SONGBIRD BANDING IN LASKEEK BAY, 1998-2001

Anthony J. Gaston
CWS/NWRC 100 Gamelin Blvd., Hull, Quebec, K1O 0H3, Canada

Jean-Louis Martin and Sylvain Allombert
CEFE/CNRS-UPR 9056, 1919 route de Mende, F-34293 Montpellier Cedex 5, France

ABSTRACT

Banding of forest birds was carried out as part of the programme of the Research Group on Introduced Species during the songbird breeding seasons of 1998-2001. Seven sites were used, of which three were on Reef Island and one each at Vertical Point, East Limestone Island, Low Island and West Skedans Island. Only two sites at Reef Island were used after 1998 (sites 13 and 16) : West Skedans Island was used only in 2000 and 2001. More than 2000 birds of 18 species were trapped, the most abundant being Orange-crowned Warbler (399). More than 100 of seven other species (Fox Sparrow, Golden-crowned Kinglet, Hermit Thrush, Song Sparrow, Swainson's Thrush, Townsend's Warbler and Winter Wren) were trapped. Adults made up 51% of those caught and juveniles 49%. Rates of catching were highest at Low and East Limestone islands (about 60 birds/100 net-h). West Skedans Island was intermediate and Vertical Point and the two Reef Island sites the least productive (<30 birds/100 net-h). Capture rates at Low and East Limestone islands were very high in 1998. When this year was omitted, capture rates ranged from 13-45/100 net-h. Proportions of different species captured varied from island to island: Hermit Thrushes were abundant at all sites except Low Island, where they were very uncommon; Golden-crowned Kinglets constituted >20% of captures at East Limestone Island, but were less than half as important elsewhere. Over 100 birds were trapped in more than one year, including 18 trapped in three years and four trapped in every year: 2 Swainson's Thrushes, both caught near camp on Reef Island and 2 Hermit Thrushes, one at East Limestone Island and one at Vertical Point. Four birds were trapped at more than one site, but never in the same year. We also present data on mean mass and wing-length for species where samples were adequate.

INTRODUCTION

From its inception, the research programme of the Research Group on Introduced Species has included a component dealing with the effects of deer browsing and squirrel predation on the reproductive success of terrestrial birds. Initial research involved the placing of artificial nests, baited with Quail eggs, on islands with different combinations of deer and squirrels, to determine whether the presence of these two introduced species affected the likelihood that eggs in an artificial nest would survive the normal nesting period (Martin et al 2001, Martin and Joron in press) . The results of these experiments demonstrated that the presence of squirrels increased rates of predation on artificial nests, as a result of direct predation by the squirrels. At the same time, it was shown that decreased vegetation cover around the nest increased predation risk by native predators suggesting that the presence of deer had the effect of increasing predation , by opening out the understory, making it easier for sight-hunting predators, such as Crows, to find nests. However, increased nest predation does not necessarily cause reduced breeding success for species that lay replacement clutches in the event that the first clutch fails: they may simply make more nesting attempts. Moreover, predation on artificial nests, or on natural nests found by searching, may give an exaggerated idea of the overall impact of predation, because such nests may be easier for predators to find than the average nest.

In order to investigate the overall impact of deer and squirrels on breeding success, we attempted to obtain a comparative measure of reproductive success by observing the proportions of young birds in the population at the end of the breeding season (juveniles as a proportion of all birds trapped). The comparison of juvenile proportions among islands with different combinations of introduced mammals will be reported elsewhere. In this paper, we summarise the results of trapping carried out, in terms of species composition and measurements, and describe the proportion of birds recaptured one or more years after banding.

METHODS

The proportion of juveniles in the population was assessed by trapping birds with mist nets set in standard sites on several islands in Laskeek Bay and examining each individual in order to determine whether or not it had fledged that year. The techniques of Pyle (1997) were used to determine age. For some species, especially thrushes and kinglets, plumage characters were sufficient. For others, the shape of the tail feathers and the presence of residual gape at the margins of the bill were used. If other methods were not conclusive, the skull was examined to determine whether ossification was complete. The sex of most birds was also determined based either on plumage characteristics, on the presence of a cloacal protuberance, or on the presence of a brood patch, which in most species develops only in the female (note that this criterion will distinguish a female with certainty, but birds without brood-patches may be either males or females that have not yet begun incubation). To distinguish Hermit and Swainson's Thrush, the wing formula was used from 2000 onwards (in Hermit Thrush the 9th primary is shorter than the 6th, which is emarginated; in Swainson's Thrush the 9th primary is longer than the 6th, which is not emarginated). A few thrushes trapped in earlier years may have been misidentified.

