MIGRATION MONITORING AT TTPBRS
Fall 2005

by
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Toronto and Region Conservation

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Introduction

In April of 2003, Toronto and Region Conservation Authority (TRCA) established a research station at Tommy Thompson Park (TTP). The primary objective of this endeavour was to aid conservation efforts at the local, national and international level through monitoring, research and education. The core program of the Tommy Thompson Park Bird Research Station (TTPBRS) is the Migration Monitoring Program (MMP). This report details results of the fall 2005 MMP.

Study Site

Tommy Thompson Park (TTP) is located on Toronto's waterfront, which is situated on the northwestern shore of Lake Ontario. The park (formerly Leslie Street Spit) is a man-made peninsula, which extends 5 kilometers in a southwestern direction into Lake Ontario. The Toronto Harbour Commission (now known as the Toronto Port Authority) began construction of a landbase at the foot of Leslie Street in the late 1950's to expand port facilities in anticipation of increased shipping activity on the Great Lakes. From the late 1950's until present day, a combination of lakefilling and dredging activities created the current configuration of the park. Tommy Thompson Park has a total land base of approximately 160 hectares and a water surface area of 100 hectares composed of the western embayments and the inner disposal cells.

Through natural succession much of the land area of TTP has been colonized by a variety of plant and animal communities. The geographic situation of the park and its natural features make it very suitable for large numbers of breeding and migrating birds. Overall, the park represents the largest area of existing natural habitat on the Toronto waterfront. Tommy Thompson Park has been designated as an Environmentally Significant Area (ESA) and was designated as an Important Bird Area (IBA) by Birdlife International in 2001.

The site selected for migration monitoring is located on peninsula D, which is one of several peninsulas that branch off the main spine of the spit. The peninsula is bordered by the Toronto harbour on the north side and an inner bay on the south side. The habitat is composed of early succession cottonwood, willow and birch forest. Beach and meadow features are also present in the study area.

Toronto and Region Conservation (TRCA)

Toronto and Region Conservation (TRCA) was formed in 1957 for the management and conservation of natural resources in the Greater Toronto Area (GTA). Since its formation Toronto and Region Conservation has prepared and delivered programs for the management of the renewable natural resources within its watersheds. Thanks to the support of all levels of government and the valuable partnerships we have established, the Authority provides: protection, enhancement, and regeneration of watersheds, sound environmental advice to promote good land management practices, community action on environmental projects, outdoor recreation opportunities on 13,000 hectares of open space, forest lands, and Conservation Areas and conservation education and heritage programs.

Objectives of the Living City Campaign (run by TRCA) include the maintenance of healthy rivers and shorelines, regional biodiversity, sustainable communities and business excellence. Migration monitoring at Tommy Thompson Park was born out of the objectives of this Living City vision.

Rationale

Migration Monitoring Overview

The Breeding Bird Survey (BBS) is the principal method used by conservation organizations to monitor bird populations. This method is effective only where breeding populations are accessible to roadside data collection. The remoteness of much of northern Canada precludes such survey methods. It is therefore necessary to monitor these populations on their southward and northward movements during migration.

Methods

Protocol

The protocol for data collection at TTPBRS is detailed in "Operations Manual for Tommy Thompson Park Bird Research Station" version 2. The protocol employs fixed effort census and point count surveys as well as a fully standardized capture regimen. Fall migration monitoring operates on a daily basis from August 5-November 12. Data used in this report alternates between DT and DST. Detected Total (DT) is the final tally from all standard surveys while the Daily Species Total (DST) includes the standard surveys as well as any non-standard banding and casual observations.

Fall Migration Monitoring Results

Synopsis

(DST used)

August

TTPBRS was set up on August 4 in preparation for the first day of fieldwork on the 5th. Migrants were few on the first day but a single Northern Waterthrush was captured along with 6 Yellow Warblers. The 6th featured more Traill's Flycatchers as well as a suite of very early records of Golden-crowned Kinglet, Myrtle Warbler, Swainson's Thrush and an adult male Wilson's Warbler (the WIWA was undergoing a complete moult). Also noteworthy on the day was the capture of an Indigo Bunting, which was just the 8th banding record and the first fall banding record. Hot and humid weather really hindered migration during the first week and this was reflected in the low banding totals from August 7-11. Despite this there were some nice observations including singles of Tennessee, Magnolia, Blackpoll and Blackburnian Warbler. The most obvious difference between the first week of fall 2005 and previous fall seasons was the absence of Cedar Waxwing and American Robin from the banding data. Sizeable feeding flocks of these two species were drawn to the abundant honeysuckle berry crop located some distance from the netting area.

During the second week of fall coverage it became clear that warblers were more numerous at this time of year than in years past. That being said, banding totals were consistent with the August average. Despite rain reducing our net hours to half on August 12 we banded 29 birds including good numbers of Traill's Flycatcher (11) and Yellow Warbler (14). At this time higher than normal numbers of Myrtle Warbler were passing through the park as daily totals hovered around 10-20 individuals. The nets were very quiet on the 13th however 6 new arrivals for the fall included a singing Alder Flycatcher (1st fall record for TTPBRS) and an Upland Sandpiper (1st record for TTPBRS). The highlight of the 14th was the biggest concentration of swallows in the three-year history of the station. Barn Swallow (620), Northern Rough-winged (150), Bank (120) and Tree Swallow (25) were observed migrating directly over the banding lab and along the north shore towards the lighthouse. Yellow-bellied Flycatchers started appearing on the 14th and were captured daily throughout the remainder of the week. Strong winds on the 17th limited overall capture rates however a good

passage of warblers was detected including the season's first Black-throated Green Warbler and 41 Myrtles!

Cooler temperatures and northerly winds seem to be appropriate conditions for "fallouts" during autumn migration at Tommy Thompson Park. The third week of fall was a record setting one for the research station as numbers of migrating warblers in particular were unusually high for that time of year. Strong south winds from August 20-21 probably limited overnight migration as daily banding totals were in the teens. New arrivals during the two days included Sharp-shinned Hawk, Red-eyed Vireo, Veery and Swamp Sparrow. A cooling trend along with winds shifting to north brought in more activity on the 22nd as 37 birds were banded. Empidonax flycatchers and warblers were dominant on the day while the 2 Hermit Thrushes banded were unusually early. A "fallout" occurred on the 23rd as 17 species of warbler were recorded and 74 birds in total were banded. Banding totals of Veery (8), Magnolia (15), Chestnut-sided (6), Black-and-white (5) and American Redstart were significant. The tall cottonwoods towards the tip were absolutely alive with birds, mostly Myrtles (110 DST)! Record early was a single Slate-coloured Junco banded (previous record early SCJU was September 18-2004). A continuation of the weather pattern resulted in another strong passage of migrants on the 24th and 25th. Data from previous fall seasons at TTPBRS indicate that the highest single-day banding total for August was 45! This record was broken each day from the 23rd to the 25th of this year.

