitoring at Las Caletas during 2004. The period selected for annual coverage beginning in 2004 is 28 March to 29 April. Based on the 2002-2003 data this should cover approximately 93% of the migration period.

## NORTHERN SAW-WHET OWL MIGRATION MONITORING

### Background

During 2003 a site in the foothills southwest of Calgary was identified as having potential for monitoring migrating Northern Saw-whet Owls. After disappointing results at IBS in 2000 the CBBS was pleased to have another opportunity to initiate a Northern Saw-whet Owl migration monitoring program.

### Methods

Monitoring was begun 7 October September and continued through 18 November. A continuous recording of Northern Saw-whet Owl and Boreal Owl calls was played at maximum volume in a portable CD "ghetto-blaster" from the center of an array of four 60-mm x 12-m mist-nets. Northern Saw-whet Owl calls and Boreal Owl calls were each played during 50% of the monitoring period (alternating 45 minute periods). The array was placed beneath a thick canopy of mature spruce trees. The area has been subject to cattle grazing and the understory and tree branches as high as a cow can rub are absent. Tape playback commenced approximately 0.5-hrs after sunset and continued for 4-hrs, weather and other factors permitting. Nets were checked every 0.75-hrs by a Bander-in-Charge (BIC) and 1-2 volunteers. Sex, age and morphometric data were collected on all owls captured. Basic weather data (wind direction and speed, sky conditions and temperature) were noted at start and finish each evening.

### Results

A total of 52 Northern Saw-whet Owls and 4 Boreal Owls were captured and banded during 159 luring hours on 34 days between 7 October and 18 November. Although peak movement appeared to be 17 October owls were captured on both 7 October (6) and 18 November (1). Examination of data from Delta Marsh Bird Observatory (2000-2003) and Beaverhill Bird Observatory indicates that the majority of Northern Saw-whet Owl movement occurs between 15 September and 31 October peaking in mid-October.

HY birds comprised 71% of the Northern Saw-whet Owls and 50% of the Boreal Owls. Females comprised 58% and 25% and males 25% and 75% of the Northern Saw-whet Owls and Boreal Owls respectively. Seventeen percent of the Northern Saw-whet Owls could not be sexed with confidence.

Northern Saw-whet Owl calls and Boreal Owl calls were each played during ~50% of the luring hours. Each species clearly selected for its own calls with 85% of Northern Saw-whet Owls captured during playing of its call and 100% of Boreal Owls captured during playing of its call.

## Discussion

This site southwest of Calgary appears to be suitable for monitoring migration of Northern Saw-whet Owls. CBBS intends to initiate a full monitoring program in 2004. Playing Northern Saw-whet Owl calls 100% of the time and monitoring from 15 September through the end of October or later should yield very good results.

## SIGNIFICANT RECAPTURES

Interesting recaptures of birds banded in previous years are listed below. All recaptures (44) of birds banded prior to 2003 are indicated in Appendix 5. No recoveries of Swainson's Thrushes banded in previous years was disappointing. However the White-throated Sparrow recovery may represent migration stopover site fidelity as this species is not a breeding bird at Inglewood Bird sanctuary.

**Tree Swallow** 2171-56495 Banded as AHY-F by Shonna Mcleod at Inglewood Bird Sanctuary on 24 May 2002. Recaptured by Ray Woods about 4-km WSW of Didsbury on 17 June 2003 having **moved ~70-km north of IBS.**

**Warbling Vireo** 1990-57936 Banded as SY-U by Greg Meyer at Inglewood Bird Sanctuary ~~in Calgary, AB~~ on 25 June 2000. Recaptured there on 26 May 2003. **At least 5-years old.**

**Black-capped Chickadee** 2160-19120 Banded as AHY-U by Greg Meyer at Inglewood Bird Sanctuary on 6 August 1998. Recaptured there on 3 May 2003. **At least 6-years old.**

**Gray Catbird** 8041-54987 Banded as AHY-U by Stefan Jungkind at Inglewood Bird Sanctuary on 26 August 1999. Recaptured there on 27 May 2003. **At least 5-years old.**

**American Robin** 1152-38740 Banded as AHY-F by Stefan Jungkind at Inglewood Bird Sanctuary ~~in Calgary, AB~~ on 18 August 1998. Recaptured there on 21 May 2003. **At least 6-years old.**

**Clay-colored Sparrow** 1990-57805 Banded as ASY-M by Greg Meyer at Cominco on 24 May 2000. Recaptured there on 25 July 2003. **At least 6-years old.**

**White-throated Sparrow** 1791-28046 Banded as AHY-U by Greg Meyer at Inglewood Bird Sanctuary on 27 May 2002. Recaptured there on 18 May 2003. **Possible stopover site fidelity.**

## TREND ANALYSIS

Table 6 presents the results of trend analysis on those species that are monitored at IBS during fall migration. Monitored species are those for which at least 10 individuals are captured on at least 5 different days (Appendix 3). Figure 7 illustrates graphically the trend to date for 4 species that are evidencing significant or nearly significant trends.

Trend analysis is based on total captures from 1995-2003 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 days monitored within the species' "window" of migration as inferred from the overall 1995-2003 capture data. Captures were left as 0 on days when monitoring did not occur. Actual confidence level (P) is indicated. Note that scientific investigation normally requires a P level of $<0.05$ and preferably $<0.01$ in order to consider results significant. Due to net-lane inconsistencies year-to-year several species could only be analyzed using a subset of the data.

Although the trends with low P values are likely real, the cause behind them is unclear. Only time and comparison to other CMMN stations will indicate whether significant trends are due to changes in regional populations or to other confounding variables such as weather or habitat change in and around IBS.

Annual indices through 2002 were obtained from Bird Studies Canada for species monitored at Last Mountain Bird Observatory and Delta Marsh Bird Observatory. These data were analyzed over the period 1995-2002 for comparison with Inglewood Bird Sanctuary trend data. Table 7 presents the comparison for all Inglewood monitored species with a trend P value of $\leq 0.30$. Two species, Swainson's Thrush and Orange-crowned Warbler, are trending consistently at all three stations. Two others, Ovenbird and Baltimore Oriole, are trending similarly at IBS and DMBO while three others, Warbling Vireo, White-throated Sparrow and Dark-eyed Junco are trending similarly at IBS and LMBO. Correlating trends between migration monitoring stations add strength to the interpretation that a trend is reflecting regional population(s).

## PERSONNEL

### Volunteers

Volunteer participation in all of the CBBS projects continues to be the key to the success of research efforts. Banding at IBS is done in an area of the sanctuary designated "reserve" and off-limits to the public. A condition of operation is 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 up to 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 8 who donated approximately 8 hours on each day indicated.

### Banders-in-Charge (BIC)

No salaried staff are involved in any CBBS projects. However, a daily per diem and travel allowance (for out-of-town banders only) is offered to all Banders-in-Charge (BIC). 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 established by the general membership for the 2003 field season was $100/day.

## 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 casualties during the 2003 migration monitoring and MAPS projects. Note that the number captured, by species, is only given where that species experienced injury or mortality. The number of mortalities during CBBS banding projects continues to remain low and is dominated by predation. The injury rate in 2003 rose slightly to 0.92% but overall remains low likely due to the increasing skill of volunteers.

Increases through 1997 were in part due to an increased awareness of banding personal to record even slight abrasions. In other words, the data pre-1998 likely underestimates the rate of injury. 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.

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FIGURES

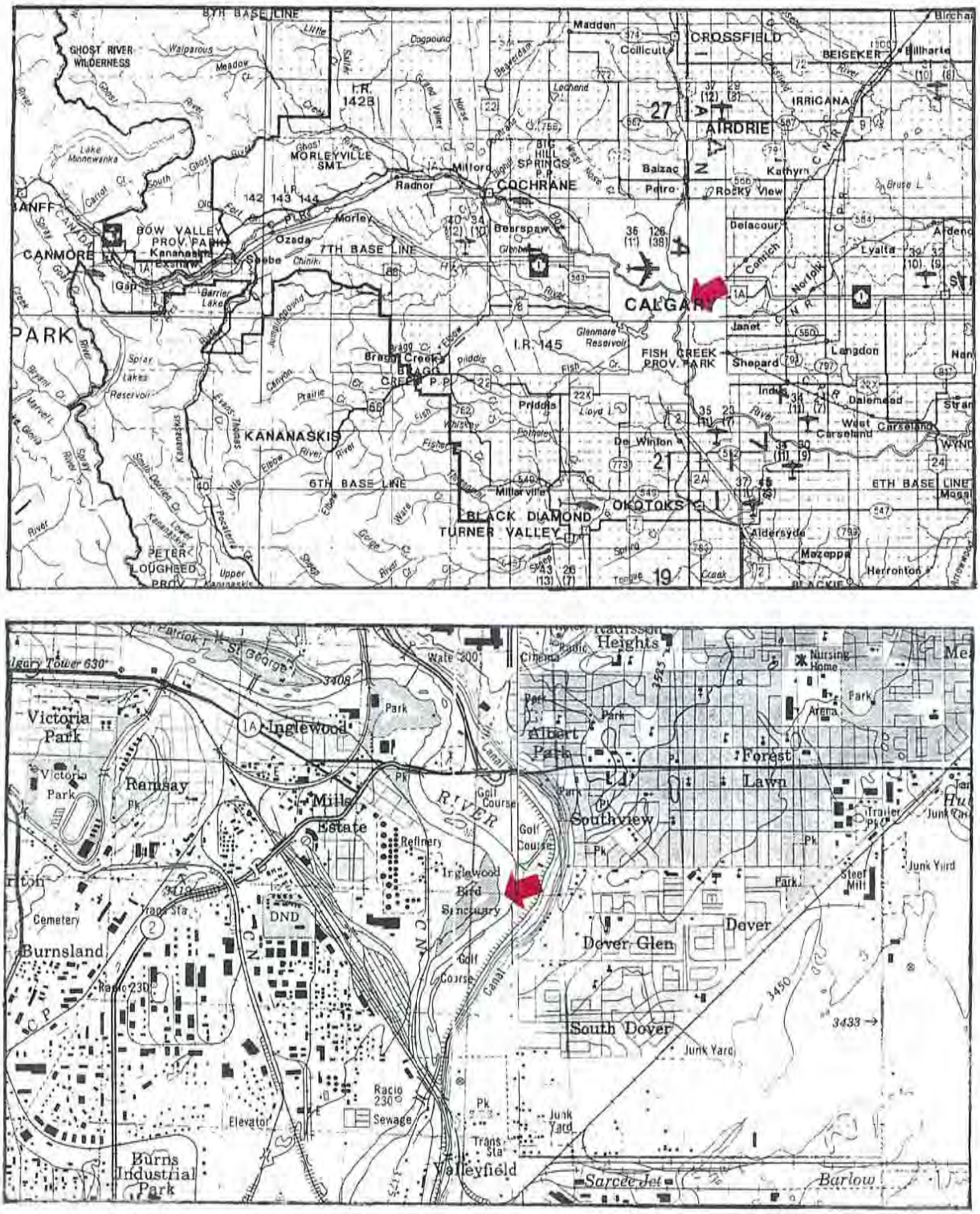



Figure 1. Topographic maps at 1:250,000 (top) and 1:50,000 (bottom) scales showing location of Inglewood Bird Sanctuary in southwestern Alberta. North is up.

