

ENVIRONMENTAL IMPACT ASSESSMENT OF
EXPERIMENTAL SPRUCE BUDWORM ADULTICIDE TRIALS:
EFFECTS ON FOREST AVIFAUNA

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ABSTRACT

Adulticide treatments involving various spray regimes of phosphamidon (Dimecron®) and aminocarb (MATACIL®) had no obvious harmful effects on forest songbird populations on the whole. Small population reductions were noted for the ruby-crowned kinglet, *Regulus calendula*, and Tennessee warbler, *Vermivora peregrina*, after a single application of phosphamidon; and the Tennessee and Cape May warblers, *Dendroica tigrina*, after 5 consecutive applications within 8 days. An immature Purple finch, *Carpodacus purpureus*, may have suffered pesticide poisoning in an area receiving three applications of aminocarb. Eight experimental programs of aerial application of pesticides for adult spruce budworm suppression were monitored from 1974 to 1977 in New Brunswick.

RÉSUMÉ

Des traitements imagocides, au moyen de vaporisations de différentes doses de phosphamidon et d'aminocarbe, n'ont eu aucun effet évident sur l'ensemble des populations d'oiseaux chanteurs forestiers. On a observé des réductions des populations de roitelets à couronne rubis et de fauvettes obscures après une seule application de phosphamidon et des réductions des populations de fauvettes obscures et de fauvettes tigrées après cinq applications consécutives dans un intervalle de huit jours. Il se peut qu'un roselin pourpre juvénile ait subi un empoisonnement aux pesticides dans une région qui avait reçu trois applications d'aminocarbe. Les divers programmes expérimentaux de pulvérisation qu'on a surveillés ont été réalisés de 1974 à 1977, au Nouveau-Brunswick.

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INTRODUCTION

Control strategies for the spruce budworm, *Choristoneura fumiferana* (Clemens), have been predominantly aimed at larvae. In 1969, B.W. Flieger of Forest Protection Limited, New Brunswick, initiated experimental aerial insecticide applications against budworm moths (Kettela and Miller, 1975). Subsequent spray trials (1972-1977) involved modifications of the spray regime (insecticide, dosage and time of treatment) in an attempt to find the most efficient means of killing moths (Miller et al. 1980). This form of spruce budworm control strategy required a lower dosage rate of insecticide than larvicide treatments, but multiple applications were necessary due to moth immigration and continual emergence (Miller et al. 1980).

In 1974, a low dosage level (0.070 kg AI/ha of phosphamidon (Dimecron®) was tested for its effectiveness as an adulticide. The number of applications was increased to 3 and 5 in 1975 in order to obtain better control. In 1976, aminocarb (MATACIL®) was found to be as effective, if not better than phosphamidon, and sprays applied later in the season were found to be more efficient against mated females (Miller et al. 1980). In 1977, earlier timed sprays were conducted in order to kill males and thereby disrupt mating. Motor stimulants were added to some treatments to increase activity of the moths and thereby bring them in contact with the spray cloud.

As adulticide treatments must occur in July, when arthropods are abundant and extremely important as a food source to songbirds, there is a potential risk to songbirds, of both direct toxic effects and indirect effects through contamination of their food sources. Studies on the effects of experimental spruce budworm adulticide sprays on songbirds carried out by the Environmental Impact Section of the Forest Pest Management Institute (formerly Chemical Control Research Institute) are reported here.

METHODS

Experimental adulticide blocks where songbirds studies were conducted are listed in Table 1 together with the treatments they received. (For clarification and readability, block size and treatment specifications are given at the beginning of each section in the results.) Forest songbird populations were assessed in both treated and untreated (control) plots, utilizing a singing-male territory mapping technique similar to that described by Kendeigh (1947). The size of plots censused varied¹. All singing and sighted birds were recorded on plot maps while the observer slowly traversed the plot along parallel lines established 40 m apart. Each male bird vocally defending a territory, was assumed to be mated, and was therefore recorded as two birds; all others (non-singing, visually observed, females or immatures) were recorded as one bird. Censuses were

¹ Plots were 8 ha during the years 1974 and 1975, 4 ha in 1976 and 1977, and checkpoints were an additional method of the 1974 and 1977 (triple application) spray programs.

Table 1

Summary of treatments in areas where songbird studies were conducted.

New Brunswick 1974-1977.

Insecticide and Regime	Year	Block or Plot	Dates	Times
Phosphamidon at 0.070 kg AI/ha				
Single application	1974	Block 10 East and West	16 July	·
		Block 31	21 July	·
Double application	1974	Block 13	13 and 17 July	··
		Block 1, 12, 16 and Plot 2	14 and 21 July	··
		Block 8 (Bowser), 11, and Plot 3	16 and 21 July	xx, ··, xx
		Block 8 (Canoe), 9 and 17	16 and 22 July	xx, ·x, ··
		Block 7	17 and 22 July	xx
Triple application	1976	Plot 1, 2 and 3	4, 6 and 9 July	x·x
		Plot 4	4, 6 and 10 July	x·x
	1977	Block 2 and 3	9, 10 and 14 July	x·Δ
		Plot 11, 12, CP3, and CP4	11, 14 and 16 July	·x·
Five applications	1975	Block 12	6, 7, 10 and 11 July	··xx·
Plus motor stimulants, twice	1977	Plot 1 and 3	10 and 14 July	·Δ
Aminocarb at 0.070 kg AI/ha				
Double application	1976	Block 5	5 and 7 July	··
Triple application	1976	Block 4	5, 7 and 10 July	···

· morning

x evening

Δ afternoon

conducted daily, commencing five days prior to the first application² and terminating several days after the final application. On the day of application, plot searches were conducted to recover any sick or dead birds for insecticide residue analysis. Fledgling studies were included in the phosphamidon plus motor stimulants program, and foliage residue studies were conducted for the phosphamidon-single, double and triple application programs. Daily census maps were later combined for prespray and postspray periods to delineate breeding territorial boundaries. Transient species and those species with territories too large to accurately monitor, were excluded from data analysis. Thus, only species of Tyrannidae, Troglodytidae, Turdidae, Sylviidae, Vireonidae, Parulidae and Fringillidae were discussed. The number of birds observed during each census was used to indicate activity trends and relative abundance in each area.

² There was no prespray data for the phosphamidon - five applications program in 1975.

RESULTS

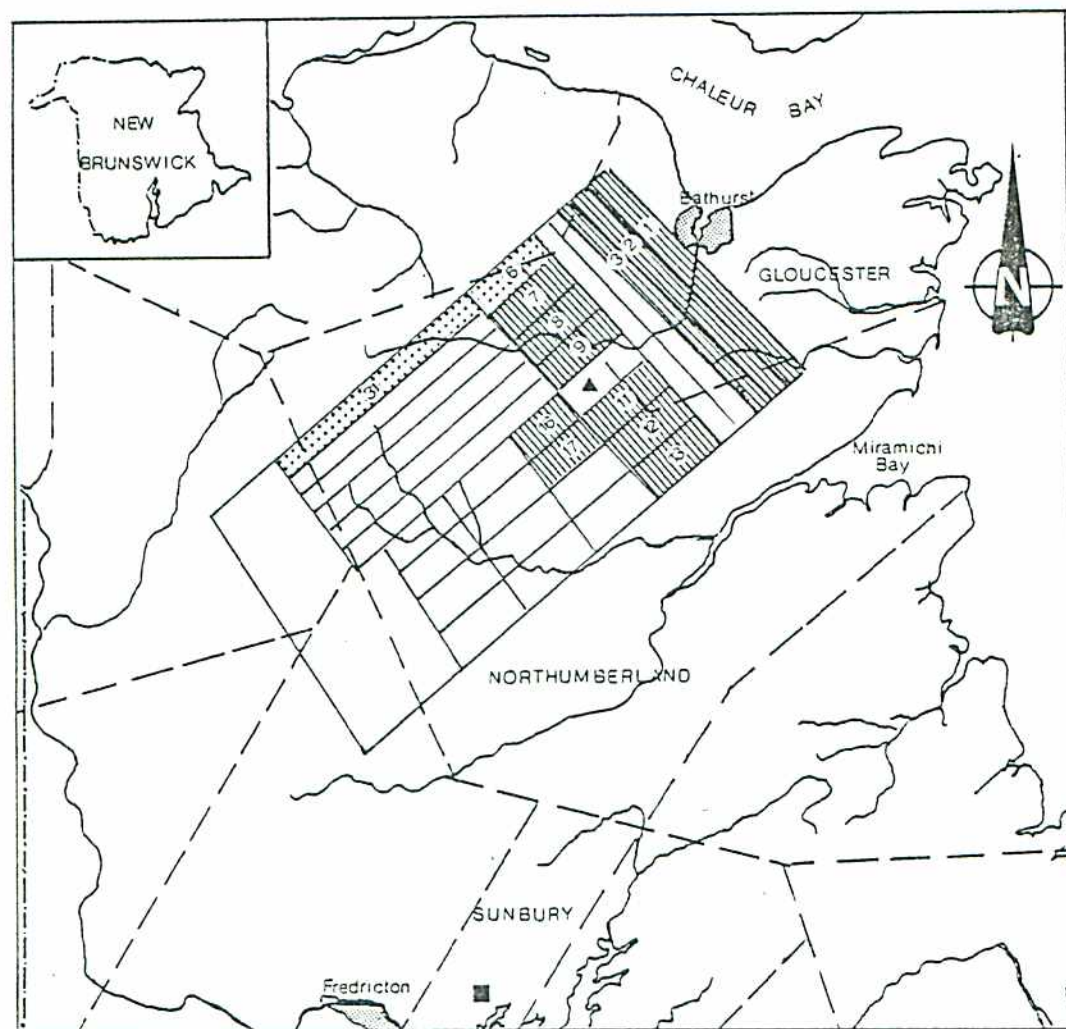
Phosphamidon - Single Application

Three blocks were monitored for the impact of a single application of phosphamidon applied at 70 g AI in 0.88 L/ha on forest songbirds. Spray blocks were located in Gloucester and Northumberland Counties, New Brunswick (Fig. 1). Treatment of Block 31 was by DC 6, Block 10 East and West by a TBM Grumman Avenger aircraft.

Foliage from white spruce, *Picea glauca* (Moench) Voss or balsam fir, *Abies balsamea* (L.) Mill. was collected from each bird census plot after each application, and preserved in residue free acetone/nitrite, then returned to the laboratory (Chemical Control Research Institute) for pesticide residue analysis. Analytical procedures used for foliage samples are described by Sundaram (1975).

Residue values for Block 10 samples were much higher than those of Block 31 (Table 2). Although greater reductions were observed for Sylviidae, and Parulidae on Block 10 east than Block 10 west (Appendix I, Tables 1 and 2), fluctuations on Block 10 in general were similar to Block 31 (Appendix I, Table 3), and with the exception of Sylviidae, similar to natural fluctuations observed on control (Appendix I, Tables 4-6). Trends in activity and species diversity of selected bird species combined for all treatment blocks closely resemble those of control, where periods of low abundance correspond to natural fluctuations due to weather conditions and natural territorial breakdown (Table 3, Fig. 2).

Six species, common to all plots, were selected in order to closely observe changes in activity on treated as compared to control plots (Table 4). The overall change was essentially equal, however the canopy feeding ruby-crowned kinglet *Regulus calendula* (Linnaeus), showed a large reduction on treatment only. Territories of the ruby-crowned kinglet indicate a marked reduction in the number of territories following treatment, not apparent on the control plots, indicating a possible disruption in the breeding activities of this species (Fig. 3). A slight reduction was also apparent for treatment populations of the Tennessee warbler, *Vermivora peregrina* (Wilson), a shrub feeder, while activity of species foraging at ground level (American robin, *Turdus migratorius* Linnaeus, Swainson's thrush, *Catharus ustulatus* (Nuttall), dark-eyed junco, *Junco hyemalis* (Linnaeus), and white-throated sparrow, *Zonotrichia albicollis* (Gmelin) (DesGranges 1980)), increased following treatment. This correlation of high exposure to increased reductions in numbers, suggests a pesticide effect, although the American robin and dark-eyed junco, species classified as having a potentially high exposure risk to aerial spray treatment (Richmond *et al.* 1979), were not affected.







-  Phosphamidon-Single application
-  Phosphamidon-Double application
-  Heath Steele
-  Acadia Forest Experimental Station

Fig. 1. Location of treated areas referred to in the text.

Table 2. Phosphamidon residues in foliage collected from spruce budworm (*C. fumiferana* (Clem.) adult spray trials in New Brunswick, July 1974.

Block No.	Date Treated	Date Collected	Foliage Sampled	Residue (ppm)
31	July 21	July 21	White spruce	0.21
			Balsam fir	0.27
10	July 16	July 16	White spruce	5.25
			White spruce	1.42

Data supplied by Dr. K.M.S. Sundaram.

Table 3
Changes in abundance of selected bird species following a single application of Phosphamidon Gloucester and Northumberland Counties, New Brunswick, 10-25 July, 1974.

Days before or after application* of Phosphamidon	Block	Plot	Treatment										
			Pre-spray					Daily avg.	Post-spray I				Daily avg.
			-5	-4	-3	-2	-1		+0	+1	+2	+3	
	10-east	7-Hwy. 430	102	152	194	106	100	130.8	148	126	128	104	126.5
	10-west	7-Hwy. 430	116	58	192	78	80	104.8	136	154	80	101	117.8
	31	31-Indian Falls	50	45	41	36	34	41.2	45	45	38	40	42.0
	Average number of birds/plot		89.3	85.0	142.3	73.3	71.3	78.0	109.7	108.3	82.0	81.7	95.4
	Average number of species/plot		14.3	13.7	16.7	13.3	12.0	14.0	13.7	13.3	13.0	13.3	13.3
			Control										
	45	Newcastle	158	203	243	132	103	167.8	154	172	147	147	155.0
		45	27	48	34	47	38	38.8	37	23	20	37	29.3
		Check plot	30	24	10	16	8	17.6	27	19	17	19	20.5
	Average number of birds/plot		71.7	91.7	95.7	65.0	49.7	74.8	72.7	71.3	61.3	67.7	68.3
	Average number of species/plot		11.7	15.3	12.3	11.7	11.7	12.5	14.0	12.3	10.7	11.0	12.0

*application emitted at 0.070 kg AI/ha.

Table 4. Changes in activity for six species of songbirds*, in single application Phosphamidon treatment and untreated control plots, New Brunswick.

Species	Treatment Plots			Control Plots		
	Before	After	Change	Before	After	Change
American robin	0.9 ¹	1.1	+ 0.2	4.1	4.3	+ 0.2
Swainson's thrush	11.4	14.8	+ 3.4	10.3	9.8	- 0.5
Ruby-crowned kinglet	4.5	0.8	- 3.7	1.2	1.9	+ 0.7
Tennessee warbler	8.9	1.6	- 5.7	5.3	2.3	- 3.0
Dark-eyed junco	0.7	1.2	+ 0.5	3.6	3.3	- 0.3
White-throated sparrow	17.7	19.8	+ 2.1	5.5	4.7	- 0.8
Total change			- 3.2			- 3.7

* species common to all plots

¹ number of birds/plot averaged over pre-spray and then post-spray time periods.

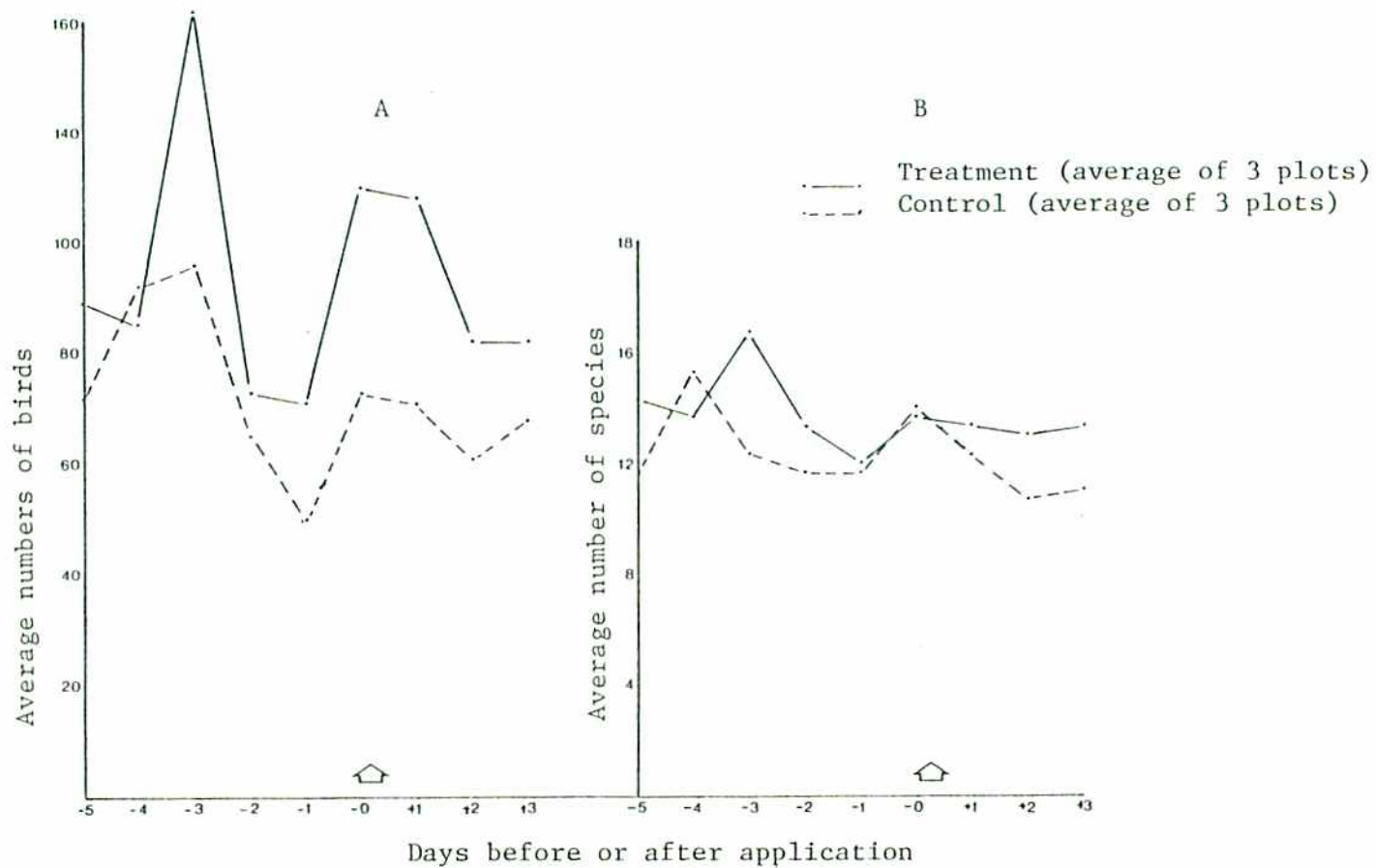


Fig. 2. A Comparison of activity of selected bird species on treatment and control plots.

B Comparison of species diversity on treatment and control plots.
Phosphamidon single application blocks, New Brunswick, 1974.