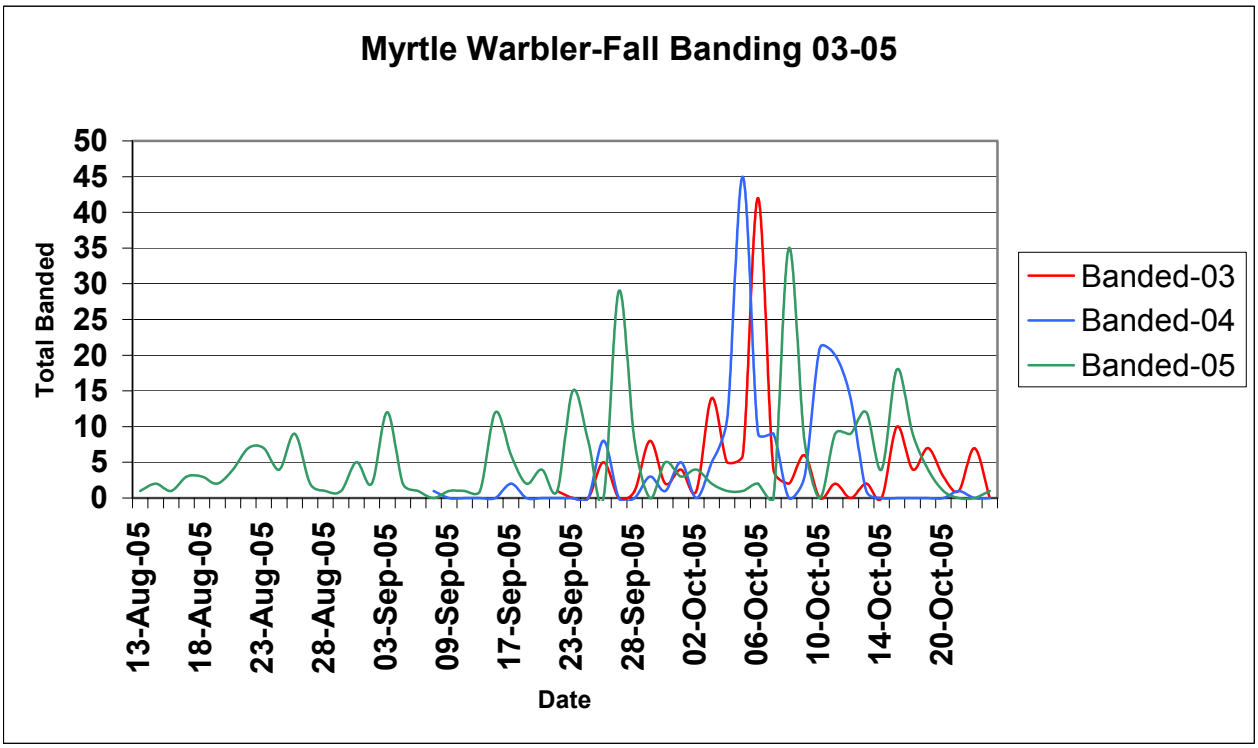

Figure 1. Fall Myrtle Warbler Banding, 2003-2005

September

September 1st was a busy day at the station as 6 new arrivals were recorded and 57 total birds were banded. There were no dominant species on the day but very good diversity as 27 species were captured and 64 total species recorded. Warblers were strongly represented but the highlights were a single Long-tailed Duck (early) and a single Common Nighthawk. The highlight of the 2nd was the banding of our second ever Connecticut Warbler (the 1st was on September 7-2003). North winds on the 3rd brought an influx of birds onto the spit as 50 were banded. The primary species captured on

the day were Myrtle Warbler (12) followed by Nashville (8) Common Yellowthroat (5) and Palm Warbler (4). Similar weather on the 4th resulted in another active day as 51 were banded. This day might well have been the final push of empidonax flycatchers as 3 Yellow-bellied, 1 Traill's and 3 Least were banded. The day also featured a sudden influx of Swainson's Thrushes (12 banded). The most memorable event of the day was watching a Merlin hunt dragonflies (successfully) just above the banding lab in the early morning.

Friday, September 9 was our busiest day of the fall to that point as 83 birds were banded. Swainson's Thrush, Magnolia Warbler, Wilson's Warbler and White-throated Sparrow were a few of the common species on the day. We also captured an Eastern Phoebe, a single Sharp-shinned Hawk, 3 Northern Parula (one day record banding total) and the season's first Brown Creeper. Other season firsts on the day included Ruby-crowned Kinglet, American Pipit and Wood Thrush. The indisputable highlight of the 10th was an American White Pelican observed just prior to census (1st record for TTPBRS). The north winds of the 9th and 10th ended on the 11th as winds shifted to the south and bird numbers were lower. The first groups of Blue Jays were observed moving through the count area (total of 12). Warm weather from the south persisted through the 14th and was responsible for some early net closure due to excessive heat. Relatively few birds were detected during these hot days but Swainson's and Gray-cheeked Thrush as well as Philadelphia and Red-eyed Vireo continued to trickle through the park. Our second Sharp-shinned Hawk of the season was banded on the 13th along with a "late-ish" Yellow-bellied Flycatcher and several Blackpoll Warblers. Migration monitoring is all about highs and lows and the 14th was certainly the latter as just 7 birds were captured and overall diversity was more reminiscent of early August! The week ended on a high note with the return of north winds on the 15th. A total of 89 birds were banded of 21 species. The day belonged to the Gray-cheeked Thrush as 16 were banded.

The seventh week of fall migration was the busiest of the season to that point as high numbers of thrushes, warblers and White-throated Sparrows were on the move. The week also featured some passage of vireos (mostly Red-eyed), kinglets and creepers. In all 343 birds were banded during a week filled with strong northerly winds. High winds associated with a cold front on the 16th cancelled banding coverage on that day, however bird activity was noticeably higher on the following morning as 101 birds were banded. There was a sharp influx of Northern Flicker (20 DT), Gray-cheeked Thrush (28 total, 24 banded), Myrtle Warbler (65) and White-throated Sparrow (45). Raptors were also moving through on the 18th, which resulted in our first ever capture and banding of a Northern Harrier! A small surge of late fall migrant species such as Brown Creeper, Ruby-crowned Kinglet and Winter Wren arrived on this day. September 19 was another solid day of migration monitoring as 92 birds were banded of 23 species. Our second ever Hooded Warbler was captured and the first Semipalmated Sandpipers for the TTPBRS checklist were observed. Winds shifted to the south and west for the 21st and 22nd respectively which meant fewer birds but still some excellent variety.

As expected the week of September 23-29 was our busiest of the fall to that point, however high winds and rain resulted in an unusual amount of net closure. September 23rd was all about the warblers as 45 of the 59 total birds banded were of this family. Warblers and thrushes quickly gave way to kinglets, creepers and sparrows on the 24th when 161 birds were banded from just 35.5 standard net hours! It was as if fall had arrived overnight as late fall species were abundant and temperatures were noticeably cooler. A cold front on the 25th and 26th resulted in another big day at Tommy Thompson Park as 164 birds were banded on the 27th. The most dominant species on the day were the kinglets and Myrtle Warblers however there were more House Wrens, Hermit Thrushes, Blue-headed Vireos and Black-throated Green Warblers around as well. Numbers of birds were certainly lower on the 28th although we can always count on kinglets to keep us occupied during late fall! Impressive 70km/hour winds on the 29th forced yet another cancellation of fieldwork although we were able to host our first school class of the season. Interestingly September 23-29 was a busy week last year also. During this week in 2004 a total of 561 birds were banded from 624 net hours (.89 birds/net hour). For the same period in 2005 443 birds were banded from 281 net hours for a capture rate of 1.57 birds/net hour! September 30th belonged to the Blue Jays as some 3000 were

estimated to have flown over during the morning. Also joining the flyover jays were the first largish groups of Red-winged Blackbirds, Rusty Blackbirds and American Pipits.

October

The study area had taken on a distinctive golden colour as autumn settled in although temperatures were unusually warm during the first week of October. From previous reports you will know that warm-southerly weather in the fall usually means few birds at TTPBRS and this week was a good example. We banded 280 birds for the week culminating in a low of 12 from a full complement of net hours on October 6. By contrast during the same week a year ago 626 birds were banded and more new arrivals were noted such as Fox Sparrow and Pine Siskin. It was quiet up until Oct 3 when 80 birds were banded of a respectable 20 species. The banding total included 5 Red-eyed Vireo. Kinglets were easily the most prevalent bird species at Tommy Thompson Park during the period and the bulk of our captures during the week were of these "little mites". Our "Winged Migration" education program kicked into full gear during the week as school groups were welcomed daily at TTPBRS and would be for the rest of the month. Additionally, on Sept 30 we had 114 visitors from Deloitte & Touche join us for the day.

October 7-13 was one of the busiest 7-day periods ever at TTPBRS. North winds and rain on the 7th kept the nets closed but census revealed some high activity. Even in the midst of a steady downpour after census it was clear that a substantial movement had occurred. The next day showed just that as extraordinary numbers of kinglets, Hermit Thrush, Yellow-bellied Sapsucker, Myrtle Warbler and several species of sparrow were evident during the morning and afternoon. A total of 204 birds were banded (over half were Golden-crowned Kinglets) of 28 species and another 135 birds were released unbanded. Unusual captures on the day included 1 Pine Warbler, 2 Scarlet Tanager and the 1st Fox Sparrow of the season. Birds continued to move through en masse on the 9th as 232 birds were banded and another 124 were released. Only 10 recaptures were recorded on the day which indicated a high rate of turnover and another influx. Intermittent drizzle on the 10th limited our net hours to just 1.5 out of a possible 90 although birds were still much in evidence including the first Pine Siskin of the fall. Continued north winds on the 11th yielded 131 banded and the first flocks of what would become an invasion of Black-capped Chickadee. We had expected some sort of break at this point but found high numbers once again on the 12th which included 33 Yellow-bellied Sapsucker (2 banded) and 220 Ruby-crowned Kinglet (58 banded). Remarkable numbers of birds were again detected on the 13th with a total of 205 birds banded.

This was our busiest fall ever at TTPBRS in terms of both the monitoring and education. Migrating birds continued to pass through the count area in high numbers during the third week of October and we also had a steady stream of school groups coming down to the station. Kinglets were abundant on October 14 as ~100 each of Ruby and Golden-crowned Kinglet were recorded. Hermit Thrush and Brown Creeper were also present in good numbers. The first American Tree Sparrow of the fall was banded on October 16th along with 94 individuals of other species. Most interesting on the day was the capture and banding of 20 Black-capped Chickadees, which was a record high one-day banding total (previous mark of 10 on November 1-2004). Northwest winds on the 17th probably assisted in bringing in another influx of migrants as 160 birds were banded. Pine Siskin and American Pipits were heard flying over throughout the morning although still in small numbers. Chickadees, kinglets, Hermit Thrush and Dark-eyed Junco were the primary species moving that day. The slowest day of the week was October 19th when 23 birds were banded. This day featured the first substantive counts of waterfowl which included both species of Scaup, Long-tailed Duck, Common Goldeneye and Bufflehead to name a few. The 20th featured another record-breaking day at the station for Chickadees as 81 were banded! The Black-capped Chickadee is commonly considered a resident species however they do migrate and during October and November in some years their numbers in eastern North America can be significantly higher than "normal". These irruptions are attributed to seed crop failure in the north as well as high breeding productivity.