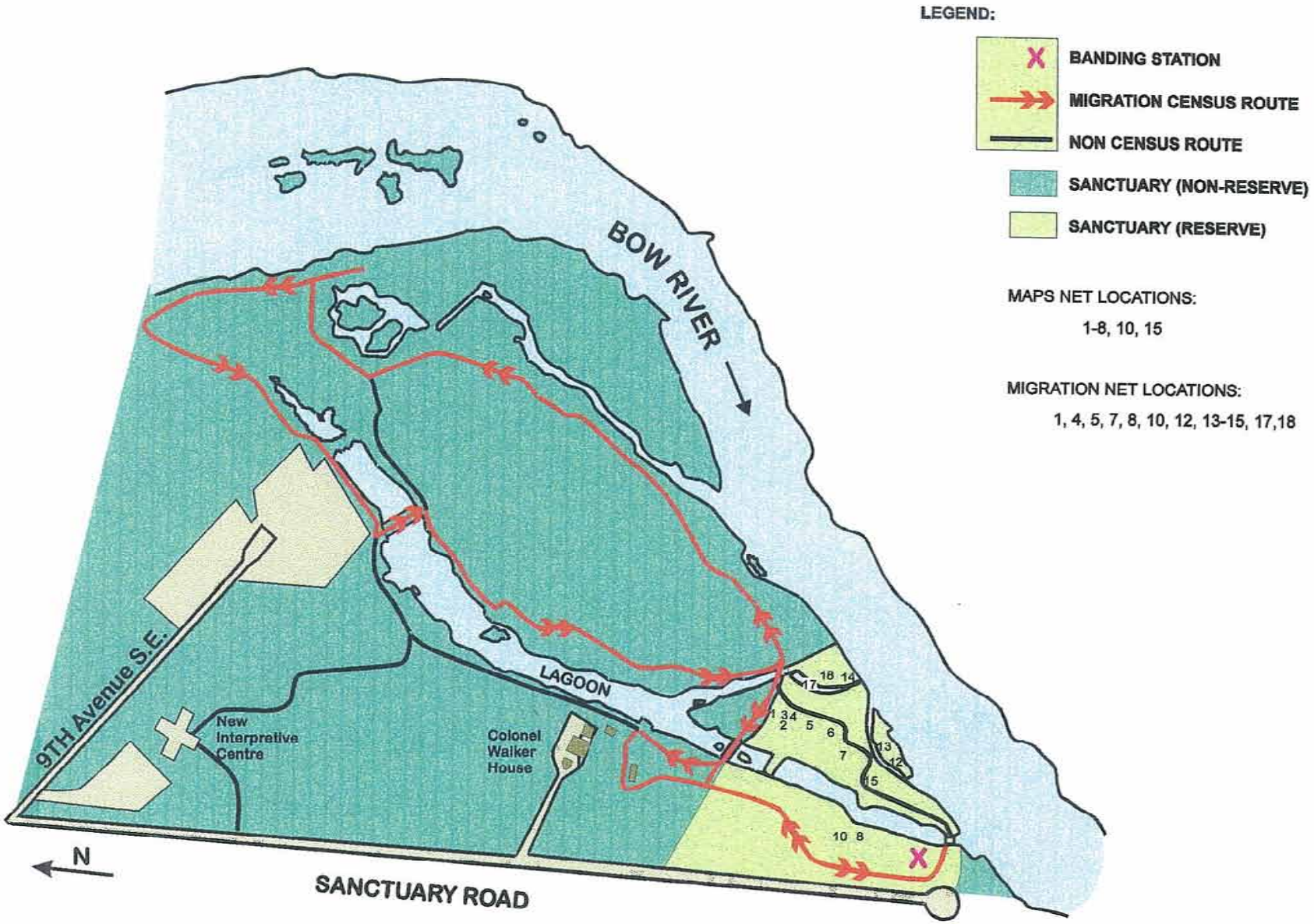



Figure 2. Schematic of Inglewood Bird Sanctuary migration monitoring station

**Figure 3a. New Bandings at Inglewood Bird Sanctuary - Spring 2003**

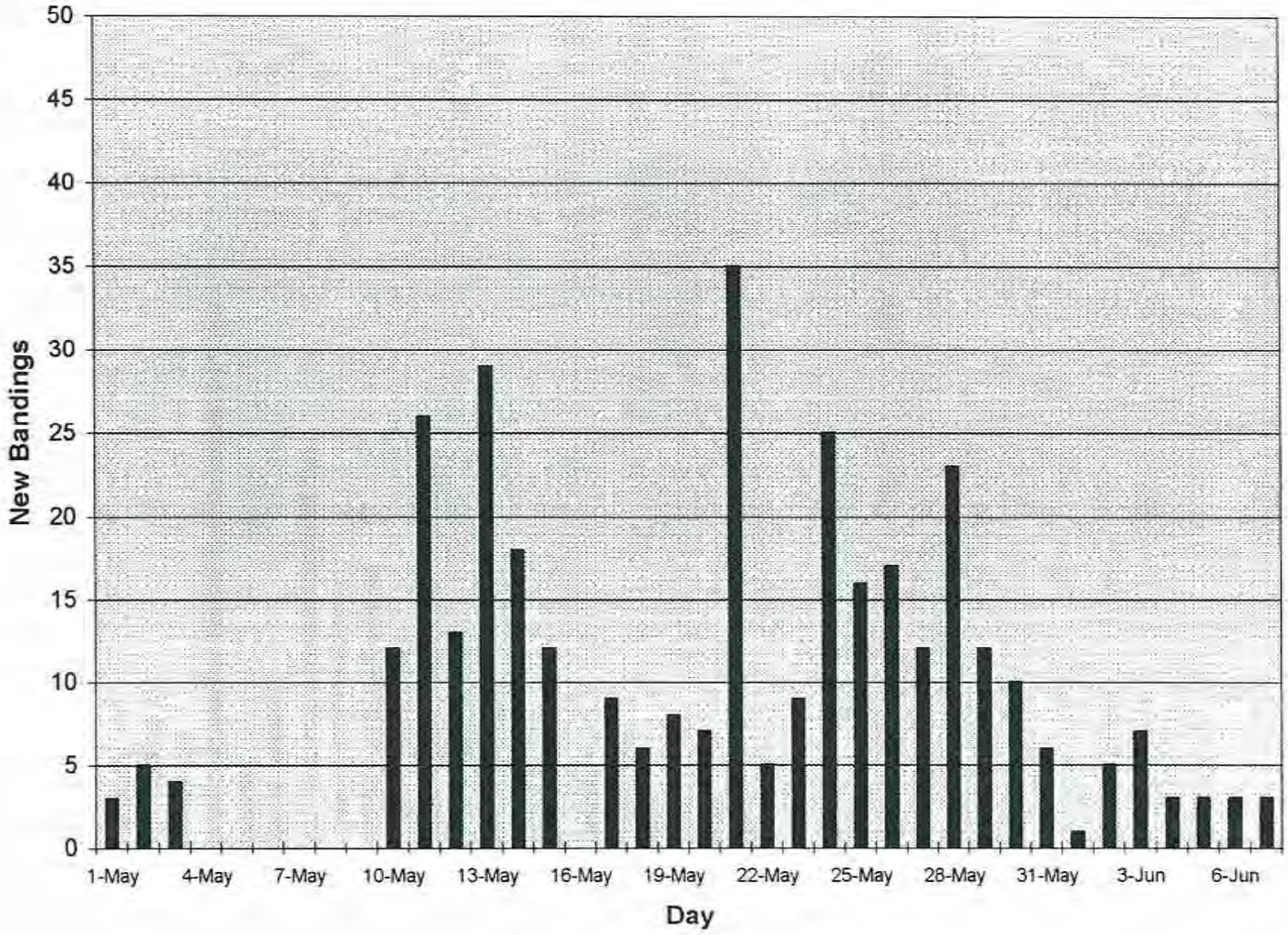


**Figure 3b. New Bandings at Inglewood Bird Sanctuary - Fall 2003**

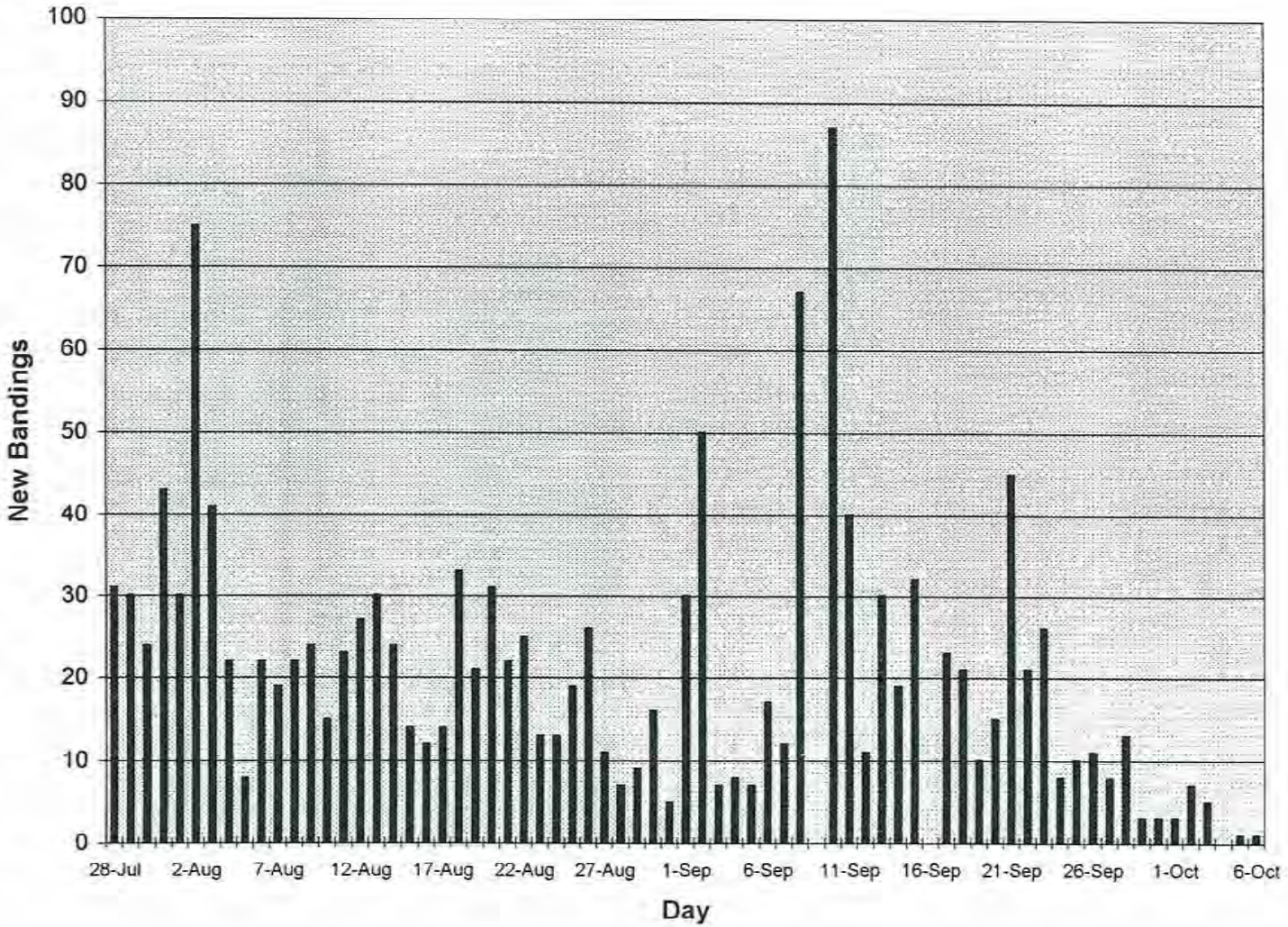



**Figure 4. Location of CBBS Migration Monitoring Site at Las Caletas, Costa Rica**

**Figure 5. MAPS at Inglewood Bird Sanctuary 1992-2003**

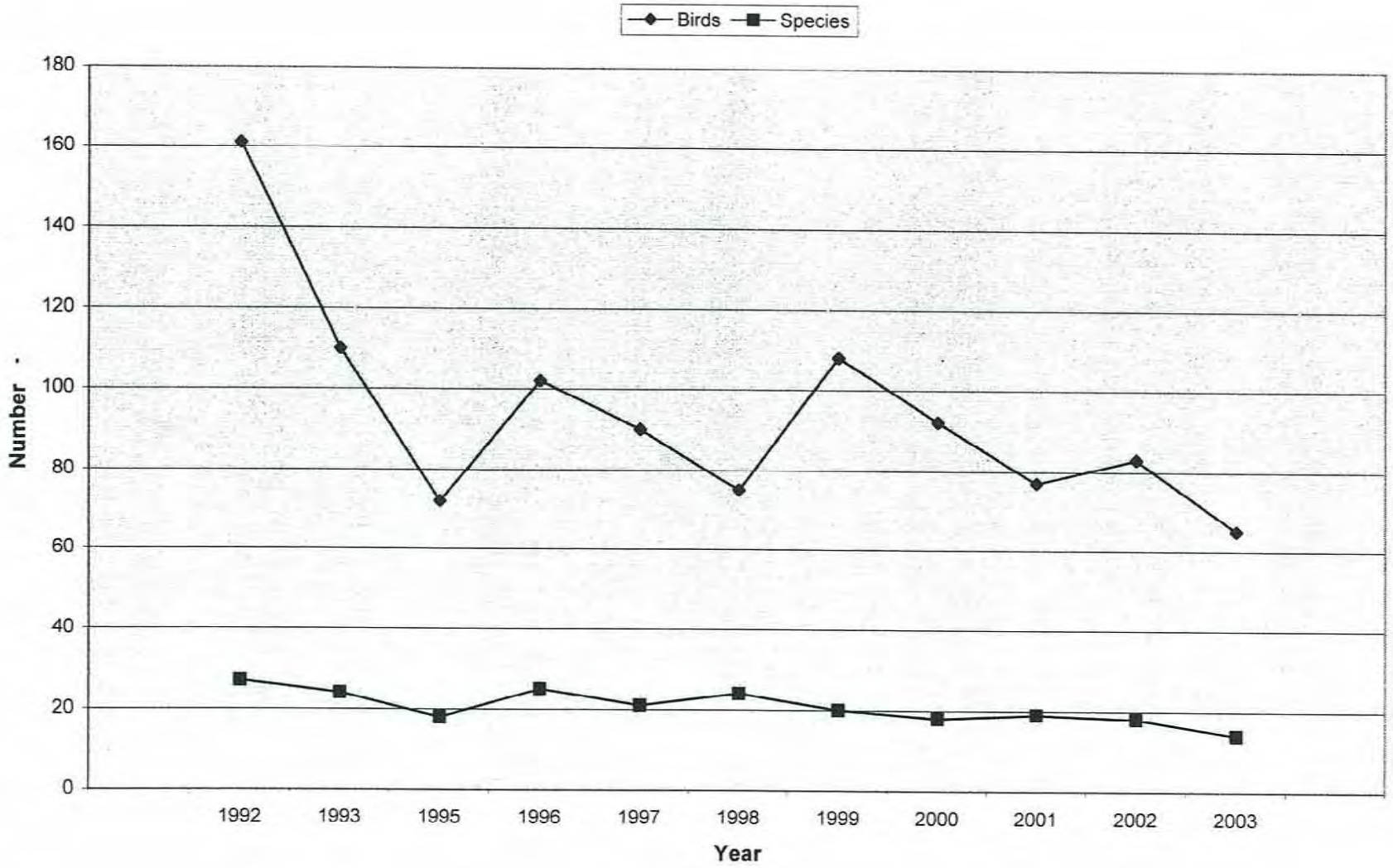


**Figure 6. Migrant Captures at Las Caletas, Costa Rica 2002-2003**

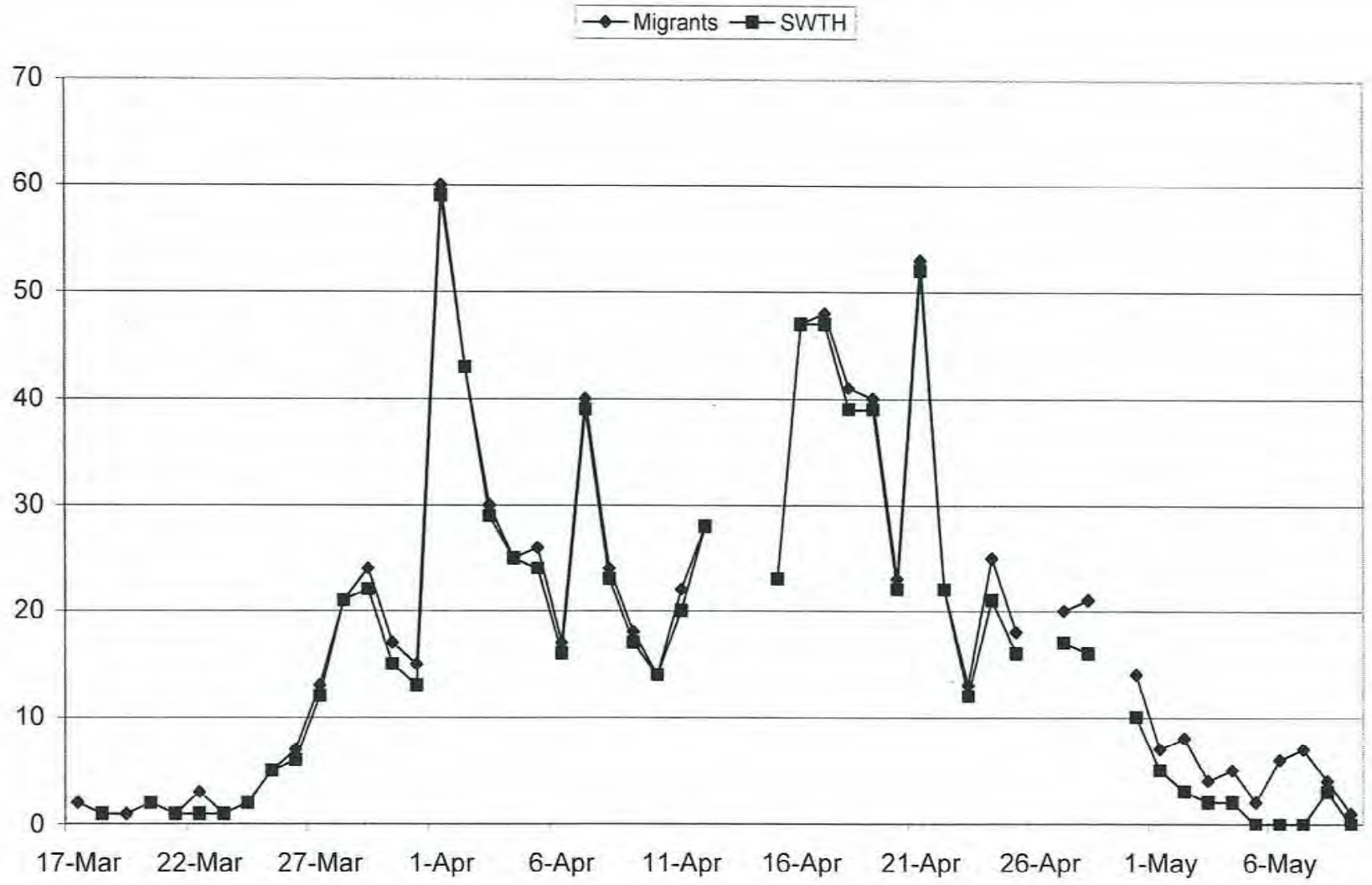


**Figure 7. Trends in Select Species at Inglewood Bird Sanctuary**

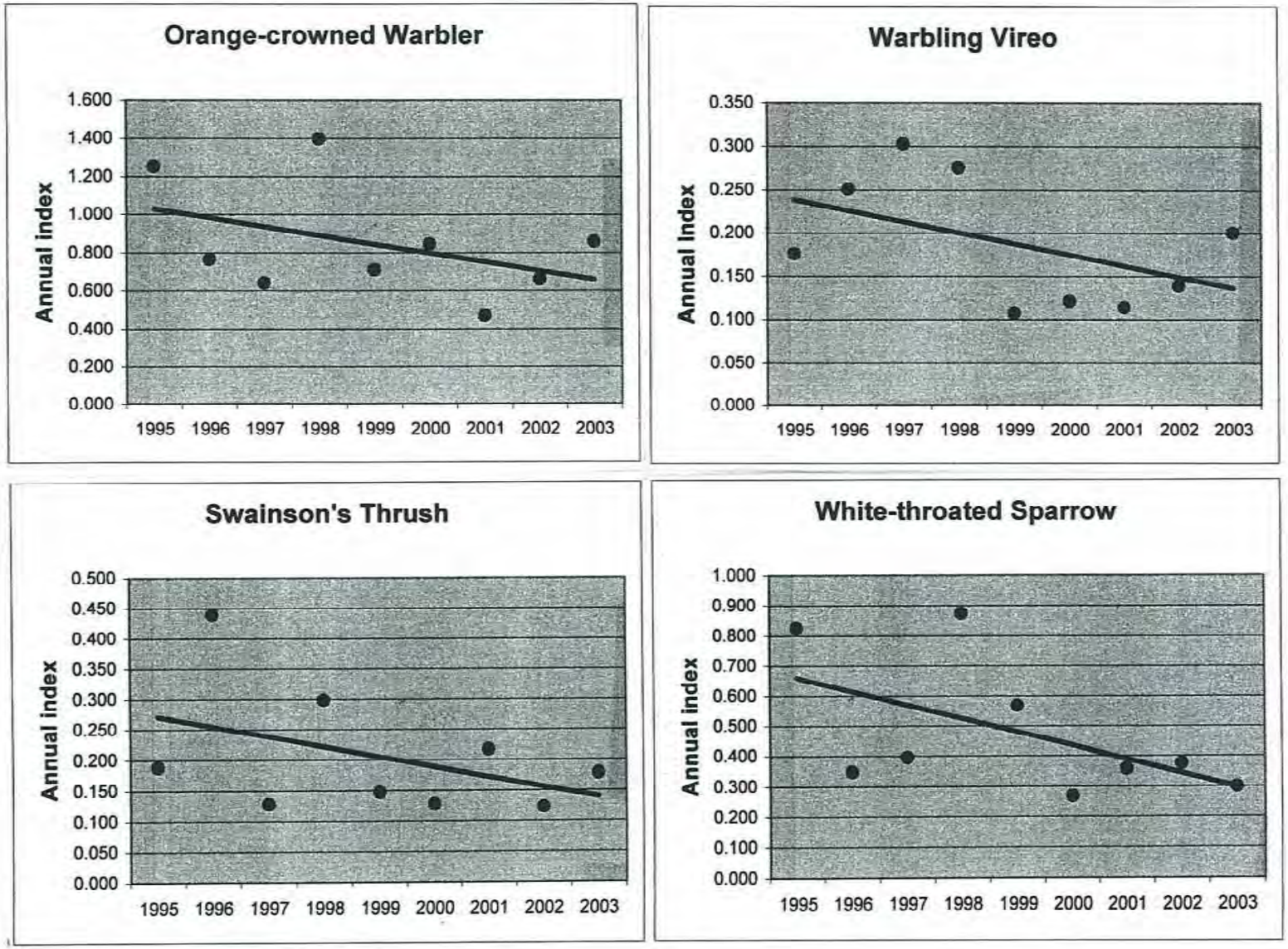
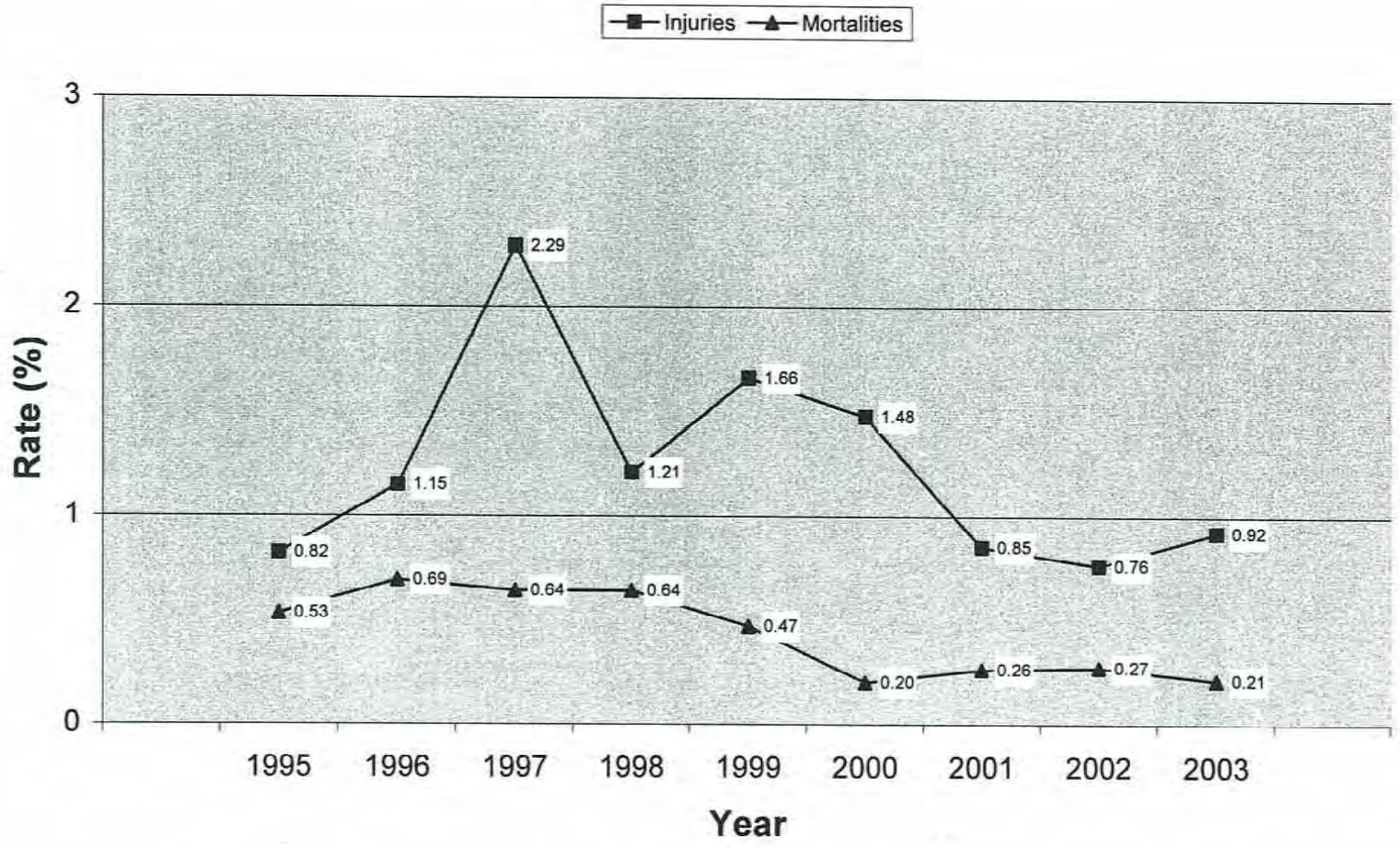


**Figure 8. Casualty Rates for all CBBS Banding Projects - 2003**



TABLES

## Table 1a. Coverage and Capture Rates During 2003 Spring MM at IBS

| Date | Net-hours | Captures | | | | Total | Captures/100 Net-hours |
|---|---|---|---|---|---|---|---|
| | | New Bandings | Recaptures | Escapes | Mortalities | | |
| | | | | | | | |
| 01-May | 72.0 | 3 | 1 | | | 4 | 6 |
| 02-May | 72.0 | 5 | 1 | | | 6 | 8 |
| 03-May | 69.2 | 4 | 2 | | | 6 | |
| 04-May | weather | | | | | 0 | |
| 05-May | weather | | | | | 0 | |
| 06-May | weather | | | | | 0 | |
| 07-May | weather | | | | | 0 | |
| 08-May | weather | | | | | 0 | |
| 09-May | weather | | | | | 0 | |
| 10-May | 72.0 | 12 | 1 | | | 13 | 18 |
| 11-May | 74.1 | 26 | 12 | | | 38 | 51 |
| 12-May | 72.0 | 13 | 3 | | | 16 | 22 |
| 13-May | 72.0 | 29 | 6 | | | 35 | 49 |
| 14-May | 72.0 | 18 | 2 | | | 20 | 28 |
| 15-May | 72.5 | 12 | 1 | | | 13 | 18 |
| 16-May | weather | | | | | 0 | |
| 17-May | 72.0 | 9 | 2 | | | 11 | 15 |
| 18-May | 72.0 | 6 | 5 | | | 11 | 15 |
| 19-May | 73.2 | 8 | 3 | | | 11 | 15 |
| 20-May | 72.0 | 7 | 4 | | | 11 | 15 |
| 21-May | 73.0 | 35 | 7 | 1 | | 43 | 59 |
| 22-May | 72.0 | 5 | 1 | | | 6 | 8 |
| 23-May | 72.6 | 9 | 5 | | | 14 | 19 |
| 24-May | 72.0 | 25 | 1 | | | 26 | 36 |
| 25-May | 73.8 | 16 | 3 | 1 | | 20 | 27 |
| 26-May | 72.3 | 17 | 10 | 2 | | 29 | 40 |
| 27-May | 72.0 | 12 | 10 | | | 22 | 31 |
| 28-May | 72.1 | 23 | 8 | 1 | | 32 | 44 |
| 29-May | 60.8 | 12 | 9 | | | 21 | 35 |
| 30-May | 72.1 | 10 | 5 | | | 15 | 21 |
| 31-May | 72.1 | 6 | 1 | | | 7 | 10 |
| 01-Jun | 48.0 | 1 | 2 | | | 3 | 6 |
| 02-Jun | 72.2 | 5 | 4 | | | 9 | 12 |
| 03-Jun | 55.8 | 7 | 6 | | | 13 | 23 |
| 04-Jun | 59.8 | 3 | 1 | | | 4 | 7 |
| 05-Jun | 60.1 | 3 | 1 | | | 4 | 7 |
| 06-Jun | 60.6 | 3 | 2 | | 1 | 6 | 10 |
| 07-Jun | 60.0 | 3 | | | | 3 | 5 |
| | | | | | | | |
| **Total** | **2138** | **347** | **119** | **5** | **1** | **472** | 22 |

## Table 1b. Coverage and Capture Rates During 2003 Fall MM at IBS

| Date | Net-hours | Captures | | | | Total | Captures/100 Net-hours |
|---|---|---|---|---|---|---|---|
| | | New Bandings | Recaptures | Escapes | Mortalities | | |
| | | | | | | | |
| 28-Jul | 73.6 | 31 | 2 | 1 | | 34 | 46 |
| 29-Jul | 72.7 | 30 | 6 | | | 36 | 50 |
| 30-Jul | 74.2 | 24 | 9 | | | 33 | 44 |
| 31-Jul | 73.0 | 43 | 9 | 1 | | 53 | 73 |
| 01-Aug | 72.0 | 30 | 9 | 1 | | 40 | 56 |
| 02-Aug | 73.6 | 75 | 21 | | | 96 | 130 |
| 03-Aug | 74.2 | 41 | 11 | | | 52 | 70 |
| 04-Aug | 73.7 | 22 | 6 | 1 | | 29 | 39 |
| 05-Aug | 73.8 | 8 | 6 | | | 14 | 19 |
| 06-Aug | 72.2 | 22 | 9 | | | 31 | 43 |
| 07-Aug | 73.5 | 18 | 8 | 3 | | 29 | 39 |
| 08-Aug | 73.0 | 22 | 7 | 5 | | 34 | 47 |
| 09-Aug | 72.2 | 24 | 13 | | | 37 | 51 |
| 10-Aug | 73.6 | 15 | 8 | | | 23 | 31 |
| 11-Aug | 73.5 | 23 | 8 | | | 31 | 42 |
| 12-Aug | 74.8 | 27 | 7 | | | 34 | 45 |
| 13-Aug | 73.0 | 30 | 13 | | | 43 | 59 |
| 14-Aug | 73.7 | 24 | 11 | | | 35 | 47 |
| 15-Aug | 72.7 | 14 | 8 | | | 22 | 30 |
| 16-Aug | 72.7 | 12 | 6 | | | 18 | 25 |
| 17-Aug | 72.5 | 14 | 7 | | | 21 | 29 |
| 18-Aug | 72.4 | 33 | 14 | | | 47 | 65 |
| 19-Aug | 72.0 | 21 | 9 | 1 | 1 | 32 | 44 |
| 20-Aug | 76.4 | 31 | 13 | | | 44 | 58 |
| 21-Aug | 72.6 | 22 | 15 | | | 37 | 51 |
| 22-Aug | 72.8 | 25 | 7 | 1 | | 33 | 45 |
| 23-Aug | 72.0 | 13 | 5 | | | 18 | 25 |
| 24-Aug | 71.8 | 13 | 11 | 1 | | 25 | 35 |
| 25-Aug | 73.5 | 19 | 8 | | | 27 | 37 |
| 26-Aug | 72.3 | 26 | 10 | 1 | | 37 | 51 |
| 27-Aug | 71.8 | 11 | 4 | | | 15 | 21 |
| 28-Aug | 72.3 | 7 | 3 | | | 10 | 14 |
| 29-Aug | 72.7 | 9 | 4 | 1 | | 14 | 19 |
| 30-Aug | 72.0 | 16 | 8 | | | 24 | 33 |
| 31-Aug | 72.5 | 5 | 6 | | | 11 | 15 |
| 01-Sep | 75.1 | 30 | 8 | 1 | | 39 | 52 |
| 02-Sep | 72.2 | 50 | 6 | 2 | | 58 | 80 |
| 03-Sep | 71.9 | 7 | 6 | 1 | | 14 | 19 |

## Table 1b. Coverage and Capture Rates During 2003 Fall MM at IBS

| Date | Net-hours | Captures | | | | Total | Captures/100 Net-hours |
|---|---|---|---|---|---|---|---|
| | | New Bandings | Recaptures | Escapes | Mortalities | | |
| | | | | | | | |
| 04-Sep | 71.9 | 8 | 5 | 1 | | 14 | 19 |
| 05-Sep | 71.8 | 7 | 5 | 1 | | 13 | 18 |
| 06-Sep | 72.0 | 17 | 6 | 2 | | 25 | 35 |
| 07-Sep | 73.2 | 12 | 2 | | | 14 | 19 |
| 08-Sep | 73.1 | 67 | 4 | 2 | | 73 | 100 |
| 09-Sep | rain | | | | | | |
| 10-Sep | 72.3 | 87 | 12 | 4 | | 103 | 142 |
| 11-Sep | 72.3 | 40 | 10 | 3 | | 53 | 73 |
| 12-Sep | 50.8 | 11 | 8 | 1 | | 20 | 39 |
| 13-Sep | 72.1 | 30 | 10 | 1 | | 41 | 57 |
| 14-Sep | 76.5 | 19 | 10 | | | 29 | 38 |
| 15-Sep | 72.0 | 32 | 6 | 1 | 1 | 40 | 56 |
| 16-Sep | snow | | | | | | |
| 17-Sep | 48.4 | 23 | 7 | | | 30 | 62 |
| 18-Sep | 72.1 | 21 | 18 | 1 | 1 | 41 | 57 |
| 19-Sep | 72.0 | 10 | 7 | | | 17 | 24 |
| 20-Sep | 72.4 | 15 | 1 | 1 | | 17 | 23 |
| 21-Sep | 71.9 | 45 | 6 | 1 | | 52 | 72 |
| 22-Sep | 69.4 | 21 | 5 | 1 | | 27 | 39 |
| 23-Sep | 72.0 | 26 | 4 | 1 | | 31 | 43 |
| 24-Sep | 45.6 | 8 | 3 | | | 11 | 24 |
| 25-Sep | 73.0 | 10 | 1 | | | 11 | 15 |
| 26-Sep | 72.0 | 11 | 5 | | | 16 | 22 |
| 27-Sep | 72.6 | 8 | 2 | | | 10 | 14 |
| 28-Sep | 72.7 | 13 | 2 | 1 | 1 | 17 | 23 |
| 29-Sep | 63.1 | 3 | 2 | | | 5 | 8 |
| 30-Sep | 72.0 | 3 | 2 | | | 5 | 7 |
| 01-Oct | 72.3 | 3 | 1 | | | 4 | 6 |
| 02-Oct | 61.6 | 7 | | | | 7 | 11 |
| 03-Oct | 72.8 | 5 | 1 | | | 6 | 8 |
| 04-Oct | 72.2 | 0 | | | | 0 | 0 |
| 05-Oct | 73.9 | 1 | 2 | | | 3 | 4 |
| 06-Oct | 73.5 | 1 | | | | 1 | 1 |
| | | | | | | | |
| **Total** | **4928** | **1451** | **468** | **43** | **4** | **1966** | 40 |