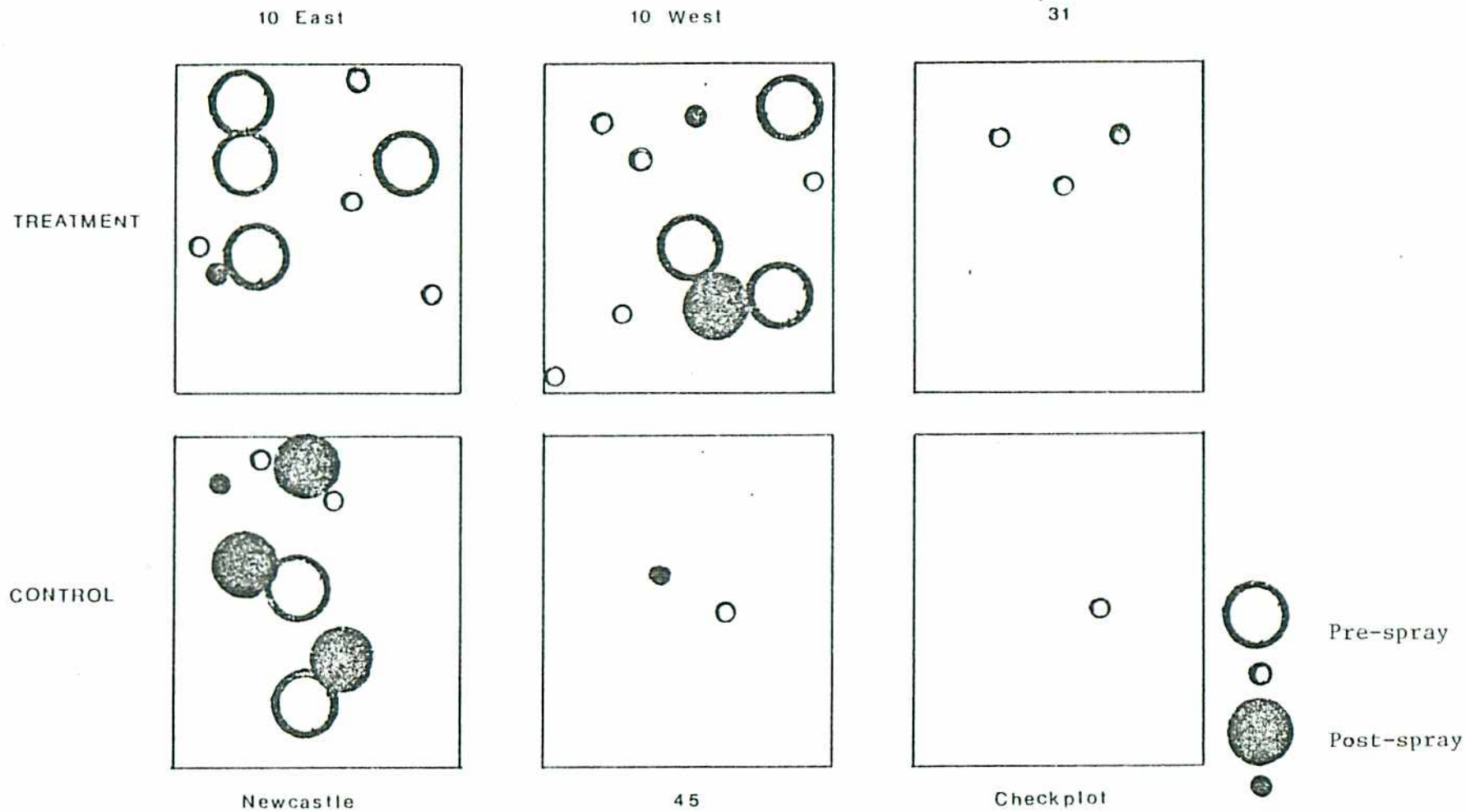


Fig. 3. Breeding territories of the Ruby-crowned kinglet. Phosphamidon single application blocks, New Brunswick, 1974. Large circles represent nesting territories and small circles represent single records.

Phosphamidon - Double Application

In July of 1974, an area of 5141 km² in Northern New Brunswick (Gloucester and Northumberland counties) was treated with a double application of phosphamidon applied at 70 g AI in 0.88 L/ha. Twelve plots were monitored for the impact on forest songbirds (Fig. 1). Bird plots Allardville 2 and 3 were treated by a DC-6 aircraft. The remaining blocks were treated by TBM Avenger aircraft.

Foliage samples for residue analysis were collected and processed as previously described.

The population structure of forest avifauna on treated and control plots was similar (Appendix II, Tables 1-12). In comparing the activity of the predominant families on treated and control plots, the obvious trend was a natural reduction in singing due to changes in territorial behaviour (Fig. 4). Increased residue levels for the second application (Table 5) had no visible influence on bird activity as a more noticeable decline occurred after the first application, and activity trends closely resemble those of control (Table 6, Fig. 6). Species diversity however, decreased after the second application while control remained fairly constant (Table 6, Fig. 5). This is probably because on the treatment plots, a larger proportion of the species not observed after the second application was made up of uncommon species observed on less than two consecutive days in one time period and therefore not well established in territories.

Species common to all plots were graphed according to numbers to determine possible pesticide effects at the species level (Fig. 7). Activity of the Swainson's thrush, a species which forages at ground level (DesGranges, 1980), was not affected by treatment. Nor was there a significant difference between treatment and control blocks for the Tennessee warbler, and ruby-crowned kinglet, species occupying niches of high exposure to the spray (Richmond et al. 1979). A marked increase in activity of the baybreasted warbler, *Dendroica castanea* (Wilson), during the second postspray period on the control block, corresponding with a decrease on treatment, was most likely due to error introduced by a change in the census taker (observer). Birds formerly identified as American redstarts, *Setophaga ruticilla* (Linnaeus), were possibly identified as baybreasted warblers and magnolia warblers, *Dendroica magnolia* (Wilson), by the new observer (Table 7). An increase in Nashville warbler, *Vermivora ruficapilla* (Wilson), activity was also observed following the change in observer, which may explain the activity graph for this species as well (Fig. 7). Although activity of the purple finch, increased in the control area, territories were reduced by 70%, a decrease comparable to that in the treatment block which was recorded as 74%.

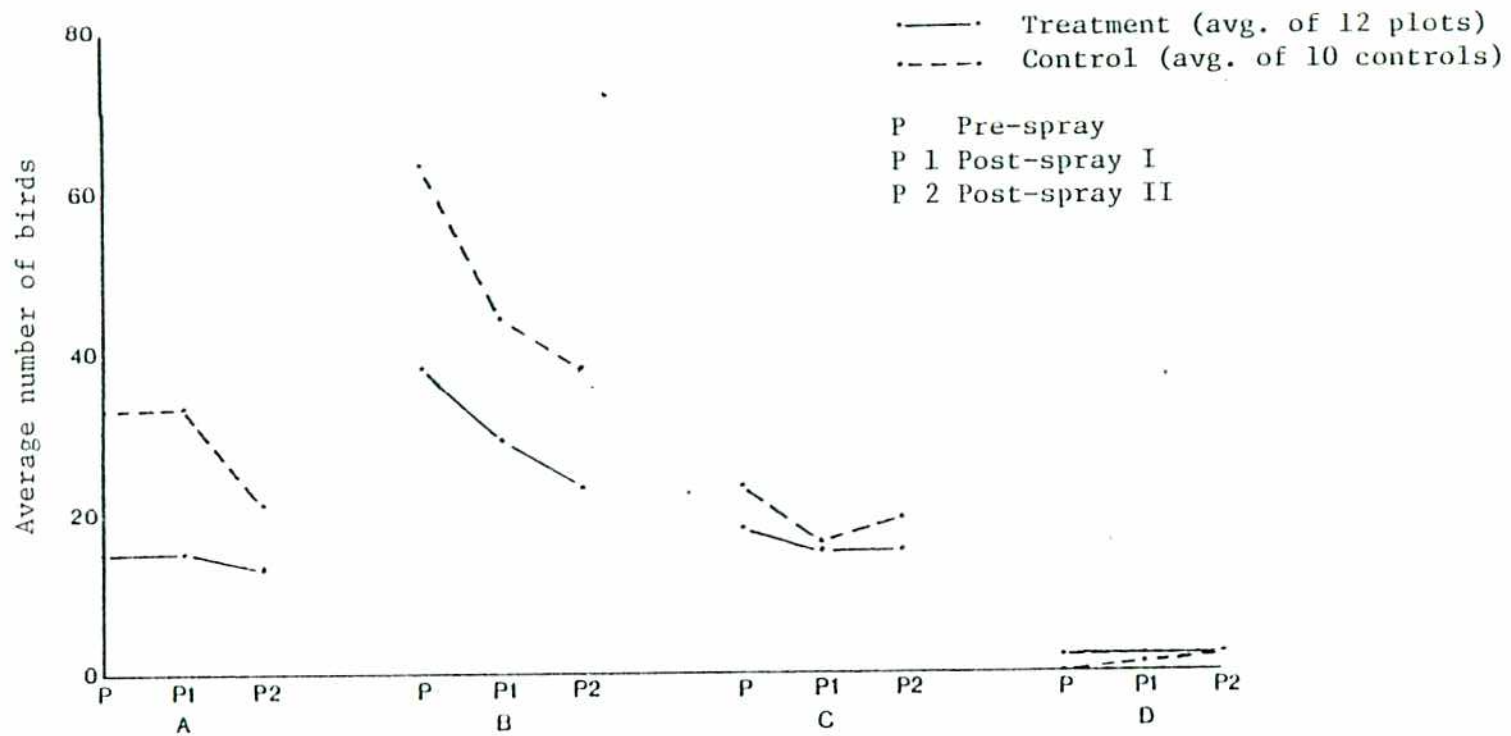


Fig. 4. Comparison of activity of predominant families during pre- and postspray time periods on phosphamidon double application and control plots, New Brunswick, 1974. A = Turdidae, B = Parulidae, C = Fringillidae, D = Tyrannidae.

Table 5. Phosphamidon residues in foliage collected from spray blocks in New Brunswick, July 1974.

Block No.	Plot No.	Treatment # 1				Treatment # 2			
		Date treated	Date collected	Foliage sampled	Residue (p.p.m.)	Date treated	Date collected	Foliage sampled	Residue (p.p.m.)
1		July 14	July 14	white spruce	0.92	July 21	July 21	white spruce	0.37
7		July 17	July 17	white spruce	0.60				
8		July 16	July 16	balsam fir	0.88	July 21-22	July 21	balsam fir	2.46
				white spruce	1.32			white spruce	3.51
								balsam fir	1.06
9	9	July 16	July 16	white spruce	1.35	July 21-22	July 21	balsam fir	5.38
11	12	July 16	July 16	white spruce	3.83	July 21	July 21	white spruce	0.70
				white spruce	3.06				
				balsam fir	4.58				
12	3	July 14	July 14	white spruce	0.93	July 21	July 21	white spruce	7.60
13	13	July 13	July 13	white spruce	0.18	July 17	July 21	white spruce	2.43
16	4	July 14	July 14	balsam fir	3.00	July 21-23	July 21	balsam fir	3.41
17	5	July 16	July 16	white spruce	1.19	July 22	July 22	balsam fir	10.63
				white spruce	0.16				
	2	July 14	July 14	balsam fir	0.27	July 22	July 22	white spruce	1.50
	3	July 16	July 16	white spruce	0.96	July 21	July 21	white spruce	1.67
Average 1.55					Average 3.39				

Data provided by Dr. K.M.S. Sundaram.

Table 6
 Changes in abundance of selected bird species
 following a double application of Phosphamidon
 Gloucester and Northumberland Counties, New Brunswick.
 8-25 July, 1974.

Days before or after application* of Phosphamidon	Treatment															
	Pre-spray					Daily avg.	Post-spray I				Daily avg.	Post-spray II			Daily avg.	
	-5	-4	-3	-2	-1		+1	+2	+3	+4		+1	+2	+3		
<u>Block</u>	<u>Plot</u>															
1	Allardville	14 ¹	27	23	25	26	23.0	29	25	31	23	27.0	30	35	23	29.3
7	44 mile Brook	73	75	66	66	53	66.6	49	47	42	41	44.8	46	46	26	39.3
8	Canoe Lake	54	79	41	73	60	61.4	56	29	24	30	34.8	27	29	25	27.0
8	Bowser Lake	39	62	62	58	38	51.8	49	57	12	30	37.0	33	47	34	38.0
9	9-Heath Steele Mines	58	51	56	51	50	53.2	43	68	53	22	46.5	58	35	40	44.3
11	12-Urquharts	185	134	146	114	56	127.0	90	101	106	58	88.8	60	96	100	85.3
12	3	126	93	74	119	85	99.4	54	112	94	126	96.5	40	112	26	59.3
13	13-Hwy 430	178	182	120	98	208	157.2	166	137	100	146	137.3	157	151	84	130.7
16	4-Airport Rd.	121	117	112	100	134	116.8	69	87	115	109	95.0	46	105	115	88.7
17	5-Airport Rd.	84	112	74	89	45	80.8	100	75	81	63	79.8	86	21	14	40.3
	2	53	85	61	42	76	63.4	39	76	88	95	74.5	65	55	86	68.7
	3	20	42	41	53	65	44.2	54	34	23	24	33.8	38	37	31	35.3
Average number of birds		83.8	88.3	73.0	74.0	74.7	78.8	66.6	70.7	64.1	63.9	66.3	57.2	64.1	50.5	57.2
Average number of species		14.1	14.6	13.6	12.6	14.5	13.9	13.5	13.3	13.3	13.3	13.4	12.6	13.5	11.9	12.7
<u>Control</u>																
	<u>Block</u>															
	1	214	158	203	214	243	206.4	132	103	154	147	134.0	161	108	108	125.7
	7	34	47	38	37	23	35.8	20	37	23	35	28.8	37	26	27	30.0
	8 & 9	48	34	47	38	37	40.8	23	20	23	35	25.3	37	26	27	30.0
	8	12	18	33	29	30	24.4	24	10	16	8	14.5	19	17	19	18.3
	11	203	214	243	132	103	179.0	154	172	147	147	155.0	161	108	108	125.7
	12	200	214	203	214	243	214.8	103	154	172	147	144.0	108	108	108	108.0
	13	200	214	158	203	214	197.8	243	132	103	154	158.0	172	147	147	155.3
	16	214	158	203	214	243	206.4	103	154	172	147	144.0	161	108	108	125.7
	17 & 3	12	18	33	29	10	20.4	24	10	16	8	14.5	19	17	19	18.3
	2	158	203	214	243	132	190.0	103	154	172	147	144.0	108	108	108	108.0
Average number of birds		129.5	127.8	137.5	135.3	127.8	131.6	92.9	94.6	99.8	97.5	96.2	98.3	77.3	77.9	84.5
Average number of species		15.4	15.0	17.5	16.4	15.3	15.9	14.4	14.4	14.2	13.6	14.2	14.5	13.7	14.8	14.3

*application omitted at 0.070 kg AI/ha.

¹ number of birds/day

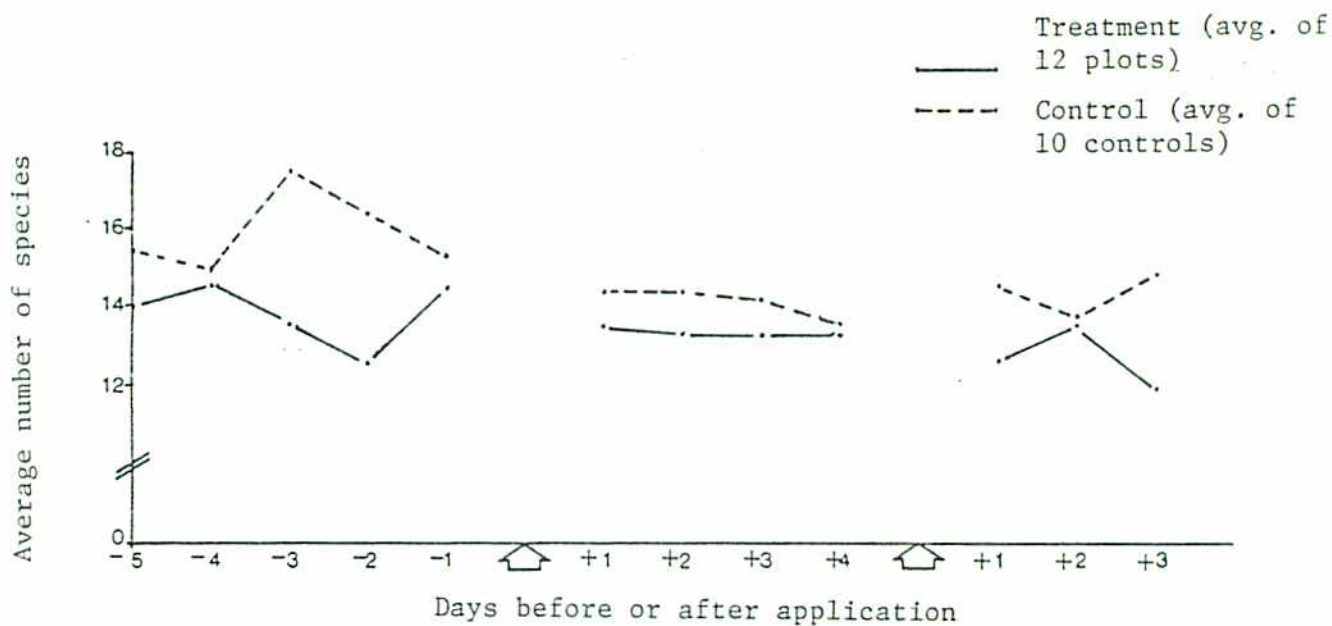


Fig. 5. Comparison of species diversity on treatment and control plots, Phosphamidon double application blocks, New Brunswick, 1974.

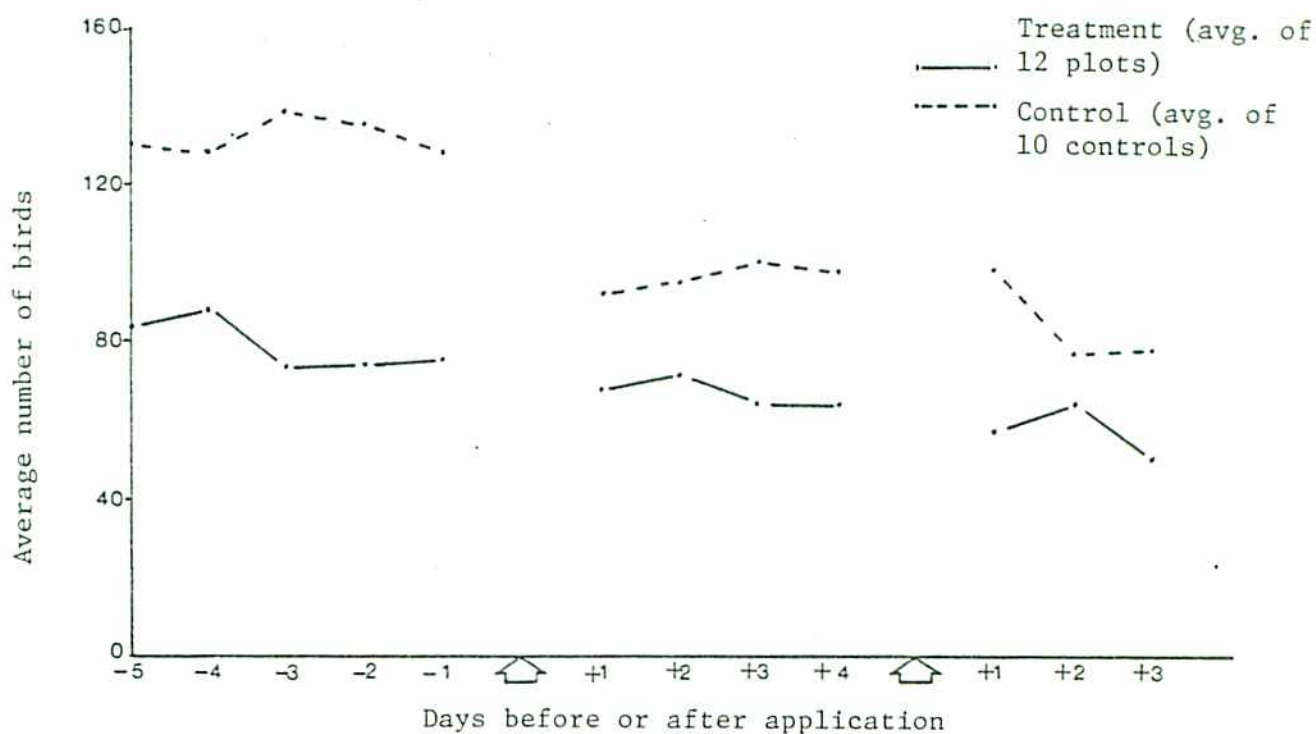


Fig. 6. Comparison of activity of selected species on treatment and control plots. Phosphamidon double application blocks, New Brunswick, 1974.