The week of October 21-27 began with temperatures near zero and north winds on the 21st which must have initiated some movement as 110 birds were banded including 46 Golden-crowned Kinglets, 8 Ruby-crowned Kinglets, 12 White-throated Sparrows, 9 Slate-coloured Juncos and a couple of Fox Sparrows. The first Hairy Woodpecker of 2005 was observed on this day. After some inclement weather limited coverage on the 22nd and 23rd, full monitoring resumed on the 24th when an estimated 140 Black-capped Chickadee were in the count area. October 27th featured the arrival of Eastern Bluebird and Snow Bunting along with noticeably higher counts of Horned Lark, Purple Finch, Pine Siskin and several raptor species. A total of 7 Red-tailed Hawks were tallied on the day which is a record high one-day total for this species at TTPBRS. In terms of banding, Black-capped Chickadee were again observed moving through the count area in flocks of between 3 and 30 birds at a time and in the end 51 were banded and 7 recaptured.

Migration slowed considerably during the remainder of October and into early November at Tommy Thompson Park although numbers of blackbirds, pipits, larks and Snow Buntings were significant as were the surging counts of waterfowl. On October 28th, 54 birds were banded of which 22 were Black-capped Chickadee. A single Blue-headed Vireo along with 5 Hermit Thrushes were also banded that day. Red-winged Blackbird reached a season high count of 434 and Common Grackle peaked at 54. October 29 was probably our last busy day of the fall as 104 birds were banded of which 86 were chickadees. An average of 6 birds were banded from October 30-November 1 and it was evident that the flocks of Chickadees, kinglets and sparrows had passed us by.

November

Juncos and American Tree Sparrows were perhaps the most conspicuous landbird species in the area although we had never seen a big push of these species in November. November 2nd was another good day for flyovers as 360 Red-winged Blackbirds were counted along with 48 Snow Buntings and several Rusty Blackbirds and House Finches. The final week featured south and west winds (often gusty) and warm temperatures which didn't help with the bird numbers at the station. There were some breaks in this weather pattern, which resulted in good numbers of high-flying American Pipits, Horned Larks, American Goldfinches and Red-winged Blackbirds. A record high one-day count of American Pipit was established on November 5 as 280 were tallied. Waterfowl continued to increase in density and a few raptors were recorded during the period. Banding was very quiet as our busiest day was 21 on both the 4th and 7th. On November 11th we were fortunate to capture our 2nd ever Hairy Woodpecker. A Golden Eagle was recorded on November 7th, which is the first of this species ever recorded at the station.

Overview of Fall Coverage and Results

Coverage in fall 2005 was good as 91 of 100 target days received at least some coverage, this is a little below the coverage level set in 2004 (95/100). After each field day, a coverage code is assigned based on completeness of all surveys. The optimal coverage code of 7 indicates that there were 90 total net hours, complete census and 3 completed point counts. This fall 48 days were coded with a 7 compared to 60 days in 2004. In terms of net hours, 6,816 hours were logged which is 76% of the target (100days x 90hrs/day) which is down from 80% in 2004 but higher than the 2003 mark of 74%. Weather is responsible for most of the lost hours as safe mist-net operation is contingent upon suitable weather conditions.

During fall 2005 4,247 birds were banded, 560 recaptured and an additional 382 birds were released unbanded. A total of 180 species were recorded for the season. Fall 2005 eclipsed previous fall seasons in terms of total birds banded, banding rate and total species observed. Also, a record number of volunteer hours were contributed as 2,112 hours were logged. Refer to Table 1 for a summary of Fall 2005 coverage and results compared to previous years.

Table 1. Coverage Statistics and Results Summary

Unit	2005	2004	2003
Days with at least some coverage	91	95	84
Days with full coverage (Code 7)	48	60	0
Total Species Detected	180	173	161
Birds Banded	4247	3870	3327
Birds Recaptured	560	614	623
Captured Unbanded	382	429	152
Total Captures	5189	4913	4102
Net Hours	6816	7388	6726
Birds banded/net hour	.62	.52	.49

Bird Captures

Banding

Capturing and banding birds is an important component of the methodology at a migration monitoring site. A fully standardized banding program is a strong method of sampling bird populations, especially when utilized in concert with surveys. Banding also provides valuable information on migrant stopover rates and ecology, migrant fitness, age ratios, and is also an important aspect of our education program at TTPBRS.

Each season of migration monitoring at TTPBRS has been unique and fall 2005 was no exception. It is interesting to note that each spring and fall season the results improve over the last in terms of total birds banded and species observed although it is unrealistic to expect this trend to continue much longer! Refer to Appendix A for a complete breakdown of fall banding totals per species for years 2003-2005.

It was clear from the beginning this fall that something unusual was happening as species were showing up early and in record numbers. This was most evident for Myrtle Warbler (see Fig.1). Myrtles appeared in early August and maintained a consistent presence throughout the fall period. Also unusual was the high percentage of birds undergoing moult during migration. Most migratory species finish moulting prior to migration because the demands of feather replacement coupled with the stress of migration is very taxing. Of the 285 Myrtles captured this fall, 80% were hatch-year (HY) which is lower than the 88% average for all birds captured on the season. Of the 55 adults captured, 19 were undergoing complete moults ranging from August 17 to October 18! This is curious given that this species is known to moult between Jul-September, prior to their migration. Equally strange was the 10 of 35 HY Myrtles banded during August that were still in Juvenile Plumage. It is not clear what was happening here however the birds were clearly in a rush as evidenced by early arrival in record numbers and percentage of birds undergoing moult during migration. A total of 285 Myrtles were banded in fall 2005 which is nearly double that of any other season. There were reports from other Ontario stations of unprecedented numbers of several warbler species including Nashville and Myrtle Warbler. Perhaps carrying capacity was exceeded by an exceptional breeding season in northern forests, which led to an early exodus of several species including Myrtle Warbler. This would be consistent with record high totals at TTPBRS for another species this fall, the Black-capped Chickadee.

A remarkable 484 Black-capped Chickadees were banded this fall, which shattered the previous high season total of 54 in 2004! This species is known to be irruptive when a combination of high breeding productivity and food shortage occurs. A chickadee invasion occurred in fall 2005 all across Ontario. This chickadee invasion may shed some light on why some other migrant species were so early and abundant at TTPBRS this fall.

Migration monitoring stations across Ontario reported an average spring but record numbers of birds during fall. This fall at TTPBRS a total of 37 species were banded in record high numbers including 7 species that had never been banded during autumn before. While spring 2005 was rather lackluster for warblers the opposite was true for the fall when 17 species were banded in record high numbers. The only warbler species that dropped in numbers compared to previous years was Orange-crowned Warbler. A significant decrease is also evident for American Robin and Cedar Waxwing although these declines are probably due to the enormous honeysuckle berry crop at Tommy Thompson Park, which likely altered the "normal" feeding patterns of these species during August, thereby resulting in lower captures. Pronounced increases are evident for many species while decreases are apparent for relatively few. Refer to Table 2 for a summary of species showing marked change in 2005.

Table 2. Selected Species Showing Marked Increase/Decrease (banding)

Increase				Decrease			
Species	2005	2004	2003	Species	2005	2004	2003
Black-capped Chickadee	484	54	32	Cedar Waxwing	3	83	19
Gray-cheeked Thrush	92	70	23	Northern Cardinal	4	15	8
Magnolia Warbler	126	98	76	Orange-crowned Warbler	4	12	17
Myrtle Warbler	285	159	137	Winter Wren	34	83	52
Northern Parula	8	2	3	Yellow-shafted Flicker	8	15	14
Red-eyed Vireo	60	39	13	American Robin	11	33	38
Swainson's Thrush	152	117	93	Gray Catbird	26	37	42
Traill's Flycatcher	81	55	32				

Once again October was by far the busiest month at TTPBRS followed by September, August and November. The banding rate was record high for each month in 2005 with the exception of November although the proportions banded in each month are basically the same as previous fall seasons. Given the unusual abundance of warblers at stations across Ontario it was expected that the discrepancy between early and late fall would have lessened to some extent however the unprecedented banding total for chickadee countered this.