## Table 2a. New Bandings at Inglewood Bird Sanctuary - Spring

| Year | | 2002 | 2003 |
|---|---|---|---|
| | | | |
| Start | | 01-May | 01-May |
| Finish | | 07-Jun | 07-Jun |
| # Days | | 27 | 31 |
| | | | |
| Total | | 624 | 347 |
| Species | | 46 | 36 |
| Net-hours | | 1884 | 2138 |
| Bandings/100 Net-hours | | 33.1 | 16.2 |
| | | | |
| American Kestrel | | 1 | |
| Solitary Sandpiper | | 1 | |
| Spotted Sandpiper | | 2 | |
| Belted Kingfisher | | 1 | |
| Downy Woodpecker | | 5 | 1 |
| Northern Flicker | | 1 | |
| Western Wood-Pewee | | 5 | 1 |
| Traill's Flycatcher* | | 6 | 4 |
| Least Flycatcher | | 16 | 6 |
| Eastern Phoebe | | 1 | |
| Eastern Kingbird | | | 3 |
| Blue-headed Vireo | | 2 | 1 |
| Warbling Vireo | | 4 | 2 |
| Red-eyed Vireo | | | 1 |
| Tree Swallow | | 18 | 6 |
| N Rough-winged Swallow | | 5 | |
| Bank Swallow | | | 1 |
| Barn Swallow | | 1 | |
| Black-capped Chickadee | | 3 | |
| Red-breasted Nuthatch | | 1 | |
| White-breasted Nuthatch | | 2 | |
| House Wren | | 13 | 15 |
| Ruby-crowned Kinglet | | | 2 |
| Veery | | | 1 |
| Swainson's Thrush | | 54 | 38 |

## Table 2a. New Bandings at Inglewood Bird Sanctuary - Spring

| Year | 2002 | 2003 |
|---|---|---|
| | | |
| Hermit Thrush | 2 | 2 |
| American Robin | 28 | 35 |
| Gray Catbird | 13 | 13 |
| Cedar Waxwing | 3 | |
| Orange-crowned Warbler | 19 | 6 |
| Yellow Warbler | 33 | 20 |
| Yellow-rumped Warbler | 249 | 100 |
| Blackpoll Warbler | 30 | 2 |
| American Redstart | 2 | 1 |
| Northern Waterthrush | 8 | 3 |
| Common Yellowthroat | 21 | 6 |
| Wilson's Warbler | 4 | 1 |
| Western Tanager | 1 | |
| Chipping Sparrow | 3 | 6 |
| Clay-coloured Sparrow | 15 | 9 |
| Savannah Sparrow | 3 | |
| Fox Sparrow | | 1 |
| Song Sparrow | 3 | 1 |
| Lincoln's Sparrow | 19 | 31 |
| White-throated Sparrow | 5 | 2 |
| White-crowned Sparrow | 6 | 7 |
| Dark-eyed Junco | 1 | |
| Rose-breasted Grosbeak | 1 | |
| Red-winged Blackbird | 3 | 5 |
| Brown-headed Cowbird | 5 | 3 |
| Baltimore Oriole | 4 | 7 |
| American Goldfinch | 1 | 4 |

*Note: Traill's Flycatcher includes both Willow and Alder

## Table 2b. New Bandings at Inglewood Bird Sanctuary - Fall

| Year | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start | 03-Aug | 18-Aug | 01-Aug | 31-Jul | 31-Jul | 25-Jul | 26-Jul | 01-Aug | 25-Jul | 27-Jul | 28-Jul | all |
| Finish | 22-Sep | 09-Sep | 30-Sep | 12-Oct | 15-Oct | 02-Oct | 08-Oct | 30-Sep | 06-Oct | 06-Oct | 06-Oct | years |
| # Days | 26 | 20 | 54 | 70 | 65 | 61 | 68 | 55 | 73 | 68 | 69 | |
| Total | 841 | 466 | 1549 | 1121 | 1455 | 1898 | 1276 | 1262 | 1402 | 1466 | 1452 | 14188 |
| Species | 52 | 48 | 61 | 59 | 64 | 64 | 66 | 68 | 64 | 66 | 60 | 99 |
| Net-hours | 934 | 1078 | 3456 | 4547 | 4608 | 4371 | 4426 | 3842 | 5152 | 4838 | 4928 | 42182 |
| Bandings/100 Net-hours | 90.0 | 43.2 | 44.8 | 24.7 | 31.6 | 43.4 | 28.8 | 32.8 | 27.2 | 30.3 | 29.5 | 33.6 |
| Wood Duck | | | 1 | | | | | | | | | 1 |
| Mallard | | | | | | | 1 | | | | | 1 |
| Sharp-shinned Hawk | 2 | 2 | | 1 | 5 | 4 | 3 | 1 | 1 | 3 | | 22 |
| Cooper's Hawk | | | | 1 | 1 | | | 1 | | 1 | | 4 |
| Northern Goshawk | | | | 1 | | | | | | | | 1 |
| Broad-winged Hawk | | | | | | 1 | | | | | | 1 |
| Solitary Sandpiper | 3 | 2 | 3 | 14 | 13 | 14 | 2 | 8 | 4 | 12 | 5 | 80 |
| Spotted Sandpiper | | 1 | 2 | | 3 | 3 | 2 | | | 5 | 1 | 17 |
| Common Snipe | | | | | | | | 1 | | 1 | | 2 |
| Belted Kingfisher | 2 | 2 | 8 | 8 | 6 | 8 | 10 | 7 | 2 | 5 | 6 | 64 |
| Yellow-bellied Sapsucker | | | 1 | | | | | | | 1 | | 2 |
| Downy Woodpecker | | 1 | 2 | 3 | 5 | 7 | 3 | 9 | 9 | 13 | 12 | 64 |
| Hairy Woodpecker | | | | | | | | 1 | | 1 | | 2 |
| Northern Flicker | 2 | 1 | 4 | 8 | 7 | 3 | 11 | 2 | | 4 | 7 | 49 |

## Table 2b. New Bandings at Inglewood Bird Sanctuary - Fall

| Year | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Olive-sided Flycatcher | 3 | | 3 | | 5 | 2 | | 2 | | 2 | | 17 |
| Western Wood-Pewee | 6 | 4 | 11 | 2 | 33 | 8 | 10 | 7 | 14 | 14 | 11 | 120 |
| Yellow-bellied Flycatcher | | | 1 | | | | 1 | | | | | 2 |
| Traill's Flycatcher* | 24 | 16 | 29 | 25 | 50 | 36 | 24 | 40 | 46 | 45 | 32 | 367 |
| Least Flycatcher | 16 | 5 | 16 | 9 | 30 | 14 | 11 | 21 | 20 | 21 | 9 | 172 |
| Dusky Flycatcher | | | 2 | 1 | | | | | | | | 3 |
| Pacific-slope Flycatcher | | | 1 | | 1 | | | | | | | 2 |
| Eastern Phoebe | | 1 | | | | | | 1 | | | 1 | 3 |
| Great-crested Flycatcher | | | | | | | | | 1 | | | 1 |
| Eastern Kingbird | 1 | 2 | 7 | 18 | 17 | 19 | 2 | 7 | 17 | 7 | 15 | 112 |
| Yellow-throated Vireo | | | | | | | | | | | 1 | 1 |
| Blue-headed Vireo | 1 | | 1 | 1 | 2 | | | 1 | | 2 | | 8 |
| Warbling Vireo | 8 | 15 | 13 | 18 | 27 | 18 | 8 | 7 | 12 | 9 | 17 | 152 |
| Philadelphia Vireo | 1 | | | | | | | 1 | 1 | | 1 | 4 |
| Red-eyed Vireo | 3 | 1 | 2 | 4 | 3 | 12 | 2 | 4 | 2 | 2 | 4 | 39 |
| Blue Jay | | | | 1 | | | | 1 | | | | 2 |
| Black-billed Magpie | | | 2 | 1 | 8 | 2 | 2 | 1 | 3 | 1 | 3 | 23 |
| Tree Swallow | | | | | | | | | | 1 | | 1 |
| N Rough-winged Swallow | | | | | 2 | | | | | | | 2 |
| Black-capped Chickadee | 9 | 12 | 7 | 17 | 5 | 19 | 10 | 19 | 14 | 13 | 19 | 144 |
| Red-breasted Nuthatch | | 3 | | 2 | | 4 | 2 | 20 | 7 | 1 | 2 | 41 |
| White-breasted Nuthatch | 1 | 1 | 6 | | 4 | 4 | 4 | 5 | 5 | 5 | 7 | 42 |

## Table 2b. New Bandings at Inglewood Bird Sanctuary - Fall

| Year | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brown Creeper | 1 | | | | | | 1 | 1 | | | | 3 |
| House Wren | 3 | 3 | 50 | 45 | 52 | 49 | 33 | 57 | 59 | 72 | 58 | 481 |
| Winter Wren | | | | | | | | 1 | | | | 1 |
| Golden-crowned Kinglet | 2 | | 2 | 1 | 1 | 1 | 2 | 1 | | 2 | | 12 |
| Ruby-crowned Kinglet | 3 | 1 | 10 | 18 | 20 | 14 | 5 | 11 | 15 | 14 | 24 | 135 |
| Townsend's Solitaire | | | | 1 | | | | | 1 | | 1 | 3 |
| Veery | 2 | | | | | 1 | | | | | | 3 |
| Gray-cheeked Thrush | 1 | | | | | 1 | | 1 | | | | 3 |
| Swainson's Thrush | 34 | 13 | 17 | 52 | 10 | 28 | 19 | 13 | 30 | 13 | 19 | 248 |
| Hermit Thrush | 4 | | 3 | 14 | 6 | 9 | 9 | 4 | 11 | 11 | 5 | 76 |
| American Robin | 5 | 11 | 114 | 81 | 81 | 31 | 60 | 32 | 105 | 37 | 89 | 646 |
| Varied Thrush | | | | | | | | | 1 | | | 1 |
| Gray Catbird | | 1 | | 5 | 7 | 6 | 5 | 4 | 14 | 8 | 19 | 69 |
| Brown Thrasher | | | | | 3 | | | | | | 1 | 4 |
| European Starling | | | 2 | | | | | | 4 | | | 6 |
| Bohemian Waxwing | | | | | | | 1 | | | | | 1 |
| Cedar Waxwing | 12 | 1 | 42 | 14 | 67 | 11 | 25 | 26 | 49 | 27 | 21 | 295 |
| Tennessee Warbler | 43 | 5 | 33 | 30 | 52 | 74 | 106 | 167 | 46 | 76 | 147 | 779 |
| Orange-crowned Warbler | 24 | 36 | 177 | 116 | 86 | 207 | 91 | 84 | 58 | 71 | 115 | 1065 |
| Nashville Warbler | | | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | | 9 |
| Yellow Warbler | 56 | 19 | 44 | 62 | 137 | 91 | 138 | 89 | 101 | 119 | 82 | 938 |
| Chestnut-sided Warbler | 1 | | | | | | 1 | | | | 1 | 3 |

## Table 2b. New Bandings at Inglewood Bird Sanctuary - Fall

| Year | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Magnolia Warbler | 9 | 4 | 2 | 2 | 4 | 4 | 2 | 2 | 1 | 9 | 6 | 45 |
| Cape May Warbler | | | | | | | | | | | 2 | 2 |
| Yellow-rumped Warbler | 293 | 171 | 496 | 92 | 191 | 638 | 195 | 200 | 246 | 248 | 223 | 2993 |
| Black-throated Green Warbler | | | | | 1 | 1 | 1 | | | | | 3 |
| Townsend's Warbler | 1 | | | | 1 | 2 | 3 | 1 | 2 | 2 | | 12 |
| Palm Warbler | | 3 | 7 | 4 | 3 | 8 | 7 | 1 | 6 | 4 | 1 | 44 |
| Bay-breasted Warbler | | | 1 | | | | 1 | 1 | | | 1 | 4 |
| Blackpoll Warbler | 17 | 5 | 17 | 8 | 6 | 30 | 5 | 8 | 11 | 7 | 7 | 121 |
| Black-and-white Warbler | 4 | 1 | 1 | 2 | | 3 | | | 2 | 3 | 3 | 19 |
| American Redstart | 19 | 4 | 3 | 6 | 4 | 20 | 5 | 3 | 16 | 27 | 18 | 125 |
| Ovenbird | 22 | 6 | 10 | 30 | 11 | 38 | 11 | 11 | 24 | 7 | 18 | 188 |
| Northern Waterthrush | 22 | 8 | 23 | 56 | 46 | 26 | 41 | 34 | 44 | 33 | 29 | 362 |
| Connecticut Warbler | 2 | 2 | 4 | 4 | 1 | 3 | 3 | 3 | 4 | 1 | | 27 |
| Mourning Warbler | 4 | 2 | 5 | 10 | 3 | 9 | 1 | 4 | 5 | 7 | 10 | 60 |
| MacGillivray's Warbler | 2 | | 3 | 8 | 10 | 6 | 2 | 5 | 4 | 4 | 5 | 49 |
| Common Yellowthroat | | 1 | 6 | 1 | 8 | 10 | 8 | 4 | 12 | 8 | 9 | 67 |
| Wilson's Warbler | 121 | 68 | 102 | 175 | 119 | 113 | 100 | 167 | 152 | 145 | 224 | 1486 |
| Canada Warbler | 1 | | | 2 | 1 | 3 | 1 | 1 | 1 | 2 | | 12 |
| Western Tanager | 1 | 1 | 12 | 1 | 3 | 2 | 4 | 1 | 5 | 6 | 3 | 39 |
| American Tree Sparrow | | | 10 | 3 | 3 | 7 | 2 | 1 | 1 | 2 | 4 | 33 |
| Chipping Sparrow | 4 | 1 | 29 | 14 | 151 | 27 | 83 | 50 | 47 | 92 | 23 | 521 |
| Clay-coloured Sparrow | | 1 | 1 | 6 | 21 | 37 | 26 | 9 | 30 | 26 | 6 | 163 |

## Table 2b. New Bandings at Inglewood Bird Sanctuary - Fall

| Year | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brewer's Sparrow | | | | | | | 1 | | | | | 1 |
| Savannah Sparrow | | 1 | | | 2 | | | 1 | 1 | | | 5 |
| Fox Sparrow | 1 | 1 | 1 | | | 2 | 1 | | 2 | 1 | 1 | 10 |
| Song Sparrow | | 1 | 9 | 9 | 15 | 18 | 21 | 9 | 3 | 13 | 5 | 103 |
| Lincoln's Sparrow | 9 | 7 | 53 | 28 | 13 | 59 | 48 | 30 | 39 | 88 | 43 | 417 |
| Swamp Sparrow | | | | 2 | | 7 | 3 | | 1 | 2 | 1 | 16 |
| White-throated Sparrow | 13 | 11 | 73 | 28 | 39 | 77 | 54 | 18 | 35 | 51 | 25 | 424 |
| Harris' Sparrow | | | 1 | | | | | | 1 | | | 2 |
| White-crowned Sparrow | 5 | 4 | 20 | 24 | 22 | 21 | 22 | 23 | 27 | 30 | 18 | 216 |
| Dark-eyed Junco | 5 | 3 | 15 | 15 | 3 | 10 | 8 | 6 | 1 | 6 | 3 | 75 |
| Rose-breasted Grosbeak | 6 | | | | 1 | 3 | 2 | 3 | 1 | 3 | 7 | 26 |
| Red-winged Blackbird | | | 4 | | | | 2 | | | 3 | | 9 |
| Common Grackle | | | 3 | | | | | | | | 1 | 4 |
| Brown-headed Cowbird | | | 1 | 2 | 2 | 1 | | 2 | 4 | 5 | 1 | 18 |
| Baltimore Oriole | 4 | | 21 | 12 | 12 | 8 | 5 | 1 | 8 | 9 | 20 | 100 |
| Purple Finch | | 1 | | | 2 | 1 | 1 | 2 | 6 | | | 13 |
| Pine Siskin | | | | | 2 | | | | | | | 2 |
| American Goldfinch | 3 | | | 2 | 4 | 2 | 2 | 1 | 4 | 2 | | 20 |
| House Sparrow | | | | | | | | | 3 | | | 3 |

*Note: Traill's Flycatcher includes both Willow and Alder

## Table 3. Inglewood Bird Sanctuary MAPS New Bandings - 2003

| | 5 Jun | 15 Jun | 28 Jun | 6 Jul | 13 Jul | 28 Jul | 5 Aug | | Total |
|---|---|---|---|---|---|---|---|---|---|
| Downy Woodpecker | | | | | 1 | | | | 1 |
| Traill's Flycatcher | | | | | | | 1 | | 1 |
| Warbling Vireo | | | | | | 3 | | | 3 |
| Black-capped Chickadee | | | 2 | | 1 | | 1 | | 4 |
| House Wren | | | 1 | 2 | | 7 | 1 | | 11 |
| Swainson's Thrush | | | | | 1 | | | | 1 |
| American Robin | | 1 | | 4 | 7 | 7 | | | 19 |
| Gray Catbird | 1 | 4 | 1 | 2 | | | 1 | | 9 |
| Cedar Waxwing | | 2 | | 1 | | | | | 3 |
| Tennessee Warbler | | | | | | 1 | | | 1 |
| Yellow Warbler | 2 | 1 | | 1 | 1 | 4 | | | 9 |
| Yellow-rumped Warbler | | | | | | | 1 | | 1 |
| American Redstart | 1 | | | | | | | | 1 |
| Song Sparrow | | | | | | | 1 | | 1 |
| | | | | | | | | | |
| Total birds | 4 | 8 | 4 | 10 | 10 | 22 | 6 | | 65 |
| Total species | 3 | 4 | 3 | 5 | 4 | 5 | 6 | | 13 |

## Table 4. Inglewood Bird Sanctuary MAPS Summary - 1992-2003

| | New Bandings | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | |
| American Kestrel | | | 1 | | | | | | | | | 1 |
| Downy Woodpecker | 1 | 3 | 1 | 5 | 4 | 1 | | | 1 | | 1 | 17 |
| Hairy Woodpecker | 1 | 1 | 1 | | | 1 | | | | | | 4 |
| Yellow-shafted Flicker | 1 | 1 | 1 | | | | | | | | | 3 |
| Flicker Intergrade | | | 2 | | | | 2 | | | | | 4 |
| Northern Flicker | | | | 2 | | | | | | | | 2 |
| Western Wood-Pewee | 6 | 1 | 1 | 1 | 1 | 2 | | 1 | 3 | | | 16 |
| Traill's Flycatcher | | | | 3 | 3 | | 1 | 1 | 4 | 1 | 1 | 14 |
| Least Flycatcher | 14 | 8 | 3 | 2 | 3 | 4 | 2 | 1 | 2 | 1 | | 40 |
| Eastern Kingbird | 2 | 1 | | | 3 | 1 | 3 | | 2 | 1 | | 13 |
| Warbling Vireo | 7 | 7 | 1 | 4 | 2 | | 2 | 2 | 1 | 4 | 3 | 33 |
| Red-eyed Vireo | 1 | | | | | | | | | | | 1 |
| Black-billed Magpie | | | | 1 | 2 | | | | | | | 3 |
| Tree Swallow | 3 | | | | | | 2 | | | | | 5 |
| Bank Swallow | 1 | | | | | | | | | | | 1 |
| Black-capped Chickadee | 5 | 7 | 5 | 9 | 2 | 3 | 5 | 4 | 4 | 2 | 4 | 50 |
| White-breasted Nuthatch | 3 | 4 | | 2 | | | | | | 1 | | 10 |
| House Wren | 5 | 11 | 9 | 9 | 13 | 8 | 9 | 18 | 11 | 2 | 11 | 106 |
| Veery | 2 | | | | | 1 | | | | | | 3 |
| Swainson's Thrush | 10 | 8 | 6 | 4 | 3 | 1 | 4 | | 3 | 1 | 1 | 41 |
| Hermit Thrush | | | | | | | | 1 | | | | 1 |
| American Robin | 21 | 6 | 26 | 25 | 23 | 10 | 8 | 14 | 20 | 19 | 19 | 191 |
| Gray Catbird | 3 | | | 1 | 1 | 4 | 8 | 1 | 6 | 16 | 9 | 49 |
| European Starling | | | 1 | | | | | | | | | 1 |
| Cedar Waxwing | 27 | 8 | | 6 | 1 | 9 | 5 | 7 | 5 | 13 | 3 | 84 |
| Tennessee Warbler | 1 | 6 | | 7 | 1 | 3 | 4 | 22 | 1 | 1 | 1 | 47 |
| Orange-crowned Warbler | | | | | | 1 | | | | | | 1 |

## Table 4. Inglewood Bird Sanctuary MAPS Summary - 1992-2003

| | New Bandings | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | |
| Yellow Warbler | 20 | 14 | 7 | 2 | 6 | 9 | 24 | 13 | 4 | 7 | 9 | 115 |
| Yellow-rumped Warbler | 10 | | | | | 2 | | 2 | 1 | | 1 | 16 |
| American Redstart | | 1 | | | | | | | | | 1 | 2 |
| Ovenbird | 3 | | | 1 | | 1 | | | | | | 5 |
| Northern Waterthrush | | | | | | 1 | 1 | | 1 | | | 3 |
| Mourning Warbler | 1 | | | | | | | | | | | 1 |
| Wilson's Warbler | | | | 2 | | 1 | 1 | | | | | 4 |
| Western Tanager | | 1 | 3 | 1 | 2 | | 4 | | | | | 11 |
| Chipping Sparrow | | 7 | | | 1 | | | | | | | 8 |
| Clay-coloured Sparrow | | 1 | | | | 6 | 17 | 1 | 2 | | | 27 |
| Song Sparrow | | 1 | | 1 | | 1 | 4 | | | | 1 | 8 |
| Lincoln's Sparrow | | 3 | 1 | 2 | 5 | 2 | | 1 | | | | 14 |
| White-throated Sparrow | | | | 2 | | | | | | 1 | | 3 |
| Rose-breasted Grosbeak | | | | 1 | | | | | | | | 1 |
| Common Grackle | | | 1 | | 2 | | | | | 1 | | 4 |
| Brown-headed Cowbird | 6 | | | | 3 | | | 1 | 1 | 2 | | 13 |
| Baltimore Oriole | 3 | 7 | 2 | 8 | 9 | 1 | 2 | 1 | 5 | 9 | | 47 |
| Purple Finch | | 1 | | | | | | 1 | | | | 2 |
| American Goldfinch | 2 | 2 | | 1 | | | | | | 1 | | 6 |
| House Sparrow | 2 | | | | | 2 | | | | | | 4 |
| | | | | | | | | | | | | |
| Total | 161 | 110 | 72 | 102 | 90 | 75 | 108 | 92 | 77 | 83 | 65 | 970 |
| Species | 27 | 24 | 18 | 25 | 21 | 24 | 20 | 18 | 19 | 18 | 14 | 47 |