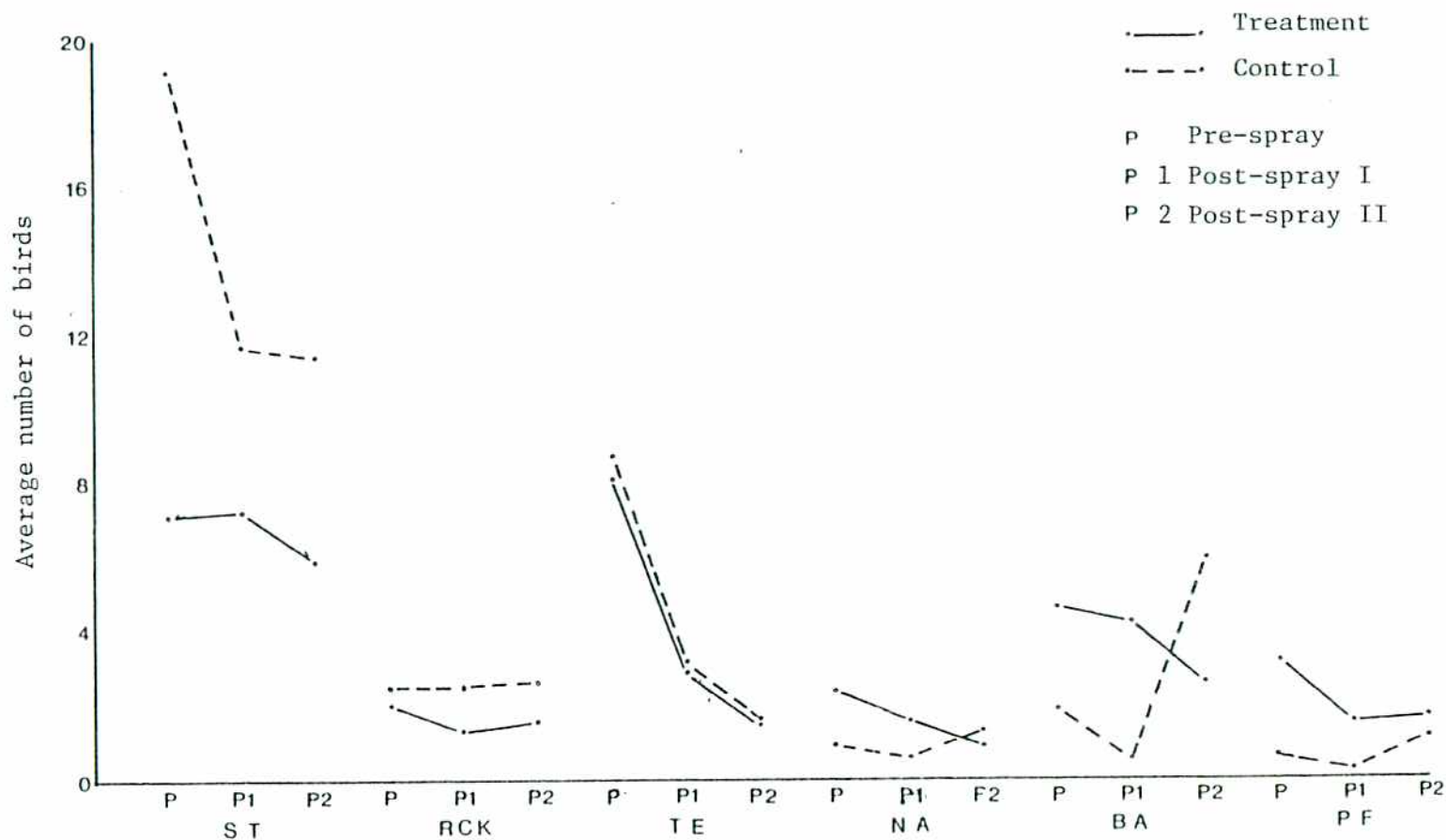


Figure 7. Changes in activity of selected species over pre- and post-spray time periods. ST = Swainson's thrush, RCK = Ruby-crowned Kinglet, TE = Tennessee warbler, NA = Nashville warbler, BA = Baybreasted warbler, PF = Purple finch. Phosphamidon double application blocks, New Brunswick, 1974.

Table 7. Pre- and Post-spray Numbers of the American redstart, bay-breasted, and magnolia warblers in the untreated control block.

Days before or after application	Pre-spray					Post-spray I				Post-spray II*		
	-5	-4	-3	-2	-1	+1	+2	+3	+4	+1	+2	+3
Species												
American redstart	36	44	46	50	50	30	26	38	42	2	2	6
Baybreasted warbler	2	2	2	0	5	0	0	1	0	10	14	22
Magnolia warbler	0	2	1	2	0	4	4	0	0	14	14	29

* change in observer for post-spray II censuses

- denotes days before the first spray

+ denotes days after each spray

Phosphamidon-Triple Application

Spray blocks treated with three applications of phosphamidon, were located in Acadia Forest, Sunbury County (1976 and 1977) and in Heath Steele, Northumberland County (1977) (Fig. 1). Treatments were on 4, 6 and 9 July in 1976³, on 9, 10 and 14 July in Acadia Forest, 1977⁴, and on 11, 14 and 16 July in Heath Steele, 1977⁴.

Foliage from white spruce, growing in open areas on treatment plots, was collected shortly after each application for the 1976 program only. Needles and twigs (100 g) were preserved in 100 ml of residue free ethyl acetate and returned to the laboratory for gas-liquid chromatographic analysis.

The residues recovered indicate a fairly even distribution over the 1976 trial plots (Table 8). Residue levels were generally lower than those obtained from foliage samples in 1974 (Tables 2 and 5). As the collection techniques were alike, the difference may have been due to the laboratory analysis technique or a lighter deposition rate in 1976.

Four plots were monitored for pesticide effects of the 1976 spray program. Census results for each plot plus controls are given in Appendix III (Tables 1-6). Bird activity at the time of treatment (4 to 9 July) had declined from a peak level around mid-June. Two plots and two checkpoints were monitored for pesticide effects of the 1977 spray program. Census results for these plots plus controls are given in Appendix III (Tables 7-14).

It is apparent from both data sets that activity patterns on treatment plots follow natural trends observed on control plots (Tables 9 and 10, Fig. 8). Following the third application, in both the treatment and control plots song frequency declined, coupled with a reduction in species diversity (Fig. 9) due to reductions in the territorial behavior of the breeding male birds. Activity patterns of predominant families were not visibly affected by treatment (Fig. 10). Species such as the American robin, ruby-crowned kinglet, American redstart and dark-eyed junco, which occupy niches of high exposure to aerial applications, were not affected by the treatments (Fig. 11). Extensive plot searches did not reveal any dead birds or birds exhibiting signs of pesticide stress. Nests of the magnolia warbler, and Swainson's thrush were observed throughout the 1977 spray program, and the young fledglings were unharmed.

³ 0.070 kg AI/ha phosphamidon in 0.73 L/ha formulation.

⁴ 0.070 kg AI/ha phosphamidon in 0.73 L/ha formulation, with water as the carrier.

Table 8. Phosphamidon residues analyzed from foliage collected from spruce budworm *C. fumiferana* (Clem.) adult suppression trials. Acadia Forest Experiment Station, New Brunswick July, 1976.

Plot No.	Date of treatment	Time foliage sampled relative to treatment (hours)	Emitted dosage rate (kg AI/ha)	Phosphamidon residues (ppm)
Plot 1		pre-spray sample	nil	N.D.
Plot 2		pre-spray sample	nil	N.D.
Plot 3		pre-spray sample	nil	N.D.
Plot 4		pre-spray sample	nil	N.D.
1st application				
Plot 1	July 4	18	0.070	0.37
Plot 2	July 4	18	0.070	0.68
Plot 3	July 4	18	0.070	1.36
Plot 4	July 4	18	0.070	0.41
2nd application				
Control Plot	July 6	5	nil	N.D.
Plot 1	July 6	6	0.070	0.62
Plot 2	July 6	8	0.070	0.66
Plot 3	July 6	4	0.070	0.19
Plot 4	July 6	4	0.070	0.27
3rd application				
Plot 1	July 9	18	0.070	0.76
Plot 2	July 9	18	0.070	0.30
Plot 3	July 9	18	0.070	0.61
Plot 4	July 9	18	0.070	0.61

N.D. - Not detectable.

Residue analysis performed by Dr. K.M.S. Sundaram.

Table 9
 Changes in the abundance of selected bird species
 following a triple application of Phosphamidon
 Acadia Forest, Sunbury County, New Brunswick.
 28 June-13 July, 1976.

		Treatment																		
		Pre-spray					Post-spray I			Post-spray II					Post-spray III					
Days before or after application* of Phosphamidon		-6	-5	-4	-1	-0	Daily avg.	+1	+2	Daily avg.	+0	+1	+2	+3	+4	Daily avg.	+1	+2	+3	Daily avg.
Block	Plot																			
1	1	74 ¹	71	91	82	84	80.4	106	87	96.5	-	85	83	98	-	88.7	123	90	77	96.7
1	2	69	60	59	100	117	81.0	107	93	100.0	-	83	64	96	-	81.0	125	81	90	98.7
2	3	107	102	90	40	112	90.2	137	107	122.0	-	129	84	119	-	110.7	118	133	56	102.3
2	4	108	118	105	100	81	102.4	88	-	88.0	98	112	126	117	115	113.6	86	70	72	76.0
Average number of birds		89.5	87.8	86.3	80.5	98.5	88.5	109.5	95.7	102.6	98.0	102.3	89.3	107.5	115.0	102.4	113.0	93.5	73.8	93.4
Average number species		18.8	18.3	18.5	17.5	19.5	18.5	20.5	20.0	20.3	23.0	21.0	19.5	21.0	22.0	21.3	20.3	20.5	18.0	19.6
		Control																		
Control	for 1,2,3	129	109	109	116	112	115.0	105	118	111.5	-	119	103	92	-	104.7	133	94	95	107.3
	for 4	129	109	109	116	112	115.0	105	-	105.0	118	119	103	92	133	113.0	94	95	66	85.0
Average number of birds		129	109	109	116	112	115.0	105	118	111.5	118	119	103	92	133	113.0	113.5	94.5	80.5	96.2
Average number of species		24	23	24	23	23	23.4	19	24	21.5	24	23	26	22	26	24.2	24.5	25.0	23.5	24.3

*application emitted at 0.070 kg AI/ha
¹ number of birds/day

Table 10
 Changes in the abundance of selected bird species
 following a triple application of Phosphamidon
 Sunbury and Northumberland Counties, New Brunswick
 4-21 July, 1977.

Days before or after application* of Phosphamidon	Treatment																	
	Pre-spray					Daily avg.	Post-spray I		Daily avg.	Post-spray II		Daily avg.	Post-spray III					Daily avg.
	-5	-4	-3	-2	-1		+1	+3		+1	+1		+1	+2	+3	+4	+5	
<u>Plot</u>																		
CP 3	16 ¹	14	22	18	18	17.6	21	21	21.0	17	17.0	9	8	19	5	6	9.4	
CP 4	20	6	25	25	20	19.2	30	29	29.5	18	18.0	23	12	14	12	6	13.4	
11	28	47	44	53	31	40.6	42	58	50.0	-	-	41	-	-	33	10	28.0	
12	48	28	59	38	43	43.2	54	45	49.5	-	-	53	-	12	27	30	30.5	
Average number of birds	28.0	23.8	37.5	33.5	28.0	30.2	36.8	38.3	37.5	17.5	17.5	31.5	10.0	15.0	19.3	13.0	17.8	
Average number of species	8.5	7.3	12.0	10.8	9.3	9.6	12.5	11.0	11.8	6.5	6.5	9.0	3.5	6.3	6.5	4.5	6.0	
<u>Control</u>																		
<u>Plot</u>																		
CP 1	23	14	12	18	18	17.0	16	18	17.0	14	14.0	19	10	15	11	9	12.8	
CP 2	23	14	23	23	20	20.6	26	18	22.0	28	26.0	25	11	17	21	14	17.6	
Control for plot 11	30	26	58	30	35	35.8	57	39	48.0	-	-	48	-	-	33	8	29.7	
Control for plot 12	50	26	58	30	35	39.8	57	39	48.0	-	-	48	-	-	33	8	29.7	
Average number of birds	31.6	20.0	37.8	25.3	27.0	28.3	39.0	28.5	33.8	21.0	21.0	35.0	10.5	16.0	24.5	4.8	18.2	
Average number of species	8.8	7.0	12.5	6.8	8.8	8.8	10.0	7.5	8.8	7.0	7.0	10.8	5.5	5.5	7.8	3.3	6.6	

*Application emitted at 0.070 kg AI/ha
¹number of birds/day

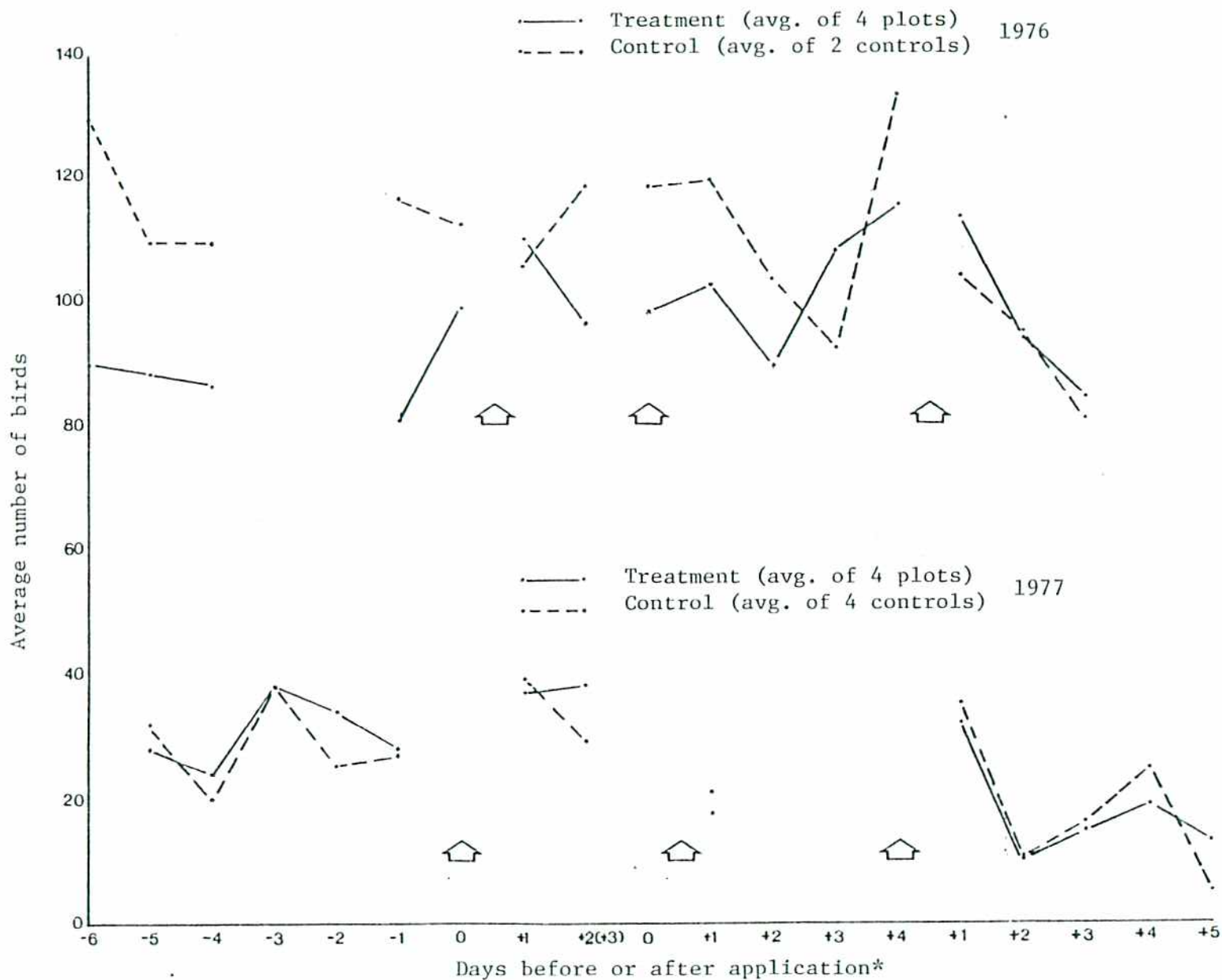


Figure 8. Comparison of activity of selected bird species on treatment and control plots for two different years. *The number in brackets is for 1977 data. Phosphamidon triple application blocks, New Brunswick, 1976 and 1977.