Table 3. Monthly Capture Statistics

Month	Banded 2005	Net Hours	Banded /Hour	Banded 2004	Net Hours	Banded /Hour	Banded 2003	Net Hours	Banded / Hour
August	581	2122.7	.27	581	2498.2	.23	293	1433	.20
September	1349	2027.9	.67	1322	2550.5	.52	795	2344	.34
October	2204	1924.9	1.14	1909	1889.5	1.01	2111	2597	.81
November	113	741	.15	58	450	.13	128	352	.36
Total	4247	6816	.62	3870	7388.2	.52	3327	6726	.49

Recaptures

Recapture totals by species are presented below in Table 4. There was a slight drop-off in total number of "recaps" in fall 2005 versus 2004. Together Golden- and Ruby-crowned Kinglets makeup a majority of birds recaptured (37%). The invasion of Black-capped Chickadee this fall resulted in 109 recaptures of this species which is significantly higher than normal. No foreign banded birds were encountered in fall 2005.

Table 4. Recapture Totals

Species	Recap	Species	Recap	Species	Recap
American Goldfinch	2	Common Yellowthroat	11	Ovenbird	7
American Redstart	11	Downy Woodpecker	5	Philadelphia Vireo	1
American Robin	2	Eastern White-crowned Sparrow	1	Red-eyed Vireo	11
American Tree Sparrow	2	Fox Sparrow	1	Ruby-crowned Kinglet	92
Baltimore Oriole	3	Golden-crowned Kinglet	116	Slate-colored Junco	4
Black-and-White Warbler	3	Gray Catbird	11	Song Sparrow	2
Black-capped Chickadee	109	Gray-cheeked Thrush	3	Swainson's Thrush	10
Black-throated Blue Warbler	2	Hermit Thrush	38	Traill's Flycatcher	3
Blue-headed Vireo	1	House Wren	1	Veery	2
Brown Creeper	18	Least Flycatcher	3	Warbling Vireo	5
Brown Thrasher	1	Magnolia Warbler	15	White-breasted Nuthatch	1
Canada Warbler	6	Mourning Warbler	2	White-throated Sparrow	12
Cape May Warbler	1	Myrtle Warbler	15	Wilson's Warbler	11
Cedar Waxwing	1	Nashville Warbler	1	Yellow Warbler	8
Chestnut-sided Warbler	2	Northern Cardinal	2	Yellow-bellied Sapsucker	1
				Total	**560**

Stopover Ecology at TTPBRS

Recapture of banded birds is extremely valuable because it affords us the opportunity to draw spatial and temporal lines for individual birds. One such example is investigation into how migratory birds utilize the environments they depend on for survival during migration. Habitat conservation at nesting and wintering grounds of migratory birds has been well emphasized however if the birds have insufficient habitats along the way to and from these areas then this emphasis is inadequate. We need to understand this complex issue if we are going to be able to accurately define what appropriate stopover habitats are and where and how much to implement. Here in Toronto there is a complex network of greenspaces that provide essential resources for hundreds of thousands of birds on an annual basis. Composed of a myriad of sizes, types and "qualities" these natural areas are critical to migratory bird populations. The Tommy Thompson Park Bird Research Station was established to address this kind of issue. It would be shortsighted to assume that simply planting and setting aside "greened" areas will be good for the birds although it is true that any tree is better than no tree. By carefully analyzing data from migration monitoring at Tommy Thompson Park we can contribute to the understanding and conservation of migrant bird species in Toronto.

Presented here is a preliminary analysis of fall 2005 banding and recaptures with specific emphasis on arrival condition and mass change at Tommy Thompson Park. It would be pure speculation to make any conclusions based on preliminary analysis but the following findings point to an urgent need for further study. Table 5 presents selected statistics on fat levels in fall 2005 for a number of criteria including; age, family, species and time.

There is a substantial amount of variation within each criteria. The average fat score (scale of 0-7, 7 being highest fat level) on arrival (initial banding) is higher for young birds than adult birds. In terms of migrant family, kinglets (2.88) arrived with the highest fat level while flycatchers (.71) arrived with the lowest average score. The picture becomes more complicated when you assess the data at the species level as there is further variation between species of the same family. For example, American Redstart arrived at TTPBRS with an average fat score of .60 while Nashville Warbler arrived at 2.66. When the data is analysed by migration timing, there is a clear differentiation between early and late fall with respect to fat content on arrival. In August the average arrival fat score for all birds is .95 while the October average is 2.63. Therefore as a general rule late fall migrants arrive fatter than earlier fall species. The influence of stopover habitat type and quality is a very important

consideration for these findings. Perhaps the greenspaces making up the Don River Migratory Bird Corridor are efficient in supporting some species more than others (e.g. late fall species). More extensive analysis and further data collection would be valuable as a means of measuring the integrity of habitats for migratory birds in the GTA.

Table 5. Stopover Statistics, Fall 2005

Category	Criteria	Sample Size	Average Fat Score	Recapture Rate
Overall	Fall 2005 Overall	4196	2	
Age	HY	3702	2.04	
	AHY	473	1.85	
Family	Warblers	947	1.38	11.5
	Flycatchers	159	0.71	8.2
	Thrushes	480	1.19	12.9
	Kinglets	1197	2.88	22.4
	Sparrows	486	1.47	8.14
Species	Black-capped Chickadee	482	3.02	
	Brown Creeper	78	2.55	
	Ovenbird	38	1.02	
	American Redstart	65	0.6	
	Common Yellowthroat	36	2.52	
	Nashville Warbler	98	2.66	
	Swainson's Thrush	151	1.15	
	Hermit Thrush	208	1.25	
	White-throated Sparrow	265	1.43	
Month	August	579	0.95	
	October	2171	2.63	
	September	1337	1.38	

Taking one species as an example of how Tommy Thompson Park functions as a stopover site it is apparent how vital these habitats are. Stopover sites are especially critical for migratory birds near geographic borders such as large water bodies. A bird arriving on the Toronto lakeshore requires sufficient cover and food to go any further. In the case of Golden-crowned and Ruby-crowned Kinglets the significance of TTP is substantial. These two species are abundant migrants during late fall at TTPBRS. Banding data for kinglets during fall 2005 were analyzed for both initial weight (at banding) and final weight (last recapture record). Analysis indicated that kinglets gain an average of 4.11% of their original body weight during their stay (see Fig.2). There was a record of a bird having gained 15% of its original body weight in a five-day stopover at TTPBRS! It is probably not coincidence that kinglets show the highest percentage of weight gain and the highest rate of recapture (22.4%). So why are there so many kinglets that stopover and what do they feed on in late October? Vast numbers of kinglets are commonly seen feeding close to the ground often hovering like hummingbirds over goldenrods. Further study would confirm what they are feeding on but visual inspections of the plants revealed the only likely food source to be introduced red ants! The ants are certainly a common topic of conversation at the station as the irritation of their bite is surpassed only by their sheer numbers!

This brief assessment of stopover mechanics from one fall season at TTPBRS is introductory but does point to the significance of TTPBRS data in the understanding of migratory birds in the GTA. With further data collection and research we can contribute to local urban planning with respect to the needs of migratory birds.