## Table 5. Captures at Las Caletas, Costa Rica 2003

| Date | Net hours | Residents | | | | Migrants | | | | Total captures | Captures/ net-hour | Mortalities | | Hummingbirds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | New bandings | Recaptures | Unbanded captures | Total | New bandings | Recaptures | Unbanded captures | Total | | | Residents | Migrants | |
| 15-Apr | 44 | 26 | 9 | 10 | 45 | 23 | 0 | 0 | 23 | 68 | 1.56 | 1 | | 6 |
| 16-Apr | 94 | 18 | 14 | 13 | 45 | 47 | 4 | 0 | 51 | 96 | 1.02 | | | 11 |
| 17-Apr | 92 | 19 | 6 | 4 | 29 | 48 | 2 | 0 | 50 | 79 | 0.86 | | | 4 |
| 18-Apr | 92 | 32 | 22 | 1 | 55 | 40 | 0 | 1 | 41 | 96 | 1.05 | | | 1 |
| 19-Apr | 90 | 19 | 14 | 8 | 41 | 40 | 1 | 0 | 41 | 82 | 0.91 | | | 6 |
| 20-Apr | 100 | 11 | 7 | 5 | 23 | 23 | 0 | 0 | 23 | 46 | 0.46 | | | 5 |
| 21-Apr | 92 | 14 | 11 | 7 | 32 | 52 | 1 | 1 | 54 | 86 | 0.93 | 1 | | 6 |
| 22-Apr | 97 | 9 | 13 | 7 | 29 | 22 | 1 | 0 | 23 | 52 | 0.54 | | | 7 |
| 23-Apr | 88 | 11 | 11 | 5 | 27 | 13 | 0 | 0 | 13 | 40 | 0.45 | | | 4 |
| 24-Apr | 99 | 14 | 16 | 11 | 41 | 24 | 1 | 1 | 26 | 67 | 0.67 | | | 11 |
| 25-Apr | 81 | 11 | 16 | 7 | 34 | 18 | 2 | 0 | 20 | 54 | 0.67 | | | 7 |
| 26-Apr | 27 | 3 | 3 | 6 | 12 | 6 | 0 | 1 | 7 | 19 | 0.70 | | 1 | 6 |
| 27-Apr | 74 | 9 | 8 | 10 | 27 | 20 | 1 | 0 | 21 | 48 | 0.65 | | | 10 |
| 28-Apr | 60 | 14 | 8 | 5 | 27 | 21 | 2 | 0 | 23 | 50 | 0.84 | | | 4 |
| 29-Apr | 27 | 1 | 4 | 3 | 8 | 2 | 0 | 0 | 2 | 10 | 0.36 | 1 | | 2 |
| 30-Apr | 97 | 18 | 13 | 4 | 35 | 14 | 3 | 0 | 17 | 52 | 0.53 | | | 4 |
| 01-May | 95 | 18 | 17 | 9 | 44 | 7 | 2 | 0 | 9 | 53 | 0.56 | | | 9 |
| 02-May | 97 | 13 | 21 | 8 | 42 | 8 | 1 | 0 | 9 | 51 | 0.53 | | | 8 |
| 03-May | 96 | 5 | 14 | 12 | 31 | 4 | 0 | 0 | 4 | 35 | 0.36 | | | 12 |
| 04-May | 95 | 9 | 12 | 9 | 30 | 5 | 0 | 0 | 5 | 35 | 0.37 | | | 9 |
| 05-May | 100 | 10 | 14 | 8 | 32 | 2 | 0 | 0 | 2 | 34 | 0.34 | | | 8 |
| 06-May | 96 | 9 | 10 | 13 | 32 | 6 | 0 | 0 | 6 | 38 | 0.40 | | | 13 |
| 07-May | 95 | 8 | 11 | 11 | 30 | 7 | 0 | 0 | 7 | 37 | 0.39 | | | 11 |
| 08-May | 91 | 11 | 20 | 13 | 44 | 4 | 0 | 0 | 4 | 48 | 0.53 | | | 13 |
| 09-May | 104 | 9 | 15 | 8 | 32 | 1 | 0 | 0 | 1 | 33 | 0.32 | | | 8 |
| Total | 2123 | 321 | 309 | 197 | 827 | 457 | 21 | 4 | 482 | 1309 | 0.62 | 3 | 1 | 185 |

## Table 6. Trend Analysis of Monitored Species at Inglewood Bird Sanctuary 1995-2003

| Species | Analysis Interval | Trend | P |
|---|---|---|---|
| | | % /year | value |
| Solitary Sandpiper | 1996-1998, 2000-2003 | -1.8 | **0.06** |
| Western Wood-Pewee | 1996-2003 | 0.2 | 0.92 |
| Traill's Flycatcher | 1995-2003 | 0.6 | 0.62 |
| Least Flycatcher | 1995-2003 | -0.6 | 0.58 |
| Eastern Kingbird | 1995-1998, 2000-2003 | -0.4 | 0.71 |
| Warbling Vireo | 1995-2003 | -1.3 | 0.20 |
| House Wren | 1995-2003 | 0.2 | 0.86 |
| Ruby-crowned Kinglet | 1995-2003 | 0.7 | 0.58 |
| Swainson's Thrush | 1995-2003 | -1.6 | 0.25 |
| American Robin | 1995-2003 | -2.2 | 0.30 |
| Cedar Waxwing | 1995-1998, 2000-2003 | 0.1 | 0.97 |
| Tennessee Warbler | 1996-1998, 2000-2003 | 3.6 | 0.32 |
| Orange-crowned Warbler | 1995-2003 | -4.5 | 0.25 |
| Yellow Warbler | 1995-2003 | 2.0 | 0.31 |
| Yellow-rumped Warbler | 1996-2003 | 2.7 | 0.72 |
| Blackpoll Warbler | 1996-2003 | -0.2 | 0.91 |
| Ovenbird | 1996-2003 | -2.2 | 0.29 |
| Northern Waterthrush | 1996-1998, 2000-2003 | -1.6 | **0.09** |
| Wilson's Warbler | 1995-2003 | 1.6 | 0.33 |
| Chipping Sparrow | 1996-1998, 2000-2003 | -0.9 | 0.85 |
| Clay-coloured Sparrow | 1996-1998, 2000-2003 | 0.2 | 0.95 |
| Song Sparrow | 1995-1998, 2000-2003 | -1.0 | 0.24 |
| Lincoln's Sparrow | 1995-2003 | 0.7 | 0.74 |
| White-throated Sparrow | 1995-2003 | -3.3 | 0.27 |
| White-crowned Sparrow | 1995-2003 | 0.2 | 0.72 |
| Dark-eyed Junco | 1995-2003 | -2.3 | **0.02** |
| Baltimore Oriole | 1995-2003 | -0.7 | 0.56 |

## Table 7. Comparison of Fall Trends at Inglewood, Delta and Last Mountain Migration Monitoring Stations 1995-2002

| Species | Inglewood | | Delta | | Last Mountain | |
|---|---|---|---|---|---|---|
| | Trend (%/yr) | P value | Trend (%/yr) | P value | Trend (%/yr) | P value |
| Traill's Flycatcher | +1.9 | 0.23 | -11.6 | 0.01 | -1.3 | 0.61 |
| Warbling Vireo | -2.0 | 0.11 | +2.2 | 0.62 | -7.9 | 0.06 |
| Swainson's Thrush | -2.0 | 0.26 | -6.9 | 0.24 | -6.9 | 0.26 |
| American Robin | -3.6 | 0.20 | -5.0 | 0.39 | | |
| Orange-crowned Warbler | -6.6 | 0.19 | -7.3 | 0.17 | -8.9 | 0.01 |
| Yellow Warbler | +3.8 | 0.09 | +2.4 | 0.71 | -2.5 | 0.55 |
| Ovenbird | -3.2 | 0.24 | -7.3 | 0.03 | +3.0 | 0.60 |
| Northern Waterthrush | -1.6 | 0.20 | -3.3 | 0.64 | +3.6 | 0.54 |
| White-throated Sparrow | -4.4 | 0.23 | +4.1 | 0.65 | -5.1 | 0.29 |
| White-crowned Sparrow | +0.5 | 0.30 | | | -7.4 | 0.32 |
| Dark-eyed Junco | -2.7 | 0.04 | +8.1 | 0.60 | -9.9 | 0.11 |
| Baltimore Oriole | -2.4 | 0.03 | -6.3 | 0.22 | | |

## Table 8. Bander-in-Charge and Volunteer Effort 2003

| | Bander-in-Charge | | | | | Vounteer | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inglewood | | | | CR | Inglewood | | | | CR |
| | Spring MM | MAPS | Fall MM | NSOW | Spring MM | Spring MM | MAPS | Fall MM | NSOW | Spring MM |
| Yousif Attia | | | | | | 1 | | | 2 | |
| Christine Bennett | | | | | | 2 | | 6 | | |
| Grahame Booth | | | | | | 1 | | | 2 | |
| Vivian Brissette* | | | | | | | | | 1 | |
| Amanda Cole | | | | | | 1 | | 4 | | |
| Doug Collister | | | 1 | | 25 | | | 1 | 2 | |
| Judy Crawford-Parr | | | | | | 1 | 1 | 8 | 1 | |
| Ross Dickson | | | 19 | | | | | 1 | | |
| Dick Flynn | | | | | | 2 | | 3 | 2 | |
| Lenora Flynn | | | | | | 3 | | 3 | 2 | |
| Gabriel Gareau | | | | | | | | 4 | | |
| Kevin Heaney | | | | | | 1 | | | 1 | |
| Garry Hornbeck | | | | | | 2 | | 3 | 1 | |
| Danielle Kaschube* | | | | | | | | 2 | | |
| Bev Kissinger* | | | | | | | | | 1 | |
| Maryanne Kissinger | | | | | | | | | 1 | |
| Michelle Koch | | | | | | | | 3 | 1 | |
| Jennifer Lane | | | | | | | | | | 10 |
| Steve Lane | 8 | 4 | 19 | 18 | | 1 | | 1 | | 10 |
| Suzanne Maidment | | | | | | 4 | | | | |
| Shonna McLeod | 3 | | 5 | 11 | | 3 | | 13 | 4 | |
| Greg Meyer | 20 | | 10 | | | | | 3 | | |
| Pat Mitchell | 4 | | 3 | 11 | | 2 | 1 | 6 | 1 | |
| Kerry Moffat | | | | | | 4 | 1 | 5 | 1 | |
| Mike Mulligan | | | | | | 4 | | 3 | 1 | |

## Table 8. Bander-in-Charge and Volunteer Effort 2003

| | Bander-in-Charge | | | | | Vounteer | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inglewood | | | | CR | Inglewood | | | | CR |
| | Spring MM | MAPS | Fall MM | NSOW | Spring MM | Spring MM | MAPS | Fall MM | NSOW | Spring MM |
| Alexandra Torn | | | | | | | | | 2 | |
| El Peterson | | | | 2 | | 5 | | 5 | 1 | |
| Mark Raymond | | | | | | 4 | 1 | 4 | | |
| Ron Reist | | | | | | 1 | | | | |
| Carl Savignac | | | 4 | | | | | | | 12 |
| Gwen Smiley | | | | | | 3 | | 4 | 3 | 10 |
| Don Stiles | | | | | | | | 5 | 3 | |
| Philip Stiles * | | | | | | | | | 1 | |
| Jeff Swingler | | | | | | | | 1 | 1 | |
| Bill Taylor | | | | | | 5 | 1 | 8 | | |
| Miles Tindal | | | | | | 1 | | | 1 | |
| Barry Trakalo | | | | | | 4 | | 4 | | 12 |
| Catherine Watson | | | | | | | | 5 | 1 | 12 |
| Catherine Watson-MacDonald | | | | 3 | | 2 | | 6 | | |
| Linda Wiggins | | | | | | 1 | | 2 | 1 | |
| Scott Wilson | | | 8 | | | | | | | |

* guest volunteer

## Table 9. Injuries and Mortalities Systained During 2003 CBBS Projects

| Species | Number Captured | Injuries | | Mortalities | |
|---|---|---|---|---|---|
| | | Number | Type | Number | Cause |
| Northern Flicker | 11 | 1 | strained hallux | | |
| | | 1 | wing abrasion | | |
| Buff-throated Foliage-gleaner | 17 | 1 | wing abrasion | | |
| Wedge-billed Woodcreeper | 37 | 1 | cut foot | 1 | dead in net (shock? heat?) |
| Streak-headed Woodcreeper | 7 | 1 | wing abrasion | | |
| Black-hooded Antshrike | 20 | | | 1 | died durng banding (shock?) |
| Dot-winged Antwren | 20 | 1 | strained wing | | |
| Bicolored Antbird | 27 | 1 | cut toe | | |
| Black-faced Antthrush | 2 | 1 | wing abrasion | | |
| Traill's Flycatcher | 38 | 1 | leg abrasion | | |
| Orange-collared Manakin | 38 | 1 | dislocated leg | | |
| Red-capped Manakin | 38 | 2 | wing abrasion | 1 | dead in bag (shock?) |
| Black-billed Magpie | 4 | | | 1 | hawk predation |
| Black-capped Chickadee | 76 | | | 1 | weasel predation |
| Swainson's Thrush | 496 | 2 | cut toe | 2 | hawk predation |
| | | 3 | wing abrasion | | |
| | | 2 | wing strain | | |
| House Wren | 192 | 1 | wing strain | | |
| American Robin | 167 | 6 | wing abrasion | 1 | unknown predation |
| | | 2 | cut tongue | | |
| Gray Catbird | 81 | 2 | wing abrasion | | |
| | | 1 | leg abrasion | | |
| Tennessee Warbler | 218 | 1 | wing abrasion | 1 | dead in net (shock?) |
| | | 1 | strained wing | | |
| Yellow-rumped Warbler | 391 | 1 | wing strain | | |
| Ovenbird | 24 | 1 | cut neck | | |
| | | 1 | strained wing | | |
| Wilson's Warbler | 304 | 1 | broken leg | | |
| Blue-black Grosbeak | 12 | 1 | cut toe | | |
| Red-winged Blackbird | 7 | 1 | cut tongue | | |
| | | | | | |
| **TOTAL CAPTURES** | **4235** | **39** | **0.92%** | **9** | **0.21%** |

APPENDIX 1

# Appendix 1a. New Bandings at Inglewood Bird Sanctuary - Spring 2003

| | May | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Downy Woodpecker | | | | | | | | | | | 1 | | | | | | | | | |
| Western Wood-Pewee | | | | | | | | | | | | | | | | | 1 | | | |
| Alder Flycatcher | | | | | | | | | | | | | | | | | | | | |
| Least Flycatcher | | | | | | | | | | | | | | | | | | | | |
| Eastern Kingbird | | | | | | | | | | | | | | | | | | | | |
| Blue-headed Vireo | | | | | | | | | | | | | | | | | | | | |
| Warbling Vireo | | | | | | | | | | | | | | | | | | | | |
| Red-eyed Vireo | | | | | | | | | | | | | | | | | | | | |
| Tree Swallow | | | | | | | | | | | | 1 | | | | | | | | 1 |
| Bank Swallow | | | | | | | | | | | | | | | | | | | | |
| House Wren | | | | | | | | | | | | | 1 | | | | | | | |
| Ruby-crowned Kinglet | | | | | | | | | | | | | | | | | | | | |
| Swainson's Thrush | | | | | | | | | | 9 | 1 | | | | | | | | | 1 |
| Hermit Thrush | | | | | | | | | | 1 | | | | | | | | | | |
| Veery | | | | | | | | | | | | | | | | | | | | |
| American Robin | | 2 | | | | | | | | | 2 | 3 | 1 | | | | 2 | | | |
| Gray Catbird | | | | | | | | | | | | | | | | | | | | |
| Orange-crowned Warbler | 1 | | 1 | | | | | | | | 1 | | 1 | | | | | 1 | | |
| Yellow Warbler | | | | | | | | | | | | | | | | | | | | |
| Yellow-rumped Warbler | 2 | 2 | 1 | | | | | | | | 19 | 7 | 22 | 16 | 9 | | 4 | 3 | 3 | |
| Blackpoll Warbler | | | | | | | | | | | | | | | | | | | | |
| American Redstart | | | | | | | | | | | | | | | | | | | | |
| Northern Waterthrush | | | | | | | | | | | | | | | | | | | | 1 |
| Common Yellowthroat | | | | | | | | | | | | | | | | | | | | |
| Wilson's Warbler | | | | | | | | | | | | | | | | | | | | |
| Chipping Sparrow | | | | | | | | | | | | | | | | | | 1 | | |
| Clay-coloured Sparrow | | | | | | | | | | | | | | | | | | | 1 | |
| Fox Sparrow | | | | | | | | | | | | | | | 1 | | | | | |
| Song Sparrow | | | | | | | | | | | | | | | | | | | | |
| Lincoln's Sparrow | | 1 | 2 | | | | | | | 2 | 2 | 1 | 2 | 1 | 1 | | 1 | 1 | 3 | 4 |
| White-throated Sparrow | | | | | | | | | | | | | | | | | | | 1 | |
| White-crowned Sparrow | | | | | | | | | | | | 1 | 2 | | 1 | | 1 | | | |
| Red-winged Blackbird | | | | | | | | | | | | | | | | | | | | |
| Brown-headed Cowbird | | | | | | | | | | | | | | 1 | | | | | | |
| Baltimore Oriole | | | | | | | | | | | | | | | | | | | | |
| American Goldfinch | | | | | | | | | | | | | | | | | | | | |

# Appendix 1a. New Bandings at Inglewood Bird Sanctuary - Spring 2003

| | May | | | | | | | | | | | June | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Downy Woodpecker | | | | | | | | | | | | | | | | | | | 1 |
| Western Wood-Pewee | | | | | | | | | | | | | | | | | | | 1 |
| Alder Flycatcher | | | | | | | | | | | | | 1 | 1 | 1 | | 1 | | 4 |
| Least Flycatcher | | | | 2 | 1 | 2 | 1 | | | | | | | | | | | | 6 |
| Eastern Kingbird | | | | | | | | 2 | | 1 | | | | | | | | | 3 |
| Blue-headed Vireo | | | | | | 1 | | | | | | | | | | | | | 1 |
| Warbling Vireo | 1 | | | | | | | | | | 1 | | | | | | | | 2 |
| Red-eyed Vireo | | | | | | | | | | | | | | | | | 1 | | 1 |
| Tree Swallow | | 2 | | | | | 1 | | | | | | | 1 | | | | | 6 |
| Bank Swallow | | | | | | | | | 1 | | | | | | | | | | 1 |
| House Wren | | | 1 | | 2 | 2 | 3 | 2 | 2 | | | | | 1 | 1 | | | | 15 |
| Ruby-crowned Kinglet | 2 | | | | | | | | | | | | | | | | | | 2 |
| Swainson's Thrush | 2 | | | 5 | 4 | 5 | 1 | 3 | 2 | 1 | 2 | | 2 | | | | | | 38 |
| Hermit Thrush | | | | | | | 1 | | | | | | | | | | | | 2 |
| Veery | | | | | | | 1 | | | | | | | | | | | | 1 |
| American Robin | 2 | | 2 | 4 | 2 | 1 | 2 | 4 | 3 | 3 | | | | | | | 1 | 1 | 35 |
| Gray Catbird | | | | | 2 | | 1 | 3 | 1 | 3 | | | | 2 | | 1 | | | 13 |
| Orange-crowned Warbler | | | 1 | | | | | | | | | | | | | | | | 6 |
| Yellow Warbler | | | | 6 | 1 | 3 | | 5 | 1 | 1 | | | | | 1 | 2 | | | 20 |
| Yellow-rumped Warbler | 11 | | | 1 | | | | | | | | | | | | | | | 100 |
| Blackpoll Warbler | 2 | | | | | | | | | | | | | | | | | | 2 |
| American Redstart | | | | | | | | 1 | | | | | | | | | | | 1 |
| Northern Waterthrush | 1 | 1 | | | | | | | | | | | | | | | | | 3 |
| Common Yellowthroat | 2 | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | 6 |
| Wilson's Warbler | | | | | | 1 | | | | | | | | | | | | | 1 |
| Chipping Sparrow | 3 | | 1 | | | 1 | | | | | | | | | | | | | 6 |
| Clay-coloured Sparrow | 2 | | 1 | 1 | 1 | | | | 1 | | | | 1 | 1 | | | | | 9 |
| Fox Sparrow | | | | | | | | | | | | | | | | | | | 1 |
| Song Sparrow | | | | | | | | | | | | | | 1 | | | | | 1 |
| Lincoln's Sparrow | 6 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | 31 |
| White-throated Sparrow | | | 1 | | | | | | | | | | | | | | | | 2 |
| White-crowned Sparrow | 1 | | | 1 | | | | | | | | | | | | | | | 7 |
| Red-winged Blackbird | | | | 3 | 1 | | | | | | | 1 | | | | | | | 5 |
| Brown-headed Cowbird | | 1 | | | 1 | | | | | | | | | | | | | | 3 |
| Baltimore Oriole | | | | | | | | 3 | 1 | 1 | 2 | | | | | | | | 7 |
| American Goldfinch | | | | | | | | | | | 1 | | 1 | | | | | 2 | 4 |

# Appendix 1b. New Bandings at Inglewood Bird Sanctuary - Fall 2003

| | July | | | | August | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 28 | 29 | 30 | 31 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Solitary Sandpiper | | | | | 1 | | | | | 1 | | | | | | | 1 | 1 | 1 | | |
| Spotted Sandpiper | | | | | | 1 | | | | | | | | | | | | | | | |
| Belted Kingfisher | | | | | | | | | | | | | | | | | | | 1 | | |
| Downy Woodpecker | 1 | 1 | 1 | 1 | | 4 | | | | | | | | 1 | | | | | | | |
| Northern Flicker | | | | 1 | | | | 1 | | 2 | | | 1 | | | | | | | | |
| Western Wood-Pewee | | | | 2 | | 4 | | | | 1 | | | | | | | | | | | |
| Alder Flycatcher | | 1 | | 1 | | 1 | | | 1 | 1 | | | 1 | | | 3 | | | | | |
| Willow Flycatcher | | | | | | | | | | | | | | | | | | | | | |
| Least Flycatcher | | | | | | | | | | 1 | | | | | | | | | | | 2 |
| Eastern Phoebe | | | | | | | | | | | | | | | | | | | | | |
| Eastern Kingbird | | | | | 1 | 3 | 1 | | 1 | | | 1 | 2 | | | | | 1 | 1 | | |
| Yellow-throated Vireo | | | | | | 1 | | | | | | | | | | | | | | | |
| Warbling Vireo | 3 | | 1 | | 2 | | | | | | | | | | | | | | 1 | 1 | |
| Philadelphia Vireo | | | | | | | | | | | | | | | | | | | | | |
| Red-eyed Vireo | | | | | | | | | | | | | | | | | | | | | |
| Black-billed Magpie | | | | | | | | | | | | | | | | | | | | | |
| Black-capped Chickadee | | 1 | 6 | 3 | | | | | 1 | 1 | 2 | | | 1 | | | | 1 | | | |
| Red-breasted Nuthatch | | | | | | | | | | | 1 | | | | | | | | | | |
| White-breasted Nuthatch | | | | | | | | | | | | | | | | | 1 | | | | |
| House Wren | 7 | 6 | 4 | 9 | 2 | 7 | | | 1 | | 2 | | 1 | | | 2 | | 1 | | 1 | |
| Ruby-crowned Kinglet | | | | | | | | | | | | | | | | | | | | | |
| Townsend's Solitaire | | | | | | | | | | | | | | | | | | | | | |
| Swainson's Thrush | | | | | | | | | | | | | | | | | | | | | |
| Hermit Thrush | | | | | | | | | | | | | | | | | | | | | |
| American Robin | 12 | 9 | | 7 | 4 | 11 | 4 | 3 | 1 | 2 | 3 | | 2 | 2 | 2 | 1 | 5 | 2 | | 1 | 1 |
| Gray Catbird | | 1 | | | 1 | | 2 | 1 | 1 | | 1 | | 1 | 1 | | 1 | 1 | | 1 | | 1 |
| Brown Thrasher | | | | | | | | | | | | | | | | | | | | | |
| Cedar Waxwing | 1 | | | | | | | | | 1 | 1 | | | | | | | 3 | | | |
| Tennessee Warbler | 1 | 6 | 7 | 9 | 10 | 9 | 20 | 8 | 1 | 7 | 5 | 4 | 3 | 8 | 8 | 8 | 4 | 3 | 1 | 1 | 1 |
| Orange-crowned Warbler | | | 1 | | | | | | | | | | | | | | | | | | |
| Yellow Warbler | 6 | 2 | | 4 | 1 | 5 | 8 | 1 | | 3 | 1 | 4 | 4 | 2 | 5 | 6 | 11 | 1 | 3 | 1 | |
| Chestnut-sided Warbler | | | | | | | | | | | | | | | | | | | | | |
| Magnolia Warbler | | | | | | | | | | | | | | | | | | 1 | | | |
| Cape May Warbler | | | | | | | 1 | | | | | | | | | | | | | | |
| Yellow-rumped Warbler | | 1 | 1 | 2 | 6 | 13 | 3 | 6 | 1 | 1 | 2 | 8 | 7 | | 6 | 1 | 5 | 1 | 1 | 1 | 5 |
| Palm Warbler | | | | | | | | | | | | | | | | | | | | | |
| Bay-breasted Warbler | | | | | | 1 | | | | | | | | | | | | | | | |
| Blackpoll Warbler | | | | | | | | | | | | | | | | | | | | | 1 |
| Black-and-white Warbler | | | | | | | | | | | | | | | | | | | | | |
| American Redstart | | | | | | | | | | | | | | | | | 1 | | | | |
| Ovenbird | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 |
| Northern Waterthrush | | | 1 | | | | | 2 | | | | 1 | 2 | | 2 | 1 | 1 | | 1 | | 1 |
| Mourning Warbler | | | | | | | | | | | | | | | | | | | | | 1 |
| MacGillivray's Warbler | | | | | | | | | | | | | | | | | | | | | |
| Common Yellowthroat | | | | | | | | | | | | | | | | | | | | | |
| Wilson's Warbler | | | | | | | | | | | | | | | | 1 | | 8 | | 3 | |
| Western Tanager | | | | | 1 | | | | | | | | | | | | | | | | |
| American Tree Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Chipping Sparrow | | | | 1 | | 8 | 1 | | | | 1 | | | | | 3 | | | | | |
| Clay-coloured Sparrow | | | | | | 2 | | | | | | | | | | | | | 1 | | |
| Fox Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Song Sparrow | | | | | | | 1 | | | | | | | | | | | | 1 | | |
| Lincoln's Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Swamp Sparrow | | | | | | | | | | | | | | | | | | | | | |
| White-throated Sparrow | | | | | | | | | | | | | | | | | | | | | |
| White-crowned Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Dark-eyed Junco | | | | | | | | | | | | | | | | | | | | | |
| Rose-breasted Grosbeak | | | | | | | | | | | | | | | | | | | | | |
| Common Grackle | | | 1 | | | | | | | | | | | | | | | | | | |
| Brown-headed Cowbird | | 1 | | | | | | | | | | | | | | | | | | | |
| Baltimore Oriole | | 1 | 1 | 3 | 1 | 5 | | | | 1 | | 4 | | | | | | | | 3 | |