Birds were trapped in 12 x 2.5 m, 5-shelf, small mesh (32 mm), mist nets, set on aluminium poles in groups of 6-12 and, mostly, left in place with nets furled and tied when not in use. The initial protocol for trapping, based on observations of breeding in earlier years, called for eight 5 h sessions to be carried out at each netting site between mid June and mid July, working on a rotation. For the most part, two teams of banders were used, the one based at Reef Island carrying out banding at Reef and Low islands, and the East Limestone Island team dealing with East Limestone Island, Vertical Point and West Skedans Island. However, three teams were sometimes active simultaneously and some swapping of sites between teams was necessary. Sessions began about 7 am and ended at 12 noon. This time period was selected on the basis of trial sessions run from ½ hour after sun rise to ½ hour before sunset that showed a peak in capture rates between 9 and 11 am.

In 1998, trapping began on 5 May, as mist-net sites were developed and tested, was interrupted at the end of May, during chick rearing and resumed June 12th at a time identified by the monitoring of natural nests as the likely onset of the fledging period for several species. Mist netting continued until 8 July (Table 1). In 1999, observations of nests suggested that the season was much later than in 1998, so trapping started only on 28 June and continued to 23 July. The initial protocol was followed in the earlier year of 2000, when, apart from a test session at West Skedans Island on 8 June, the main trapping period was 18 June - 28 July. In 2001, another late season, trapping was carried out from 20 June - 22 July. A small amount of trapping was carried out prior to the main study period in all years, for training purposes. In this paper we include data on all trapping.

Most birds trapped were weighed (± 0.5 g) on a Pesola spring balance. The length of the wing (from the carpus to tip of longest feather), tarsus and bill (± 0.05 mm) were measured on some individuals, with the wing being measured most commonly in 1998 and 1999 and the tarsus in 2000 and 2001. Tarsus measurements were taken to allow body mass to be corrected for 'size'. On occasions when the trapping rate was high and birds were in danger of being held for more than 10 min, some birds were released without measuring. However, all individuals except hummingbirds were banded.

All birds trapped were banded with a standard metal band, supplied by the Canadian Wildlife Service. In addition, a plastic colour band, made by A.C. Hughes, Ltd., UK, was placed on the same leg, either above (adult), or below (juvenile) the metal band. The colour used was specific to the island: Reef Island (all sites), red; East Limestone Island, blue; Vertical Point, yellow; Low Island, orange; West Skedans Island, green. On hatching-year birds, the metal band was placed above the plastic band. For older birds the order was reversed.

Table 1
Dates of mist-netting sessions at localities in Laskeek Bay in 1998-2001

Year	Month	Dates of netting						
		Reef 13	**Reef 14**	**Reef 16**	**Limestone I.**	**Vertical Pt**	**Low I.**	**W Skedans I.**
1998								
	May	21,22,28	6,7,8,9	8,9,10,11, 12,14	11,12,14,16			
	June	16,17,22, 24,26,30	3	18,25,28	3,4,7,23,25, 28,29	20,21,23, 24,27,29	6,12,19,27	
	July	1,3,6,8		2	1,2	1,4,7	4	
	Total (days)	13	5	10	14	9	5	
1999								
	June	28			29	30		
	July	1,4,8,12, 16,18,20		1,3,6,13, 15,17,19, 22	2,5,7,9,12,14,1 7	4,6,12,14,1 7,19,21	5,7,11,13, 16,20,21,23	
	Total (days)	8		8	8	8	8	
2000								
	June	18,24,28		24,26,30,	24,28	21,26,30	20,22,25, 29	8,23,27
	July	2,6,14,17, 22,28		4,8,11,15,1 9,25	2,6,14,18,21, 25	4,11,15,20, 23	3,7,13,18, 23	1,5,13,17,2 1,26
	Total (days)	9		9	8	8	9	9
2001								
	June	21,25,29		21,25,29	20,25,28	21,25,29	23,28	22,26,30
	July	2,14,16,21, 25		4,11,15,20, 22	3,9,14,16,19	4,10,16,19, 22	1,10,14,18, 20,24	7,11,15,18, 21
	Total (days)	8		8	8	8	8	8
	Total, all yr	38	5	35	38	33	30	17

RESULTS

More than two thousand birds were trapped in Laskeek Bay over the four years, with the maximum in one year being in 2000, when nearly 900 were trapped (Table 2). The increase in numbers between 1999 and 2000 was partly the result of a late and partially unsuccessful breeding season in 1999 and partly the result of adding the West Skedans Island banding site in 2000, which produced many more birds than the discontinued sites (14 and 15) used at Reef Island in 1998. The most abundant species trapped was Orange-crowned Warbler (399) and more than 100 were trapped of seven other species (Fox Sparrow, Golden-crowned Kinglet, Hermit Thrush, Song Sparrow, Swainson's Thrush, Townsend's Warbler and Winter Wren). Adults (classified as AHY = after hatching year) made up 51% of those caught and juveniles (HY) 49%. Some birds were trapped more than once in the same year, but not all birds were aged every time they were caught. The total number of captures for which the age was recorded was 2769.