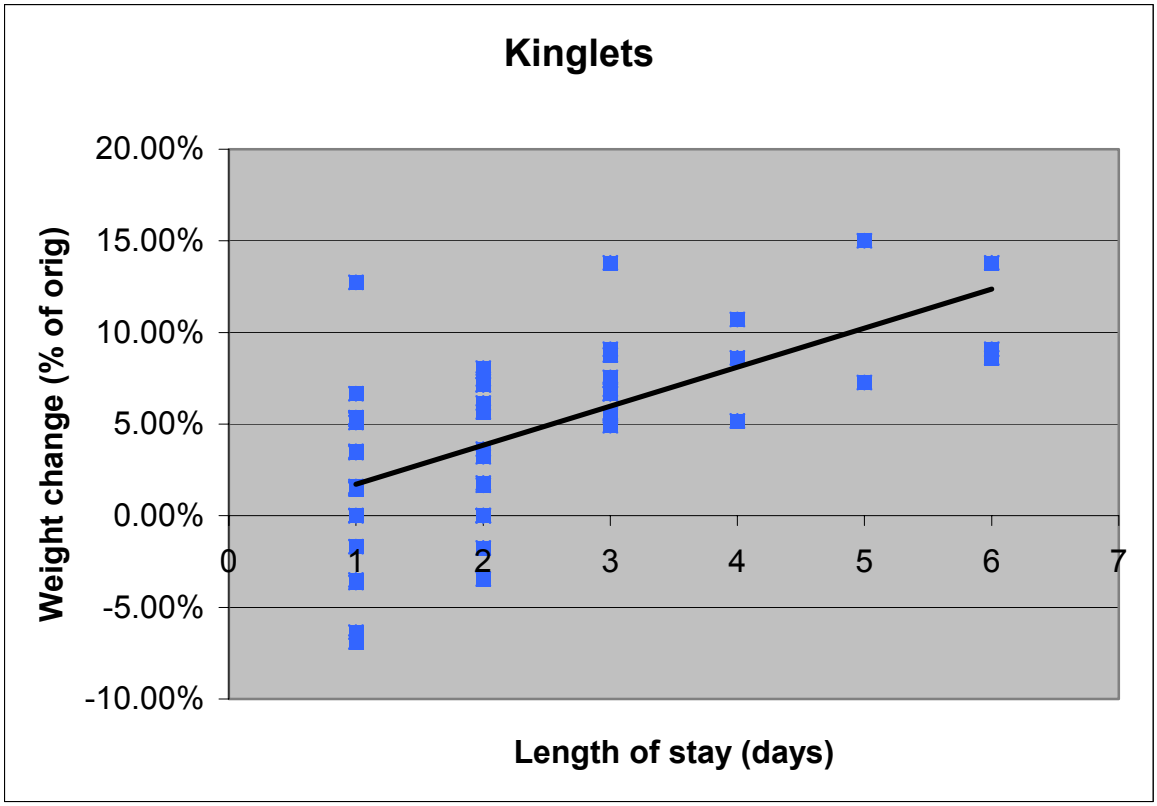

Figure 2. Weight gain of kinglets at TTPBRS

Net Productivity

A fixture of the season reports from TTPBRS is the assessment of net capture rates. This information is useful as a means of monitoring the relationship between habitat succession/change and capture totals. Ideally habitat effects on net productivity are minimal as we want to avoid any bias on long-term trends. A complete 3-year picture of net location productivity is presented in Table 6. For fall 2005 there two notable changes in capture rate. Net 8 jumped from a rate of .67birds/net hour in 2004 to 1.18/hour in 2005. Also, the rate for net 1 jumped from .69 to .99 in 2005. The change in productivity for net 8 is attributable to the chickadee invasion of 2005 as a high percentage of chickadees were captured in this net. The rest of the nets in 2005 remained consistent in productivity with 2004.

Table 6. Net Productivity

Net	Captured	Hours	Banded/Hour 2005	Banded/Hour 2004	Banded/Hour 2003	Rank 2003	Rank 2004	Rank 2005
1	468	475	.99	.69	.86	**2**	4	**2**
2	343	475	.72	.76	.71	5	**2**	5
3	267	472	.57	.49	.46	8	8	7
4	444	472	.94	.85	.35	11	**1**	**3**
5	203	464	.44	.38	.31	13	9	10
6	250	466	.54	.49	.35	11	8	9
7	368	467	.79	.72	.42	9	3	4
8	559	472	1.18	.67	.52	7	5	**1**
9	229	413	.55	.52	.75	4	7	8
10	170	413	.41	.43	1.01	**1**	10	12
11	178	413	.43	.33	.81	**3**	12	11
12	144	449	.32	.24	.34	12	13	15
13	151	452	.33	.34	.40	10	11	14
14	154	452	.34	.34	.34	12	11	13
15	313	464	.67	.55	.57	6	6	6

Examining the data for all 3 years it is apparent that the top 3 most productive nets were very different in fall 2003. In 2003 nets 10 and 11 were ranked 1 and 3 respectively overall. These two nets have ranked between 10 and 12 in 2004 and 2005. However, this is due to coverage and species assemblage not habitat change. In 2003 nets 10 and 11 were operated beginning September 26 and run through the end of that season. This differs from the following two fall seasons in which the nets were run for the entire season beginning August 5. Quite simply the productivity is very low in August and September and good to very good in October. Therefore the 2003 productivity rate is biased to the month of October. Also, in 2003 there were more White-throated Sparrows than in any fall season since and they favour the area where nets 10 and 11 are located. Running the nets in October only coupled with a strong year for White-throated Sparrow would likely result in a much higher rank for nets 10 and 11.

Table 7. Net 10 and 11 in 2003 vs. 2005

Year	Birds Banded	Net Hours	Banded/Hour	WTSP Banded
2003	337	372	.91	103
2005	348	884.75	.39	58
2005 (Sept 26-Nov 12)	206	344.5	.60	

Unusual Records

Below are a few of the unusual records at the bird research station this fall. There were a total of 6 new additions to the TTPBRS checklist. These new species bring the TTPBRS checklist to a total of 223.

Alder Flycatcher- (1st TTPBRS fall record)- A singing individual on August 13 (DGD)
American White Pelican- (1st TTPBRS record)- Observed during census on September 10 (WTF)
Canvasback- 3 birds on August 20 are probably of the family reared in the triangle pond (DJ)
Common Nighthawk- (1st TTPBRS fall record) 2 birds, 1 on September and September 4 (AJ)
Connecticut Warbler- (2nd TTPBRS record)- banded on September 2 (mobs)
Dunlin- Scarce this fall with 7 birds seen on October 30 (SNL) and 2 on November 3 (DSL)
Golden Eagle- (1st TTPBRS record) A flyby individual was spotted on November 7 (SNL)
Golden-crowned Kinglet- A record early individual on August 6 (DGD, PV)
Hooded Warbler-(2nd TTPBRS record) The first ever capture of this species occurred on September 19
Indigo Bunting- (1st TTPBRS fall record)- A single bird banded on August 6 (Mobs)
Long-eared Owl- A single bird flushed from the owl-net area on November 11 (SNL)
Long-tailed Duck- A record early individual was detected on September 1 (IS, AJ)
Myrtle Warbler- A weird season for this species started with a record early bird on August 6 (DGD)
Northern Goshawk- A total of 4 birds on 3 dates beginning with a single bird on October 28 (Mobs)
Northern Harrier- (1st TTPBRS banding record)-A female was banded on September 18 (mobs)
Red Knot- A single individual appeared on September 14 and lingered until the 23rd (Mobs)
Ruddy Duck- 2 birds recorded on October 20 (IS)
Semipalmated Sandpiper- (1st TTPBRS record)- 10 birds detected on September 19 (DJ)
Short-billed Dowitcher- (1st TTPBRS record)-A flock of 7 on August 14 (DGD)
Solitary Sandpiper- Single birds on August 26 (RGM) and 27 (DGD)
Thayer's Gull- (1st TTPBRS record) A single individual found loafing on the sandbar on October 30 (WTF)
Tundra Swan- 2 birds on November 11 (mobs)
Turkey Vulture- A single bird September 27 (IS) and November 7 (KM)
Upland Sandpiper- (1st TTPBRS record)- Heard and briefly seen on August 13 (PNP)
White-winged Scoter- Just 2 birds with the first on Oct 1 (WTF) and the last on November 11
Wilson's Warbler- An adult male undergoing complete moult was captured on August 6 (mobs)
Wood Duck- 2 birds on August 13 (DGD)

Observers

Seabrooke Leckie	SNL	Paul Prior	PNP	Paolo Viola	PV
Dan Derbyshire	DGD	Dave Langford	DSL	Ian Sturdee	IS
Kerry McGuire	KM	Tom Flinn	WTF	Richard Miller	RGM
Andrew Jano	AJ	Don Johnston	DJ	Many Observers	mobs

Personnel

Volunteer support for fall 2005 was exceptional as a record high 2,112.5 hours were contributed to TTPBRS programs. We welcomed new volunteers John Mayberry (Toronto), Rob Skeates (England), and Yoann Lechauve (France) this fall and we hope to see them return in the future. Thanks to all of the volunteers for their essential support in 2005!

Table 8. Volunteer Effort

Name	Hours	Name	Hours	Name	Hours
Andrew Jano	286	Norma Vanderzon	65.25	Lisa Wong	36
Kerry McGuire	266.75	Jan McDonald	64.25	Paolo Viola	29
Don Johnston	207.5	Bob Kortwright	60	John Mayberry	24
Ian Sturdee	193.5	Pierre Robillard	58.5	Jennifer Miles	12
Teresa Carlin	159.5	Attila Fust	51.25	Maria	8.5
Rick Miller	135	Mary Boswell	49	Lori Nichols	6
Yoann Lechauve	104.5	Tom Flinn	38.75	Rob Skeates	6
Dave Langford	83.5	Steve Gillis	37.75	Mitch Meredith	6
Bert Vanderzon	81.25	Tamara Chipperfield	36.75	Bethany Foster	6
				TOTAL	2112.5

Research Projects

Nocturnal Owl Monitoring Program

Owl monitoring was conducted once again on a volunteer basis for 15 nights starting on October 5th and ending on November 14th. A total of 70 NSWO were captured this year, which is up from 30 in 2004 but significantly lower than the 187 captured in 2003. 65 NSWO were new bandings and 5 were foreign recoveries.