# Appendix 1b. New Bandings at Inglewood Bird Sanctuary - Fall 2003

| | August | | | | | | | | | | | | | | September | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Solitary Sandpiper | | | | | | | | | | | | | | | | | | | | | |
| Spotted Sandpiper | | | | | | | | | | | | | | | | | | | | | |
| Belted Kingfisher | | | | | 2 | | | | | | | | 1 | | | | | | | | |
| Downy Woodpecker | | | | | | | | | | | | | | | | | | | | | |
| Northern Flicker | | | | | | | | | | | | | | | | | | | | | |
| Western Wood-Pewee | | | | | | | 1 | | | | | | | | 1 | 1 | | | | | |
| Alder Flycatcher | 2 | | 5 | | 2 | | 2 | 1 | 2 | | 1 | | 1 | 1 | | 2 | 1 | | | | |
| Willow Flycatcher | | | | | | | 1 | | | | | | | | | | | | | | |
| Least Flycatcher | | | | 1 | | | | | | | | 1 | | | | | | | | | 1 |
| Eastern Phoebe | | | | | | | | | | | | | | | | 1 | | | | | |
| Eastern Kingbird | 2 | | 1 | | 1 | | | | | | | | | | | | | | | | |
| Yellow-throated Vireo | | | | | | | | | | | | | | | | | | | | | |
| Warbling Vireo | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | |
| Philadelphia Vireo | | | | | | | | | | | 1 | | | | | | | | | | |
| Red-eyed Vireo | | 1 | 1 | | | | | | 1 | | | | | | | | | | | | |
| Black-billed Magpie | | | | | | | | | | | | | | | | | | | | 2 | |
| Black-capped Chickadee | 1 | | | | | | | | | | | | | | | | | | | | |
| Red-breasted Nuthatch | | | | | | | | | | | | | | | | | | | | | |
| White-breasted Nuthatch | | | | | | | | | | | | | | | | | | | | | |
| House Wren | 2 | 2 | | | 1 | 1 | 1 | 1 | | 2 | 1 | | | | | 1 | | | 1 | | |
| Ruby-crowned Kinglet | | | | | | | | | | | | | | | | | | | | | |
| Townsend's Solitaire | | | | | | | | | | | | | | | | | | | | | |
| Swainson's Thrush | | | | | | | | | | | | | | | | 2 | | 1 | | | |
| Hermit Thrush | | | | | | | | | | | | | | | | | | | | | |
| American Robin | 1 | 2 | | | | | | | 1 | 1 | | | | | | | | | | 1 | |
| Gray Catbird | | | | | | | | | | | | | 1 | | | 2 | | | | 1 | |
| Brown Thrasher | | | | | | | | | | | | | | | | | | | | 1 | |
| Cedar Waxwing | 2 | 1 | | | | | | 6 | 2 | 1 | 1 | | | | | | | | 1 | | |
| Tennessee Warbler | 5 | 2 | 2 | 2 | 2 | | | 2 | 1 | | | 1 | | | | 2 | | | | 2 | |
| Orange-crowned Warbler | | 1 | | | | | | 1 | | | | 1 | | | 3 | 10 | 1 | | 2 | 2 | 3 |
| Yellow Warbler | 2 | 3 | 1 | | 2 | | 1 | 1 | 2 | | | | | | 1 | | | | | | |
| Chestnut-sided Warbler | | | | | | | | | | | | | | | | | | 1 | | | |
| Magnolia Warbler | | 1 | | | | | | | | 1 | | | | | | 2 | | | | | |
| Cape May Warbler | 1 | | | | | | | | | | | | | | | | | | | | |
| Yellow-rumped Warbler | 2 | 2 | 1 | 8 | 2 | 3 | 1 | 1 | 3 | | | | 1 | 1 | 10 | 8 | | | | 3 | 3 |
| Palm Warbler | | | | | | | | | | | | | | | | | | | | | |
| Bay-breasted Warbler | | | | | | | | | | | | | | | | | | | | | |
| Blackpoll Warbler | | | | | | | | | | | | 1 | | | | | | | | | 1 |
| Black-and-white Warbler | 1 | | | | | | | | | | | | | | 1 | | | 1 | | | |
| American Redstart | 3 | 1 | 1 | 1 | | 1 | | 1 | 1 | 2 | 1 | | | | 1 | 1 | | | | 1 | |
| Ovenbird | | 1 | | | 2 | | | 2 | 1 | | | 1 | | | 2 | 2 | | | | | |
| Northern Waterthrush | 1 | | | 3 | 1 | 3 | 1 | | 1 | 1 | | 1 | | | 2 | | | | 1 | | |
| Mourning Warbler | | | 3 | | 1 | | | | 3 | | | | | | 1 | | | | | | |
| MacGillivray's Warbler | 1 | | | | 1 | | | | 2 | | | | | | 1 | | | | | | |
| Common Yellowthroat | | | | | | | | | | | 1 | | | | | | | | | | |
| Wilson's Warbler | 5 | | 13 | 6 | 1 | 1 | 1 | 1 | 3 | 1 | | 2 | 10 | 2 | 2 | 7 | 3 | | | 1 | 1 |
| Western Tanager | | | 1 | | | | 1 | | | | | | | | | | | | | | |
| American Tree Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Chipping Sparrow | 1 | | | | | | | | | | 1 | | | 1 | 1 | 1 | | | | 3 | |
| Clay-coloured Sparrow | | | | | 1 | | | | 1 | | | | | | | | | | | | |
| Fox Sparrow | | | | | | | | | | | | | | | | | | | | | |
| Song Sparrow | | | | | | 1 | 1 | | | | | | | | 1 | | | | | | |
| Lincoln's Sparrow | | 1 | | | 1 | 2 | | 1 | | 2 | | | 1 | | 1 | 5 | 2 | 4 | 2 | | 2 |
| Swamp Sparrow | | | | | | | | | | | | | | | | | | | | | |
| White-throated Sparrow | | 1 | | | | | 1 | | | | | | | | 1 | 2 | | | | | |
| White-crowned Sparrow | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | 1 | | | 1 |
| Dark-eyed Junco | | | | | | | | | | | | | | | | | | | | | |
| Rose-breasted Grosbeak | | | 1 | | 4 | | | | 1 | | | | | | | | | | | | |
| Common Grackle | | | | | | | | | | | | | | | | | | | | | |
| Brown-headed Cowbird | | | | | | | | | | | | | | | | | | | | | |
| Baltimore Oriole | | 1 | | | | | | | | | | | | | | | | | | | |

# Appendix 1b. New Bandings at Inglewood Bird Sanctuary - Fall 2003

| | September | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| Solitary Sandpiper | | | | | | | | | | | | | | | | | | |
| Spotted Sandpiper | | | | | | | | | | | | | | | | | | |
| Belted Kingfisher | | | 1 | | | | | | | | | 1 | | | | | | |
| Downy Woodpecker | | | | | | | | | | | | | | | | | | |
| Northern Flicker | | | 2 | | | | | | | | | | | | | | | |
| Western Wood-Pewee | 1 | | | | | | | | | | | | | | | | | |
| Alder Flycatcher | | | | | | | | 2 | | | | | | | | | | |
| Willow Flycatcher | | | | | | | | | | | | | | | | | | |
| Least Flycatcher | | | | | | | | | | 1 | | | 1 | 1 | | | | |
| Eastern Phoebe | | | | | | | | | | | | | | | | | | |
| Eastern Kingbird | | | | | | | | | | | | | | | | | | |
| Yellow-throated Vireo | | | | | | | | | | | | | | | | | | |
| Warbling Vireo | | | | | | | | | | | | | | | | | | |
| Philadelphia Vireo | | | | | | | | | | | | | | | | | | |
| Red-eyed Vireo | | | | | | | | | | | | | | | | | | 1 |
| Black-billed Magpie | | | | | | | | | | | | | | | | | | 1 |
| Black-capped Chickadee | | | | | | | | | | | 1 | 1 | | | | | | |
| Red-breasted Nuthatch | | | 1 | | | | | | | | | | | | | | | |
| White-breasted Nuthatch | 1 | | | | | | | | | | | | | | 1 | | | |
| House Wren | | | | | | | | | | | | 1 | | | | | | |
| Ruby-crowned Kinglet | | | | | | 3 | 1 | 1 | | 3 | 4 | | 2 | 2 | | 4 | 1 | |
| Townsend's Solitaire | | | | 1 | | | | | | | | | | | | | | |
| Swainson's Thrush | | | 2 | | 1 | 1 | | | | 1 | | | | 4 | 1 | | 2 | |
| Hermit Thrush | | | | | | | | | | | | | 2 | 1 | | 2 | | |
| American Robin | | | | | | | | | | | | | | | 5 | | | |
| Gray Catbird | | | 1 | | | | | | | | | | | 1 | | | | |
| Brown Thrasher | | | | | | | | | | | | | | | | | | |
| Cedar Waxwing | | | | 1 | | | | | | | | | | | | | | |
| Tennessee Warbler | | | | | | | | | | | | | | 1 | 1 | | | |
| Orange-crowned Warbler | 5 | | 11 | 1 | 3 | 8 | 11 | 9 | | 10 | 6 | 3 | 3 | 4 | 3 | | 3 | 5 |
| Yellow Warbler | | | | | | | | 1 | | | | | | | | | | |
| Chestnut-sided Warbler | | | | | | | | | | | | | | | | | | |
| Magnolia Warbler | | | 1 | | | | | | | | | | | | | | | |
| Cape May Warbler | | | | | | | | | | | | | | | | | | |
| Yellow-rumped Warbler | 53 | | 11 | 1 | 1 | | | | | | | | 4 | 21 | 1 | 5 | | 1 |
| Palm Warbler | | | | | | | | | | | | 1 | | | | | | |
| Bay-breasted Warbler | | | | | | | | | | | | | | | | | | |
| Blackpoll Warbler | | | | | | 2 | | 1 | | 1 | | | | | | | | |
| Black-and-white Warbler | | | | | | | | | | | | | | | | | | |
| American Redstart | 1 | | | | | | | 1 | | | | | | | | | | |
| Ovenbird | 1 | | 2 | | | | | 1 | | | | | | | | | | |
| Northern Waterthrush | 1 | | | | | | | | | | | | | | 1 | | | |
| Mourning Warbler | | | | | | | | | | | 1 | | | | | | | |
| MacGillivray's Warbler | | | | | | | | | | | | | | | | | | |
| Common Yellowthroat | | | | 2 | | | | 1 | | | 1 | 1 | | 1 | | 1 | | |
| Wilson's Warbler | 1 | | 53 | 30 | 3 | 16 | 5 | 15 | | 7 | 6 | 1 | 2 | 3 | 5 | 4 | | |
| Western Tanager | | | | | | | | | | | | | | | | | | |
| American Tree Sparrow | | | | | | | | | | | | | | | | | | |
| Chipping Sparrow | | | | | | | | | | | | 1 | | | | | | |
| Clay-coloured Sparrow | 1 | | | | | | | | | | | | | | | | | |
| Fox Sparrow | | | | | | | 1 | | | | | | | | | | | |
| Song Sparrow | | | | | | | | | | | | | | | | | | |
| Lincoln's Sparrow | 1 | | 1 | 2 | 1 | | | | | | 2 | | 1 | 3 | 2 | 1 | 1 | |
| Swamp Sparrow | | | | | | | | | | | | | | | | 1 | | |
| White-throated Sparrow | 1 | | | 1 | | | | | | | | | | 3 | | 5 | 1 | 1 |
| White-crowned Sparrow | | | | 1 | 2 | | 1 | | | | | | | | 1 | 2 | | 1 |
| Dark-eyed Junco | | | | | | | | | | | | | | | | 1 | | |
| Rose-breasted Grosbeak | | | 1 | | | | | | | | | | | | | | | |
| Common Grackle | | | | | | | | | | | | | | | | | | |
| Brown-headed Cowbird | | | | | | | | | | | | | | | | | | |
| Baltimore Oriole | | | | | | | | | | | | | | | | | | |

## Appendix 1b. New Bandings at Inglewood Bird Sanctuary - Fall 2003

| | September | | | | | October | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26 | 27 | 28 | 29 | 30 | 1 | 2 | 3 | 4 | 5 | 6 | |
| Solitary Sandpiper | | | | | | | | | | | | 5 |
| Spotted Sandpiper | | | | | | | | | | | | 1 |
| Belted Kingfisher | | | | | | | | | | | | 6 |
| Downy Woodpecker | 1 | 1 | | | 1 | | | | | | | 12 |
| Northern Flicker | | | | | | | | | | | | 7 |
| Western Wood-Pewee | | | | | | | | | | | | 11 |
| Alder Flycatcher | | | | | | | | | | | | 31 |
| Willow Flycatcher | | | | | | | | | | | | 1 |
| Least Flycatcher | | | | | | | | | | | | 9 |
| Eastern Phoebe | | | | | | | | | | | | 1 |
| Eastern Kingbird | | | | | | | | | | | | 15 |
| Yellow-throated Vireo | | | | | | | | | | | | 1 |
| Warbling Vireo | | | | | | | | | | | | 17 |
| Philadelphia Vireo | | | | | | | | | | | | 1 |
| Red-eyed Vireo | | | | | | | | | | | | 4 |
| Black-billed Magpie | | | | | | | | | | | | 3 |
| Black-capped Chickadee | | | | | | | | | | | | 19 |
| Red-breasted Nuthatch | | | | | | | | | | | | 2 |
| White-breasted Nuthatch | 2 | | | | 2 | | | | | | | 7 |
| House Wren | | | 1 | | | | | | | | | 58 |
| Ruby-crowned Kinglet | | 2 | 1 | | | | | | | | | 24 |
| Townsend's Solitaire | | | | | | | | | | | | 1 |
| Swainson's Thrush | 1 | 1 | 1 | 1 | | | | | | | | 19 |
| Hermit Thrush | | | | | | | | | | | | 5 |
| American Robin | | | | 1 | | | 5 | | | | | 89 |
| Gray Catbird | | | | | | | | | | | | 19 |
| Brown Thrasher | | | | | | | | | | | | 1 |
| Cedar Waxwing | | | | | | | | | | | | 21 |
| Tennessee Warbler | | | | | | | | | | | | 147 |
| Orange-crowned Warbler | 3 | | 1 | | | 1 | | | | | | 115 |
| Yellow Warbler | | | | | | | | | | | | 82 |
| Chestnut-sided Warbler | | | | | | | | | | | | 1 |
| Magnolia Warbler | | | | | | | | | | | | 6 |
| Cape May Warbler | | | | | | | | | | | | 2 |
| Yellow-rumped Warbler | | | 1 | | | | | 2 | | 1 | 1 | 223 |
| Palm Warbler | | | | | | | | | | | | 1 |
| Bay-breasted Warbler | | | | | | | | | | | | 1 |
| Blackpoll Warbler | | | | | | | | | | | | 7 |
| Black-and-white Warbler | | | | | | | | | | | | 3 |
| American Redstart | | | | | | | | | | | | 18 |
| Ovenbird | | | | | | | | | | | | 18 |
| Northern Waterthrush | | | | | | | | | | | | 29 |
| Mourning Warbler | | | | | | | | | | | | 10 |
| MacGillivray's Warbler | | | | | | | | | | | | 5 |
| Common Yellowthroat | | | 1 | | | | | | | | | 9 |
| Wilson's Warbler | 1 | | | | | | | | | | | 224 |
| Western Tanager | | | | | | | | | | | | 3 |
| American Tree Sparrow | | 1 | | | | 2 | | 1 | | | | 4 |
| Chipping Sparrow | | | | | | | | | | | | 23 |
| Clay-coloured Sparrow | | | | | | | | | | | | 6 |
| Fox Sparrow | | | | | | | | | | | | 1 |
| Song Sparrow | | | | | | | | | | | | 5 |
| Lincoln's Sparrow | 2 | | | 1 | | | 1 | | | | | 43 |
| Swamp Sparrow | | | | | | | | | | | | 1 |
| White-throated Sparrow | 1 | | 4 | | | | 1 | 2 | | | | 25 |
| White-crowned Sparrow | | 2 | 2 | | | | | | | | | 18 |
| Dark-eyed Junco | | 1 | 1 | | | | | | | | | 3 |
| Rose-breasted Grosbeak | | | | | | | | | | | | 7 |
| Common Grackle | | | | | | | | | | | | 1 |
| Brown-headed Cowbird | | | | | | | | | | | | 1 |
| Baltimore Oriole | | | | | | | | | | | | 20 |

**APPENDIX 2**

## Appendix 2. Top 20 New Bandings at Inglewood Bird Sanctuary

| Spring | | | | |
|---|---|---|---|---|
| Species | Total | | 2003 | |
| | Rank | Number | Rank | Number |
| Yellow-rumped Warbler | 1 | 349 | 1 | 100 |
| Swainson's Thrush | 2 | 92 | 2 | 38 |
| American Robin | 3 | 63 | 3 | 35 |
| Yellow Warbler | 4 | 53 | 5 | 20 |
| Lincoln's Sparrow | 5 | 50 | 4 | 31 |
| Blackpoll Warbler | 6 | 32 | | 2 |
| House Wren | 7 | 28 | 6 | 15 |
| Common Yellowthroat | 8 | 27 | 11 | 6 |
| Gray Catbird | 9 | 26 | 7 | 13 |
| Orange-crowned Warbler | 10 | 25 | 11 | 6 |
| Clay-coloured Sparrow | 11 | 24 | 8 | 9 |
| Tree Swallow | 11 | 24 | 11 | 6 |
| Least Flycatcher | 13 | 22 | 11 | 6 |
| White-crowned Sparrow | 14 | 13 | 9 | 7 |
| Baltimore Oriole | 15 | 11 | 9 | 7 |
| Northern Waterthrush | 15 | 11 | 19 | 3 |
| Traill's Flycatcher* | 17 | 10 | 17 | 4 |
| Chipping Sparrow | 18 | 9 | 11 | 6 |
| Red-winged Blackbird | 19 | 8 | 16 | 5 |
| Brown-headed Cowbird | 19 | 8 | 19 | 3 |
| American Goldfinch | | | 17 | 4 |

* includes Alder and Willow Flycatcher

| Fall | | | | |
|---|---|---|---|---|
| Species | Total | | 2003 | |
| | Rank | Number | Rank | Number |
| Yellow-rumped Warbler | 1 | 2993 | 2 | 223 |
| Wilson's Warbler | 2 | 1486 | 1 | 224 |
| Orange-crowned Warbler | 3 | 1065 | 4 | 115 |
| Yellow Warbler | 4 | 938 | 6 | 82 |
| Tennessee Warbler | 5 | 779 | 3 | 147 |
| American Robin | 6 | 646 | 5 | 89 |
| Chipping Sparrow | 7 | 521 | 13 | 23 |
| House Wren | 8 | 481 | 7 | 58 |
| White-throated Sparrow | 9 | 424 | 11 | 25 |
| Lincoln's Sparrow | 10 | 417 | 8 | 43 |
| Traill's Flycatcher* | 11 | 367 | 9 | 32 |
| Northern Waterthrush | 12 | 362 | 10 | 29 |
| Cedar Waxwing | 13 | 295 | 14 | 21 |
| Swainson's Thrush | 14 | 248 | 16 | 19 |
| White-crowned Sparrow | 15 | 216 | 19 | 18 |
| Ovenbird | 16 | 188 | 19 | 18 |
| Least Flycatcher | 17 | 172 | | |
| Clay-coloured Sparrow | 18 | 163 | | |
| Warbling Vireo | 19 | 152 | | |
| Black-capped Chickadee | 20 | 144 | 16 | 19 |
| Ruby-crowned Kinglet | | | 12 | 24 |
| Baltimore Oriole | | | 15 | 20 |
| Gray Catbird | | | 16 | 19 |

**APPENDIX 3**

## Appendix 3. Monitored Species at Inglewood Bird Sanctuary

| | Spring 2002-2003 Mean | | Fall 1995-2003 Multi-year Mean | | |
|---|---|---|---|---|---|
| | Number | Frequency | Number | Frequency | BSC priority |
| Solitary Sandpiper | | | 8 | 6 | |
| Western Wood-Pewee | | | 12 | 8 | C |
| Traill's Flycatcher * | 5 | 5 | 36 | 20 | A |
| Least Flycatcher | 11 | 7 | 17 | 13 | C |
| Eastern Kingbird | | | 12 | 9 | C |
| Warbling Vireo | | | 14 | 11 | C |
| Tree Swallow | 12 | 8 | | | C |
| House Wren | 14 | 8 | 53 | 24 | E |
| Ruby-crowned Kinglet | | | 15 | 10 | B |
| Swainson's Thrush | 46 | 15 | 22 | 14 | A |
| American Robin | 32 | 17 | 70 | 24 | D |
| Gray Catbird | 13 | 8 | | | E |
| Cedar Waxwing | | | 31 | 11 | D |
| Tennesee Warbler | | | 81 | 24 | A |
| Orange-crowned Warbler | 13 | 8 | 112 | 27 | A |
| Yellow Warbler | 27 | 11 | 96 | 25 | C |
| Yellow-rumped Warbler | 175 | 17 | 281 | 38 | B |
| Blackpoll Warbler | 16 | 4 | 11 | 7 | A |
| Ovenbird | | | 18 | 12 | C |
| Northern Waterthrush | 6 | 5 | 37 | 19 | A |
| Common Yellowthroat | 14 | 7 | | | C |
| Wilson's Warbler | | | 144 | 32 | A |
| Chipping Sparrow | | | 57 | 16 | C |
| Clay-colored Sparrow | 12 | 8 | 18 | 12 | C |
| Song Sparrow | | | 11 | 10 | D |
| Lincoln's Sparrow | 25 | 14 | 45 | 24 | A |
| White-throated Sparrow | | | 44 | 18 | B |
| White-crowned Sparrow | | | 23 | 13 | B |
| Dark-eyed Junco | | | 7 | 5 | B |
| Baltimore Oriole | | | 11 | 5 | E |

*

## CRITERIA USED TO DEFINE AND PRIORITIZE 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 and Alaskan breeding range covered by the Breeding Bird Survey and <60% of winter range within Canada and U.S.