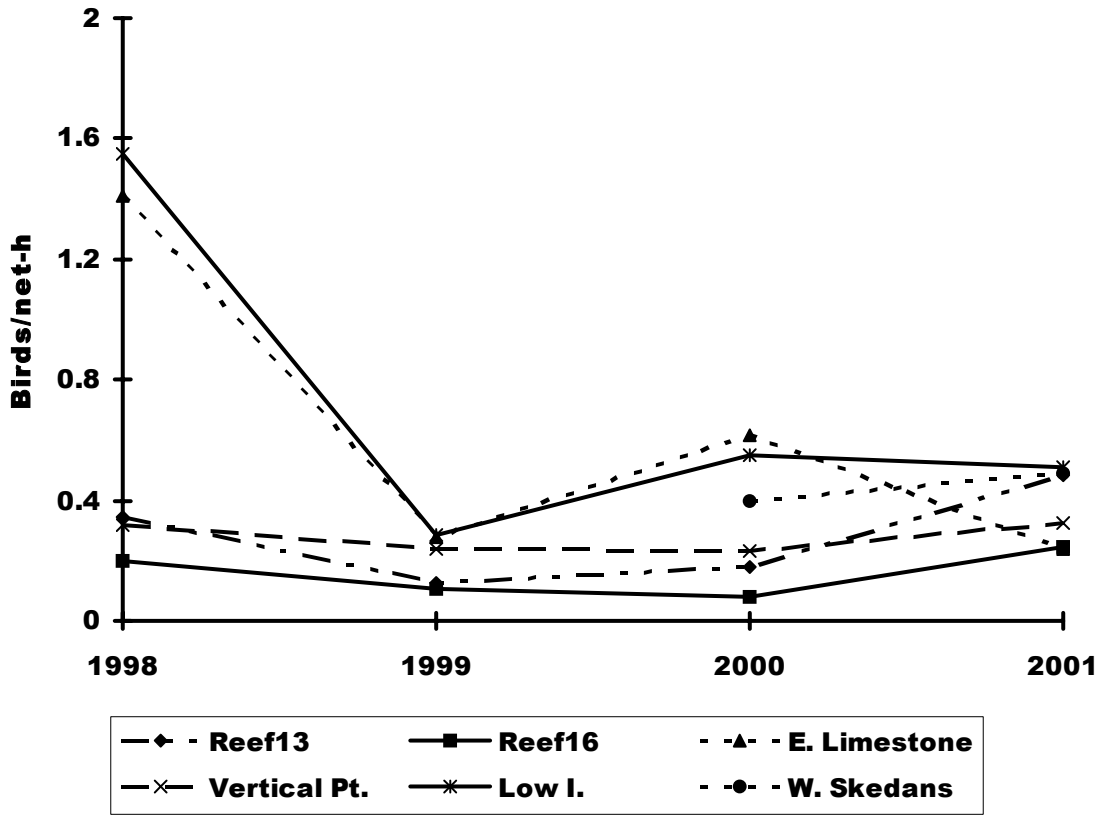
Captures by site

More birds were trapped at Reef Island than at any other island, but this was because two, sometimes as many as four banding localities were used (Table 3). Altogether, there were 77 netting sessions carried out at Reef Island, more than twice as many as at East Limestone Island, the next most frequently used. Among sites used regularly,

numbers of birds captured per session were highest at West Skedans Island (39), followed by Low Island (19) and East Limestone Island (17) and lowest at Reef Island (13) and Vertical Point (11).

To obtain a more rigorous comparison of catching rates, we reduced the sample to the period of 24 days following the start of fledging for the majority of species (starting on 15 June in 1998, 1 July 1999, 14 June 2000 and 18 June 2001). To allow for differences in effort among islands, we multiplied the number of nets used by the time deployed, to estimate the total net-hours of effort at each site during this period. We then compared sites on the basis of numbers of birds caught per 100 net-hours. When all years were combined, Low Island and East Limestone Island provided the highest rates of catching (61 and 60 birds/100 net-h, respectively; Table 4), with West Skedans intermediate and Vertical Point and the two Reef Island sites the least productive (26, and 14 birds/net-h at sites 13 and 16, respectively). Much of the difference between Low and East Limestone islands and the rest was based on very high capture rates at these two sites in 1998 (Figure 1). When this year was omitted, capture rates ranged from 13/100 net-h at site 16 on Reef Island to 44/100 net-h at West Skedans Island and 45/100 net-h at Low Island.