Table 9. Nocturnal Owl Monitoring Summary

Date	No. Of Nets	Standard Net Hours	Non-standard Hours	Total Hours	Foreign Recoveries	Banded	Banded/ Net Hour
5-Oct	12	48					
10-Oct	12	48				3	
11-Oct	9	18					
14-Oct	12	48				2	
19-Oct	9	36	31.5			11	
20-Oct	9	36	40.5			9	
21-Oct	9	36	27.6			7	
26-Oct	9	36	43		2	12	
27-Oct	9	36	23		1	15	
28-Oct	9	36			1	2	
31-Oct	9	36					
2-Nov	8	32					
3-Nov	8	24					
8-Nov	8	32	39		1	4	
14-Nov	6	24	6				
2003		549	75.25	624.25	3	184	0.29
2004		457	141	598		30	0.05
2005		526	210.6	736.6	5	65	0.08

After 3 seasons of pilot owl banding at TTPBRS it became clear that our operation could be adjusted to sample a higher number of owls and improve net security. Nets have been moved from the triangle

configuration between nets 15 and 5/6 to the dense shrub area between nets 4 and 7. Analysis of the banding data revealed that an overwhelming percentage of birds were being caught in the triangle net facing the southern shoreline. This is consistent with high owl capture rates in nets 4, 7 and 8 which are located in willow shrub along this shoreline. An L-shaped configuration was chosen which should be more productive in capturing less aggressive owls. A summary of foreign recoveries of NSWO is provided in Table 10.

Table 10. Foreign Recoveries of Northern Saw-whet Owls

Band Number	Species	Date Banded	Location	Date Recovered	Location
0924-11420	NSWO	12/11/2004	Holiday Beach, ON	10/10/2005	TTPBRS
0844-15557	NSWO	21/11/2003	Casselman River, MD	26/10/2005	TTPBRS
0924-11840	NSWO	19/10/2005	Bobcaygeon, ON	26/10/2005	TTPBRS
0854-42863	NSWO	?		27/10/2005	TTPBRS
0924-15099	NSWO	07/10/2004	Prince Edward Pt., ON	08/11/2005	TTPBRS
0924-07501	NSWO	20/10/2003	TTPBRS	05/11/2005	Bergton, VA

The Nocturnal Owl Monitoring Program at Tommy Thompson Park will be an annual initiative of the TTPBRS and as such we are seeking membership with Project Owlnet. Project Owlnet is a network of owl banding stations that operate with a shared protocol so that populations of migratory owl species can be monitored.

A pilot NOMP in spring is planned for late March-April in 2006 to provide an assessment of spring owl migration at Tommy Thompson Park.

Barcoding Canadian Birds

The TTPBRS collaborated with the Canadian Wildlife Service (CWS) on a project on genetic barcoding of Canadian birds. The purpose of the project was to determine genetic identification of North American bird species. Preliminary results from the effort have led to considerable interest from the scientific community and may lead to the designation of several new species. Feather samples were taken from select species at TTPBRS to contribute to a pool of samples drawn from banding stations across Canada for analysis.

Breeding Birds of Tommy Thompson Park

A baseline assessment of breeding birds at TTP was undertaken in summer 2005, which led to many point count surveys and nest searching expeditions. In all some 80 nests were discovered and monitored and a suite of 9 point count stations were visited multiple times throughout the breeding period. Highlights of the project included singing American Redstart, Red-eyed Vireo, Field Sparrow and Least Flycatcher as well as observations of Indigo Bunting and Orchard Oriole. This proved to be a very enjoyable and worthwhile effort and we look forward to future summers at the park! Results of the fieldwork were submitted to the Ontario Breeding Bird Atlas and will serve as year 1 of a long-term monitoring program for TTP. Thanks to Ian Sturdee and Seabrooke Leckie for assistance with this program.

Avian Monitoring of the Baselands and Cell-1

Staff and volunteers also assisted TRCA in their monitoring needs for the baselands area and cell 1 of Tommy Thompson Park. Census and area search surveys were completed throughout the spring, summer and fall and these will be important monitoring schemes for these areas. Thanks to Ian Sturdee, Andrew Jano, Don Johnston, Seabrooke Leckie and Rick Miller for assisting with the surveys.

Education and Events

2005 was an important year for educational programming at TTPBRS. A total of 389 people were reached directly in spring followed by over 900 people during the fall season. The Winged Migration program was operated on a daily basis in October and TTPBRS was able to engage the kids on days when the weather cooperated. The programs for schools and the general public are proving to be successful and rewarding and will be refined and developed further in the coming year. While this report is focused on the results of migration monitoring and other research interests of TTPBRS the educational programs are of equal importance as we believe that helping birds and their environments is contingent upon public awareness and action.

Acknowledgements

The following are to be acknowledged for their contributions to the Migration Monitoring Program in fall 2005:

- Toronto and Region Conservation Authority
- All the volunteers who lent their skills and time to the birds this fall
- Kerry McGuire for her assistance with entry of fall MMP data

The author especially thanks the following for their assistance in fall 2005: Paul Barrie, Tamara Chipperfield, Seabrooke Leckie, Greg Sadowski, Dan Stuckey and Ralph Toninger.

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Appendices

Appendix A. Banding Totals

Species	2005	2004	2003	Species	2005	2004	2003
American Goldfinch	15	24	2	Lincoln's Sparrow	14	8	16
American Redstart	65	51	38	**Magnolia Warbler**	126	98	76
American Robin	11	33	38	Marsh Wren			1
American Tree Sparrow	18	19	50	Mourning Warbler	6	7	1
American Woodcock		1	2	**Myrtle Warbler**	285	159	137
Baltimore Oriole	10	19	4	Nashville Warbler	99	129	112
Barn Swallow	2			Northern Cardinal	4	15	8
Bay-breasted Warbler	7	4	4	Northern Harrier	1		
Black-and-White Warbler	19	11	9	**Northern Parula**	8	2	3
Black-billed Cuckoo		2		Northern Saw-whet Owl			1
Blackburnian Warbler	3	5	1	Northern Shrike			1
Black-capped Chickadee	484	54	32	**Northern Waterthrush**	25	22	17
Blackpoll Warbler	36	20	53	Orange-crowned Warbler	4	12	17
Black-throat. Blue Warbler	33	32	31	**Ovenbird**	38	34	16
Black-throat. Green Warbler	23	35	20	**Philadelphia Vireo**	10	4	4
Blue Jay	8	9	123	Pine Warbler	1		
Blue-gray Gnatcatcher		1		Purple Finch			2
Blue-headed Vireo	21	17	11	Red-breasted Nuthatch	5	23	2
Blue-winged Warbler	1			**Red-eyed Vireo**	60	39	13
Brown Creeper	90	97	139	Red-tailed Hawk		1	
Brown Thrasher	3		3	Red-winged Blackbird		5	2
Canada Warbler	20	12	5	**Rose-breasted Grosbeak**	3	2	2
Cape May Warbler	6	3	5	**Ruby-crowned Kinglet**	536	401	399
Cedar Waxwing	3	83	19	Savannah Sparrow			1
Chestnut-sided Warbler	27	20	21	**Scarlet Tanager**	3	1	
Chipping Sparrow		2		Sharp-shinned Hawk	4	3	15
Common Grackle		4		Slate-colored Junco	108	92	132
Common Yellowthroat	36	28	17	Song Sparrow	48	44	64
Connecticut Warbler	1		1	**Swainson's Thrush**	152	117	93
Cooper's Hawk			1	Swamp Sparrow	21	23	25
Downy Woodpecker	6	7	3	**Tennessee Warbler**	18	6	16
Eastern Kingbird	5	10	2	**Traill's Flycatcher**	81	55	32
Eastern Phoebe	18	17	27	**Veery**	29	17	21
Eastern Towhee	1	1	2	Warbling Vireo	14	43	14
East. White-crown. Sparrow	15	26	19	Western Palm Warbler	16	15	31
Eastern Wood-Pewee	1	2	5	White-breasted Nuthatch	5		
European Starling	8	29	13	White-crowned Sparrow			2
Field Sparrow	2	1	5	White-eyed Vireo		1	
Fox Sparrow	14	12	17	White-throated Sparrow	265	305	394
Gamb.White-crown Sparrow			2	**Wilson's Warbler**	42	29	29
Golden-crowned Kinglet	685	856	525	Winter Wren	34	83	52
Gray Catbird	26	37	42	Wood Thrush	1	1	1
Gray-cheeked Thrush	92	70	23	Yellow Warbler	70	109	20
Gray-cheeked/Bick. Thrush		1		**Yellow-bellied Flycatcher**	18	16	11
Great Crested Flycatcher	5	1	3	Yellow-bellied Sapsucker	19	20	6
Hairy Woodpecker	1			Yellow-billed Cuckoo		1	
Hermit Thrush	208	226	185	Yellow-breasted Chat		1	
House Wren	5	3	1	Yellow-shafted Flicker	8	15	14
Indigo Bunting	1						
Least Flycatcher	31	27	21	Total	4247	3870	3327

Appendix B. Fall 2005 Species Accounts (Data included DT only)