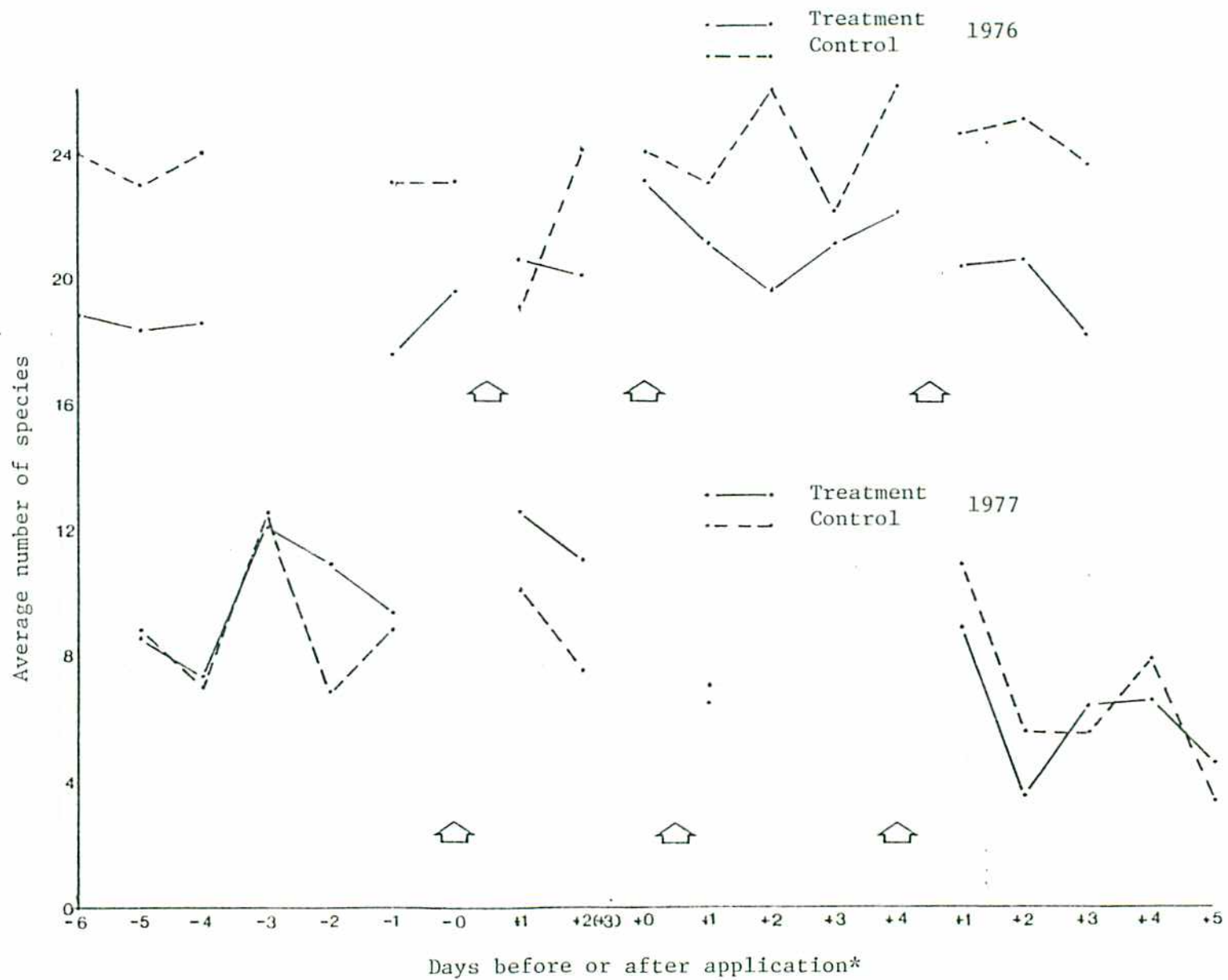


Figure 9. Comparison of species diversity on treatment and control plots for two different years. *The number in brackets is for 1977 data. Phosphamidon triple application blocks, New Brunswick, 1976 and 1977.

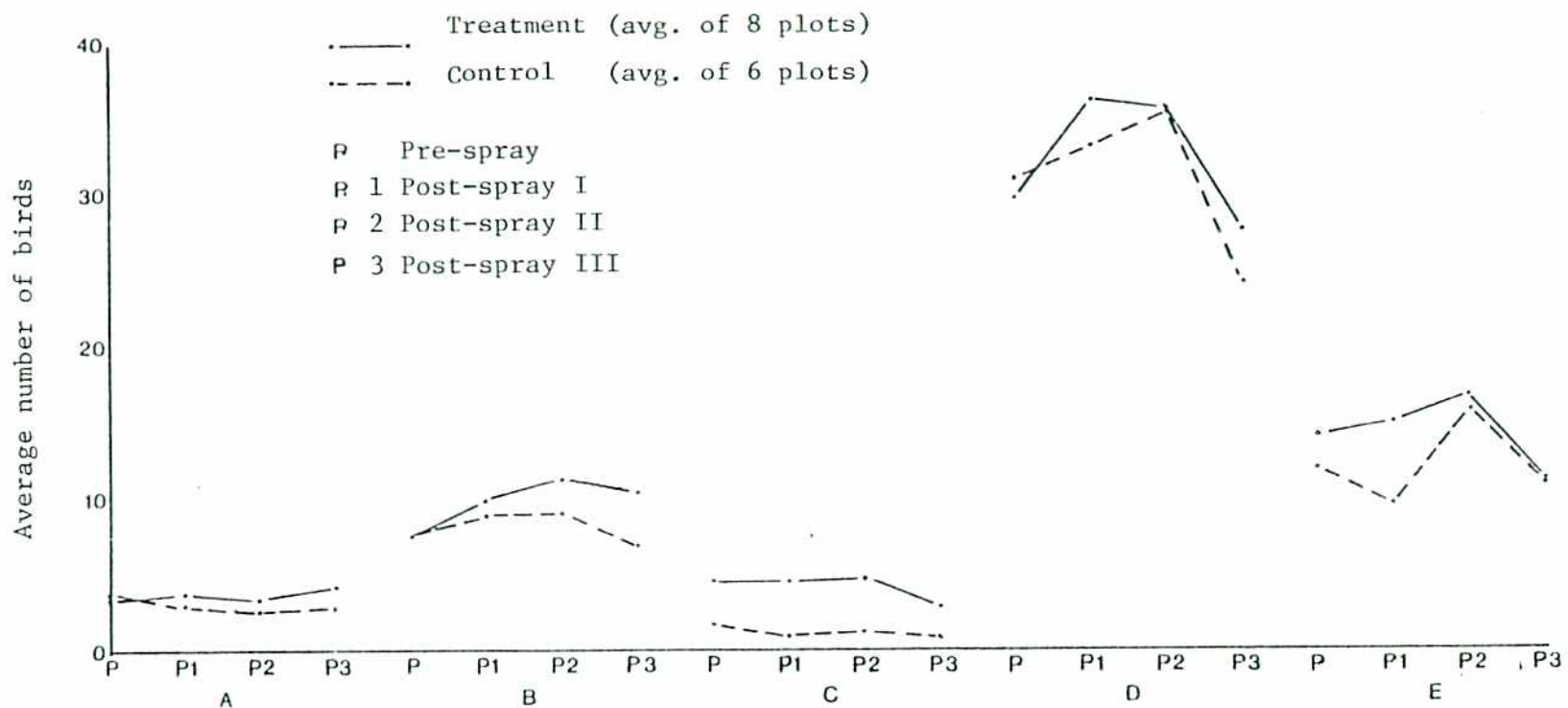


Figure 10. Comparison of activity of predominant families on treatment and control plots for both 1976 and 1977 combined. A = Tyrannidae, B = Turdidae, C = Sylviidae, D = Parulidae, E = Fringillidae. Phosphamidon triple application blocks, New Brunswick, 1976 and 1977.

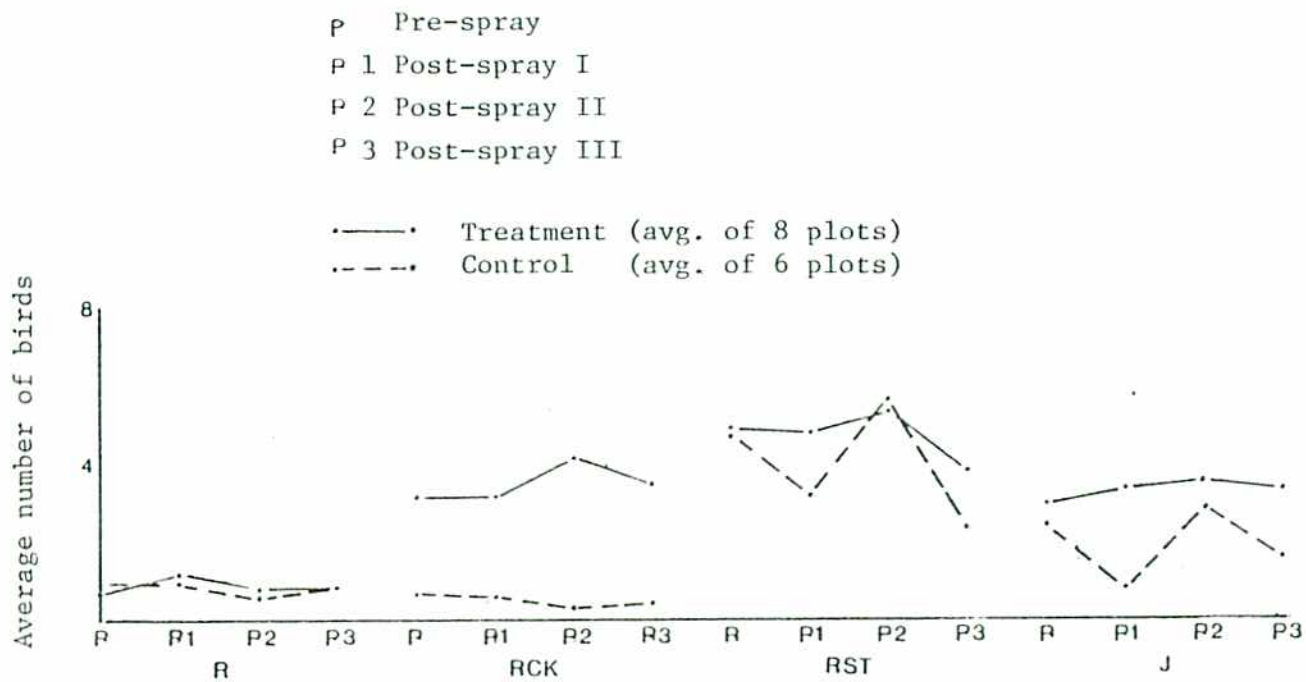


Figure 11. Comparison of activity of selected species on treatment and control plots for both 1976 and 1977 combined. R = American robin, RCK = Ruby-crowned Kinglet, RST = American redstart, J = Dark-eyed Junco. Phosphamidon triple application blocks, New Brunswick, 1976 and 1977.

Phosphamidon-Five Applications

One block, located in Northumberland County (Fig. 1), received five applications of phosphamidon emitted at 70 g AI/ha on 6, 7, 10, 11 and 13 July, 1975. No censuses were conducted before the first two treatments so trends in this block must be compared to those in the control area.

Generally, the treated plot contained a more diverse avifauna than that of the control (Table 11). The population levels and species diversity tended to decrease slightly in the treated plots but rose considerably in the untreated control plot (Figs. 12 and 13). Daily totals in the treatment from 7 to 14 July were largely influenced by the occurrence of small foraging flocks of birds (Evening grosbeaks, *Hesperiphona vespertina* (Cooper), purple finches, and pine siskins *Spinus tristis* (Linnaeus)) which increased the total number of birds by up to 35% over the resident bird population (Appendix IV, Table 1). When present, evening grosbeaks and purple finches were consistently in flocks. Only one male purple finch appeared to have established a territory. Groups of 5 to 12 pine siskins were observed together. Breeding individuals of pine siskins are known to congregate in social flocks away from their nesting territory (Bent 1968). This may also explain the large decrease in Fringillidae activity seen after the treatment, but not observed in the control area (Fig. 14). However, the large decrease in thrushes appears to be due to a reduction in activity of the woodthrush *Hylocichla mustelina* (Gmelin), a species not recorded in the control block. Activity of other thrushes, (American robin, Swainson's thrush, veery, *Catharus fuscescens* (Stephens)), present in the control shows similar trends suggesting that reduction of the woodthrush activity was not pesticide related. The large increase in warbler activity on control, was mainly due to a flock of Tennessee warblers and unidentified warblers on 15 July (Appendix IV, Table 2). This was most likely pre-migratory flocking behavior as many juvenile warblers were observed in the control, however no young were sighted on treatment. Both the Tennessee and Cape May warblers were not recorded on treatment during the second post-spray period (Appendix IV, Table 1). Control observations of the Tennessee warbler were of transient birds, and with no control data for the Cape May warbler, it is difficult to assess the impact. Both are canopy feeders as are the American redstart, and the Northern parula warbler, *Parula americana* (Linnaeus). With no indication of an effect on these species, the significance of the reductions is not known. Resident population numbers of Vireonidae and Sylviidae were extremely low (Appendix IV, Tables 1 and 2) though apparently unaffected by treatment.

Table 11
 Changes in abundance of selected bird species
 following five applications* of Phosphamidon.
 Northumberland County, New Brunswick.
 7-17 July, 1975.

Family	Treatment										Control								
	1st Post-spray census period**					2nd post-spray census period***					1st Post-spray census period				2nd post-spray census period				
	July 7	July 8	July 9	July 10	Daily avg.	July 14	July 15	July 16	July 17	Daily avg.	July 8	July 9	July 10	Daily avg.	July 14	July 15	July 16	July 17	Daily avg.
Tyrannidae	2	0	0	0	0.5	0	2	2	0	1.0	0	0	0	0.0	0	2	4	0	1.5
Turdidae	12	11	24	25	18.0	17	12	18	10	14.3	8	13	12	11.0	10	10	17	12	12.3
Sylviidae	0	0	0	0	0.0	0	0	2	4	1.5	0	0	0	0.0	0	0	0	4	1.0
Vireonidae	2	0	0	2	1.0	2	0	0	0	0.5	0	0	0	0.0	0	0	0	6	1.5
Parulidae	34	22	28	26	27.5	32	30	28	32	30.5	15	28	26	23.0	22	48	44	30	36.0
Fringillidae	54	32	51	32	42.3	52	26	13	12	25.8	2	2	1	1.7	6	9	8	8	7.8
Number of birds	104	65	103	85	89.3	103	70	63	58	73.5	25	43	39	35.7	38	69	73	60	60.0
Number of species	20	16	19	20	18.8	20	16	18	14	17.0	8	9	9	8.7	11	17	19	15	15.5

*application emitted at 0.070 kg AI/ha.

**after first two phosphamidon applications

***after all five phosphamidon applications

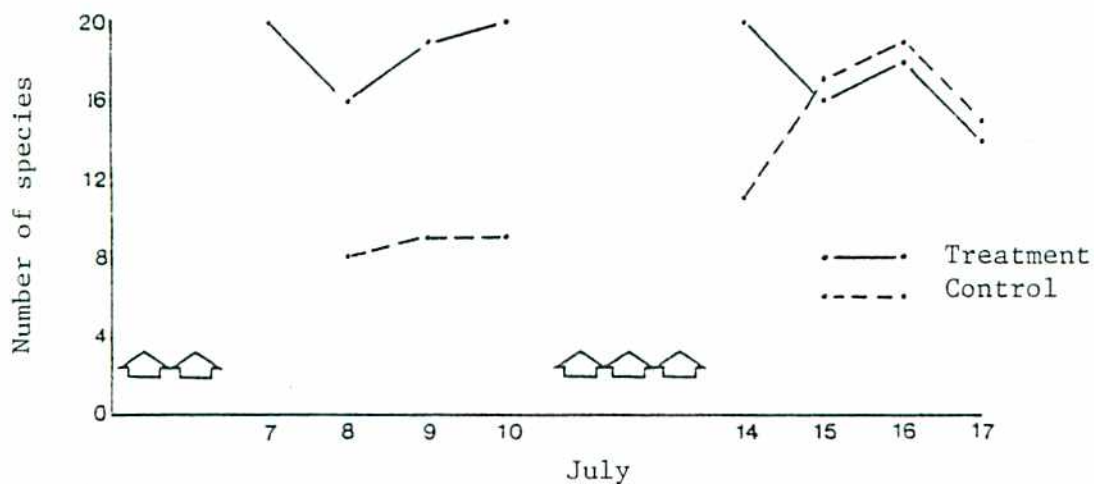


Figure 12. Comparison of species diversity on treatment and control plots. Phosphamidon five application blocks, New Brunswick, 1975.

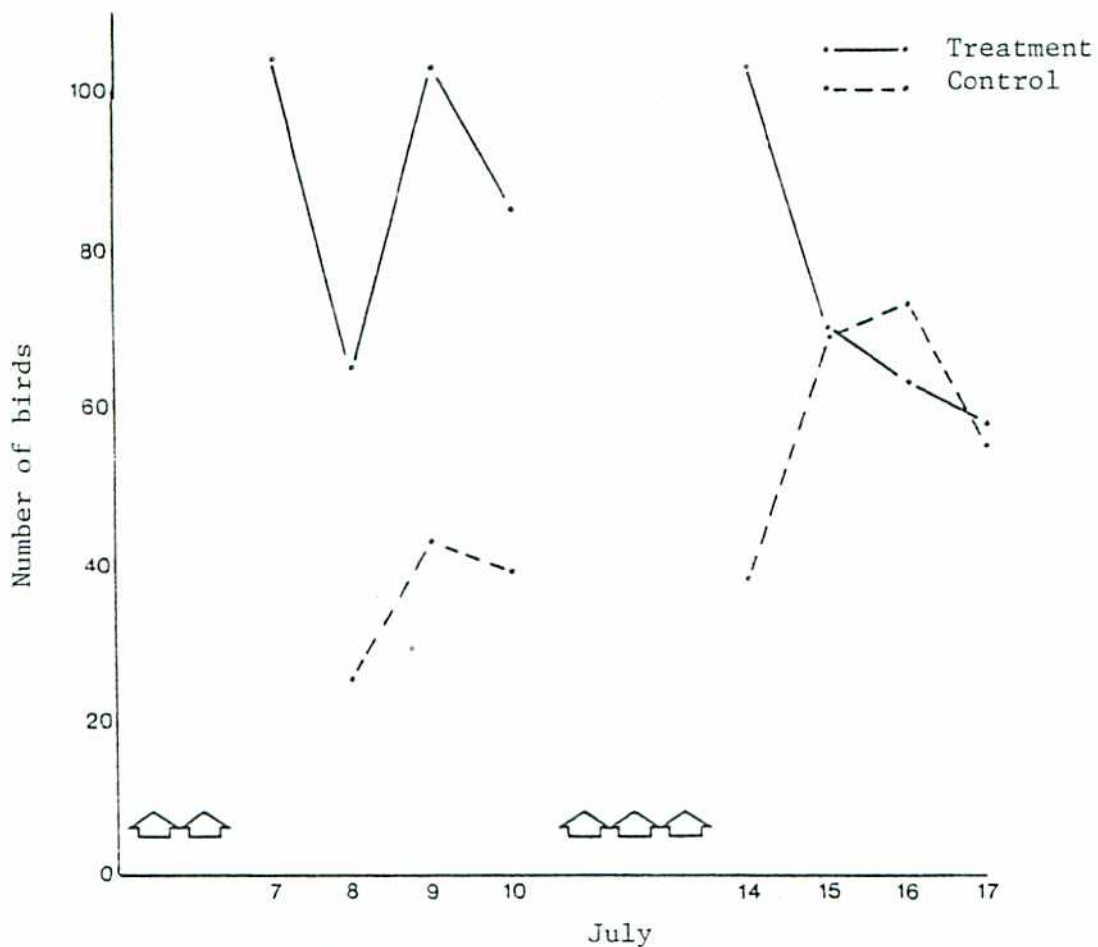


Figure 13. Comparison of activity of selected bird species on treatment and control plots. Phosphamidon five application blocks, New Brunswick, 1975.