Figure 1
Numbers of birds captured per 100 net-hours in relation to netting station and year



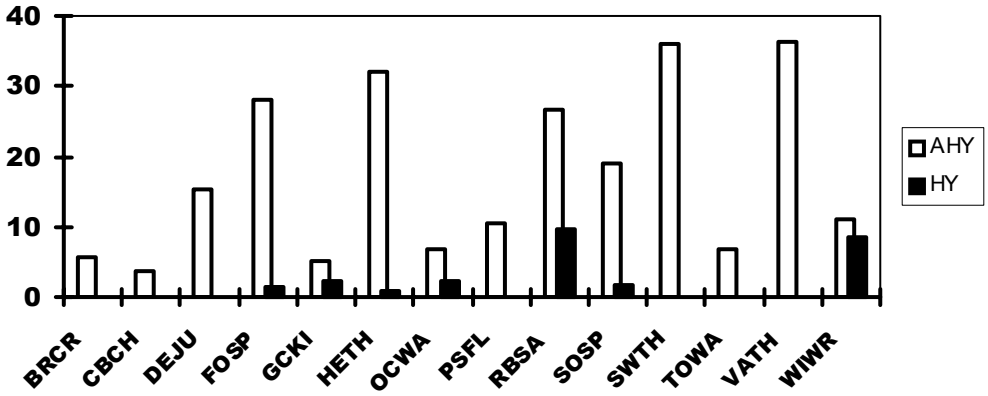
To compare the proportions of different species caught at different netting sites, we examined captures in 2000 and 2001 only, using only captures after 20 June (Table 5). For these two years, the numbers of species trapped at eash site were very similar (range 12-15 species). Nevertheless, there was great variation among sites in the relative proportion of different species trapped. Most striking was the predominance of Hermit Thrushes at Vertical Point where this species comprised 47% of all captures (Table 5): at Low island this species made up only 2% of captures. Conversely, Fox Sparrows constituted >20% of captures on Low and West Skedans islands, but no more than 5% elsewhere: they were not trapped at all at Vertical Point. Also at Vertical Point, 17 Dark-eyed Juncos were trapped: only one was trapped at all other sites combined.

At East Limestone Island, Golden-crowned Kinglets made up 20% of captures, whereas they did not exceed 10% at any other locality. Song Sparrows made up 20% of birds caught at site 16 on Reef Island, but were not trapped at Vertical Point and comprised <1% of those caught at East Limestone Island. Only the Winter Wren made up >3% of captures on every island (Table 5).

Recaptures in later years

Most birds captured were seen in only one year, but 127 individuals were trapped in more than one year, of which 105 were trapped in two years and 18 were trapped in three years (5 Fox Sparrows, 1 Golden-crowned Kinglet, 3 Hermit Thrushes, 1 Orange-crowned Warbler, 1 Red-breasted Sapsucker, 1 Song Sparrow, 4 Swainson's Thushes, 1 Varied thrush and 1 Winter Wren). Four birds were trapped in every year of the study: 2 Swainson's Thrushes, both at site 13 on Reef Island (beside camp) on all occasions, and 2 Hermit Thrushes, one at East Limestone Island and one at Vertical Point.

Figure 2
Proportion (%) of birds trapped in one year which were recaptured in the next.



Considering only recaptures in consecutive years, about 15% (N=782) of birds caught as adults were caught again the next year, with little variation among years (13-18%, Table 6). For obvious reasons, this only includes birds initially trapped in 1998-2000. Comparing species, five had adult recapture rates in the next year of >20%: Fox Sparrow, Hermit Thrush, Red-breasted Sapsucker, Swainson's Thrush and Varied Thrush (Figure 2). The Varied Thrush had the highest recapture rate (36.4%, N=11), with Swainson's Thrush close behind with 35.9% (N=78). The three small warbler-like birds, Townsend's and Orange-crowned warblers and Golden-crowned Kinglet, all had adult recapture rates in the range of 5-7%. Only 2% (N=868) of birds trapped as juveniles (HY = hatching year) were recaptured the following year. The highest recapture rates for juveniles were for Red-breasted Sapsucker (9.5%, N=15) and Winter Wren (8.5%, N=64).

Movements between sites

Only three birds moved between sites, a Fox Sparrow trapped as an adult at East Limestone Island in 1998 and recaptured in 2000 on Low Island, a Pacific Slope Flycatcher trapped as an adult at site 13 on Reef Island in 1999 and recaptured the next year at Low Island, and a juvenile Red-Breasted Sapsucker trapped at East Limestone Island in 1998 and recaptured at Vertical Point the following year. In addition, two Hermit Thrushes carrying red bands, and hence banded on Reef Island, were sighted elsewhere: one on West Skedans Island in 1999 and one on South Low Island in 2000.

Mass and measurements

Mean mass and wing-length for all birds of known age trapped are given in Tables 7 and 8. These tables include repeat captures of the same individuals and a few cases where a bird was caught in one year as a juvenile and in a later year as an adult. The mass and wing-length of juveniles were generally lower than those of adults (Figures 4 and 5), except in the case of the Winter Wren, where juveniles were heavier and had longer wings. Juvenile Townsend's Warblers also had longer wings than adults. Juvenile Hairy Woodpeckers, although weighing much less than adults, had slightly longer wings.

Figure 3
Juvenile mass in relation to adult mass, difference in %.