**B** Those species that have <50% of Canadian and Alaskan breeding range covered by the Breeding Bird Survey but 60% of their winter range is within Canada and U.S.

**C** Those species with <60% coverage of Canadian and Alaskan breeding range (but 50% of NA range) covered by the Breeding Bird Survey and have <60% of wintering range in Canada and U.S.

**D** Those species with <60% coverage of Canadian and Alaskan breeding range covered by the Breeding Bird Survey but have >60% of their wintering range in Canada and U.S.

**E** Those species with >60% coverage of Canadian and Alaskan breeding range covered by the Breeding Bird Survey but have <60% of their wintering range in Canada and U.S.

**F** Those species with >60% coverage of Canadian and Alaskan breeding range covered by the Breeding Bird Survey and have >60% of their wintering range in Canada and U.S.

Appendix 4

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# A CROSS-CANADA COMPARISON OF MASS CHANGE IN BIRDS DURING MIGRATION STOPOVER

ERICA H. DUNN[1]

ABSTRACT.—I estimated hourly mass change at stopover sites for 14 species of migrant passerines from 15 sites across southern Canada by analyzing size-corrected mass of birds at first capture as a function of time of day of handling. Mean mass gains were 0.40% of lean body mass/h during spring and 0.53% during fall. Mass gain estimates varied significantly with season, site, and species, and were negatively related to condition of birds in the early morning. However, standard errors were large, such that few individual estimates were significantly different. Several sites with consistently low rates of mass gain had characteristics that probably reduced local food supply. Swainson's Thrushes (*Catharus ustulatus*) also had consistently low rates of mass gain. I estimated the time required to accumulate sufficient mass to fuel a 10-h migratory flight, and found that the majority of estimated mass gains were sufficient for birds to refuel during <1 week of stopover in southern Canada. At mean rates of mass gain from this study, migrants in southern Canada could potentially refuel completely during 2–3 days in both seasons, but true periods are likely somewhat longer. Analysis of mass change along migration routes (instead of across them, as in this study) is needed to detect whether there are differences among species in timing and location of maximum fuel deposition, as has been found in Europe.
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Between migratory flights, birds must replenish energy stores in order to successfully complete their journeys, and the rate at which birds change mass during stopover should be an index of site quality. This measure reflects food abundance as well as incorporating effects of weather conditions, levels of competition and predator harassment, and other external factors that could affect mass change. However, endogenous factors also affect fattening rates, and must be taken into account when interpreting mass change with respect to site quality. For example, birds with optimal fat stores should maintain mass rather than gain more, and optimal fuel loads may vary according to proximity to the final destination or to large geographic barriers such as the Gulf of Mexico. Finally, there may be differences in migratory strategy among species, such as speed of migration or length of migratory flights, that also could affect mass change patterns.

Study of mass change at many sites across a large geographic area may help to tease these factors apart. The only example of such a study to date on nocturnally migrating passerines involved six species captured at 34 sites distributed from northern Europe to North Africa (Schaub and Jenni 2000). Results showed marked differences among species in overall migration strategy, with variation in the time period and location at which maximum fuel loads were accumulated. Such differences have important implications for conservation planning and protection of stopover sites. Similar variation is likely in North American passerine migrants, yet there are only a few studies that have compared mass change among sites, and these were very limited in geographic scope (Dunn 2000, 2001).

Here I compare mass change of 14 species of nocturnally migrating passerines at 15 sites across southern Canada, with the aim of detecting and explaining variation in mass gain among locations. Sample sites were distributed across the main migration routes (Brewer et al. 2000) rather than along a path between breeding and wintering areas. Because all sites were close to the breeding grounds of the target species and distant from major geographic barriers, I expected variation in physiological condition and migratory motivation to be small. Any marked and consistent variation in mass change, therefore, likely would be related to the quality of sites and their surrounding landscapes. The second aim of the study was to estimate the amount of time it would take for actively migrating birds to refuel in southern Canada following depletion of fat reserves. While many assumptions were involved in the model, it provided context for interpretation of the mass change estimates.

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FIG. 1. The Canadian Migration Monitoring Network stations contributing data on mass change during migration stopover to this study were distributed across all of southern Canada. Station names are shown in Table 1.

## METHODS

I assessed mass change by regression of mass at first capture on time of day (Morris et al. 1996, Jones et al. 2002). Assumptions of this method are discussed in Winker et al. (1992), Winker (1995), and Dunn (2000, 2001).

*Data set.*—Data from 15 sites were contributed by 13 member stations in the Canadian Migration Monitoring Network (CMMN), including the three stations operated by Long Point Bird Observatory (LPBO; Fig. 1). I chose 14 target species for analysis (see results) because they were broadly distributed across Canada and large numbers were captured at many CMMN stations. All were small nocturnal migrants, ranging in mean mass from 6.6–31.5 g (median = 12.0 g).

All birds included in analyses were caught in mist nets or in Heligoland traps (Hussell and Woodford 1961). Birds caught in baited ground traps were excluded due to the likelihood of unusual mass gain due to eating baits. Nets were opened at or before dawn and were run for ≥6 h on a daily basis during one or both migration seasons, weather permitting. Birds were transported and held individually in cloth bags or holding boxes until banding, at which time wing chord was measured (unflattened, to the nearest mm) and birds were weighed (usually to the nearest 0.1 g on a triple beam balance or electronic scale). Fat in furcular deposits was scored using a variety of scoring systems, but in all cases it was possible to identify birds that had no fat or only a trace amount of fat, and these were the only fat data used in this paper. Time of day was recorded as shown in Table 1, usually to the nearest 10 min. For this analysis, I expressed times as decimal values and converted them to h after local sunrise to account for progressive change in timing of sunrise during each season. For each site, I applied the sunrise data for 1999 to all years, since variance in the time of sunrise among years was trivial.

Most data came from the late 1990s, but LPBO data covered the 1980s as well. Unless there are long term trends in conditions affecting mass change at a particular site, comparisons among sites should not be affected by variation in the time periods analyzed. Dunn (2000) demonstrated annual variation in rate of mass change and recommended that estimates be based on several years of data to best reflect typical conditions, but those results gave no evidence of long term trends.

To standardize hours of coverage among sites, I limited analysis for each species to data from the first 7 h after sunrise. A few sites operated for only 6 h, but birds captured at the end of the day often were weighed after nets were closed, and the 7-h cutoff al-

TABLE 1. Mass change data of migrating passerines were obtained from 15 stopover sites.

| Station | Seasons[a] | Years in sample | Time recorded[b] |
|---|---|---|---|
| Atlantic Bird Observatory (Bon Portage), NS (ABO) | F | 1996–98 | CS |
| Beaverhill Bird Observatory, AB (BBO) | B | 1997–98 | CE |
| Delta Marsh Bird Observatory, AB (DMBO) | S | 1992–99 | W (1992–94), CS |
| Delta Marsh Bird Observatory, AB (DMBO) | F | 1995–99 | CS |
| Innis Point Bird Observatory, ON (IPBO) | F | 1997–99 | W |
| Inglewood Bird Sanctuary, AB (IBS) | B | 1995–99 | CS |
| Haldimand Bird Observatory (Selkirk), ON (HBO) | S | 1996–99 | CE |
| Last Mountain Bird Observatory, SK (LMBO) | B | 1989–99 | W |
| Lesser Slave Lake Bird Observatory, AB (LSLBO) | B | 1994–99 | C |
| Long Point Bird Observatory, ON (LPBO): 3 sites | B | 1980–96 | CM + W |
| Mackenzie Nature Observatory, BC (MNO) | F | 1996–99 | CS |
| Prince Edward Point Bird Observatory, ON (PEPtBO) | S | 1995–99 | W |
| Rocky Point Bird Observatory, BC (RPBO) | F | 1999 | CS |
| Thunder Cape Bird Observatory, ON (TCBO) | B | 1991–98 | CM + W |

[a] Season for which data were contributed. S = spring, F = fall, B = both.
[b] C = time of capture. CS = start of net check, CM = approximate middle of net check, CE = end of net check, W = time of weighing. Where both capture and time of weighing were recorded (CM+W), time of capture was used in analyses.

lowed these individuals to be included. For each site, I deleted records of individuals with mass or wing length falling below the 1st percentile or above the 99th percentile of all measurements taken at that site, to exclude possible errors in measurement or recording. I also restricted the data for each species from a given site to the species specific migration period at that site. This was determined by plotting number of birds weighed against date and, for species that summer or winter at or near that site, eliminating data beyond the range of dates during which there was a marked build-up to, and drop-off from, a strong seasonal peak in numbers banded. This limitation, and the fact that I included only first captures in the analyses, minimized the inclusion of locally breeding or overwintering individuals. I did not analyze data for a species unless the final data set for the site and season included ≥100 individuals.

*Statistical analyses.*—I adjusted mass for body size by calculating a condition index (CI = mass × 100/wing length, in which multiplication by 100 reduces rounding error). Some previous analyses used a different index (e.g., mass × 10,000/wing length$^3$; Winker et al. 1992, Dunn 2001). However, Winker (1995) found that the newer formula was more effective at correcting mass for structural body size. The regression model was $CI = b_0 + b_1H$, where $H$ is the time of day of capture or weighing, expressed as h after sunrise. The coefficient $b_1$ is the estimate of hourly change in condition index and can be converted to hourly change in mass using the formula: mass change = $b_1$(wing length)/100. Wing length used in the conversion was the mean for each species, specific to site and season. The result gave an estimate of hourly mass change for a bird of mean wing length at mean date of capture for the site and season.

The sites contributing to this study recorded time of day of handling in different ways (Table 1). I analyzed data for 39 species from three high volume sites where times were recorded for both capture and weighing, and found that when the latter was used in analysis instead of time of capture, mass change estimates were slightly reduced (due to mass loss prior to weighing; Dunn 1999). However, the mean reduction was only 2% (EHD unpubl. data), so any effect of variation in weighing time among contributing sites should be small.

I compared mass change over the first 7 h after sunrise to mass change over the same period exclusive of the first hour, to determine whether there was an initial rapid gain due to birds filling their guts after a night of fasting. The mean 7-h mass change was only slightly higher than the 6-h change (0.015% of lean mass/h, paired $t_{123} = 1.09$, $P = 0.18$), but there was no consistent pattern among cases in whether the mass change estimate increased or decreased when birds captured during the first hour were omitted. Results presented here are for the full 7-h period, to take advantage of the larger sample size. Two sites, LPBO and Thunder Cape Bird Observatory regularly operated for ≥12 h. For these sites, I estimated mass change over the first 12 h after sunrise, as well as over the first 7 h, to investigate variation in rate of mass change over the course of the day.

I converted all estimates of hourly mass change to percent of lean body mass to allow direct comparison among species of different body size. I defined lean body mass for each species (calculated separately for each site and season to account for any differences in populations being sampled) as the mean mass for birds classified as having no visible fat in the furculum. In a few cases, the mean mass for birds with no fat and a trace of fat combined was lower than the mean for birds with no fat alone (apparently due to individual variation in fat scoring), in which case the lower value was taken as the lean mass. Readers should note that

this definition of lean differs from the conventional definition, usually meaning fat free.

For an index of mean physiological condition of birds at a site during early morning, I calculated mean mass during the first 3 h after sunrise, subtracted lean mass (mass of birds with no visible fat) and expressed the difference as a percent of lean mass to remove effects of different body size among species: small samples at some sites precluded use of data from the first hour or two alone. I examined variation in morning condition according to site, season, and species using general linear models (GLM). I also used GLM to examine the effect of these factors and of morning condition on hourly mass gain, using Tukey's studentized range test to evaluate the significance of effects.

Estimates of hourly mass change can be interpreted more easily if compared with some threshold value, which was defined here as the energetic break even point over 24 h during which no migration takes place. For each species, I estimated overnight energy use as existence energy costs (Kendeigh 1970) between sunset and sunrise at the mean passage date for the site and season. I then converted energy use to mass loss, on the assumption that all energy came from burning fat (see Dunn 2001 for additional details and justification of assumptions). This threshold value must be surpassed with energy gain during daytime feeding if energy is to be accumulated for fueling of continued migration. While based on many assumptions, this value can be used as a general reference point for interpreting results of mass change analyses.

For each site, season, and species, I estimated the number of days of refueling that would be required for a lean bird (one without visible fat) to gain enough mass to sustain a 10-h migratory flight without falling below its lean mass. I conducted two analyses: one assuming that rate of change over the first 7 h of the day would be continued over all daylight hours (specific to season, site, and species), and the other assuming no further gain or loss during daylight hours subsequent to 7 h of feeding. For these estimations I assumed that mass loss on nights without migration was the threshold value described above, and that hourly mass loss during migration was $0.0533 \times \text{mass}^{0.40}$ (Hussell and Lambert 1980). The latter formula was based on mass loss experienced by nine small passerine species during actual nocturnal migration (exclusive of Blackpoll Warbler, *Dendroica striata*, for which mass loss was exceptionally low), and amounted to about 0.9% of body mass/h.

Mass change estimates are presented as the estimate ± SE, expressed as percent of lean body mass/h. Results were considered significant if $P < 0.05$. Other mean values are shown as the estimate ± SD.

## RESULTS

Hourly mass change estimates for each site and season are listed in Table 2. Mean rates were 0.40% of lean body mass/h during spring ($n = 76$) and 0.53% during fall ($n = 106$). Comparison of values for species-sites for which results were available from both seasons showed that fall values were significantly higher (paired $t_{52} = 2.18$, $P = 0.034$), and were less likely to fall below threshold values (19% of cases during fall versus 38% during spring).

Standard errors of mass change estimates were high, so there were few significant differences among estimates (Table 2), despite their spanning a broad range of values (−0.66 to 1.95% of lean mass/h). Nonetheless, there were some exceptions. During spring there were three sites at which fewer than half of the species met or surpassed threshold values (Beaverhill and Last Mountain bird observatories, and site 1 at LPBO; Table 3). During fall, only Atlantic Bird Observatory had a low proportion of species surpassing their thresholds. Delta Marsh Bird Observatory had a particularly high mean mass change during spring, as did Rocky Point Bird Observatory during fall (Table 3).

Table 4 shows a similar summary of data for species. During spring, there were two species that failed to attain or surpass threshold mass change at half or more of the sites for which they were analyzed: Swainson's Thrush (*Catharus ustulatus*), and White-crowned Sparrow (*Zonotrichia leucophrys*). During fall, only the Swainson's Thrush fell below this level.

The mean value of early morning mass (first 3 h after sunrise) relative to lean mass was low (1.20 ± 2.87% above lean body mass, $n = 182$). However, this index of early morning condition varied significantly with species, site, and season (Table 5). For species-sites for which there were data for both seasons, early morning mass was higher during spring than during fall (1.21% versus −0.05% above lean mass, respectively; paired $t_{52} = 3.74$, $P < 0.001$). Among species, Swainson's Thrushes were the heaviest during early morning (5% above lean mass during spring and 2.8% above during fall). Among sites, early morning mass was highest at Delta Marsh and Haldimand bird observatories during spring (5.4% and 8.7% above lean mass, respectively), and at Atlantic Bird Observatory during fall (6.3% above lean mass). Rate of mass gain was negatively related to the difference between early morning and lean mass

TABLE 2. Estimated rates of mass change[a] during migration stopover covered a wide range of values, but had large standard errors. Most estimates showed mass gain sufficient to support a 10-h migratory flight within 1 week (median = 4 days during spring and 3 days during fall). See Table 1 for site names.

| Species and site | Spring | | | | Difference between seasons | Fall | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | Difference[b] | Mass change (mean ± SE) | Days to refuel[c] | | *n* | Difference | Mass change (mean ± SE) | Days to refuel[c] |
| Least Flycatcher, *Empidonax minimus* | | | | | | | | | |
| BBO | 117 | a | −0.43 ± 0.33 | — | | 198 | b | 0.43 ± 0.21 | 4 |
| DMBO | 226 | a | 0.61 ± 0.28 | 2 | | 380 | ab | 0.67 ± 0.17 | 2 |
| LMBO | 292 | a | 0.12 ± 0.31 | — | * | 683 | a | 1.39 ± 0.25 | 1 |
| LPBO-1 | 1,415 | a | 0.07 ± 0.09 | — | * | 1,612 | b | 0.66 ± 0.09 | 2 |
| LPBO-2 | 424 | a | 0.21 ± 0.20 | — | | 571 | b | 0.52 ± 0.15 | 3 |
| LPBO-3 | 653 | a | 0.40 ± 0.15 | 4 | | 618 | b | 0.45 ± 0.16 | 4 |
| LSLBO | 330 | a | 0.22 ± 0.21 | 8 | | 210 | b | 0.06 ± 0.23 | — |
| MNO | | | | | | 324 | b | 0.40 ± 0.15 | 3 |
| TCBO | | | | | | 143 | b | 0.21 ± 0.28 | — |
| Ruby-crowned Kinglet, *Regulus calendula* | | | | | | | | | |
| DMBO | | | | | | 236 | b | 0.75 ± 0.18 | 3 |
| HBO | 411 | a | 0.89 ± 0.24 | 2 | | | | | |
| IPBO | | | | | | 102 | bc | 0.44 ± 0.32 | 20 |
| LMBO | | | | | | 251 | abc | 0.72 ± 0.23 | 4 |
| LPBO-1 | 1,490 | b | −0.23 ± 0.11 | — | | 2,188 | c | 0.09 ± 0.09 | — |
| LPBO-2 | 1,774 | b | −0.25 ± 0.11 | — | | | | | |
| LPBO-3 | 2,980 | a | 0.48 ± 0.08 | 5 | | 5,135 | b | 0.72 ± 0.06 | 4 |
| MNO | | | | | | 898 | b | 0.56 ± 0.10 | 4 |
| PEPtBO | 1,013 | a | 0.85 ± 0.17 | 2 | | | | | |
| RPBO | | | | | | 181 | a | 1.73 ± 0.29 | 2 |
| TCBO | 106 | ab | 0.16 ± 0.45 | — | | 374 | ab | 0.78 ± 0.19 | 4 |
| Swainson's Thrush, *Catharus ustulatus* | | | | | | | | | |
| DMBO | 122 | a | 0.69 ± 0.56 | 1 | | 262 | a | 0.11 ± 0.34 | — |
| HBO | 169 | a | 0.06 ± 0.33 | — | | | | | |
| IBS | | | | | | 102 | a | −0.19 ± 0.46 | — |
| LMBO | 139 | a | −0.20 ± 0.61 | — | | 182 | a | 0.43 ± 0.40 | 2 |
| LPBO-1 | 305 | a | −0.60 ± 0.35 | — | | 1,319 | a | −0.10 ± 0.11 | — |
| LPBO-2 | 216 | a | −0.03 ± 0.36 | — | | 1,036 | a | −0.04 ± 0.12 | — |
| LPBO-3 | 504 | a | 0.20 ± 0.22 | 5 | | 1,707 | a | 0.10 ± 0.09 | — |
| MNO | | | | | | 250 | a | 0.38 ± 0.22 | 2 |
| PEPtBO | 149 | a | −0.57 ± 0.48 | — | | | | | |
| TCBO | | | | | | 926 | a | 0.14 ± 0.12 | — |
| Tennessee Warbler, *Vermivora peregrina* | | | | | | | | | |
| BBO | | | | | | 149 | ab | 0.23 ± 0.33 | 20 |
| DMBO | | | | | | 1,345 | b | 0.09 ± 0.11 | — |
| LMBO | | | | | | 440 | a | 1.21 ± 0.28 | 1 |
| LPBO-1 | | | | | | 235 | ab | 0.41 ± 0.29 | 6 |
| LPBO-2 | | | | | | 545 | ab | 0.67 ± 0.23 | 3 |
| LPBO-3 | 307 | b | −0.21 ± 0.38 | — | | 358 | a | 0.93 ± 0.22 | 2 |
| TCBO | 515 | a | 1.17 ± 0.18 | 1 | * | 841 | ab | 0.45 ± 0.15 | 4 |
| Magnolia Warbler, *Dendroica magnolia* | | | | | | | | | |
| HBO | 229 | a | 0.81 ± 0.32 | 2 | | | | | |
| LMBO | | | | | | 223 | a | 0.78 ± 0.29 | 2 |
| LPBO-1 | 600 | b | −0.66 ± 0.20 | — | * | 723 | a | 0.93 ± 0.15 | 2 |
| LPBO-2 | 509 | ab | 0.22 ± 0.24 | — | | 1,649 | a | 0.58 ± 0.10 | 4 |
| LPBO-3 | 2,890 | a | 0.02 ± 0.09 | — | * | 1,732 | a | 0.65 ± 0.10 | 3 |
| LSLBO | | | | | | 101 | a | 0.16 ± 0.37 | — |
| MNO | | | | | | 200 | a | 0.44 ± 0.20 | 4 |
| PEPtBO | 485 | a | 0.23 ± 0.23 | 25 | | | | | |
| TCBO | 330 | a | 0.39 ± 0.19 | 4 | | 659 | a | 0.45 ± 0.14 | 5 |

TABLE 2. Continued.

| Species and site | Spring | | | | Difference between seasons | Fall | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | Difference[b] | Mass change (mean ± SE) | Days to refuel[c] | | *n* | Difference | Mass change (mean ± SE) | Days to refuel[c] |
| Yellow-rumped Warbler, *D. coronata* | | | | | | | | | |
| ABO | | | | | | 512 | abc | 0.26 ± 0.22 | — |
| BBO | | | | | | 429 | abc | 0.36 ± 0.16 | 6 |
| DMBO | 279 | a | 1.03 ± 0.35 | 1 | | 580 | ab | 0.57 ± 0.14 | 3 |
| HBO | 258 | ab | 0.25 ± 0.28 | 11 | | | | | |
| IBS | | | | | | 1,084 | ab | 0.68 ± 0.13 | 2 |
| IPBO | 446 | a | 0.43 ± 0.24 | 3 | | | | | |
| LMBO | 260 | ab | 0.05 ± 0.36 | — | | 4,025 | c | 0.26 ± 0.06 | — |
| LPBO-1 | 900 | b | −0.43 ± 0.15 | — | * | 3,135 | c | 0.16 ± 0.07 | — |
| LPBO-2 | 595 | ab | −0.04 ± 0.20 | — | | 207 | abc | 0.67 ± 0.24 | 3 |
| LPBO-3 | 614 | a | 0.63 ± 0.19 | 2 | | 5,155 | a | 0.66 ± 0.06 | 3 |
| LSLBO | 172 | ab | 0.24 ± 0.27 | 7 | | 673 | bc | 0.32 ± 0.11 | 7 |
| MNO | | | | | | 328 | bc | 0.14 ± 0.16 | — |
| PEPtBO | 813 | a | 0.35 ± 0.16 | 4 | | | | | |
| TCBO | 323 | a | 0.31 ± 0.21 | 5 | | 675 | abc | 0.37 ± 0.14 | 12 |
| Blackpoll Warbler, *D. striata* | | | | | | | | | |
| ABO | | | | | | 218 | a | −0.06 ± 0.46 | — |
| LMBO | | | | | | 623 | a | 0.39 ± 0.17 | 5 |
| LPBO-1 | | | | | | 1,333 | a | 0.73 ± 0.11 | 2 |
| LPBO-2 | | | | | | 708 | a | 0.60 ± 0.16 | 3 |
| LPBO-3 | 104 | | 1.95 ± 0.51 | 1 | | 388 | a | 0.75 ± 0.20 | 2 |
| TCBO | | | | | | 348 | a | 0.25 ± 0.21 | — |
| American Redstart, *Setophaga ruticilla* | | | | | | | | | |
| ABO | | | | | | 149 | b | −0.14 ± 0.39 | — |
| DMBO | 153 | a | 1.64 ± 0.42 | 1 | | 408 | ab | 0.93 ± 0.17 | 2 |
| LMBO | | | | | | 456 | ab | 0.56 ± 0.18 | 3 |
| LPBO-1 | 213 | c | −0.04 ± 0.31 | — | | 498 | ab | 0.47 ± 0.16 | 6 |
| LPBO-2 | 154 | ab | 1.36 ± 0.30 | 1 | * | 637 | b | 0.37 ± 0.15 | 11 |
| LPBO-3 | 515 | bc | 0.43 ± 0.18 | 4 | | 831 | ab | 0.72 ± 0.13 | 3 |
| LSLBO | 423 | c | 0.28 ± 0.18 | 6 | | 831 | ab | 0.52 ± 0.12 | 3 |
| MNO | | | | | | 1,150 | ab | 0.69 ± 0.09 | 2 |
| PEPtBO | 206 | a | 0.63 ± 0.29 | 2 | | | | | |
| TCBO | 460 | c | 0.36 ± 0.15 | 5 | * | 1,553 | a | 0.90 ± 0.10 | 2 |
| Northern Waterthrush, *Seiurus noveborecensis* | | | | | | | | | |
| ABO | | | | | | 131 | a | 0.57 ± 0.27 | 2 |
| DMBO | | | | | | 365 | a | 0.79 ± 0.21 | 1 |
| IBS | | | | | | 180 | a | 0.79 ± 0.29 | 1 |
| LMBO | | | | | | 215 | a | 0.19 ± 0.34 | 36 |
| LPBO-1 | | | | | | 262 | a | 0.95 ± 0.29 | 1 |
| LPBO-2 | 140 | a | 0.42 ± 0.38 | 3 | | 822 | a | 0.20 ± 0.16 | — |
| LPBO-3 | 132 | a | 0.74 ± 0.45 | 1 | | 313 | a | 0.60 ± 0.26 | 2 |
| MNO | | | | | | 887 | a | 0.31 ± 0.10 | 4 |
| TCBO | | | | | | 376 | a | 0.40 ± 0.22 | 3 |
| Wilson's Warbler, *Wilsonia pusilla* | | | | | | | | | |
| DMBO | 171 | a | 1.78 ± 0.50 | 1 | | | | | |
| IBS | | | | | | 516 | a | 0.84 ± 0.18 | 2 |
| LMBO | | | | | | 482 | a | 0.37 ± 0.27 | 7 |
| LPBO-1 | 136 | b | −0.21 ± 0.44 | — | | 233 | a | 0.94 ± 0.28 | 2 |
| LPBO-2 | 190 | ab | 0.68 ± 0.37 | 2 | | 240 | a | 0.84 ± 0.27 | 2 |
| LPBO-3 | 617 | ab | 0.47 ± 0.21 | 4 | | 388 | a | 0.99 ± 0.23 | 2 |
| LSLBO | | | | | | 120 | a | 0.96 ± 0.37 | 2 |
| MNO | | | | | | 309 | a | 0.86 ± 0.15 | 2 |
| RPBO | | | | | | 236 | a | 0.55 ± 0.16 | 3 |