Species	No. of Dates	Arrival Date	Peak DT	Peak Date	Season Sum
ABDU	61	05-Aug-05	11	02-Nov-05	133
AGWT	23	02-Sep-05	4	multiple	21
AMCO	17	19-Oct-05	2	19-Oct-05	2
AMCR	16	21-Aug-05	5	17-Oct-05	25
AMGO	81	24-Aug-05	18	08-Nov-05	410
AMGP	4	13-Sep-05	1	13-Sep-05	1
AMKE	7	16-Aug-05	1	multiple	3
AMPI	41	30-Sep-05	62	05-Nov-05	98
AMRE	38	17-Aug-05	18	25-Aug-05	106
AMRO	66	01-Sep-05	12	multiple	196
AMWI	21	17-Sep-05	4	18-Oct-05	9
AMWO	15	15-Aug-05	1	multiple	2
ATSP	16	16-Oct-05	7	11-Nov-05	36
AWPE	1	10-Sep-05	1	10-Sep-05	1
BAEA	4	15-Sep-05	1	multiple	2
BANS	10	21-Aug-05	11	11-Aug-05	22
BAOR	24	05-Aug-05	7	18-Aug-05	57
BARS	29	28-Aug-05	23	14-Aug-05	185
BAWW	29	06-Aug-05	6	23-Aug-05	36
BBCU	3	25-Aug-05	1	25-Aug-05	1
BBPL	17	14-Sep-05	1	multiple	2
BBWA	17	25-Aug-05	2	multiple	13
BCCH	88	10-Aug-05	120	29-Oct-05	1192
BEKI	73	08-Aug-05	3	17-Oct-05	67
BGGN	8	06-Aug-05	2	26-Aug-05	6
BHVI	17	19-Sep-05	5	12-Oct-05	31
BLBW	10	21-Aug-05	2	23-Sep-05	5
BLJA	39	15-Sep-05	395	30-Sep-05	1143
BLPW	33	20-Aug-05	8	15-Sep-05	66
BRCR	50	09-Sep-05	10	multiple	164
BRTH	44	09-Aug-05	3	11-Aug-05	28
BTBW	33	24-Aug-05	5	24-Sep-05	55
BTNW	26	11-Sep-05	5	multiple	33
BUFF	23	16-Oct-05	170	03-Nov-05	933
BWTE	8	18-Aug-05	2	14-Sep-05	5
BWWA	3	27-Aug-05	1	multiple	2
CAGO	88	03-Oct-05	63	19-Sep-05	1361
CANV	2	20-Aug-05	3	20-Aug-05	3
CAWA	19	14-Aug-05	4	09-Sep-05	29
CEDW	57	25-Aug-05	114	13-Aug-05	346
CHSP	5	09-Oct-05	3	06-Aug-05	6
CHSW	22	06-Aug-05	7	27-Aug-05	33
CMWA	10	21-Aug-05	3	23-Aug-05	10
COGO	12	07-Nov-05	30	12-Nov-05	57
COGR	31	06-Aug-05	6	28-Oct-05	31
COHA	15	03-Sep-05	2	01-Sep-05	5
COLO	6	07-Oct-05	1	multiple	3
CONW	1	02-Sep-05	1	02-Sep-05	1
COTE	1	05-Sep-05	1	05-Sep-05	1
COYE	35	21-Aug-05	6	03-Sep-05	61
CSWA	18	16-Aug-05	13	09-Sep-05	42
DOWO	56	05-Aug-05	3	23-Aug-05	42

Species	No. of Dates	Arrival Date	Peak DT	Peak Date	Season Sum
DUNL	2	03-Nov-05	2	03-Nov-05	2
EAKI	27	14-Aug-05	9	06-Aug-05	77
EAPH	35	24-Aug-05	5	24-Sep-05	44
EATO	5	03-Oct-05	2	27-Sep-05	5
EAWP	17	23-Aug-05	2	multiple	12
EUST	64	07-Sep-05	130	11-Aug-05	1059
FISP	4	08-Oct-05	1	multiple	2
FOSP	17	08-Oct-05	4	09-Oct-05	24
GADW	49	27-Aug-05	25	20-Sep-05	125
GBBG	40	28-Sep-05	3	multiple	28
GBHE	48	06-Aug-05	4	23-Aug-05	28
GCFL	12	28-Aug-05	3	30-Aug-05	11
GCKI	51	06-Aug-05	220	09-Oct-05	1537
GCTH	21	08-Sep-05	25	17-Sep-05	110
GRCA	66	14-Aug-05	6	multiple	165
GREG	14	08-Aug-05	2	28-Aug-05	6
GRSC	30	17-Aug-05	260	12-Nov-05	310
GRYE	27	11-Aug-05	2	multiple	12
HAWO	7	29-Oct-05	1	multiple	4
HETH	54	07-Aug-05	40	17-Oct-05	374
HOFI	10	02-Nov-05	8	05-Nov-05	9
HOGR	15	08-Aug-05	1	multiple	5
HOLA	9	11-Nov-05	6	05-Nov-05	9
HOME	47	10-Sep-05	12	11-Nov-05	85
HOSP	6	09-Aug-05	1	09-Aug-05	1
HOWA	1	19-Sep-05	1	19-Sep-05	1
HOWR	10	12-Aug-05	2	27-Sep-05	8
INBU	1	06-Aug-05	2	06-Aug-05	2
KILL	42	07-Aug-05	4	13-Sep-05	34
LEFL	28	05-Aug-05	5	24-Aug-05	45
LEOW	1	11-Nov-05	1	11-Nov-05	1
LESC	14	13-Sep-05	3	11-Nov-05	12
LEYE	25	13-Aug-05	7	06-Aug-05	15
LISP	12	01-Sep-05	3	10-Sep-05	15
MALL	90	04-Oct-05	211	06-Aug-05	7571
MAWA	45	08-Aug-05	16	23-Aug-05	174
MERL	8	17-Sep-05	1	17-Sep-05	1
MODO	45	06-Aug-05	8	18-Aug-05	27
MOWA	10	16-Aug-05	2	25-Aug-05	8
MUSW	90	13-Aug-05	53	multiple	1651
MYWA	80	08-Aug-05	65	08-Oct-05	1004
NAWA	48	06-Aug-05	10	21-Sep-05	129
NOCA	55	07-Aug-05	3	multiple	61
NOGO	3	08-Nov-05	1	08-Nov-05	1
NOHA	11	18-Sep-05	1	multiple	2
NOPA	8	03-Sep-05	5	09-Sep-05	11
NOWA	28	05-Aug-05	4	13-Aug-05	33
NRWS	22	16-Aug-05	5	15-Aug-05	29
NSHO	6	20-Oct-05	1	20-Oct-05	1
OCWA	7	12-Sep-05	2	23-Sep-05	5
OLDS	23	01-Sep-05	670	12-Nov-05	5159
OVEN	40	12-Aug-05	5	15-Sep-05	50
PEFA	12	22-Aug-05	1	multiple	6
PHVI	15	04-Sep-05	2	multiple	15

Species	No. of Dates	Arrival Date	Peak DT	Peak Date	Season Sum
PISI	19	10-Oct-05	4	29-Oct-05	11
PIWA	4	09-Sep-05	1	multiple	3
PUFI	15	10-Oct-05	5	26-Oct-05	6
PUMA	13	08-Aug-05	4	11-Aug-05	6
RBGR	7	28-Aug-05	1	multiple	5
RBME	4	16-Aug-05	3	04-Nov-05	6
RBNU	43	17-Aug-05	5	09-Sep-05	44
RCKI	48	09-Sep-05	110	12-Oct-05	1048
REDH	4	03-Nov-05	2	29-Oct-05	3
REKN	8	14-Sep-05	1	multiple	7
REVI	39	20-Aug-05	7	multiple	103
RNDU	1	19-Oct-05	1	19-Oct-05	1
RTHA	8	01-Oct-05	2	26-Oct-05	4
RTHU	22	17-Aug-05	2	multiple	21
RUBL	9	24-Oct-05	4	02-Nov-05	6
RWBL	50	08-Aug-05	183	02-Nov-05	347
SAND	8	21-Sep-05	11	22-Sep-05	24
SCJU	51	23-Aug-05	35	09-Oct-05	293
SCTA	10	16-Sep-05	2	08-Oct-05	4
SNBU	7	05-Nov-05	10	07-Nov-05	13
SOSA	2	26-Aug-05	1	26-Aug-05	1
SOSP	70	23-Aug-05	12	06-Aug-05	206
SPSA	24	05-Aug-05	3	11-Aug-05	17
SSHA	32	26-Aug-05	5	16-Oct-05	32
SWSP	15	20-Aug-05	7	08-Oct-05	25
SWTH	42	06-Aug-05	30	19-Sep-05	220
TEWA	21	16-Aug-05	5	04-Sep-05	22
THGU	1	30-Oct-05	1	30-Oct-05	1
TRES	23	12-Aug-05	15	14-Aug-05	62
TRFL	34	10-Aug-05	12	12-Aug-05	118
TUSW	2	11-Nov-05	2	11-Nov-05	2
VEER	21	30-Aug-05	8	23-Aug-05	35
WAVI	33	05-Aug-05	6	30-Aug-05	73
WBNU	23	10-Sep-05	4	13-Oct-05	23
WCSP	19	21-Sep-05	5	24-Sep-05	34
WIFL	9	05-Aug-05	2	13-Aug-05	10
WIWA	28	06-Aug-05	7	24-Aug-05	67
WIWR	43	05-Sep-05	14	13-Oct-05	87
WOTH	4	18-Sep-05	1	13-Oct-05	2
WPWA	25	01-Sep-05	4	02-Sep-05	27
WTSP	61	04-Sep-05	80	24-Sep-05	839
WWSC	2	11-Nov-05	1	11-Nov-05	1
YBCU	1	02-Sep-05	1	02-Sep-05	1
YBFL	10	14-Aug-05	4	15-Aug-05	19
YBSA	26	23-Sep-05	12	08-Oct-05	96
YSFL	62	05-Aug-05	16	17-Sep-05	136
YWAR	31	18-Aug-05	20	12-Aug-05	186