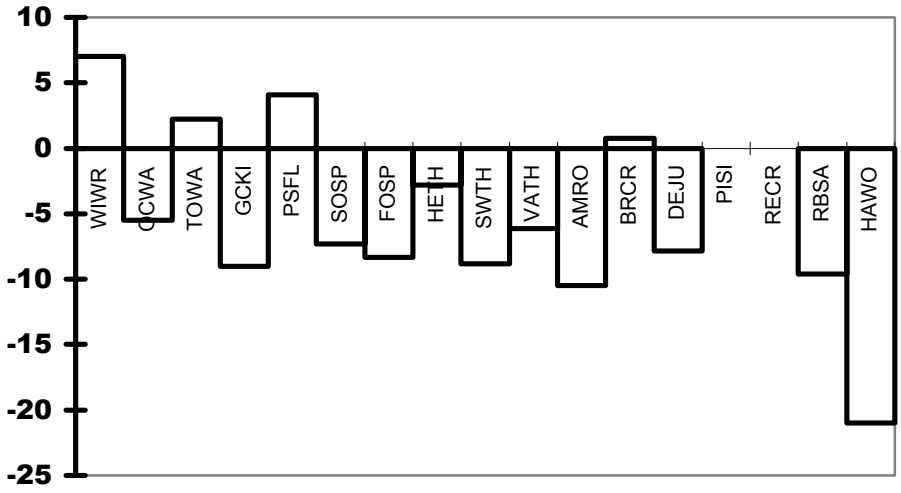


Figure 4
Juvenile wing length in relation to adult wing length, difference in %.

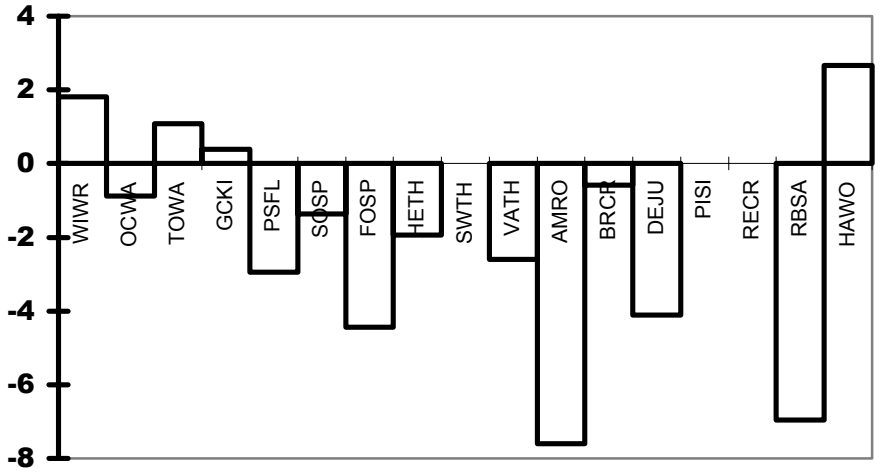


Table 2

Numbers of birds mist-netted on the Islands of Laskeek Bay by the RGIS/LBCS banding project during 1998-2001. In 1998 trapping occurred at East Limestone Island, at Vertical Point, Louise Island, at Low Island and at four sites on Reef Island (13, 14, 15, 16). After 1998, sites 14 and 15 at Reef Island were not used and in 2000 and 2001, a station was added on West Skedans Island.

Species	1998		1999		2000		2001		Totals		Grand
	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	Total
American Robin	2	0	0	1	0	2	0	2	2	5	7
Brown Creeper	13	4	7	10	16	20	4	8	40	42	82
Chestnut-backed Chickadee	7	5	12	5	8	17	9	13	36	40	76
Dark-eyed Junco	7	4	4	1	2	0	8	2	21	7	28
Fox Sparrow	11	3	12	6	34	56	28	25	85	90	175
Golden-crowned Kinglet	34	23	13	2	31	63	9	17	87	105	192
Hairy Woodpecker	2	3	1	3	0	1	1	2	4	9	13
Hermit Thrush	33	45	21	29	32	67	43	68	129	209	338
Orange-crowned Warbler	54	95	31	2	50	84	66	17	201	198	399
Pine Siskin	1	0	0	0	4	0	2	0	7	0	7
Pacific Slope Flycatcher	8	0	12	2	18	8	21	0	59	10	69
Red-breasted Sapsucker	5	7	4	5	6	9	11	10	26	31	57
Red Crossbill	0	0	0	0	3	1	1	0	4	1	5
Song Sparrow	10	25	16	16	16	74	15	28	57	143	200
Swainson's Thrush	21	1	20	0	38	2	52	1	131	4	135
Townsend's Warbler	38	41	29	4	37	20	39	17	143	82	225
Varied Thrush	7	14	4	1	3	7	4	9	18	31	49
Winter Wren	25	25	9	9	34	48	28	20	96	102	198
Totals	278	295	195	96	332	479	341	239	1146	1109	2255
Grand Totals (AHY+HY)		573		291		811		580			

Table 3
Numbers and proportions (%) of birds trapped (including recaptures) by island