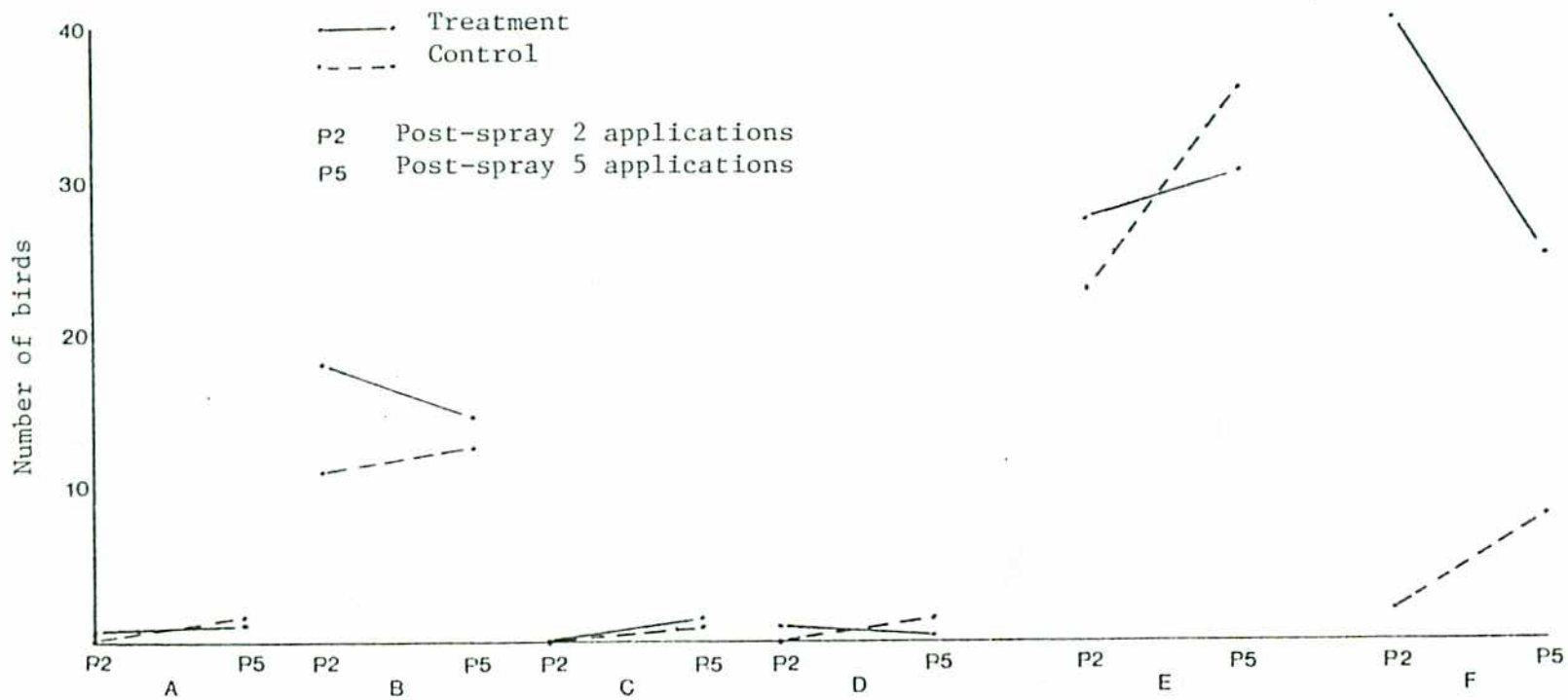


Figure 14. Comparison of activity of predominant families on treatment and control plots.
 A = Tyrannidae, B = Turdidae, C = Sylviidae, D = Vireonidae, E = Parulidae,
 F = Fringillidae. Phosphamidon five application blocks, New Brunswick, 1975.

Phosphamidon-plus motor stimulants, Double application

In July 1977, one spray block (approximately 100 ha), located in Acadia Forest (Fig. 1), Sunbury County, was treated with phosphamidon coupled with a moth irritant⁵. Two treatment plots, plus a control, were monitored for impact on forest songbirds. The population structure of each plot is presented in Appendix V (Tables 1-3).

Decreased numbers of selected species corresponded to a decrease in song frequency due to a gradual breakdown of breeding territories (Table 12). This was especially apparent in the control block (Fig. 15). Species diversity remained fairly stable however, with the fluctuations mainly due to censusing conditions (Fig. 16). During the second post-spray period in the control block, the census on "day+1" was conducted later in the day when frequency of singing is naturally decreased. Windy conditions on "days+1 and +4" may have further depressed activity. In comparing activity of predominant families, the numbers closely resemble those of the control with a natural breakdown of territories again apparent (Fig. 17). The numbers of Turdidae are especially low during the second post-spray period in the control block due to the census conditions on day+1, already explained above. Redstart activity was more depressed in the treatment block than in the control, however other species occupying niches of high exposure to aerial treatments (American robin, dark-eyed junco), were not affected by the treatments (Fig. 18). Furthermore, fledgling counts were higher in the treatment than in the control, indicating survival of healthy populations including species potentially at risk due to their high exposure (Tables 13, 14 and 15).

⁵ 70 g/ha Phosphamidon + 1.7 g/ha pyrethrin + 7 g piperonyl butoxide (a synergist).

Table 12
 Changes in abundance of selected bird species
 following a double application of Phosphamidon
 plus a motor stimulant.
 Sunbury County, New Brunswick, 5-19 July 1977.

Days before or after application ^a	Treatment															Daily avg.	
	Pre-spray					Daily avg.	Post-spray I			Daily avg.	Post-spray II						
	-5	-4	-3	-2	-1		+1	+3	+4		+1	+2	+3	+4	+5		
<u>Block</u>	<u>Plot</u>																
1	1	112 ¹	107	110	106	99	106.8	107	88	66	87.0	69	67	92	63	58	69.8
1	3	72	115	63	109	98	91.4	93	107	95	98.3	90	99	98	76	66	85.8
Average number of birds		92.0	111.0	86.5	107.5	98.5	99.1	100.0	97.5	80.5	92.7	79.5	83.0	95.0	69.5	62.0	77.8
Average number of species		17.0	20.5	18.5	21.5	20.0	19.5	19.0	19.0	17.5	18.5	16.5	16.5	19.5	17.5	15.5	17.1
<u>Control</u>																	
<u>Block</u>	<u>Plot</u>																
Control	5	94	101	87	112	78	94.4	90	30	43	54.3	32	68	54	36	50	48.0
Average number of adults		94	101	87	112	78	94.4	90	30	43	54.3	32	68	54	36	50	48.0
Average number of species		23	25	25	26	21	24.0	22	14	17	17.7	11	18	18	14	15	15.2

^aapplication of 70 g phosphamidon + 1.7 g pyrethrin + 7 g piperonyl butoxide/ha.
¹number of birds/day

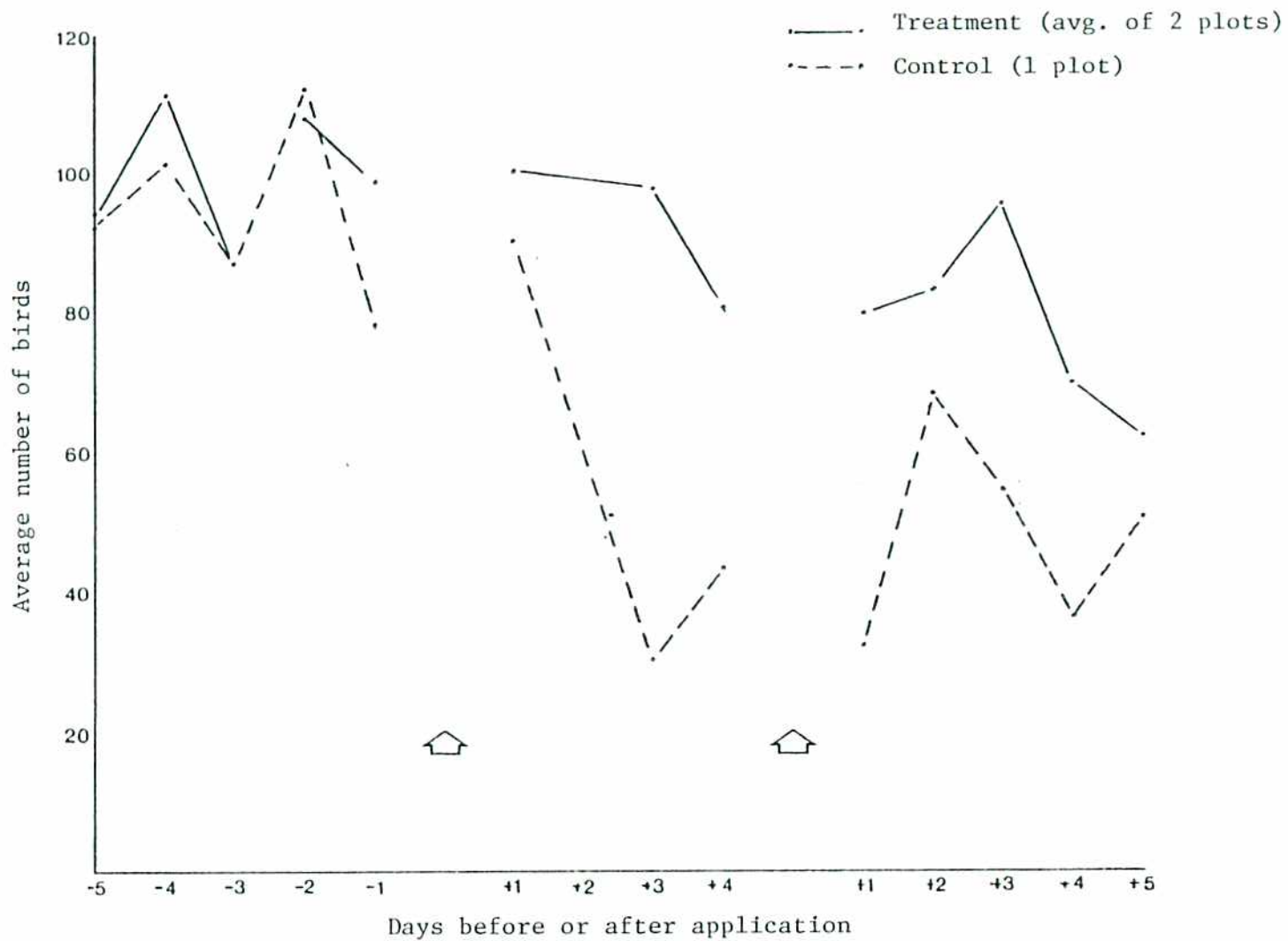


Figure 15. Comparison of activity of selected species on treatment and control plots. Phosphamidon plus a motor stimulant, New Brunswick, 1977.

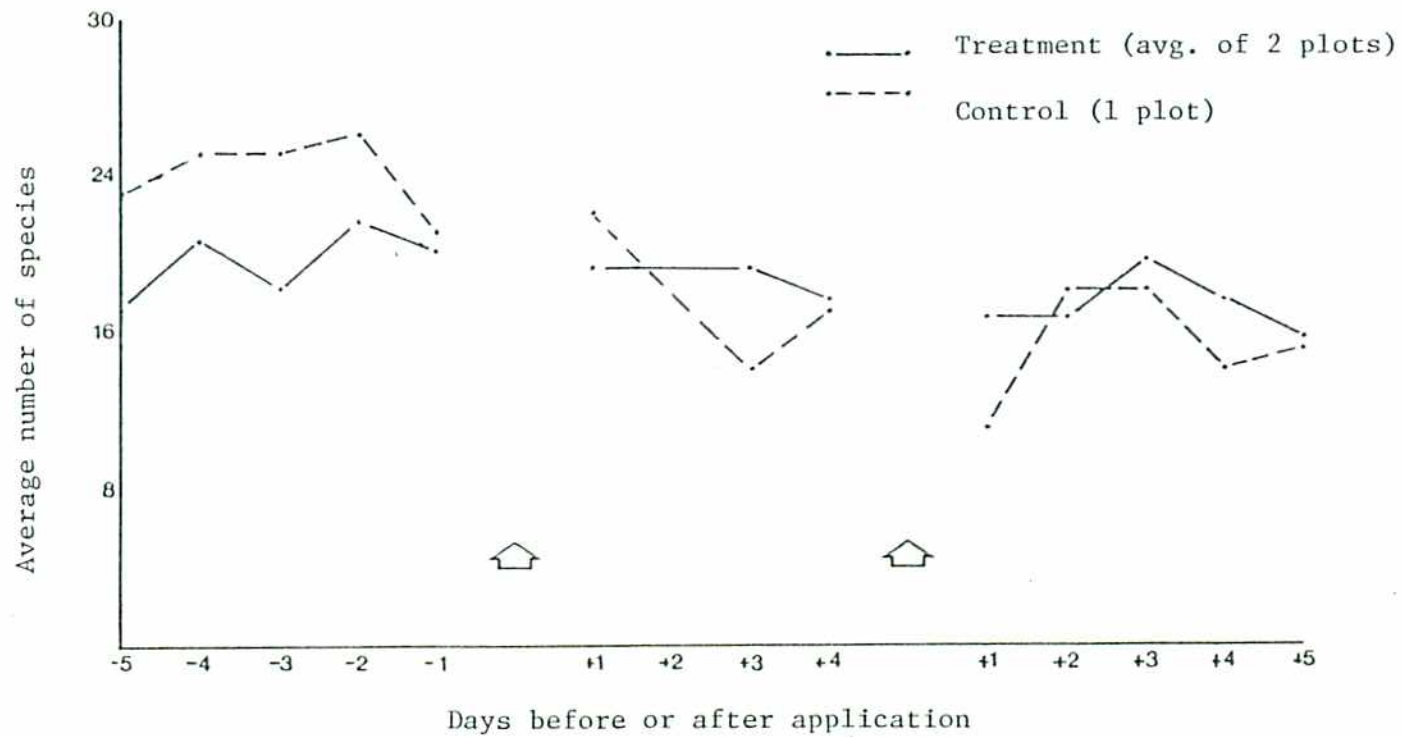


Figure 16. Comparison of species diversity in the treatment and control plots. Phosphamidon plus a motor stimulant, New Brunswick, 1977.

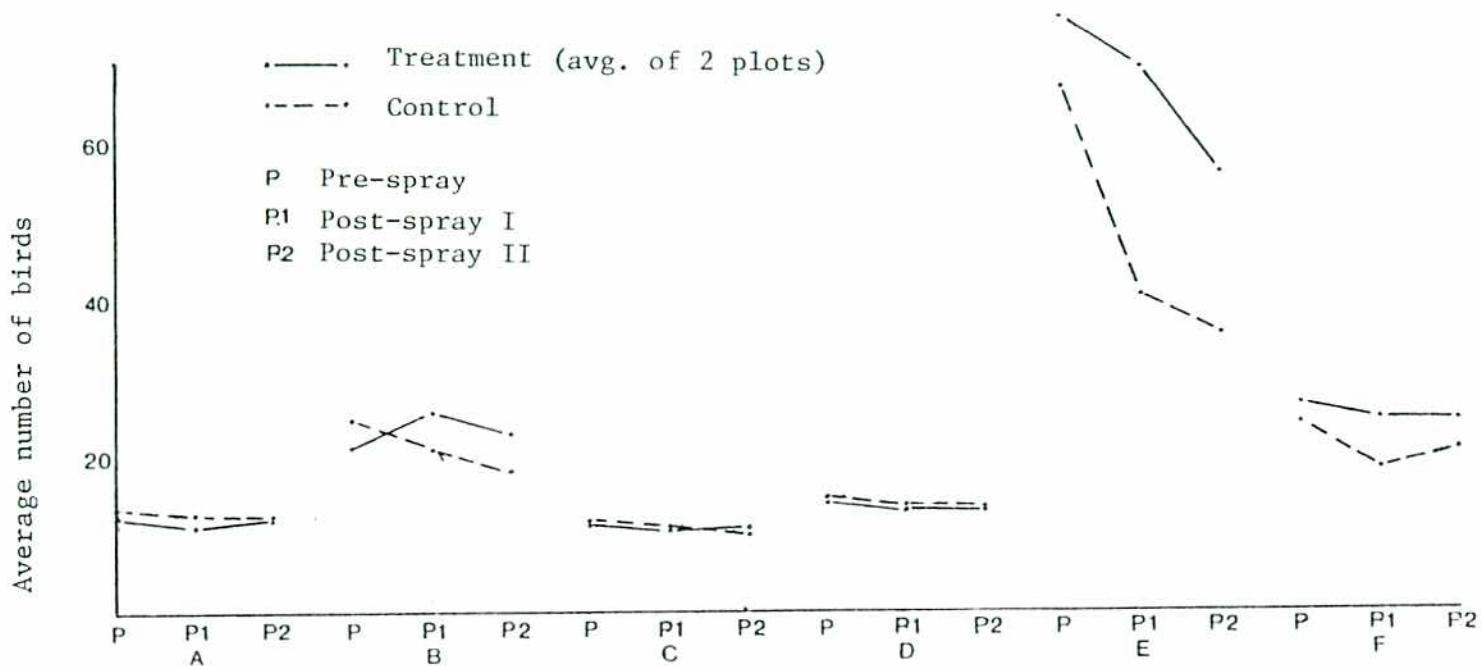


Figure 17. Comparison of activity of predominant families on treatment and control. A = Tyrannidae, B = Turdidae, C = Sylviidae, D = Vireonidae, E = Parulidae, F = Fringillidae. Phosphamidon plus a motor stimulant, New Brunswick, 1977.

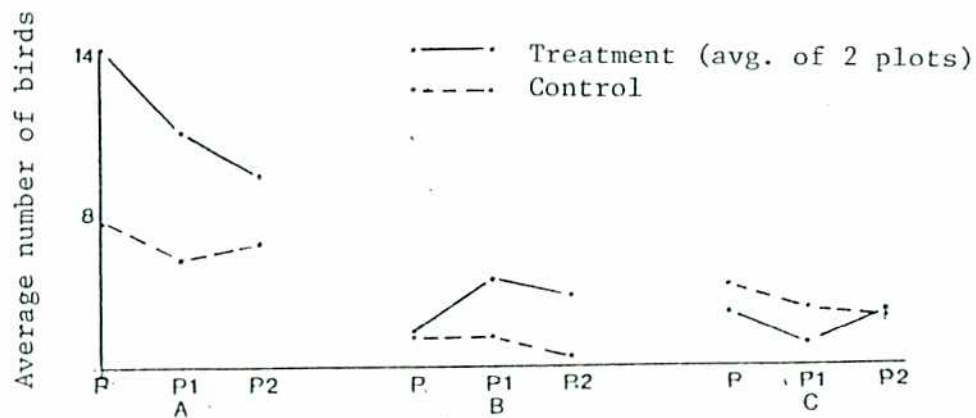


Figure 18. Changes in activity of selected species on treatment and control. A = American redstart, B = American robin, C = Dark-eyed Junco. Phosphamidon plus a motor stimulant, New Brunswick, 1977.

Table 13

Forest bird census results of fledgling counts Treatment Plot I, Sunbury County, New Brunswick, July 1977.