TABLE 2. Continued.

| Species and site | Spring | | | | Difference between seasons | Fall | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | Difference[b] | Mass change (mean ± SE) | Days to refuel[c] | | *n* | Difference | Mass change (mean ± SE) | Days to refuel[c] |
| Lincoln's Sparrow, *Melospiza lincolnii* | | | | | | | | | |
| IBS | | | | | | 154 | a | 1.13 ± 0.39 | 1 |
| LMBO | | | | | | 232 | a | 0.50 ± 0.31 | 3 |
| LPBO-1 | 651 | a | 0.16 ± 0.18 | — | | | | | |
| LPBO-2 | 407 | a | 0.83 ± 0.27 | 1 | | | | | |
| LPBO-3 | 551 | a | 0.38 ± 0.20 | 3 | | | | | |
| MNO | | | | | | 117 | a | 0.31 ± 0.45 | 4 |
| PEPtBO | 105 | a | 0.13 ± 0.43 | — | | | | | |
| RPBO | | | | | | 138 | a | 0.98 ± 0.36 | 1 |
| TCBO | | | | | | 188 | a | 1.06 ± 0.25 | 1 |
| White-throated Sparrow, *Zonotrichia albicollis* | | | | | | | | | |
| ABO | | | | | | 114 | ab | 0.07 ± 0.46 | — |
| DMBO | 270 | a | 1.72 ± 0.25 | 1 | | 399 | a | 1.04 ± 0.19 | 1 |
| HBO | 559 | b | 0.49 ± 0.18 | 2 | | | | | |
| IBS | | | | | | 210 | ab | 0.38 ± 0.32 | 3 |
| IPBO | 110 | ab | 0.87 ± 0.38 | 1 | | | | | |
| LMBO | 223 | bc | 0.36 ± 0.31 | 2 | | 412 | ab | 0.43 ± 0.21 | 3 |
| LPBO-1 | 4,333 | c | −0.05 ± 0.06 | — | | 1,056 | b | 0.17 ± 0.11 | — |
| LPBO-2 | 3,040 | b | 0.56 ± 0.07 | 1 | | | | | |
| LPBO-3 | 3,767 | b | 0.57 ± 0.06 | 1 | | 2,123 | a | 0.71 ± 0.09 | 1 |
| LSLBO | 262 | abc | 0.67 ± 0.30 | 1 | | 162 | ab | 0.52 ± 0.24 | 2 |
| PEPtBO | 719 | ab | 0.91 ± 0.18 | 1 | | | | | |
| TCBO | 204 | ab | 0.65 ± 0.29 | 1 | | 236 | ab | 0.34 ± 0.21 | 3 |
| White-crowned Sparrow, *Z. leucophys* | | | | | | | | | |
| LPBO-1 | 1,072 | b | 0.02 ± 0.15 | — | | 467 | a | 0.20 ± 0.19 | — |
| LPBO-2 | 1,051 | b | 0.00 ± 0.15 | — | | | | | |
| LPBO-3 | 119 | a | 1.38 ± 0.46 | 1 | | 204 | a | 0.64 ± 0.30 | 2 |
| MNO | | | | | | 108 | a | 0.39 ± 0.29 | 2 |
| TCBO | | | | | | 237 | a | 0.95 ± 0.22 | 1 |
| Dark-eyed Junco, *Junco hyemalis* | | | | | | | | | |
| DMBO | | | | | | 274 | ab | 0.70 ± 0.18 | 2 |
| HBO | 253 | ab | 0.39 ± 0.27 | 3 | | | | | |
| IPBO | 192 | a | 0.77 ± 0.24 | 1 | | 119 | ab | 0.52 ± 0.36 | 3 |
| LMBO | | | | | | 1,082 | ab | 0.53 ± 0.12 | 3 |
| LPBO-1 | 2,154 | b | −0.15 ± 0.09 | — | | 1,766 | b | 0.27 ± 0.09 | — |
| LPBO-2 | 1,016 | a | 0.44 ± 0.12 | 3 | | | | | |
| LPBO-3 | 784 | a | 0.43 ± 0.15 | 3 | | 930 | a | 0.84 ± 0.12 | 2 |
| MNO | | | | | | 435 | b | 0.16 ± 0.15 | — |
| PEPtBO | 314 | a | 0.84 ± 0.25 | 1 | | | | | |
| TCBO | 482 | ab | 0.14 ± 0.16 | — | | 2,421 | a | 0.61 ± 0.07 | 2 |

[a] Mass change ± SE, expressed as % of lean body mass/h.

[b] Within species and season, sites not sharing a letter in common were significantly different (Tukey's studentized range tests). Asterisks in the center column indicate significant differences in seasonal values.

[c] Calculation based on the assumption that hourly rate of mass gain was maintained over all daylight hours. A dash indicates that mass was being lost, or gained at a rate insufficient to support a full night of migration within 40 days.

(Table 5), such that a species with early morning mass 5% above lean mass would be expected to have an hourly rate of mass gain about 15% below that of a species starting the day at lean mass.

Estimates of the number of days required to build up enough fuel to sustain 10 h of migration without falling below lean mass (based on the assumption that estimated hourly mass change continued over all daylight h) showed that most birds could completely refuel in ≤1 week (59% of species during

TABLE 3. Sites varied in mean mass change values and in the percent of species achieving net gains over 24-h. Although sites differed in the suite of species analyzed, three sites (BBO, LMBO, and LPBO-1) had consistently low values during spring, and one (ABO) during fall. See Table 1 for site names.

| | Spring | | | | Fall | | | |
|---|---|---|---|---|---|---|---|---|
| Site | Mean mass change[a] | Mean threshold[b] | Percentage over threshold[c] | Number of species | Mean mass change | Mean threshold | Percentage over threshold | Number of species |
| ABO | | | | | 0.14 | 0.27 | 20 | 5 |
| BBO | −0.43 | 0.14 | 0 | 1 | 0.34 | 0.21 | 100 | 3 |
| DMBO | 1.25 | 0.14 | 100 | 6 | 0.63 | 0.22 | 78 | 9 |
| HBO | 0.48 | 0.19 | 83 | 6 | | | | |
| IBS | | | | | 0.61 | 0.20 | 83 | 6 |
| IPBO | 0.69 | 0.17 | 100 | 3 | 0.48 | 0.33 | 100 | 2 |
| LMBO | 0.08 | 0.13 | 25 | 4 | 0.60 | 0.23 | 100 | 13 |
| LPBO-1 | −0.19 | 0.18 | 9 | 11 | 0.45 | 0.27 | 54 | 13 |
| LPBO-2 | 0.37 | 0.18 | 67 | 12 | 0.49 | 0.26 | 89 | 9 |
| LPBO-3 | 0.56 | 0.18 | 86 | 14 | 0.67 | 0.27 | 92 | 13 |
| LSLBO | 0.35 | 0.13 | 100 | 4 | 0.42 | 0.19 | 67 | 6 |
| MNO | | | | | 0.42 | 0.18 | 82 | 11 |
| PEPIBO | 0.42 | 0.18 | 75 | 8 | | | | |
| RPBO | | | | | 1.09 | 0.30 | 100 | 3 |
| TCBO | 0.45 | 0.17 | 71 | 9 | 0.53 | 0.24 | 77 | 13 |

[a] Mean of species values, expressed as % of lean body mass/h.
[b] Mean across species of hourly mass gain that must be met or surpassed for mass equilibrium over 24 h with no migration (see Methods).
[c] Percentage of species with data from this site that met or surpassed their thresholds for 24-h mass balance.

spring and 73% during fall; Table 2). Median time to refuel was 4 days during spring and 3 days during fall. At the mean rates of mass change (0.40% of lean body mass/h during spring and 0.53% during fall), estimated refueling time for 12 and 20 g birds was 2–3 days, regardless of season (Fig. 2A). Larger birds required shorter refueling periods because maintenance costs decrease in proportion to increased mass. Refueling time was very sensitive to changes in mass gain up to about 1.75 times the gain needed to maintain

TABLE 4. Compared to other migrating passerines, the Swainson's Thrush stood out as having consistently low rates of mass change at most sites, during both seasons.

| | Spring | | | | Fall | | | |
|---|---|---|---|---|---|---|---|---|
| Species | Mean mass change[a] | Mean threshold[b] | Percent over threshold[c] | Number of sites | Mean mass change | Mean threshold | Percent over threshold | Number of sites |
| American Redstart, *Setophaga ruticilla* | 0.67 | 0.18 | 86 | 7 | 0.56 | 0.24 | 89 | 9 |
| Blackpoll Warbler, *Dendroica striata* | 1.95 | 0.17 | 100 | 1 | 0.44 | 0.25 | 67 | 6 |
| Least Flycatcher, *Empidonax minimus* | 0.17 | 0.16 | 57 | 7 | 0.53 | 0.21 | 78 | 9 |
| Lincoln's Sparrow, *Melospiza lincolnii* | 0.38 | 0.16 | 75 | 4 | 0.80 | 0.21 | 100 | 5 |
| Magnolia Warbler, *D. magnolia* | 0.17 | 0.20 | 67 | 6 | 0.57 | 0.25 | 86 | 7 |
| Yellow-rumped Warbler, *D. coronata* | 0.28 | 0.18 | 70 | 10 | 0.40 | 0.27 | 73 | 11 |
| Northern Waterthrush, *Seiurus noveboracensis* | 0.58 | 0.16 | 100 | 2 | 0.53 | 0.18 | 100 | 9 |
| Ruby-crowned Kinglet, *Regulus calendula* | 0.32 | 0.25 | 50 | 6 | 0.72 | 0.38 | 88 | 8 |
| Dark-eyed Junco, *Junco hyemalis* | 0.41 | 0.18 | 71 | 7 | 0.52 | 0.26 | 71 | 7 |
| Swainson's Thrush, *Catharus ustulatus* | −0.06 | 0.12 | 29 | 7 | 0.10 | 0.17 | 25 | 8 |
| Tennessee Warbler, *Vermivora peregrina* | 0.48 | 0.18 | 50 | 2 | 0.57 | 0.23 | 86 | 7 |
| White-crowned Sparrow, *Zonotrichia leucophys* | 0.47 | 0.13 | 33 | 3 | 0.55 | 0.21 | 75 | 4 |
| Wilson's Warbler, *Wilsonia pusilla* | 0.68 | 0.21 | 75 | 4 | 0.79 | 0.26 | 100 | 8 |
| White-throated Sparrow, *Z. albicollis* | 0.68 | 0.13 | 90 | 10 | 0.46 | 0.21 | 75 | 8 |

[a] Mean of site values, expressed as % of lean body mass/h.
[b] Mean across sites of hourly mass gain that must be met or surpassed for mass equilibrium over 24 h with no migration (see Methods).
[c] Percentage of sites at which species met or surpassed its threshold for 24-h mass balance.

TABLE 5. Morning condition (the difference between mean mass during the first 3 h of the day and lean mass, expressed as % of lean mass) varied with season, site and species (general linear models). Rate of mass gain also varied with these factors, and decreased with improved morning condition.

| Source of variation | df | SS | *F* | *P* |
|---|---|---|---|---|
| Morning condition | | | | |
| Season | 1 | 88.49 | 30.42 | <0.001 |
| Species | 13 | 207.67 | 5.49 | <0.001 |
| Site | 14 | 747.01 | 18.34 | <0.001 |
| Rate of mass gain | | | | |
| Season | 1 | 0.74 | 6.20 | 0.01 |
| Species | 13 | 5.39 | 3.50 | <0.001 |
| Site | 14 | 8.23 | 4.95 | <0.001 |
| Morning condition | 1 | 1.17 | 14.05 | <0.001 |

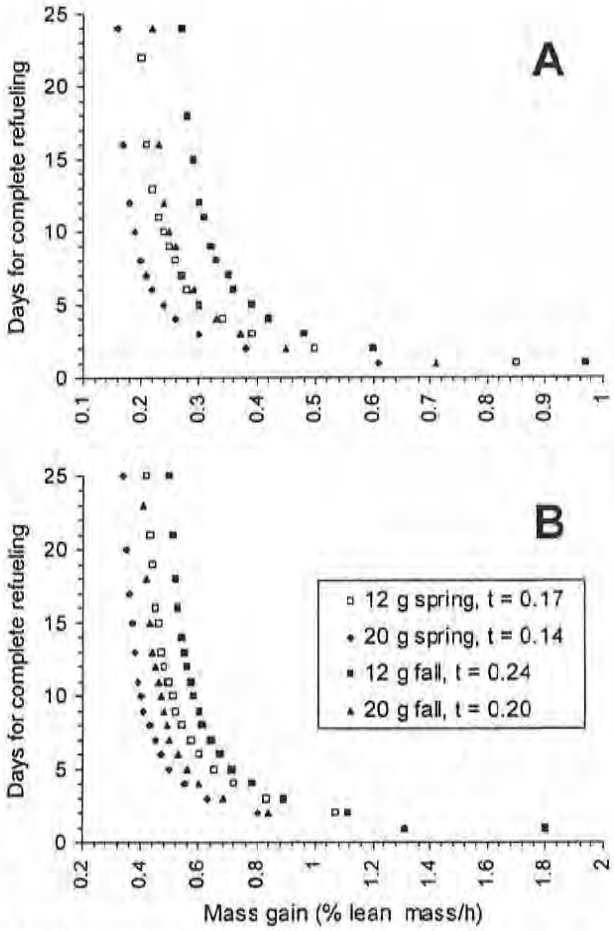


FIG. 2. Results of a model estimating days required for lean birds of two sizes to gain sufficient mass in southern Canada to undertake a 10-h migratory flight without falling below their lean mass (see Methods). (A) Birds were assumed to gain mass during every daylight hour (15 h during spring and 13 h during fall). (B) Birds gained mass for 7 h and maintained stable mass over the remaining daylight hours. Birds in Fig. 2A could fly for 10 h after 2–3 days of refueling in both seasons, whereas refueling time in Fig. 2B rose to as much as 3 weeks (note difference in x-axis scales).

24-h mass balance, after which increased rate of gain made relatively little difference.

When mass change was assumed to cease after 7 h (with mass maintained, but not increased over remaining daylight hours), refueling curves shifted to the right (Fig. 2B). Birds gaining for only 7 h would have to double their hourly mass gain in order to refuel as fast as birds that gained mass throughout the day.

At sites where data often were collected for ≥12 h (Thunder Cape Bird Observatory and LPBO), hourly mass change estimates based on 12 h were significantly higher than those based on 7 h during spring (0.46% of lean mass/h versus 0.31%, respectively; paired $t_{45} = 4.02$, $P < 0.001$), but were not significantly different during fall (0.57% of lean mass/h versus 0.53%, respectively; paired $t_{48} = 1.49$, $P = 0.14$). Results were similar for each season at each site.

## DISCUSSION

Although estimates of hourly mass change varied widely, confidence intervals were so broad that there were few significant differences among them. Wide confidence intervals are inevitable in analyses of this kind because there will nearly always be large variation in individual mass at any given time of day. This variation results from factors such as length of stopover prior to first capture, fat stores remaining at the end of the migratory flight preceding stopover, weather conditions, and fluctuations in daily food supply. Consistent results should nonetheless reflect biologically meaningful differences among estimates (Dunn 2001, Jones et al. 2002).

Two sites had consistently low mass change estimates for spring (Table 3): Last Mountain Bird Observatory and the LPBO site at the extreme end of Long Point in Lake Erie (LPBO-1). Beaverhill Bird Observatory also had a low spring value, but data were available for only one species. Last Mountain Bird Observatory is surrounded by extensive agricultural grassland, and appears to attract birds during spring primarily under unusual weather conditions, rather than serving as a regular stopover site (A. R. Smith pers. comm.). Plant phenology at LPBO-1 is strongly delayed because of the cold spring temperature of surrounding Lake Erie (Dunn 2000, 2001). The only site with consistently low mass gains during fall, Atlantic Bird Observatory, also is affected by cool surrounding water, in this case the Atlantic Ocean, and may experience more fog and high winds than other sites. Birds at this location were heavier early in the morning than birds at other sites during fall, but the predicted reduction in mass gain as a result of higher early morning mass was not enough to explain the low gains at the site.

Among species, the Swainson's Thrush was the only one to have consistently low mass gains during both seasons (Table 4). Dunn (2001) hypothesized that low mass gain for all thrushes at LPBO was a result of poor habitat for ground foragers. At sites other than LPBO, early morning mass of Swainson's Thrushes was up to 9% above lean mass, but again, rate of gain was too low to be explained by this alone.

High relative mass of birds during the early morning probably is an indicator of stopover length. At sites from which birds move on quickly, estimates of mass gain should indicate the true potential for rapid accumulation of mass at the site. Somewhat paradoxically, if birds stay on for more than a day or two at a site that has good food resources, mass gain estimates may be reduced. Heavy birds need not gain as much mass as light ones and, more importantly, may reduce the rate or cease feeding earlier in the day, violating the assumption of the analysis method that there is no bias in time of day that birds of different mass will be captured. This is a topic that needs further investigation.

Mass gain was significantly lower during spring than during fall. Migrants in southern Canada are closer to their final destination during spring and may not need to accumulate as much fuel for continued flight as during fall. However, birds moving northward often carry extra reserves (Sandberg and Moore 1996), and the many instances of spring mass loss in this study suggested that feeding conditions at the study sites often were poor. Temperatures in southern Canada during spring migration can range from near freezing to >20°C, affecting plant phenology and insect activity accordingly, whereas fall weather is much more predictable and benign.

A comparison of mass change at Delta Marsh Bird Observatory during cold versus

warm spring seasons might be a good test of the importance of weather effects. This site stood out as having particularly high mass gains during spring (Table 3), but most of the data came from a series of years with warm, early springs (H. den Haan pers. comm.). In recent years there have been several very late springs, and a comparison of mass change during early versus late seasons would be of interest.

The model of refueling time (Fig. 2) demonstrated some interesting facets of stopover energetics. The shape of the relationship between refueling time and mass gain was little affected by changing assumptions about hours of daily feeding or costs of overnight metabolism and migration, which served mainly to shift the location of the curves in the graphical space. The model showed that the number of hours of gain during the day had an important influence on refueling period (Fig. 2). In both seasons, day length varied considerably among sites, and a single species could experience as much as 3.5 h difference in daylight, depending upon latitude of the site and mean passage date. It is therefore important to consider the amount of daylight that actually is used for feeding.

Limited information in the literature indicated that birds foraged at a high rate during the first 7 h of the day, followed by rest for several hours prior to renewed feeding in late afternoon (Graber and Graber 1983). This pattern corresponds with the experience of banders, who see similar fluctuation in capture rates of migrants. One would expect individual variation in feeding intensity and duration to be great, depending upon factors such as the bird's fuel stores, its motivation to undertake another migratory flight quickly, its need for rest, and conditions of weather and predator abundance, and it is possible that more actively foraging birds have a higher chance of being captured. If that is the case, the data presented here showing that rate of mass gain remains high throughout the day may be biased upwards. The figures shown for refueling times in Table 2 and Fig. 2A should therefore be considered potential periods, while actual periods are likely to be longer. However, they are unlikely to be as long as shown in Fig. 2B, as there is no reason to expect that all birds would cease gaining mass entirely after 7 h of feeding.

The refueling periods described here are not the same as stopover periods. Depending upon factors such as local foraging conditions, weather, body condition, and motivation, birds may undertake a migratory flight of a few hours without waiting long enough to accumulate sufficient fuel to support a full night of sustained migration (Biebach et al. 1986, Moore et al. 1995). Other birds will arrive with some fuel reserves remaining, so will not have to stay in the area for the full refueling period. Stopover also could be longer than the predicted refueling period, as when weather conditions preclude continued migration.

This study was the first in North America to compare mass gain of passerines during migratory stopover across a large geographic area. It examined data retrospectively, however, and the search for patterns was hampered by the fact that data for the same species were not available from all sites and both seasons. Even with similar limitations, however, a similar study of variation in body condition and rates of mass gain along a north-south transect should be able to detect whether there are gradual or sudden changes along the migration route. For example, fall migrants thought to have migrated overland to a study site in southern Mexico had low mean mass, and mass gains were similar to those from this study (Winker 1995). In contrast, birds captured during fall along the central U.S. Gulf coast, and expected to make trans-Gulf flights, were heavier and were maintaining rather than gaining mass (Woodrey and Moore 1997). However, it is unknown whether birds intending trans-Gulf flights gain mass gradually along the migration route, or rely on good conditions for refueling close to the geographic barrier. I sought data from locations in eastern North America to undertake an analysis of mass gain along a migration route, but found there were essentially no data available from the southeastern United States. The alternative is to design a focused study similar to that described by Schaub and Jenni (2000). Results from studies on geographic patterns in mass gain are needed if conservation planners are to make informed decisions on the type and distribution of stopover habitat that should be protected along migration routes.