Species	Reef 13		Reef 14/15		Reef 16		Reef, total		E. Limestone		Vertical Pt		Low I		W Skedans	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
American Robin	0		0		0		0		0		7	2.0	3	0.4	2	0.4
Brown Creeper	16	2.9	0		6	1.9	22	2.8	28	4.4	25	7.1	4	0.8	11	2.2
Chestnut-backed Chickadee	27	5.0	0		20	6.3	47	5.8	20	3.1	15	4.3	0		0	
Dark-eyed Junco	0		0		0		0		8	1.3	28	8.0	0		0	
Fox Sparrow	21	3.9	0		13	4.1	34	4.3	2	0.3	0		131	**25.0**[1]	109	**21.5**
Golden-crowned Kinglet	31	5.5	2	7.1	24	7.6	56	7.7	137	**21.5**	12	3.4	12	2.4	40	7.9
Hairy Woodpecker	6	1.1	0	0.0	2	0.6	8	1.0	3	0.5	2	0.6	0		0	
Hermit Thrush	75	**13.2**	14	**50.0**	48	**15.2**	134	**22.2**	146	**22.9**	112	**31.8**	6	0.6	49	9.7
Orange-crowned Warbler	87	**16.0**	3	10.7	32	**10.1**	122	**16.7**	43	6.8	11	3.1	191	**35.9**	98	**19.3**
Pine Siskin	0		0		1	0.3	1	0.1	1	0.2	0		0		5	1.0
Pacific Slope Flycatcher	36	6.6	0		13	4.1	49	6.3	4	0.6	13	3.7	3	0.4	14	2.8
Red-breasted Sapsucker	17	2.8	0		3	0.9	18	2.3	26	4.1	18	5.1	0		1	0.2
Red Crossbill	1	0.2	0		4	1.3	5	0.6	0		0		0		0	
Song Sparrow	54	9.7	0		72	**22.8**	125	**15.2**	9	1.4	4	1.1	44	8.3	54	**10.7**
Swainson's Thrush	38	7.0	1	3.6	25	7.9	64	8.4	8	1.3	29	8.2	48	8.5	85	**16.8**
Townsend's Warbler	68	**12.5**	0		26	8.2	94	**12.0**	144	**22.6**	16	4.5	9	1.8	17	3.4
Varied Thrush	12	2.2	3	**10.7**	4	1.3	19	3.6	0		40	**11.4**	1	0.2	1	0.2
Winter Wren	64	**11.6**	5	**17.9**	23	7.3	91	**13.5**	58	9.1	20	5.7	83	**15.7**	21	4.1
Totals	553		28		316		889		637		352		535		507	
Days of trapping	38		5		35		77		38		33		30		13	
Mean birds/day	14.6		5.6		9.0		11.5		16.8		10.7		17.8		39.0	

[1]Percentages in boldface highlight species making up >10% of the total for that island

Table 4
Numbers trapped at different netting stations during the 24 days following the start of the fledging period

Netting station	Usual no. of nets	Total trapped in core period, 1998-2001	Total trapped in core period, 1999-2001	Birds trapped/net-h, all years	Birds trapped/net-h, 1999-2001
Reef 13	12	397	245	25.7	22.3
Reef 16	12	199	168	13.9	13.2
Low I.	6	370	232	60.9	44.7
Vertical Pt.	9	333	207	28.0	25.9
E. Limestone I.	7	473	225	59.7	36.5
W. Skedans	10	249	249	44.0	44.0

Table 5
Numbers trapped at different netting stations after 20 June in 2000 and 2001

Species	Reef I.13	%	Reef I.16	%	East Lime.	%	Low I.	%	Vert. Pt.	%	W. Sked.	%
American Robin	0		0		0		3	0.9	0		2	0.4
Brown Creeper	9	2.9	5	2.4	15	5.6	4	1.2	7	3.4	9	1.9
C-B Chickadee	19	6.0	11	5.4	9	3.3	0		11	5.4	0	
Dark-eyed Junco	0		0		1	0.4	0		17	8.3	0	
Fox Sparrow	19	6.0	11	5.4	2	0.7	93	**28.3**	0		103	**21.3**
G-C Kinglet	20	6.3	17	8.3	53	**19.6**	7	2.1	6	2.9	36	7.4
Hairy Woodpecker	2	0.6	0		0		0		2	1.0	0	
Hermit Thrush	55	**17.5**	36	**17.6**	75	**27.8**	6	1.8	96	**46.8**	46	9.5
O-C Warbler	31	9.8	17	8.3	17	6.3	84	**25.5**	3	1.5	95	**19.6**
Pine Siskin	0		1	0.5	0		0		0		5	1.0
Pacific Slope Flycatcher	21	6.7	10	4.9	3	1.1	3	0.9	7	3.4	14	2.9
R-B Sapsucker	16	5.1	3	1.5	10	3.7	0		11	5.4	1	0.2
Red Crossbill	1	0.3	4	2.0	0		0		0		0	
Song Sparrow	25	7.9	40	**19.5**	1	0.4	33	**10.0**	0		52	**10.7**
Swainson's Thrush	20	6.3	14	6.8	2	0.7	26	7.9	16	7.8	82	**16.9**
Townsend's Warbler	36	**11.4**	21	**10.2**	51	**18.9**	4	1.2	5	2.4	17	3.5
Varied Thrush	6	1.9	2	1.0	0		1	0.3	17	8.3	1	0.2
Winter Wren	35	11.1	13	6.3	31	**11.5**	65	**19.8**	7	3.4	21	4.3
	315		205		270		329		205		484	
Total species trapped	15		15		13		12		13		14	