Appendix C. Daily Totals

Date	Band	Rec	Cap	Census	PC1	PC2	PC3	DT	NSB	NSR	Obs	DST	Total Species
05-Aug-05	18	2	0	227	5	14	30	283	0	0	495	718	35
06-Aug-05	22	3	0	329	49	15	63	465	0	0	356	693	46
07-Aug-05	15	5	0	272	11	22	32	337	0	0	196	481	41
08-Aug-05	13	3	1	255	6	13	46	314	0	0	568	812	41
09-Aug-05	6	1	0	318	16	8	16	354	0	0	388	654	46
10-Aug-05	6	0	0	279	34	11	0	326	0	0	615	856	36
11-Aug-05	14	1	1	323	8	68	105	495	0	0	462	862	47
12-Aug-05	29	1	0	232	8	0	0	268	0	0	211	437	37
13-Aug-05	10	3	0	463	19	15	10	506	0	0	328	684	52
14-Aug-05	7	1	0	289	10	0	0	306	0	0	1263	1523	49
15-Aug-05	20	0	0	275	12	55	16	372	0	0	413	697	51
16-Aug-05	26	1	0	195	7	8	6	235	0	0	295	453	48
17-Aug-05	21	1	2	279	1	49	4	357	0	0	319	675	50
18-Aug-05	40	3	0	114	8	5	0	169	0	0	187	311	39
20-Aug-05	21	6	0	288	13	9	35	351	0	0	190	456	46
21-Aug-05	13	3	1	150	9	9	15	196	0	0	220	352	46
22-Aug-05	37	7	1	207	0	9	6	267	0	0	172	387	48
23-Aug-05	74	1	1	176	20	16	11	289	0	0	376	567	65
24-Aug-05	65	4	4	250	2	8	4	334	0	0	291	567	58
25-Aug-05	62	12	3	246	11	9	6	340	0	0	414	596	62
26-Aug-05	16	6	1	192	0	9	2	226	0	0	195	362	51
27-Aug-05	14	7	3	133	3	12	5	176	0	0	233	353	58
28-Aug-05	9	4	0	309	2	2	1	327	0	0	201	452	52
29-Aug-05	11	1	1	195	4	5	60	276	0	0	251	467	46
30-Aug-05	12	5	1	217	8	5	42	288	0	0	336	512	45
01-Sep-05	57	3	3	169	5	6	4	247	0	0	264	448	64
02-Sep-05	29	4	1	127	5	2	3	171	0	0	161	276	44
03-Sep-05	50	6	1	159	3	1	4	221	0	0	144	336	49
04-Sep-05	51	5	1	172	7	11	8	252	0	0	139	386	56
05-Sep-05	22	6	0	186	3	3	8	225	0	0	119	311	51
06-Sep-05	10	4	1	192	2	9	3	217	0	0	192	357	52
07-Sep-05	8	2	0	246	1	4	3	263	0	0	184	366	36
08-Sep-05	8	2	0	0	0	0	0	10	0	0	0	10	5
09-Sep-05	83	0	4	231	16	0	7	333	0	0	494	707	61
10-Sep-05	57	2	0	190	7	0	0	254	0	0	222	410	56
11-Sep-05	17	5	0	228	0	1	4	255	0	0	154	384	56
12-Sep-05	11	5	0	220	1	1	0	238	0	0	42	259	41
13-Sep-05	10	3	0	282	0	0	0	295	0	0	41	333	45
14-Sep-05	7	3	0	171	0	0	0	181	0	0	61	235	29
15-Sep-05	89	3	3	242	4	4	3	346	0	0	342	649	53
16-Sep-05	0	0	0	176	0	0	0	176	0	0	0	176	23
17-Sep-05	76	2	1	195	5	5	9	291	0	0	236	460	56
18-Sep-05	99	2	4	170	26	3	12	312	0	0	249	487	54
19-Sep-05	92	3	2	362	11	3	13	470	0	0	320	683	56
20-Sep-05	0	0	0	266	0	0	0	266	0	0	0	266	21
21-Sep-05	59	1	0	212	2	0	5	277	0	0	341	575	55
22-Sep-05	17	6	0	240	1	36	51	346	0	0	465	797	42
23-Sep-05	59	2	1	146	1	3	1	211	0	0	273	450	55
24-Sep-05	161	3	15	194	15	0	0	351	0	0	435	694	44
25-Sep-05	19	1	0	213	9	0	0	242	0	0	125	347	40
27-Sep-05	164	8	0	181	50	11	8	406	0	0	430	738	55
28-Sep-05	40	7	0	143	6	22	1	218	0	0	336	492	49

Date	Band	Rec	Cap	Census	PC1	PC2	PC3	DT	NSB	NSR	Obs	DST	Total Sp.
30-Sep-05	54	6	1	332	92	7	102	592	0	0	2958	3381	48
01-Oct-05	28	4	0	261	5	30	9	331	0	0	548	822	50
02-Oct-05	34	7	1	220	1	4	1	267	0	0	231	476	45
03-Oct-05	80	6	0	207	7	4	8	311	0	0	316	582	55
04-Oct-05	30	8	0	65	2	1	1	107	0	0	161	249	33
05-Oct-05	40	7	0	133	2	3	75	259	0	0	383	535	40
06-Oct-05	12	4	0	102	6	0	5	126	0	0	265	360	36
07-Oct-05	0	0	0	139	0	0	0	139	0	0	1	140	27
08-Oct-05	204	1	145	145	13	27	14	481	0	0	582	965	48
09-Oct-05	232	10	124	225	24	50	18	567	0	0	462	836	47
10-Oct-05	0	1	0	259	0	13	0	262	0	0	0	262	24
11-Oct-05	131	21	4	212	10	9	5	367	0	0	401	655	49
12-Oct-05	142	29	3	235	29	0	2	391	0	0	692	916	46
13-Oct-05	205	33	3	154	36	17	91	434	0	0	522	817	53
14-Oct-05	120	33	3	175	26	23	15	352	0	0	548	805	45
15-Oct-05	0	0	0	103	0	0	0	103	0	0	0	103	17
16-Oct-05	95	12	0	124	0	0	0	230	0	0	196	402	40
17-Oct-05	160	12	21	193	12	21	4	395	0	0	382	710	40
18-Oct-05	73	15	2	219	2	29	0	316	0	0	456	700	33
19-Oct-05	23	17	3	229	0	0	0	264	0	0	408	631	42
20-Oct-05	144	22	4	175	5	7	6	338	0	0	333	603	40
21-Oct-05	110	11	4	196	11	7	12	330	0	0	423	643	45
24-Oct-05	48	13	0	111	7	9	0	176	0	0	396	529	33
25-Oct-05	0	0	0	190	0	0	0	190	0	0	10	199	12
26-Oct-05	72	15	3	165	7	3	10	264	0	0	491	683	51
27-Oct-05	48	19	1	389	2	7	5	463	0	0	683	873	47
28-Oct-05	54	13	0	381	15	0	0	449	0	0	1227	1566	37
29-Oct-05	104	5	1	628	6	9	5	750	0	0	749	1250	41
30-Oct-05	8	13	0	447	11	2	4	480	0	0	671	929	36
31-Oct-05	7	3	0	383	2	0	0	393	0	0	614	888	29
01-Nov-05	1	4	0	318	0	0	0	322	0	0	216	533	19
02-Nov-05	22	5	1	864	2	0	4	893	0	0	868	1555	48
03-Nov-05	17	5	1	561	0	4	0	585	0	0	291	812	27
04-Nov-05	21	10	0	491	0	4	3	527	0	0	685	1083	37
05-Nov-05	7	7	0	846	1	5	4	867	0	0	994	1489	47
07-Nov-05	21	6	0	397	10	2	1	429	0	0	409	723	40
08-Nov-05	7	5	0	735	7	5	12	762	0	0	1462	1951	43
11-Nov-05	15	6	0	909	0	2	2	931	0	0	377	1210	38
12-Nov-05	2	3	0	1227	7	8	3	1247	0	0	1365	2489	41
Total	**4247**	**560**	**382**	**24671**	**806**	**813**	**1083**	**31621**	**0**	**0**	**36520**	**60914**	