Species	Pre-spray						Post-spray I				Post-spray II					
	July	July	July	July	July	Daily Avg.	July	July	July	Daily Avg.	July	July	July	July	July	Daily Avg.
	5	6	7	8	9		11	13	14		15	16	17	18	19	
-5	-4	-3	-2	-1		+1	+3	+4		+1	+2	+3	+4	+5		
Tennessee Warbler	0	0	1	0	2	0.6	0	0	0	0.0	0	0	0	0	0	0.0
Magnolia Warbler	0	0	0	1	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Bay-breasted Warbler	0	0	2	0	0	0.4	4	1	0	1.7	1	0	4	0	2	1.4
Ovenbird	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0
Canada Warbler	0	1	2	0	0	0.6	0	0	0	0.0	0	0	0	0	0	0.0
American Redstart	0	4	1	1	0	1.2	0	2	1	1.0	0	0	2	2	2	1.2
White-throated Sparrow	0	0	2	1	0	0.6	1	0	0	0.3	0	0	0	1	0	0.2
Total fledglings	0	5	8	3	2	3.6	5	3	3	3.7	1	0	6	3	4	2.8

Table 14

Forest bird census results of fledgling counts Treatment Plot 3, Sunbury County, New Brunswick, July 1977.

Species	Pre-spray					Daily Avg.	Post-spray I				Daily Avg.	Post-spray II					Daily Avg.
	July 5	July 6	July 7	July 8	July 9		July 11	July 13	July 14	July 15		July 16	July 17	July 18	July 19		
	-5	-4	-3	-2	-1		+1	+3	+4	+1		+2	+3	+4	+5		
Hairy Woodpecker	0	2	0	0	1	0.6	0	2	0	0.7	0	1	0	0	0	0.2	
Black-capped chickadee	0	0	0	0	0	0.0	0	0	0	0.0	0	0	0	4	0	0.8	
Swainson's Thrush	0	0	0	0	0	0.0	1	0	0	0.3	1	0	0	1	0	0.4	
Solitary Vireo	0	0	0	0	0	0.0	0	0	0	0.0	0	1	0	0	0	0.2	
Tennessee Warbler	0	0	0	0	0	0.0	0	0	0	0.0	1	0	0	0	0	0.2	
Ovenbird	0	0	0	0	0	0.0	1	0	0	0.3	3	1	2	0	0	1.2	
Canada Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	0	0	2	0	0.4	
American Redstart	0	0	0	1	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0	
Rose-breasted Grosbeak	0	0	0	0	0	0.0	0	0	0	0.0	0	0	1	1	0	0.4	
Purple Finch	0	0	0	0	0	0.0	0	3	0	1.0	0	0	0	0	0	0.0	
Pine Siskin	0	0	0	0	0	0.0	0	0	0	0.0	0	1	0	0	0	0.2	
Dark-eyed Junco	0	2	0	0	0	0.0	0	0	0	0.0	1	0	0	0	0	0.2	
White-throated Sparrow	0	2	1	0	3	1.2	0	0	0	0.0	0	0	0	1	0	0.2	
Total fledglings	0	4	1	1	4	2.0	2	5	0	2.3	6	4	3	9	0	4.4	

Table 15

Forest bird census results of fledgling counts Control Plot 5, Sunbury County, New Brunswick, July 1977.

Species	Pre-spray						Post-spray I				Post-spray II					
	July 5	July 6	July 7	July 8	July 9	Daily Avg.	July 11	July 13	July 14	Daily Avg.	July 15	July 16	July 17	July 18	July 19	Daily Avg.
	-5	-4	-3	-2	-1		+1	+3	+4		+1	+2	+3	+4	+5	
Downy Woodpecker	0	1	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Swainson's Thrush	0	2	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Black-throated Green Warbler	0	1	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Bay-breasted Warbler	0	0	0	0	0	0.0	1	0	0	0.3	0	0	0	0	0	0.0
Pine Siskin	0	0	0	0	0	0.0	0	0	0	0.0	3	0	0	0	0	0.6
Dark-eyed Junco	0	0	0	2	0	0.4	0	0	0	0.0	0	0	0	0	4	0.8
White-throated Sparrow	0	3	0	1	0	0.8	0	0	1	0.3	0	0	0	0	0	0.0
Total fledgling	0	7	0	3	0	2.0	1	0	1	0.7	3	0	0	0	4	1.4

Aminocarb - Double Application

Block 5 plot 6, located near the Acadia Forest Experimental Station, Sunbury County (Fig. 1) received two applications of aminocarb emitted at 70 g AI/ha on 5 and 7 July 1976, respectively.

Population assessment of treatment and control plots (Appendix VI, Tables 1 and 2) indicates that resident bird populations did not suffer short-term reductions in abundance or species diversity (Table 16, Fig. 19). Activity trends in the treatment plot were quite similar to natural trends observed in the control (Fig. 20). There was no observed reduction in activity of Tyrannidae, Turdidae or Parulidae during either post-spray period (Fig. 21). Populations of the ruby-crowned and golden-crowned kinglets, *Regulus satrapa* Lichenstein, (family Sylviidae) remained stable throughout the study (Fig. 22). Increased numbers in the control plot during the first post-spray period, were due to irregular sightings of the golden-crowned kinglet. Decreased numbers of Fringillidae during the second post-spray period were mainly due to a reduction in the activity of purple finches (Fig. 22). Territorial breakdown in the treatment plot (Fig. 23) corresponds well with increased sightings of juveniles:

	Pre-spray	Post-spray I	Post-spray II
Number of purple finch territories	5	3	2
Number of purple finch juveniles	2	1	5

The treatment area may have been further ahead of the untreated plot phenologically as no juveniles were sighted in the control prior to the termination of the study. Populations of other species of potentially high exposure to aerial spraying (American robin, olive-sided flycatcher (Richmond *et al.* 1979)) were not adversely affected (Fig. 22). No sick or dead birds were recovered during plot searches.

Table 16
 Changes in abundance of selected bird species
 following a double application of aminocarb
 Sunbury County, New Brunswick.
 28 June-11 July, 1976.

Days before or after application* of aminocarb	Pre-spray					Daily avg.	Post- spray I		Daily avg.	Post-spray II					Daily avg.
	-7	-6	-5	-2	-1		+0	+1		+0	+1	+2	+3	+4	
Treatment block 5, plot 6															
Number of birds	102	121	93	99	57	94.4	110	114	112.0	113	98	112	118	130	114.2
Number of species	19	20	19	20	14	18.4	22	23	22.5	21	21	20	22	21	21.0
Control block															
Number of birds	68	68	33	87	64	64.0	63	48	55.5	59	61	54	91	89	70.8
Number of species	14	17	9	16	14	14.0	18	10	14.0	13	15	16	14	17	15.0

*application emitted at 0.070 kg AI/ha

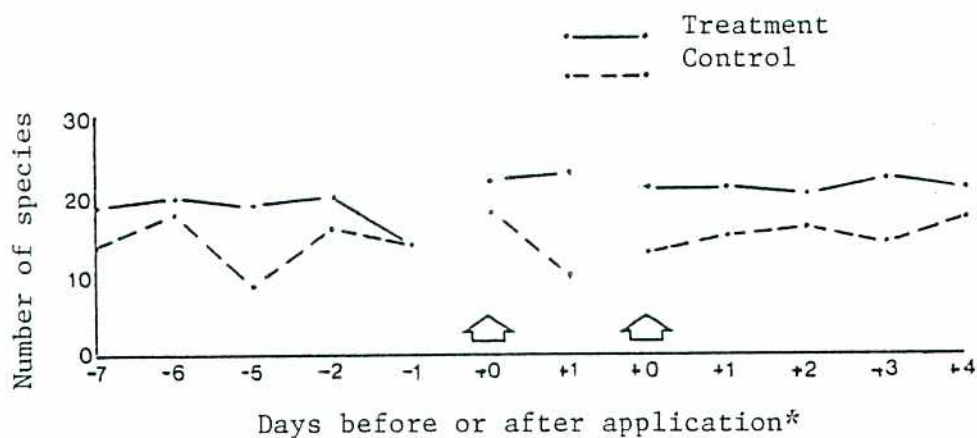


Figure 19. Comparison of species diversity on treatment and control plots. Aminocarb double application blocks, New Brunswick, 1976.

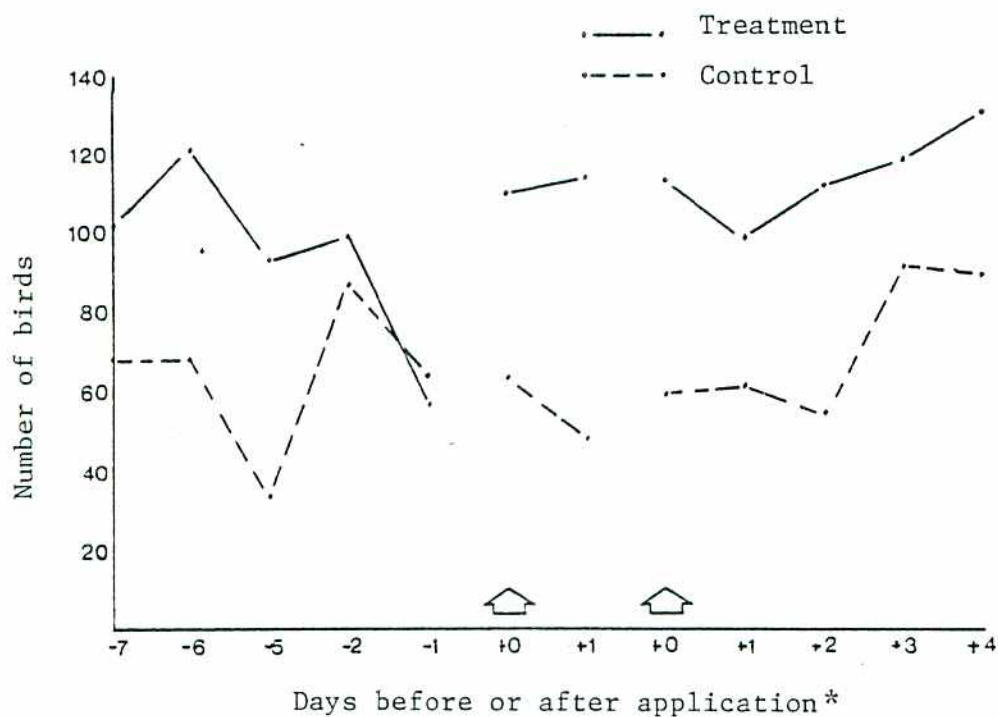


Figure 20. Comparison of activity of selected species on treatment and control plots. Aminocarb double application blocks, New Brunswick, 1976.

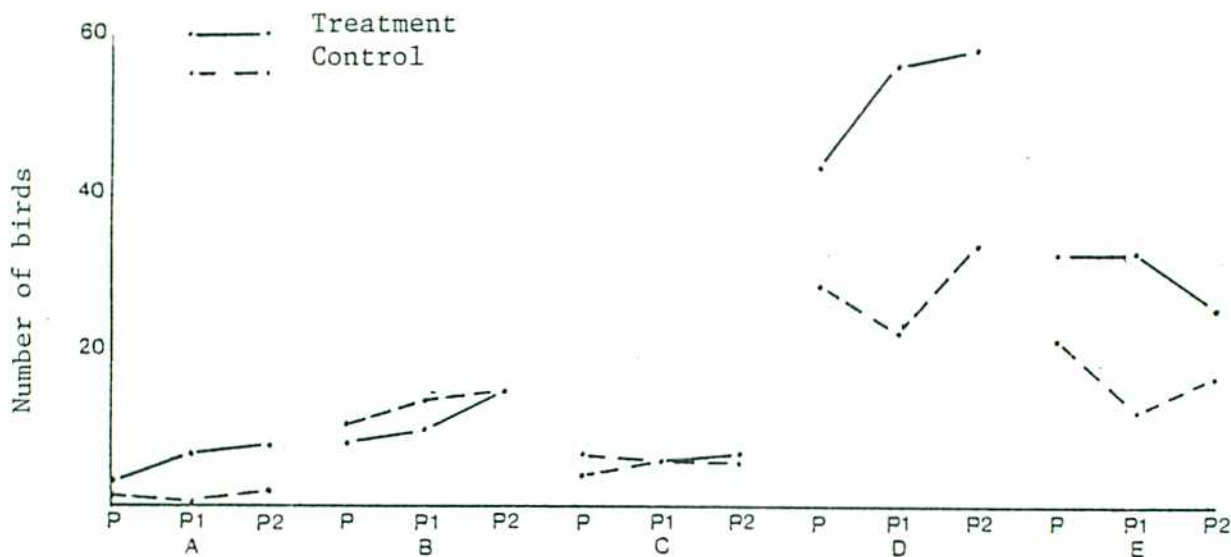


Figure 21. Comparison of activity of predominant families on treatment and control plots. A = Tyrannidae, B = Turdidae, C = Sylviidae, D = Parulidae, E = Fringillidae. Aminocarb double application blocks, New Brunswick, 1976.

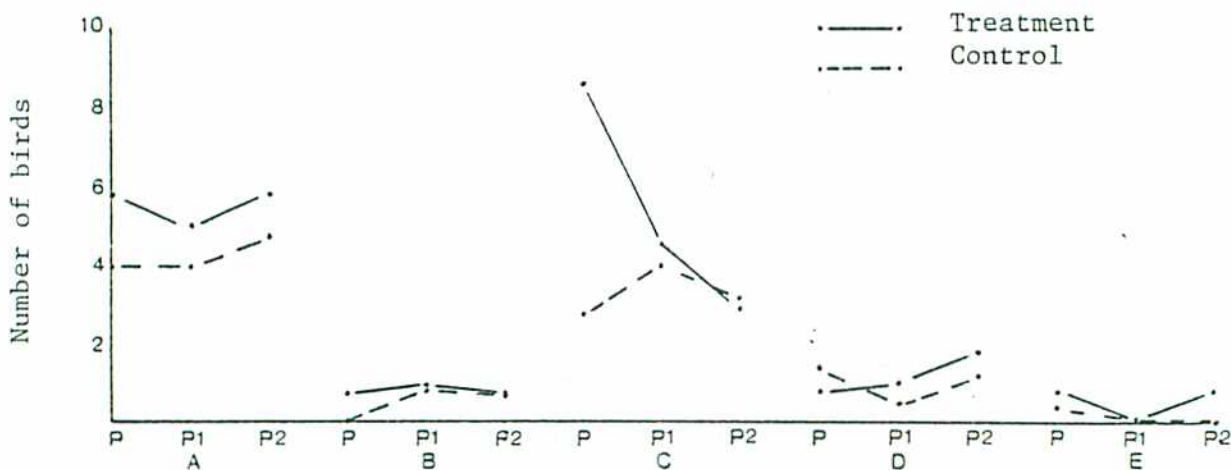


Figure 22. Changes in activity of selected species on treatment and control plots. A = Ruby-crowned Kinglet, B = Golden-crowned Kinglet, C = Purple finch, D = American robin, E = Olive-sided flycatcher. Aminocarb double application blocks, New Brunswick, 1976.

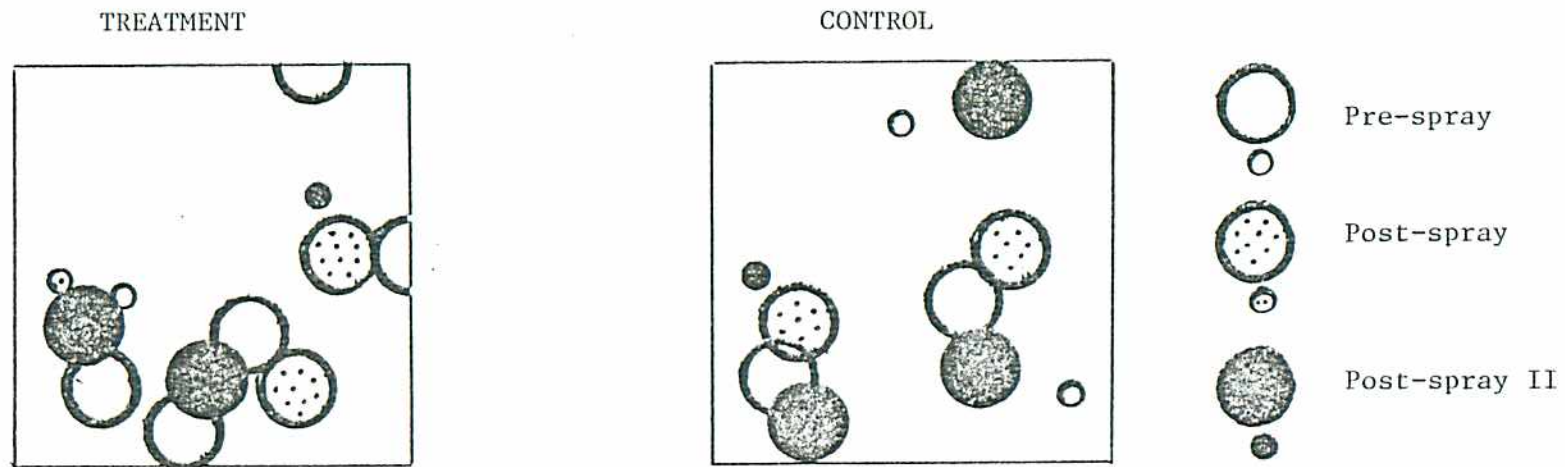


Figure 23. Breeding territories of the purple finch. Large circles represent nesting territories and small circles represent single records. Aminocarb double application blocks, New Brunswick, 1976.

Aminocarb-Triple Application

Plot 5, located near the Acadia Forest Experimental Station, Sunbury County (Fig. 1), received three applications of aminocarb emitted at 70 g AI/ha on 5, 7 and 10 July 1976, respectively. Population assessment of the treatment and control plots (Appendix VII, Tables 1 and 2) indicates that abundance and species diversity of resident bird populations were not affected (Table 17, Fig. 24). A gradual increase in activity over the study period (Fig. 25), was especially apparent for species of Turdidae and Fringillidae (Fig. 26). Although numbers of Parulidae decreased in the treatment area, activity was above the pre-spray levels and there was no apparent disruption in the breeding activities of individual species such as the yellow-rumped warbler, *Dendroica coronata* (Linnaeus), and the Tennessee and baybreasted warblers, (Fig. 27). The reduction of Sylviidae activity after treatment was mainly due to a gradual breakdown of ruby-crowned kinglet territories (Fig. 28). Although during different time periods, territorial reductions were also apparent in the control plot (Fig. 28). Observations of a white-throated sparrow nest in the treated area, identified four healthy fledglings on 11 and 12 July (day+1 and +2, Post-spray 3), and ovenbird nestlings had fledged by 8 July (day+1, Post-spray 2). Although there was no indication of a disturbance on the purple finch population (Fig. 27), an immature purple finch was found exhibiting symptoms of pesticide stress (bill wiping, unsteady perching, drooping wings and uncontrolled flight) immediately after the second aminocarb application. Unfortunately, it could not be collected for pesticide intoxication tests. No other sick birds were found during plot searches for signs of pesticide poisoning.

Table 17. Changes in abundance of selected species following a triple application of aminocarb, Sunbury County, New Brunswick, 28 June-12 July, 1976.