Numbers in boldface show proportions > 10%

Table 6
Numbers of birds trapped as adults (AHY) in 1998-2000 and numbers recaptured the following year

Species	1998 Banded	1999 Retrap	1999 Banded	2000 Retrap	2000 Banded	2001 Retrap	Totals Banded	Retrap	Proportion retrapped all years
American Robin	2	0	0		0		2	0	0.00
Brown Creeper	13	1	7		16	1	36	2	5.56
Chestnut-backed Chickadee	7	0	12		8	1	27	1	3.70
Dark-eyed Junco	7	2	4		2		13	2	15.38
Fox Sparrow	11	5	12	4	34	7	57	16	**28.07**[1]
Golden-crowned Kinglet	33	2	13	2	31	0	77	4	**5.19**
Hairy Woodpecker	2	0	1		0		3	0	0.00
Hermit Thrush	23	5	21	8	31	11	75	24	**32.00**
Orange-crowned Warbler	51	2	31	1	50	6	132	9	**6.82**
Pine Siskin	1	0	0		4		5	0	0.00
Pacific Slope Flycatcher	8	1	12	3	18		38	4	10.53
Red-breasted Sapsucker	5	1	4	1	6	2	15	4	26.67
Red Crossbill	0		0		3		3	0	0.00
Song Sparrow	10	3	16	3	16	2	42	8	19.05
Swainson's Thrush	20	5	20	7	38	16	78	28	**35.90**
Townsend's Warbler	38	1	29	3	37	3	104	7	**6.73**
Varied Thrush	4	3	4	1	3		11	4	36.36
Winter Wren	21	2	9	2	34	3	64	7	**10.94**
Totals	256	33	195	35	331	52	782	120	15.35

[1] Figures in boldface based on banding totals >50

Table 7
Mean mass of adults and juveniles trapped in 1998-2001. Probabilities in bold face highlight differences between age classes significant at P<0.05

Species	Mass (g)							
	Adults (AHY)			Juveniles (HY)				
	Mean	N	SD	Mean	N	SD	F	P
Winter Wren	8.94	107	1.15	9.56	113	1.57	11.31	**0.001**
Orange-crowned Warbler	9.45	197	0.73	8.92	216	1.36	22.80	**0.000**
Townsend's Warbler	9.79	170	1.37	10.01	85	1.05	1.69	0.195
Golden-crowned Kinglet	6.49	111	2.01	5.90	106	1.30	6.42	**0.012**
Pacific Slope Flycatcher	10.99	63	2.43	11.44	12	1.11	0.39	0.534
Song Sparrow	28.56	61	2.43	26.47	139	3.85	15.24	**0.000**
Fox Sparrow	37.50	116	4.43	34.37	123	5.67	22.41	**0.000**
Hermit thrush	24.22	191	3.89	23.53	271	3.56	3.85	**0.050**
Swainson's Thrush	31.39	180	5.35	28.63	4	6.80	1.04	0.310
Varied Thrush	79.04	20	20.11	74.19	31	19.26	0.74	0.393
American Robin	94.00	3	8.72	84.17	3	6.90	2.35	0.200
Brown Creeper	8.25	40	0.83	8.31	43	0.96	0.10	0.751
Chestnut-backed Chickadee	9.39	37	1.31	8.60	38	3.95	1.31	0.256
Dark-eyed Junco	18.52	23	1.52	17.07	7	0.97	5.62	**0.025**
Pine Siskin	14.21	7	2.06					
Red Crossbill	25.00	1	0.00	36.00	1	0.00		
Red-breasted Sapsucker	57.38	27	7.70	51.86	33	4.85	11.46	**0.001**
Hairy Woodpecker	93.67	3	10.79	74.00	9	7.96	11.76	**0.006**

Table 8
Mean wing-length of adults and juveniles trapped in 1998-2001. Probabilities in bold face highlight differences between age classes significant at P<0.05.