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Appendix 5

## Appendix 5. Year-to-Year Recaptures at Inglewood Bird Sanctuary, Dunbow Road and Cominco Natural Area

| Species | Band | Location | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | r | | |
| Downy Woodpecker | 1461-02314 | IBS | | | | | B | r | r | r | | | | |
| Downy Woodpecker | 1461-05307 | Dunbow | | | | | | B | | r | | | | |
| Downy Woodpecker | 1461-50837 | Cominco | | | | | | | | | B | r | | |
| Downy Woodpecker | 1461-63690 | IBS | | | B | r | | | | | | | | |
| Downy Woodpecker | 1461-84563 | Cominco | | | | | | | | | B | r | | |
| Downy Woodpecker | 1761-28014 | Cominco | | | | | | | | | B | r | | |
| Downy Woodpecker | 1791-28009 | IBS | | | | | | | | | | | B | r |
| Downy Woodpecker | 1791-28131 | IBS | | | | | | | | | | B | r | r |
| Hairy Woodpecker | 0962-90911 | IBS | | | | B | | | | | r | | r | |
| Hairy Woodpecker | 1152-38713 | IBS | | | | | | | B | | r | | r | |
| Northern Flicker | 1383-76804 | IBS | | | | | | | B | | | r | | |
| Northern Flicker | 1383-76830 | IBS | | | | | | | | | | | B | r |
| Northern Flicker | 1453-31301 | IBS | | | | B | r | | | | | | | |
| Western Wood-Pewee | 2160-19068 | IBS | | | | | | | B | | | r | | |
| Western Wood-Pewee | 2160-19487 | IBS | | | | | | | | B | | r | | |
| Western Wood-Pewee | 2190-10406 | IBS | | | | | | | | | | B | r | |
| Western Wood-Pewee | 2200-47351 | IBS | | | | | | | | | | B | r | r |
| Least Flycatcher | 2050-70767 | Dunbow | | | | | | B | | r | | | | |
| Eastern Kingbird | 1451-38640 | IBS | B | | | r | | | | | | | | |
| Eastern Kingbird | 1461-31482 | IBS | | | | | | | B | | | | r | |
| Eastern Kingbird | 1461-50853 | Cominco | | | | | | | | | B | r | | |
| Eastern Kingbird | 1461-50898 | Cominco | | | | | | | | | B | r | | |
| Eastern Kingbird | 1461-50899 | Cominco | | | | | | | | | B | r | | |
| Eastern Kingbird | 1461-63719 | IBS | | | | | B | r | | r | | | r | |
| Eastern Kingbird | 1461-63727 | IBS | | | | | B | | | | r | | | |
| Eastern Kingbird | 1461-63750 | IBS | | | | | | B | r | r | | | r | |
| Eastern Kingbird | 1761-28292 | IBS | | | | | | | | | | B | r | |
| Eastern Kingbird | 1791-21021 | IBS | | | | | | | | | | B | | 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 | 1990-57936 | IBS | | | | | | | | | B | | r | r |
| Warbling Vireo | 2050-70837 | IBS | | | | | | B | r | | | | | |
| Warbling Vireo | 2050-70961 | IBS | | | | | B | | r | | | | | |
| Warbling Vireo | 2161-14605 | IBS | | | | B | | | r | | | | | |
| Warbling Vireo | 2171-56330 | Cominco | | | | | | | | | B | r | | |
| Warbling Vireo | 2190-10445 | IBS | | | | | | | | | | B | r | |
| Warbling Vireo | 2220-34455 | Cominco | | | | | | | | | B | r | | |
| Warbling Vireo | 3101-45254 | IBS | | | | | | | | B | r | | | |
| Warbling Vireo | 3101-89999 | IBS | | | | | | | | B | | | r | |
| Warbling Vireo | 3121-21265 | Cominco | | | | | | | | | B | r | | |
| Tree Swallow | 2171-56493 | 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 | r | r | | |
| Black-capped Chickadee | 1950-45255 | IBS | | | B | | | | | | r | r | | |

## Appendix 5. Year-to-Year Recaptures at Inglewood Bird Sanctuary, Dunbow Road and Cominco Natural Area

| Species | Band | Location | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 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 | | | | |
| Black-capped Chickadee | 2160-19059 | IBS | | | | | | | B | r | | | | |
| Black-capped Chickadee | 2160-19120 | IBS | | | | | | | B | r | r | r | r | r |
| Black-capped Chickadee | 2160-19174 | IBS | | | | | | | B | r | | | | |
| Black-capped Chickadee | 2160-19522 | IBS | | | | | | | | B | r | r | r | r |
| Black-capped Chickadee | 2190-10126 | IBS | | | | | | | | | B | r | r | |
| Black-capped Chickadee | 2190-10128 | IBS | | | | | | | | | B | | r | |
| Black-capped Chickadee | 2200-47365 | IBS | | | | | | | | | | B | r | |
| Black-capped Chickadee | 2220-34017 | Cominco | | | | | | | | | B | r | | |
| Black-capped Chickadee | 2220-34132 | Cominco | | | | | | | | | B | r | | |
| Black-capped Chickadee | 2220-34593 | Cominco | | | | | | | | | B | r | | |
| Black-capped Chickadee | 2270-23454 | IBS | | | | | | | | | | | B | r |
| Black-capped Chickadee | 2270-80108 | IBS | | | | | | | | | | | B | r |
| Black-capped Chickadee | 2390-30780 | IBS | | | | | | | | | | B | r | |
| Black-capped Chickadee | 2390-30780 | IBS | | | | | | | | | | B | | r |
| Black-capped Chickadee | 2390-30962 | IBS | | | | | | | | | | | B | r |
| Black-capped Chickadee | 3500-89670 | Dunbow | | | | | | B | r | r | | | | |
| White-breasted Nuthatch | 1461-31479 | IBS | | | | | | | B | r | r | | | |
| White-breasted Nuthatch | 1461-84757 | IBS | | | | B | r | | r | | | | | |
| White-breasted Nuthatch | 1761-15767 | IBS | | | | | | | | | | | B | r |
| White-breasted Nuthatch | 1761-28100 | IBS | | | | | | | | | | | | |
| White-breasted Nuthatch | 1791-28150 | IBS | | | | | | | | | | B | 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 | 1990-57803 | Cominco | | | | | | | | | B | r | | |
| House Wren | 1990-57943 | IBS | | | | | | | | | B | r | | |

## Appendix 5. Year-to-Year Recaptures at Inglewood Bird Sanctuary, Dunbow Road and Cominco Natural Area

| Species | Band | Location | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| House Wren | 1990-57981 | IBS | | | | | | | | | B | r | r | 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 | | | | |
| House Wren | 2190-10308 | IBS | | | | | | | | | B | r | | |
| House Wren | 2190-10325 | IBS | | | | | | | | | | B | r | |
| House Wren | 2200-47352 | IBS | | | | | | | | | | B | r | |
| House Wren | 2200-47377 | IBS | | | | | | | | | | B | r | r |
| House Wren | 2270-23312 | IBS | | | | | | | | | | | B | r |
| House Wren | 2270-23375 | IBS | | | | | | | | | | | B | r |
| House Wren | 2270-23485 | IBS | | | | | | | | | | | B | r |
| House Wren | 2270-80132 | IBS | | | | | | | | | | | 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 | | | | | | |
| Swainson's Thrush | 1541-17673 | IBS | | | | | | | | B | r | | r | |
| American Robin | 0942-93643 | IBS | | | | | | | | | | | B | r |
| American Robin | 0962-90991 | IBS | | | | B | | r | | | | | | |
| American Robin | 0972-30082 | IBS | | | | | | | | | | B | r | |
| American Robin | 0972-30083 | IBS | | | | | | | | | | B | r | r |
| American Robin | 0972-30087 | IBS | | | | | | | | | | B | r | |
| American Robin | 0972-30095 | 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 | 1142-49261 | IBS | | | | | | | | | | | B | r |
| American Robin | 1142-55013 | IBS | | | | | | | | | | B | r | |
| American Robin | 1152-38703 | Dunbow | | | | | | | B | r | | | | |
| American Robin | 1152-38740 | IBS | | | | | | | B | r | | r | | r |
| American Robin | 1152-38887 | IBS | | | | | | | | | B | r | | |
| Gray Catbird | 1681-67028 | Cominco | | | | | | | | | B | r | | |
| Gray Catbird | 1681-67080 | IBS | | | | | | | | | | B | r | |
| Gray Catbird | 1681-67087 | IBS | | | | | | | | | | B | r | |
| Gray Catbird | 8041-54948 | IBS | | | | | | | B | r | | | | |
| Gray Catbird | 8041-54987 | IBS | | | | | | | B | B | | r | | r |
| Gray Catbird | 8041-83021 | Cominco | | | | | | | | | B | r | | |
| Gray Catbird | 8041-83028 | Cominco | | | | | | | | | B | r | | |
| Gray Catbird | 8041-83041 | Cominco | | | | | | | | | B | r | | |
| Gray Catbird | 8041-83086 | IBS | | | | | | | | | | | B | r |
| Cedar Waxwing | 1461-50802 | Cominco | | | | | | | | | 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 | | | | | |

## Appendix 5. Year-to-Year Recaptures at Inglewood Bird Sanctuary, Dunbow Road and Cominco Natural Area

| Species | Band | Location | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 1990-57734 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57738 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57802 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57864 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57898 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57916 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 1990-57935 | IBS | | | | | | | | | 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 | | | | |
| Yellow Warbler | 2160-18077 | Dunbow | | | | | | | B | r | | | | |
| Yellow Warbler | 2160-19059 | IBS | | | | | | | B | r | | | | |
| Yellow Warbler | 2160-19576 | IBS | | | | | | | | B | | r | | |
| Yellow Warbler | 2160-19766 | IBS | | | | | | | | B | r | r | | |
| Yellow Warbler | 2190-10407 | IBS | | | | | | | | | | B | | r |
| Yellow Warbler | 2200-47358 | Cominco | | | | | | | | | | B | | r |
| Yellow Warbler | 2200-47400 | IBS | | | | | | | | | | B | r | |
| Yellow Warbler | 2220-13037 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2220-13250 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2220-13258 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2220-13262 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2220-13397 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2220-34098 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2220-34171 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2220-34293 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2220-34320 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2220-34423 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2220-34438 | Cominco | | | | | | | | | B | r | | |
| Yellow Warbler | 2270-23132 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2270-23288 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2270-23333 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2270-23346 | IBS | | | | | | | | | | | B | r |
| Yellow Warbler | 2390-30570 | IBS | | | | | | | | | | B | r | |
| Yellow Warbler | 3500-89667 | Dunbow | | | | | | B | | r | | | | |
| Yellow-rumped Warbler | 1910-52603 | IBS | B | r | | | | | | | | | | |
| Yellow-rumped Warbler | 2220-34592 | Cominco | | | | | | | | | B | r | | |
| Clay-coloured Sparrow | 1990-57805 | Cominco | | | | | | | | | B | | | r |
| Clay-coloured Sparrow | 2050-70675 | Dunbow | | | | | | B | | r | | | | |
| Clay-coloured Sparrow | 2120-00157 | Dunbow | | | | | | B | r | r | | | | |
| Clay-coloured Sparrow | 2120-00170 | Dunbow | | | | | | B | | r | | | | |
| Clay-coloured Sparrow | 2120-00176 | Dunbow | | | | | | B | r | | | | | |
| Clay-coloured Sparrow | 2160-18022 | Dunbow | | | | | | | B | r | | | | |

## Appendix 5. Year-to-Year Recaptures at Inglewood Bird Sanctuary, Dunbow Road and Cominco Natural Area

| Species | Band | Location | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clay-coloured Sparrow | 2160-18028 | Dunbow | | | | | | | B | r | | | | |
| Clay-coloured Sparrow | 2160-18030 | Dunbow | | | | | | | B | r | | | | |
| Clay-coloured Sparrow | 2160-19504 | IBS | | | | | | | | B | | | r | |
| Clay-coloured Sparrow | 2220-34456 | Cominco | | | | | | | | | B | r | | |
| Clay-coloured Sparrow | 2220-34615 | Cominco | | | | | | | | | B | r | | |
| Clay-coloured Sparrow | 2390-30503 | IBS | | | | | | | | | | B | | r |
| Vesper Sparrow | 1461-05331 | Dunbow | | | | | | B | r | | | | | |
| Vesper Sparrow | 1461-31412 | Dunbow | | | | | | | B | r | | | | |
| Savannah Sparrow | 2171-56304 | Cominco | | | | | | | | | B | r | | |
| Song Sparrow | 1541-17836 | Cominco | | | | | | | | | B | r | | |
| Song Sparrow | 1541-17895 | Cominco | | | | | | | | | B | r | | |
| Lincoln's Sparrow | 2161-14607 | IBS | | | | B | r | | | | | | | |
| Lincoln's Sparrow | 3121-21261 | Cominco | | | | | | | | | B | r | | |
| White-throated Sparrow | 1791-28046 | IBS | | | | | | | | | | | B | r |
| Red-winged Blackbird | 8041-83032 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 1461-05333 | Dunbow | | | | | | B | r | | | | | |
| Brown-headed Cowbird | 1461-31414 | Dunbow | | | | | | | B | r | | | | |
| Brown-headed Cowbird | 1541-17842 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 1761-28251 | IBS | | | | | | | | | | B | r | |
| Brown-headed Cowbird | 1791-28013 | IBS | | | | | | | | | | | B | r |
| Brown-headed Cowbird | 8041-54991 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 8041-54992 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 8041-83003 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 8041-83005 | Cominco | | | | | | | | | B | r | | |
| Brown-headed Cowbird | 8041-83019 | Cominco | | | | | | | | | B | r | | |
| Baltimore Oriole | 8041-54908 | IBS | | | | | | | B | r | | | | |
| Baltimore Oriole | 8041-83030 | Cominco | | | | | | | | | B | r | | |
| Baltimore Oriole | 8041-83090 | IBS | | | | | | | | | | | B | r |
| Baltimore Oriole | 8051-65131 | IBS | | | | | | B | r | | | | | |
| American Goldfinch | 1990-57875 | Cominco | | | | | | | | | B | r | | |
| American Goldfinch | 2120-00188 | Dunbow | | | | | | B | | r | | | | |
| American Goldfinch | 2190-10309 | IBS | | | | | | | | | | B | | r |
| American Goldfinch | 2220-34131 | Cominco | | | | | | | | | B | r | | |
| American Goldfinch | 2220-34245 | Cominco | | | | | | | | | B | r | | |

B year banded
r recaptured
[illegible] banding location different than recapture location

**APPENDIX 6**

# Appendix 6. New Captures at Las Caletas, Costa Rica - 2003

| New Captures | 15-Apr | 16-Apr | 17-Apr | 18-Apr | 19-Apr | 20-Apr | 21-Apr | 22-Apr | 23-Apr | 24-Apr | 25-Apr | 26-Apr | 27-Apr | 28-Apr | 29-Apr | 30-Apr | 01-May | 02-May | 03-May | 04-May | 05-May | 06-May | 07-May | 08-May | 09-May | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tiny Hawk | | | | | | | | | | 1 | | | | | | | | | | | | | | | | 2 |
| Barred Forest-Falcon | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | 1 |
| Ruddy Ground Dove | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 |
| Blue Ground-Dove | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 |
| White-tipped Dove | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 |
| Gray-chested Dove | | 1 | | | | 1 | | 1 | | | | | | | | | | | | | 1 | 2 | 1 | | 1 | 8 |
| Bronzy Hermit | 2 | 1 | | | 1 | | | | | | 1 | | | | | | | | | | 1 | | 2 | | | 8 |
| Band-tailed Barbthroat | 1 | 2 | | | 3 | 1 | | 1 | 1 | 1 | | | | | | | 2 | 2 | 2 | | 2 | | 1 | 1 | | 20 |
| Long-tailed Hermit | | 2 | 1 | | 1 | | 1 | 1 | | 1 | | 1 | | 2 | | | | | 1 | | | 1 | 2 | 1 | | 15 |
| Stripe-throated Hemit | 3 | 1 | 1 | 1 | | | 3 | | 1 | 1 | 1 | | | | | 1 | | 1 | | | | 1 | | | 1 | 16 |
| White-necked Jacobin | | | | | | | | | | | | | 2 | | | | | | | 2 | | | | 1 | | 5 |
| Violet-crowned Woodnymph | | | | | | 1 | | 1 | | | | 1 | 1 | | | | | 1 | 1 | | | 1 | 4 | | | 11 |
| Blue-throated Goldentail | | 5 | | | | 2 | 1 | 3 | 2 | 2 | 2 | 1 | 4 | 1 | 1 | 1 | 2 | 2 | 5 | 5 | 3 | 4 | 2 | 0 | 5 | 59 |
| Charming Hummingbird | | | | | | | 1 | 1 | | 5 | 2 | 3 | 3 | 1 | | 1 | 5 | 2 | 3 | 2 | | 5 | | 4 | 2 | 40 |
| Snowy-bellied Hummingbird | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 1 |
| Rufous-tailed Hummingbird | | | 2 | | 1 | 1 | | | | 1 | 1 | | | | 1 | 1 | | | | | 1 | 1 | | | | 10 |
| Blue-crowned Motmot Kingfisher | | | | 1 | | | | | | 2 | | | 1 | | | | | | | | | | | | | 4 |
| American Pygmy Flycatcher | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 |
| White-necked Puffbird | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Rufous-tailed Jacamar | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| Olivaceous Piculet | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 |
| Buff-throated Foliage-gleaner | 1 | 1 | | 1 | | | | | | 1 | | | | | | | 3 | | | | | | | | | 7 |
| Plain Xenops | | 1 | | | | | 2 | | | | 1 | | | | | 1 | | | | | 1 | | | | | 6 |
| Scaly-throated Leaftosser | | 1 | | | | | | | | | 1 | | | | | 1 | | | | | | | | | | 3 |
| Tawny-winged Woodcreeper | | | | 1 | | | | | | 1 | | | | | | | | | | | | | | | | 2 |
| Long-tailed Woodcreeper | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| Wedge-billed Woodcreeper | 1 | | | 1 | 1 | 1 | | | | | | | | | | | 1 | | | | | | | | 1 | 6 |
| Northern Barred Woodcreeper | | | 1 | 1 | | | | 1 | | | | | 1 | | | | | | | | | | | | | 4 |
| Streaked-headed Woodcreeper | | 1 | | | 1 | | | | | | | | | 1 | | 1 | | | | | | | | | | 4 |
| Black-hooded Antshrike | 1 | 1 | | | 2 | | | | | | | | | | 1 | 1 | 1 | | | 2 | | | | | | 9 |
| Slaty Antwren | | | | | | | | | | | | 1 | | | | | | | | | | 1 | | | | 2 |
| Dot-winged Antwren | 1 | 0 | 5 | 1 | 3 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 18 |
| Chestnut-backed Antbird | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 15 |
| Bicolored Antbird | | | | 6 | | | 1 | | | | 1 | | | | | | 1 | | | | | | | | | 9 |
| Black-faced Antthrush | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 |
| Streak-chested Antpitta | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Ochre-bellied Flycatcher | 3 | 3 | 2 | 3 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 23 |
| Northern Bentbill | | | | 1 | | | | | | | 1 | | | | | | | | | 1 | | | | 1 | | 4 |
| Yellow-olive Flycatcher | | | | | | | | | 1 | | | | | | | 1 | | 1 | | | | | | | | 3 |
| Golden-crowned Spadebill | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 |
| Ruddy-tailed Flycatcher | | | 2 | | | | | | | | | | | | | | | 1 | | | | | | 1 | | 4 |
| Sulphur-rumped Flycatcher | | | | 1 | | 1 | | | | | | | | | | | | 1 | | | | | | | | 3 |

# Appendix 6. New Captures at Las Caletas, Costa Rica - 2003

| New Captures | 15-Apr | 16-Apr | 17-Apr | 18-Apr | 19-Apr | 20-Apr | 21-Apr | 22-Apr | 23-Apr | 24-Apr | 25-Apr | 26-Apr | 27-Apr | 28-Apr | 29-Apr | 30-Apr | 01-May | 02-May | 03-May | 04-May | 05-May | 06-May | 07-May | 08-May | 09-May | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black-tailed Flycatcher | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Alder Flycatcher | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 3 | 1 | 3 | 2 | 5 | 2 | 3 | 0 | 5 | 5 | 1 | 0 | 35 |
| Willow Flycatcher | | | | | | 1 | | | | 1 | | | | 1 | | | | 1 | | | 1 | | 1 | | | 3 |
| Bright-rumped Attila | | | | | | | | | | | | | | 1 | | | | | | | 1 | | | | | 2 |
| Thrushlike Schiffornis | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rufous ~~Piha~~ Hoamer | 1 | | | | | | | 1 | | | | | | | | | 1 | | | | | | | | | 2 |
| White-winged Becard | | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Orange-collared Manakin | 1 | 1 | 2 | 1 | | 1 | | | | | 1 | | | | | | 1 | 1 | 1 | | 1 | 2 | 1 | 1 | 1 | 16 |
| Blue-crowned Manakin | 2 | | | 2 | 1 | | 1 | | 1 | | 1 | | | | 1 | | 1 | | | | | | | | 1 | 11 |
| Red-capped Manakin | 4 | 0 | 1 | 4 | 0 | 4 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 3 | 2 | 1 | 0 | 3 | 1 | 31 |
| Red-eyed Vireo | | | | 2 | | | | | | | | | | | | 1 | | | | | | 1 | 1 | | 1 | 6 |
| Yellow-green Vireo | | | | | | | 1 | | 1 | 2 | 1 | | 1 | 1 | | | | | | | 2 | | 1 | | | 10 |
| Tawny-crowned Greenlet | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| Lesser Greenlet | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 |
| Black-bellied Wren | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 |
| Riverside Wren | 1 | | | 1 | | 1 | | | | 1 | | | | 2 | | 1 | | | | | | | | | | 7 |
| Scaly-breasted Wren | | | | | 1 | | | | | 1 | | | | | | | | | | | | | | | | 1 |
| Long-billed Gnatwren | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 |
| Tropical Gnatcatcher | | | | | | | | | | | | | | 1 | | | | | | | | | | | | 1 |
| Swainson's Thrush | 23 | 47 | 47 | 39 | 39 | 22 | 52 | 22 | 12 | 21 | 16 | 7 | 17 | 16 | 1 | 10 | 5 | 3 | 2 | 2 | 0 | 0 | 0 | 3 | 0 | 406 |
| Northern Waterthrush | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Bananaquit | | | | | 1 | | | | | 1 | 1 | | 1 | | | 3 | 1 | | | | 1 | | 2 | 1 | | 12 |
| Gray-headed Tanager | 1 | 3 | | | 1 | | 1 | 1 | | | | | 1 | | | | 1 | | | | | | | | | 9 |
| White-throated Shrike-Tanager | | | | | | | | | | | 1 | | | | | | | | | | | | | 1 | | 2 |
| White-shouldered Tanager | | | | | | | 3 | | 2 | | 1 | | | 1 | | 3 | | | | | | | | | | 10 |
| Black-cheeked Ant-Tanager | 2 | | | 1 | 1 | | | 3 | | | | | | 1 | | | | | | | | | | | | 8 |
| Cherrie's Tanager | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 5 |
| Golden-hooded Tanager | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 |
| Green Honeycreeper | | | | | | 1 | | | | | | | 1 | | | 1 | | 1 | | | | | | | | 4 |
| Red-legged Honeycreeper | | | | | | | | | | | | | | | | 1 | 1 | | | | | | 1 | | | 3 |
| Variable Seedeater | | 2 | 1 | 1 | 1 | 1 | | | 1 | | 1 | | | 1 | | | | 1 | | | | | | | | 10 |
| Yellow-bellied Seedeater | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | 2 |
| Thick-billed Seed-Finch | | | | | 1 | | 1 | | | | | | | | | | | | | 1 | | | | | 1 | 4 |
| Orange-billed Sparrow | 6 | 1 | 2 | 1 | 1 | | | 1 | | 2 | | 1 | | 1 | | | | 1 | | | | | | | | 17 |
| Black-striped Sparrow | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 |
| Buff-throated Saltator | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | 1 | 4 |
| Blue-black Grosbeak | | 2 | | 1 | 1 | | 1 | | | | 1 | | 1 | | | | | | | | 1 | | 1 | | | 9 |
| Spot-crowned Euphonia | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 |

Appendix 7

**CALGARY BIRD BANDING SOCIETY**
**2003 MEMBERSHIP LIST**

Peter Achuff
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Amy Wilson
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