Days before or after application* of Aminocarb	Pre-spray					Daily avg.	Post-spray I		Daily avg.	Post-spray II			Daily avg.	Post-spray III			Daily avg.
	-6	-5	-4	-1	-0		+1	+2		+0	+1	+2		+0	+1	+2	
Treatment block, plot 5																	
Number of birds	29	54	64	73	69	57.8	75	77	76.0	79	77	84	80.0	93	96	76	95.
Number of species	9	11	14	14	15	12.6	16	18	17.0	16	17	18	17.0	15	19	14	16.0
Control block																	
Number of birds	68	68	33	87	64	64.0	63	46	54.5	59	61	54	58.0	91	89	49	76.3
Number of species	17	17	9	16	14	14.6	18	13	15.5	12	15	16	14.3	14	17	15	15.3

*applications emitted at 0.070 kg AI/ha

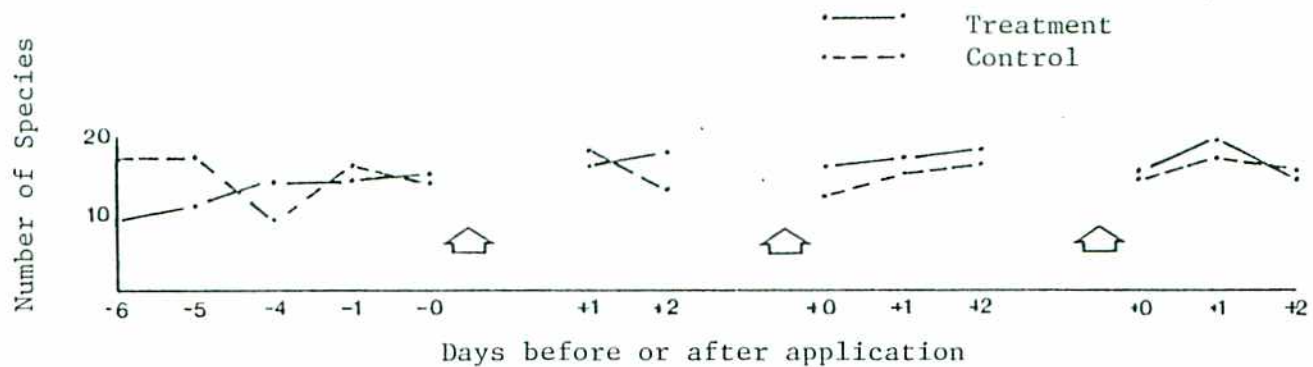


Figure 24. Comparison of species diversity on treatment and control plots.

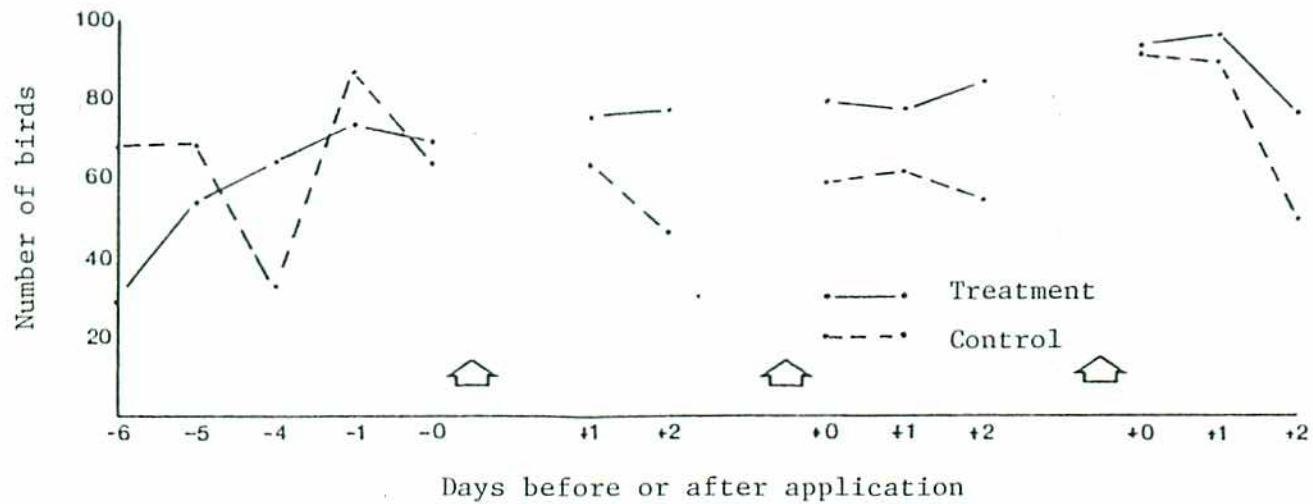


Figure 25. Comparison of activity of selected species on treatment and control plots.

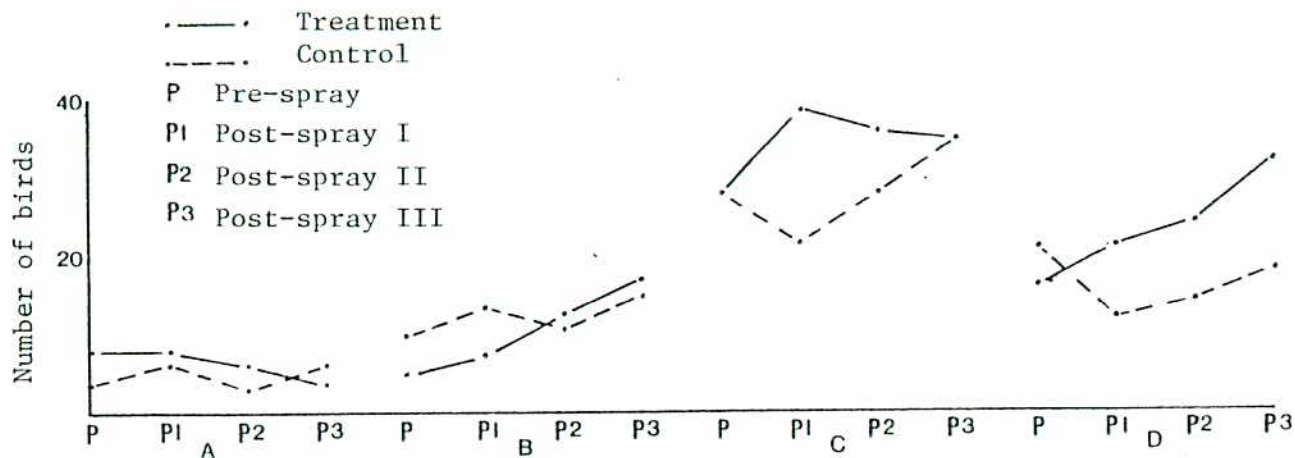


Figure 26. Comparison of activity of predominant families on treatment and control plots. A = Sylviidae, B = Turdidae, C = Parulidae, D = Fringillidae. Aminocarb triple application blocks, New Brunswick, 1976.

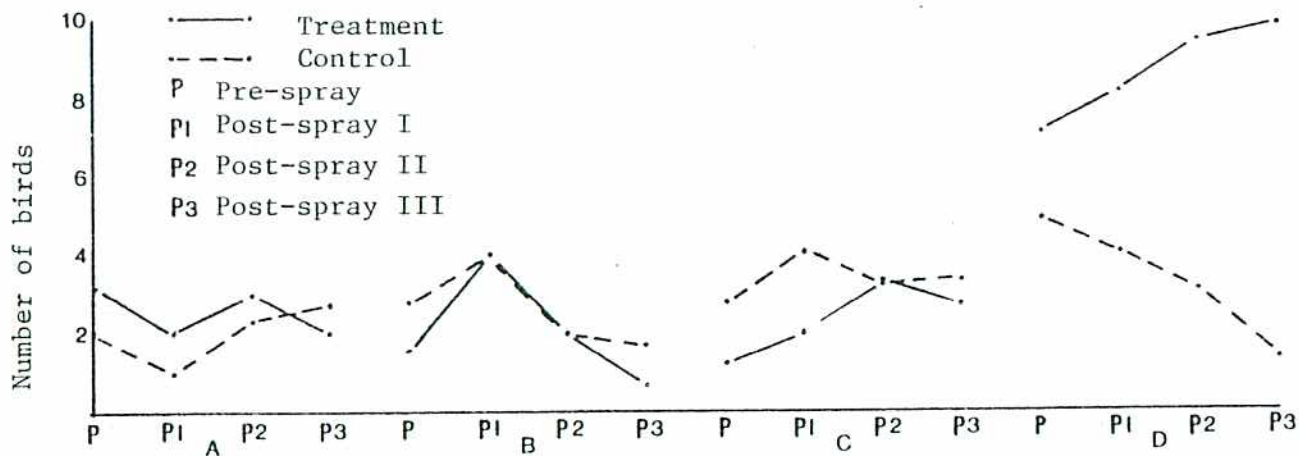


Figure 27. Changes in activity of selected species on treatment and control plots. A = Yellow-rumped warbler, B = Tennessee warbler, C = Purple finch, D = Bay-breasted warbler. Aminocarb triple application blocks, New Brunswick, 1976.

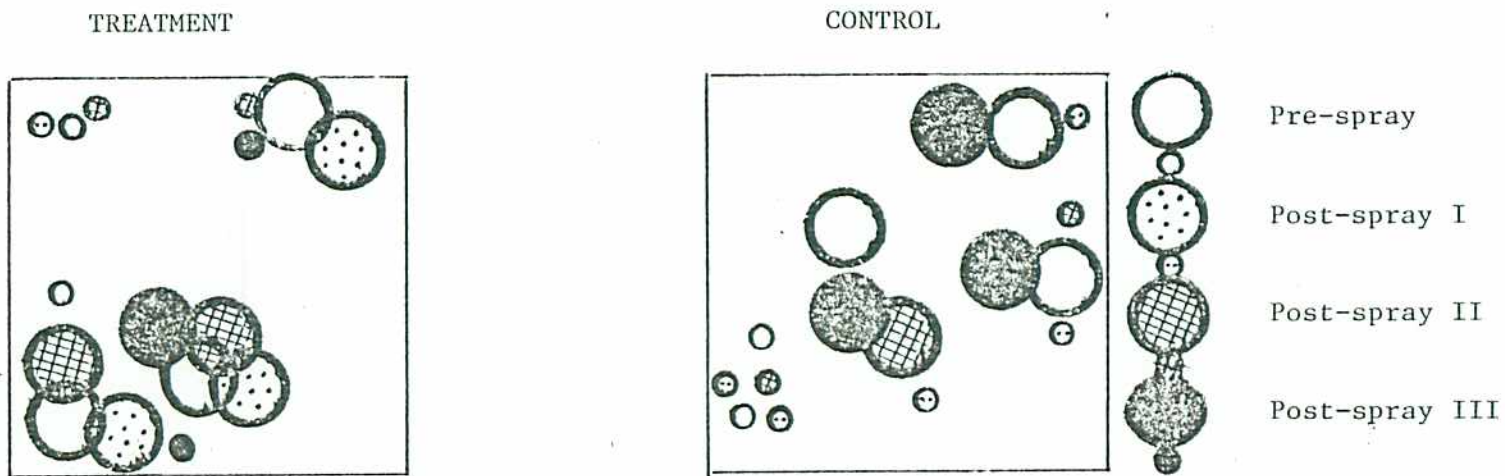


Figure 28. Breeding territories of the Ruby-crowned Kinglet. Large circles represent nesting territories and small circles represent single records. Aminocarb triple application blocks, New Brunswick, 1976.

DISCUSSION

A number of studies indicate that, as a larvicide, phosphamidon is highly toxic to birds, with exposed canopy species the most vulnerable (Pearce *et al.*, 1979, Varty, 1976). Dosage rates in those studies were all above 0.140 kg AI/ha, at least twice the dosage (0.070 kg AI/ha) used for these adulticide treatments. Buckner *et al.* (1976) and Varty (1978) found no apparent toxic effects following adulticide treatments with a single or triple application of 0.070 kg AI/ha phosphamidon respectively, which is in general accordance with the results presented in this report. Although possible effects were noted (for the ruby-crowned kinglet and Tennessee warbler following a single application, and the Tennessee and Cape May warblers following five applications), these effects were slight when compared to the large-scale mortality attributed to larvicide treatments (Pearce *et al.* 1976, 1979). Larvicides are generally applied during spring and early summer, a critical time period for successful breeding of forest songbirds, whereas adulticide treatments in July occur when most songbird nesting is complete, thereby posing less of a risk to the breeding populations. Other canopy feeders with potentially high exposure to aerial sprays were not noticeably disturbed by multiple applications of phosphamidon or by the addition of a motor stimulant to phosphamidon sprays.

It is interesting to note that the most prominent decreases in the ruby-crowned kinglet found in the work reported here, were on the 1974 single application block (Block 10). This was a TBM-treated block, in which the phosphamidon residues measured on foliage were higher than for any DC-6 treated block, and higher than the triple-application blocks for which small aircraft were used. Pearce *et al.* (1979) also reported a much greater effect when phosphamidon was sprayed by TBM aircraft than by DC-6. TBM-sprayed blocks treated with double-applications of phosphamidon also received high foliage deposits (three blocks with higher residue levels than Block 10 mentioned above), however there were no measurable effects attributable to this spray regime. Possible reasons why effects were observed with a single application but not with double application could be (1) possible multiple-swathing on the single application, (2) weather conditions at the time of spray which may have enhanced or diminished effects of the spray by influencing the life of the chemical and exposure of nontarget organisms, such as terrestrial arthropods (an important potential food source for birds) to the spray, (3) bird activity at the time of spray; (the double application program continued a week later into the breeding season when territories were naturally less stable making territorial assessment more difficult), (4) the large volume of data available for the double application program may have masked any slight or irregular effects and, conversely, small fluctuations may have been more visible with the smaller volume of data collected for the single application program. A small aircraft was used in the phosphamidon-five applications program, however foliage residues were not measured. The effects observed were most likely due to the proximity of the spray applications as all five sprays were conducted within a week.

Although studies on the environmental effects of aminocarb are numerous, there is little evidence of adverse effects on forest songbirds

(Kingsbury et al. 1981). Documented effects involve primarily canopy species, and juveniles of a species, so that lower numbers of juveniles were found in sprayed areas. Effects have also been attributed to prior treatment with fenitrothion or phosphamidon (Pearce, *et al.* 1976, 1979). Applied as an adulticide, aminocarb had no apparent effect on canopy species, and a number of fledglings in treated areas were observed to be healthy; however an immature purple finch was found exhibiting signs of pesticide stress after a triple application of aminocarb. Authors (Environmental Monitoring Committee 1979 and 1980) have postulated that effects on juveniles may be due to the lack of insect food during the critical period of nestling growth.

The timing of adulticide treatments (late June to mid- or late July), differs from larvicide sprays (early May to mid-June) in that bird migration during the former is complete and territories are well established; some are usually beginning to break down as the young become ready to fledge. At this time, large amounts of protein are required for both nestling and fledgling growth.

The adulticide treatments had a heavy knockdown effect on fir-dwelling and flying insects, mites and spiders (Miller *et al.* 1980). Knockdown increased with multiple applications and higher dosage rates, but even light treatments had more of an effect than larvicide sprays (Miller et al. 1980). Phosphamidon and aminocarb had roughly the same nontarget effect on invertebrates, although aminocarb was more lethal to spiders (Pearce et al. 1976), a food source of special nutritional value, and important for the growth of nestlings (Royama 1970).

Fowle (1965) found that sickness and death of birds exposed to phosphamidon was mainly due to accumulation of the chemical from sprayed vegetation in the first few hours after spraying. Although nearly all dead and dying birds recovered from areas treated with 500 g phosphamidon/ha had empty intestinal tracts, starvation was not considered the cause of death (Fowle 1965). Other experiments (Scott and Eschmeyer 1980) have shown that feeding is depressed by as much as 97% after experiencing the effects of organophosphates mixed with food. However, pesticides used today (as opposed to the accumulative organochlorines) can be metabolized and excreted daily if small amounts are ingested (Scott and Eschmeyer 1980). Furthermore, once the pesticide has dissipated, insect populations can quickly recuperate due to their generous capacity to reproduce (Varty 1978).

It may be argued that the singing male technique measures only adult activity and therefore may not be adequate to measure effects on the young. However, Borror (1975) and Slagsvold (1976) have found song activity to be closely related to breeding activities. Slagsvold reports a double peak in song activity over the breeding season where singing is more persistent around egg laying of the first brood, then declines during nesting, and increases again when the young are ready to fledge. It was noted for the phosphamidon-triple program (1976) that bird activity had declined

from a peak level around mid-June. A decline in singing activity was noted for most programs (phosphamidon-single, double and triple applications and phosphamidon-plus motor stimulants) in the treatment and control blocks, suggesting that the decline was a natural decrease in song activity during nesting. Increases in activity were noted for the programs phosphamidon-five applications, aminocarb-two and three applications. In all three programs, a number of fledglings were sighted which is in keeping with Slagvold's observations that activity increases with the fledging of the young.

CONCLUSIONS

Adulticide treatments involving various spray regimes of phosphamidon and aminocarb to control adult spruce budworm had no obvious harmful effects on forest songbird populations on the whole. Under certain conditions, low dosages of phosphamidon (0.070 kg AI/ha) caused population reductions in some species (the ruby-crowned kinglet and Tennessee warbler after one application of phosphamidon, and the Tennessee and Cape May warblers after five applications). However, the significance of these reductions cannot be easily extrapolated as many canopy species were not affected and some species affected in some spray regimes were not affected in others.

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APPENDIX I

Population structure of bird communities on treatment and control plots; Phosphamidon - single application.

Table 1
 Forest bird population census
 Phosphamidon treatment block 10 east, plot 7-Hwy. 430
 Northumberland County, New Brunswick
 10 July-19 July, 1974

Family	Pre-spray					Daily avg.	Post-spray				Daily avg.
	July 10	July 11	July 13	July 14	July 15		July 16	July 17	July 18	July 19	
	-6	-5	-3	-2	-1		+0	+1	+2	+3	
Picidae	8	2	12	6	2	6.0	2	6	6	6	5.0
Tyrannidae	0	0	2	0	0	0.4	2	0	0	0	0.5
Corvidae	0	0	4	0	0	0.8	0	0	0	0	0.0
Paridae	0	0	0	0	0	0.0	2	0	0	0	0.5
Troglodytidae	2	0	6	2	0	2.0	6	0	4	2	3.0
Turdidae	10	18	36	22	18	20.8	34	40	32	38	36.0
Sylviidae	4	8	10	6	4	6.4	0	2	0	0	0.5
Vireonidae	2	0	0	0	0	0.4	0	0	0	0	0.0
Parulidae	46	80	76	40	40	56.4	62	42	40	26	42.5
Fringillidae	38	46	64	36	38	44.4	44	42	52	38	44.0
Total Birds	110	154	210	112	102	137.6	152	132	134	110	132.0

Table 2
 Forest bird population census
 Phosphamidon treatment block 10 west, plot 7-Hwy. 430
 Northumberland County, New Brunswick
 10 July-19 July, 1974

Family	Pre-spray					Daily avg.	Post-spray				Daily avg.
	July 10	July 11	July 12	July 14	July 15		July 16	July 17	July 18	July 19	
Picidae	-6	-5	-4	-2	-1	0.8	+0	+1	+2	+3	1.8
Tyrannidae	2	0	6	0	0	1.6	2	0	0	0	0.5
Paridae	0	0	0	0	0	0.0	0	0	5	7	3.0
Sittidae	0	0	0	0	0	0.0	0	0	2	0	0.5
Troglodytidae	4	2	6	10	2	4.8	6	10	4	8	7.0
Turdidae	16	6	32	10	18	16.4	28	38	16	26	27.0
Sylviidae	8	4	8	8	6	6.8	2	4	8	6	5.0
Vireonidae	0	0	0	4	0	0.8	0	0	6	2	2.0
Parulidae	64	34	104	36	40	55.6	64	80	33	36	53.3
Fringillidae	22	12	36	10	14	18.8	34	22	13	23	23.0
Unidentified Birds	0	0	0	0	0	0.0	0	0	0	2	0.5
Total Birds	118	58	192	80	80	105.6	138	154	90	112	123.5

Table 3
 Forest bird population census
 Phosphamidon treatment block 31, plot 31-Indian Falls
 Northumberland County, New Brunswick
 16 July-25 July, 1974

Family	Pre-spray					Daily avg.	Post-spray					Daily avg.
	July 16	July 17	July 18	July 19	July 20		July 21	July 22	July 23	July 24	July 25	
	-5	-4	-3	-2	-1		+0	+1	+2	+3	+4	
Trochilidae	2	2	0	1	1	1.2	3	1	2	0	0	1.2
Picidae	2	0	0	0	2	0.8	2	2	0	2	0	1.2
Paridae	0	0	0	0	0	0.0	0	2	2	0	0	0.8
Sittidae	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Troglodytidae	6	4	4	4	4	4.4	4	4	6	4	4	4.4
Turdidae	12	18	7	6	7	10.0	10	9	5	7	7	7.6
Sylviidae	0	0	2	0	0	0.4	0	0	0	0	0	0.0
Vireonidae	0	2	2	2	0	1.2	4	0	0	0	0	0.8
Parulidae	26	15	17	18	21	19.4	23	26	21	19	9	19.6
Fringillidae	6	6	9	6	2	5.8	4	6	6	10	7	6.6
Total Birds	54	47	41	39	37	43.6	50	50	42	42	27	42.2

Table 4
 Forest bird population census
 Phosphamidon control block, Newcastle
 Northumberland County, New Brunswick
 10 July-19 July, 1974.