Species	Wing (mm)							
	Adults (AHY)			Juveniles (HY)				
	Mean	N	SD	Mean	N	SD	F	P
Winter Wren	45.32	42	1.69	46.15	106	1.97	5.68	**0.018**
Orange-crowned Warbler	57.96	102	2.25	57.45	208	3.29	1.99	0.160
Townsend's Warbler	62.58	167	2.02	63.25	54	2.06	4.48	**0.035**
Golden-crowned Kinglet	53.50	102	1.88	53.71	40	2.17	0.32	0.572
Pacific Slope Flycatcher	62.98	59	3.14	61.13	4	2.02	1.34	0.252
Song Sparrow	70.11	57	4.42	69.15	43	2.64	1.60	0.208
Fox Sparrow	79.86	114	3.28	76.31	27	4.50	21.88	**0.000**
Hermit thrush	87.21	180	3.44	85.52	94	3.38	15.09	**0.000**
Swainson's Thrush	95.29	177	3.45	97.00	1	0.00	0.24	0.622
Varied Thrush	127.83	18	3.37	124.50	17	3.28	8.79	**0.006**
American Robin	139.33	3	6.03	128.75	2	6.01	3.71	0.150
Brown Creeper	61.65	40	2.05	61.29	19	1.66	0.45	0.507
Chestnut-backed Chickadee	58.78	36	2.51	57.87	19	2.63	1.58	0.214
Dark-eyed Junco	71.96	25	2.52	69.00	5	1.58	6.27	**0.018**
Pine Siskin	73.29	7	2.21					
Red Crossbill	83.50	1	0.00	84.50	1	0.00		
Red-breasted Sapsucker	127.33	27	3.29	118.47	16	5.46	44.39	**0.000**
Hairy Woodpecker	120.48	4	15.07	123.69	8	1.62	0.39	0.545

DISCUSSION

Mist netting clearly gives a highly selective sample of the birds present in an area. It works best for small birds that regularly move through low cover. In the case of Laskeek Bay, those forest birds that spend most of their time in the canopy were under-represented in our samples, especially Red Crossbill, Pine Siskin and Red-breasted Nuthach, the latter never trapped at all. Conversely, birds like thrushes, wrens and sparrows, which spend most of their time near the ground are likely over-represented. Moreover, the species captured is strongly affected by the exact placement of nets, with sites in conifers more likely to capture kinglets, than sites in salal and sites in grassland more likely to catch Song Sparrows than those in forest with open understory. Hence, numbers of birds trapped cannot be taken to represent their proportion in the bird fauna as a whole. For example, the high proportion of kinglets trapped at East Limestone Island almost certainly related to the fact that most mist net sites on that island were in young conifers.

Despite the forgoing reservations, it seems unlikely that the differences in proportions of species caught at different localities could be attributed solely to differences in the nature of the mist net sites selected. The large numbers of Fox Sparrows trapped at Low and West Skedans islands, although presumably related to the habitat, is unlikely to have been due only to peculiarities in the siting of the nets. It presumably reflects a real tendency for these islands, only lightly affected by deer, to support dense populations of Fox Sparrows. Likewise, the >45% representation of Hermit Thrushes in the small sample netted at Reef Island sites 14 and 15, both under heavy canopy in the center of the island and in the larger sample at Vertical Point, probably reflected the relative abundance of this species in forest interior with open understory.

Inter-year variation in numbers trapped was especially marked for juvenile of Orange-crowned and Townsend's warblers and Golden-crowned Kinglets. These species seem to have bred late and produced few young in the cold summer of 1999, but all did very well in the warm summer of 1998. In general, birds bred later in 1999 than in other years and this seems to have been associated with the cold influence of the La Niña event that year. Further analysis of inter-year variation in age ratios and capture rates is in preparation.

Recapture rates in subsequent years are influenced by the tendency of birds to shift their territories between years, by the proportion of the population in the area that is actually caught in a given year, and by the survival rate of the population. The difference in recapture rates between adults and juveniles must reflect partly the tendency of juvenile birds to disperse away from the area where they were reared. However the difference between the thrushes and the warblers may relate either to a greater tendency for warblers to shift sites, or to our catching a higher proportion of the thrushes in our banding area each year. Irrespective, the recapture of 36% of Swainson's Thrushes and 32% of Hermit Thrushes banded as adults is rather remarkable, given that the former species travels to South America and the latter to the southern US and Mexico in winter (Jones and Donovan 1996). The majority of these birds must return rather precisely to the island where they were reared. The high recapture rate for Varied Thrushes is less surprising, given that they remain in the islands throughout the year.

REFERENCES

Jones, P.W. and T.M. Donovan. 1996. Hermit Thrush *Catharus guttatus*. Birds of North America, No. 261. (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and the American Ornithologist's Union, Washington, D.C.

Martin, J.L. and M. Joron. The influence of variation in predator community and habitat quality on nest predation in forest birds. Oikos in press.

Martin, J.L., M. Joron and A.J. Gaston. 2001. The squirrel connection: influence of squirrels as songbird nest predators in Laskeek Bay. Laskeek Bay Research 10: 43-61.

Pyle, P. 1997. Identification guide to North American birds. Slate Creek Press, Bolinas, CA.