Family	Pre-spray					Daily avg.	Post-spray					Daily avg.
	July 10	July 11	July 13	July 14	July 15		July 16	July 17	July 18	July 19		
Tetraonidae	0	1	0	0	0	0.2	0	0	0	0	0.0	
Columbidae	2	0	0	0	0	0.4	0	0	0	0	0.0	
Picidae	2	6	4	0	0	2.4	0	6	3	4	3.3	
Tyrannidae	0	0	0	0	0	0.0	6	0	2	0	2.0	
Corvidae	0	4	0	2	0	1.2	0	0	4	0	1.0	
Paridae	3	22	6	10	5	9.2	14	2	18	10	11.0	
Sittidae	0	4	4	0	2	2.0	2	4	2	0	2.0	
Troglodytidae	6	10	8	4	2	6.0	4	4	4	2	3.5	
Turdidae	44	44	62	28	12	38.0	47	49	31	31	39.5	
Sylviidae	0	6	8	4	2	4.0	3	9	7	8	6.8	
Vireonidae	4	4	9	6	10	6.6	6	10	5	8	7.3	
Parulidae	76	113	125	70	60	88.8	60	83	73	78	73.5	
Icteridae	4	4	13	8	4	6.6	5	8	10	2	6.3	
Fringillidae	28	26	31	20	17	24.4	28	17	25	20	22.5	
Unidentified Birds	0	2	0	2	0	0.8	0	0	0	0	0.0	
Total Birds	169	246	270	154	114	190.6	175	192	184	163	178.5	

Table 5
 Forest bird population census
 Phosphamidon control block 45, plot 45
 Gloucester County, New Brunswick
 10 July-19 July, 1974

Family	Pre-spray							Post-spray							Daily avg.						
	July 10	July 11	July 12	July 13	July 14	July 16	July 17	July 18	July 19	July 20	July 21	July 22	July 23	July 24		July 25	July 26	July 27	July 28	July 29	July 30
Picidae	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.3
Paridae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.3
Sittidae	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.5
Troglodytidae	2	4	2	4	0	0	2.4	2	4	2	4	2	4	2	4	2	4	2	4	4	3.0
Turdidae	2	10	8	9	10	10	7.8	11	7	8	15	7	8	15	7	8	15	7	8	15	10.3
Sylviidae	0	0	0	0	4	0	0.8	0	0	0	0	0	2	0	0	0	0	0	0	0	0.5
Parulidae	11	18	12	22	14	14	15.4	10	4	0	6	4	0	6	4	0	6	4	0	6	5.0
Fringillidae	12	16	12	12	10	10	12.4	14	8	8	12	8	8	12	8	8	12	8	12	12	10.5
Total Birds	27	53	35	47	38	38	40.0	37	26	20	38	26	20	38	26	20	38	26	20	38	30.3

Table 6
 Forest bird population census
 Phosphamidon control block, Checkplot
 Gloucester County, New Brunswick
 16 July-25 July, 1974

Family	Pre-spray					Daily avg.	Post-spray					Daily avg.
	July 16	July 17	July 18	July 19	July 20		July 21	July 22	July 23	July 24	July 25	
Picidae	1	2	0	0	0	0.6	0	0	0	0	0	0.0
Corvidae	3	4	0	0	4	2.2	0	0	2	0	1	0.6
Paridae	7	3	1	3	4	3.6	0	2	1	1	3	1.4
Turdidae	10	4	0	6	6	5.2	9	4	7	3	1	4.8
Sylviidae	0	2	0	0	0	0.4	0	0	0	0	2	0.4
Vireonidae	0	0	0	0	0	0.0	0	0	0	0	2	0.4
Parulidae	8	8	4	2	2	4.8	6	3	4	2	0	3.0
Icteridae	2	5	2	0	1	2.0	0	2	2	0	0	0.8
Fringillidae	12	10	6	8	0	7.2	12	12	6	14	12	11.2
Total Birds	43	38	13	19	17	26.0	27	23	22	20	21	22.6

APPENDIX II

Population structure of bird communities on treatment and control plots; Aminocarb - double application.

Table 1
 Forest bird population census
 Phosphamidon treatment block 1, Allardville
 Gloucester County, New Brunswick
 9-24 July, 1974.

Family	Pre-spray					Daily avg.	Post-spray I					Daily avg.	Post-spray II				Daily avg.
	July 9	July 10	July 11	July 12	July 13		July 14	July 15	July 16	July 19	July 20		July 21	July 22	July 23	July 24	
	-5	-4	-3	-2	-1		+0	+1	+2	+5	+6		+0	+1	+2	+3	
Picidae	0	0	2	0	0	0.4	0	0	0	0	0	0.0	0	0	0	1	0.3
Tyrannidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0.5
Corvidae	0	0	2	0	0	0.4	0	0	2	0	0	0.4	0	0	0	1	0.3
Paridae	1	0	0	0	0	0.2	0	0	0	0	0	0.0	0	0	0	1	0.3
Sittidae	0	0	0	0	0	0.0	0	0	1	0	0	0.2	2	2	2	0	1.5
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	1	0.2	1	2	1	0	1.0
Troglodytidae	2	2	2	4	1	2.2	2	1	2	2	2	1.8	4	2	2	0	2.0
Mimidae	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0
Turdidae	3	4	4	4	1	3.2	3	2	5	6	4	4.0	4	6	4	4	4.5
Sylviidae	0	2	0	0	2	0.8	2	2	1	2	1	1.6	1	2	2	1	1.5
Bombycillidae	0	0	0	0	0	0.0	0	2	2	0	0	0.8	0	0	0	0	0.0
Vireonidae	0	0	3	1	2	1.2	4	2	2	2	0	2.0	4	4	4	2	3.5
Parulidae	5	14	12	14	18	12.6	18	20	9	13	12	14.4	17	12	16	11	14.1
Fringillidae	4	5	2	0	2	2.6	2	2	6	6	4	4.0	4	4	7	3	4.6
Unidentified Birds	0	0	0	2	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0
Total Birds	15	29	27	25	26	24.4	31	31	30	31	24	29.4	37	34	38	26	33.8

Table 2
 Forest bird population census
 Phosphamidon treatment block 7, 44 Mile Brook
 Northumberland County, New Brunswick
 12-25 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 12	July 13	July 14	July 16	July 17	Daily avg.	July 18	July 20	July 21	July 22	Daily avg.	July 23	July 24	July 25	Daily avg.
Trochilidae	3	3	6	4	0	3.2	1	1	0	7	2.3	7	4	0	3.7
Picidae	6	2	6	4	3	4.2	2	0	0	2	1.0	4	4	5	4.3
Tyrannidae	4	0	2	2	2	2.0	0	2	2	2	1.5	2	2	0	1.3
Corvidae	1	0	0	0	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Paridae	0	2	0	0	0	0.4	4	0	2	2	2.0	0	2	1	1.0
Sittidae	0	0	0	6	0	1.2	2	0	2	0	1.0	4	2	3	3.0
Troglodytidae	2	2	2	0	0	1.2	0	0	0	0	0.0	2	0	0	0.7
Turdidae	9	8	10	14	7	9.6	9	9	8	13	9.8	8	13	3	7.9
Sylviidae	2	2	2	2	0	1.6	2	0	2	1	1.3	2	2	2	2.0
Vireonidae	0	0	0	0	2	0.4	2	0	0	0	0.5	0	0	0	0.0
Parulidae	21	28	32	28	15	24.8	13	20	12	12	14.4	18	11	8	12.3
Fringillidae	35	35	18	20	27	27.0	23	16	18	13	17.7	14	18	13	15.0
Total Birds	83	82	78	80	56	75.8	58	48	46	52	51.0	61	58	35	51.3

Table 3
 Forest bird population census
 Phosphamidon treatment block 8, Canoe Lake
 Gloucester County, New Brunswick
 11-25 July, 1974.

Family	Pre-spray						Post-spray I					Post-spray II			
	July 11	July 12	July 13	July 14	July 16	Daily avg.	July 17	July 18	July 20	July 22	Daily avg.	July 23	July 24	July 25	Daily avg.
Trochilidae	0	1	0	1	0	0.4	1	0	0	0	0.3	0	0	1	0.3
Paridae	2	2	2	0	4	2.0	0	2	0	2	1.0	6	8	2	5.3
Sittidae	0	2	0	2	0	0.8	0	0	0	0	0.0	2	2	4	2.7
Troglodytidae	2	4	2	6	4	3.6	4	2	4	2	3.0	2	0	4	2.0
Turdidae	9	16	8	6	13	10.4	12	4	5	6	6.8	3	4	5	4.0
Sylviidae	4	2	2	10	2	4.0	2	2	0	2	1.5	2	2	0	1.3
Parulidae	22	37	12	24	21	23.2	19	12	6	10	11.8	12	11	6	9.7
Fringillidae	17	20	17	27	20	20.2	19	9	9	10	11.9	8	12	10	10.0
Total Birds	56	84	43	76	64	64.6	57	31	24	32	36.0	35	39	32	35.3

Table 4
 Forest bird population census
 Phosphamidon treatment block 8, Bowser Lake
 Gloucester County, New Brunswick
 11-25 July, 1974.

Family	Pre-spray						Post-spray I					Post-spray II				
	July 11	July 12	July 13	July 14	July 16	Daily avg.	July 17	July 18	July 19	July 20	Daily avg.	July 22	July 23	July 24	July 25	Daily avg.
Trochilidae	0	0	0	0	0	0.0	0	1	0	0	0.3	0	0	0	0	0.0
Picidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	0	2	0.5
Corvidae	0	0	0	0	0	0.0	0	1	0	4	1.3	0	0	0	0	0.0
Paridae	2	0	0	0	0	0.4	2	0	0	2	1.0	1	6	0	0	1.8
Sittidae	0	0	0	2	0	0.4	2	0	0	0	0.5	0	0	2	2	1.0
Troglodytidae	0	4	2	0	2	1.6	4	3	0	2	2.3	2	2	2	2	2.0
Turdidae	6	8	12	8	6	8.0	7	14	4	4	7.3	5	11	4	8	7.0
Sylviidae	1	4	2	2	0	1.8	2	0	0	0	0.5	0	3	2	2	1.8
Parulidae	16	23	21	26	12	19.6	20	13	2	12	11.8	10	12	8	6	9.1
Fringillidae	16	23	25	22	18	20.8	16	27	6	12	15.3	16	19	18	14	16.8
Total Birds	41	62	62	60	38	52.6	53	59	12	36	40.0	34	53	36	36	39.8

Table 5
 Forest bird population census
 Phosphamidon treatment block 9, Plot 9
 Northumberland County, New Brunswick
 11-25 July, 1974

Family	Pre-spray						Post-spray I						Post-spray II			
	July 11 -5	July 12 -4	July 13 -3	July 14 -2	July 15 -1	Daily avg.	July 17 +1	July 18 +2	July 20 +4	July 21 +5	July 22 +6	Daily avg.	July 23 +1	July 24 +2	July 25 +3	Daily avg.
Tyrannidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	1	0.3
Corvidae	1	0	0	1	0	0.4	0	0	0	0	1	0.2	0	1	0	0.3
Paridae	2	2	2	1	4	2.2	2	1	0	2	1	1.2	0	4	0	1.3
Sittidae	0	0	0	2	0	0.4	0	2	0	0	0	0.4	4	2	0	2.0
Troglodytidae	6	2	4	2	4	3.6	2	4	6	2	2	3.0	6	4	7	5.7
Turdidae	9	10	6	8	8	8.2	4	17	9	4	15	9.8	14	9	8	10.3
Sylviidae	0	0	0	0	2	0.4	2	0	2	0	0	0.8	0	0	0	0.0
Vireonidae	0	0	0	0	2	0.4	0	0	2	0	0	0.4	0	0	0	0.0
Parulidae	24	23	22	22	14	19.0	13	12	11	4	2	8.4	4	3	6	4.4
Fringillidae	19	16	24	29	20	21.6	22	35	23	12	20	22.4	34	19	19	24.0
Total Birds	61	53	58	55	54	56.2	45	71	53	24	41	46.8	62	42	41	48.3

Table 6
 Forest bird population census
 Phosphamidon treatment block 11, Plot 12
 Northumberland County, New Brunswick
 11-24 July, 1974.

Family	Pre-spray					Daily avg.	Post-spray I					Daily avg.	Post-spray II					Daily avg.
	July 11	July 12	July 13	July 14	July 15		July 16	July 17	July 18	July 19	July 20		July 21	July 22	July 23	July 24		
Tetraonidae	0	0	0	0	0	0.0	0	0	0	0	0.0	1	1	0	0	0.5		
Trochilidae	2	0	0	0	0	0.4	0	0	0	0	0.0	0	0	0	2	0.5		
Picidae	4	0	2	0	0	1.2	0	2	1	0	0.8	0	2	4	2	2.0		
Tyrannidae	6	6	2	0	0	2.8	2	2	8	4	4.0	2	2	4	8	4.0		
Corvidae	0	0	0	0	0	0.0	0	3	0	0	0.8	0	0	0	2	0.5		
Paridae	0	0	0	4	0	0.8	2	0	1	3	1.5	6	7	5	10	7.0		
Sittidae	0	0	2	0	0	0.4	0	0	0	0	0.0	1	0	1	1	0.8		
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	0.0	1	0	0	0	0.3		
Troglodytidae	2	6	4	4	2	3.6	4	8	6	2	5.0	4	4	6	6	5.0		
Turdidae	49	26	25	16	12	27.6	10	27	28	15	20.0	14	30	25	30	24.8		
Sylviidae	8	6	4	0	0	3.6	3	2	0	0	1.3	2	7	4	2	3.8		
Bombycillidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	2	0	0	0.5		
Vireonidae	0	0	2	2	0	0.8	0	2	0	0	0.5	0	4	0	2	1.5		
Parulidae	92	62	71	68	24	63.4	49	76	40	16	45.3	26	35	41	25	31.9		
Icteridae	2	1	4	2	4	2.6	2	4	4	0	2.5	0	0	0	0	0.0		
Fringillidae	28	28	28	24	18	25.2	22	34	24	21	25.3	12	14	20	28	18.6		
Unidentified Birds	0	0	0	0	0	0.0	0	0	0	1	0.3	0	0	0	0	0.0		
Total Birds	193	135	154	120	60	132.4	94	160	112	62	107.0	69	108	110	118	101.3		

Table 7
 Forest bird population census
 Phosphamidon treatment block 12, Plot 3
 Northumberland County, New Brunswick
 8-24 July, 1974.

Family	Pre-spray						Post-spray I						Pre-spray II						Post-spray II			
	July	July	July	July	July	Daily	July	July	July	July	July	Daily	July	July	July	July	July	Daily	July	July	July	Daily
	8	9	11	12	13	avg.	15	16	17	18	19	avg.	17	18	19	20	21	avg.	22	23	24	avg.
	-6	-5	-3	-2	-1		+1	+2	+3	+4	+5		-4	-3	-2	-1	-0		+1	+2	+3	
Picidae	4	2	2	0	3	2.2	1	3	1	0	2	1.4	1	0	2	0	2	1.0	0	0	0	0.0
Tyrannidae	0	0	0	2	2	0.8	1	2	0	0	0	0.6	0	0	0	2	10	2.4	2	4	0	2.1
Corvidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	2	0.4	0	2	0	0.7
Paridae	0	6	2	4	0	2.4	0	3	2	6	4	3.0	2	6	4	5	16	6.6	4	9	2	5.0
Sittidae	0	0	2	2	2	1.2	0	0	4	0	0	0.8	4	0	0	1	4	1.8	4	5	0	3.0
Certhiidae	6	0	0	0	0	1.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0.0
Troglodytidae	2	0	0	0	0	0.4	2	0	2	6	0	2.0	2	6	0	2	6	3.2	0	2	2	1.3
Turdidae	22	14	16	23	24	19.8	16	28	25	40	28	27.4	25	40	28	31	27	30.2	7	24	6	12.4
Sylviidae	8	6	6	8	2	6.0	0	6	8	2	0	3.2	8	2	0	4	0	2.8	0	5	2	2.3
Vireonidae	6	6	0	4	0	3.2	0	2	0	0	0	0.4	0	0	0	0	2	0.4	4	2	0	2.0
Parulidae	62	54	38	64	43	52.2	28	58	42	56	30	42.8	42	56	30	46	59	46.6	14	47	10	23.6
Icteridae	0	0	0	4	2	1.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0.0
Fringillidae	26	13	14	18	14	17.0	7	16	17	22	32	18.8	17	22	32	19	22	22.4	13	28	6	15.7
Unidentified Birds	0	0	0	0	0	0.0	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0.0
Total Birds	136	101	80	129	92	107.6	55	120	101	132	96	100.8	101	132	96	110	150	117.8	48	128	28	68.0

Table 8
 Forest bird population census
 Phosphamidon treatment block 13, Plot 13
 Northumberland County, New Brunswick
 8-21 July, 1974.

Family	Pre-spray					Daily avg.	Post-spray I					Daily avg.	Post-spray II					Daily avg.
	July 8	July 9	July 10	July 11	July 12		July 13	July 14	July 15	July 16	July 17		July 18	July 19	July 20	July 21		
Scelopacidae	0	0	0	0	3	0.6	0	0	0	0	0.0	1	0	0	0	0	0.2	
Trochilidae	0	2	0	0	0	0.4	0	0	0	0	0.0	0	0	0	0	0	0.0	
Picidae	6	6	2	4	6	4.8	6	0	2	2	2.5	2	6	2	2	6	3.6	
Tyrannidae	8	4	6	0	12	6.0	10	6	2	8	6.5	4	4	0	2	2	2.4	
Corvidae	2	4	0	0	0	1.2	0	0	2	0	0.5	0	0	2	0	0	0.4	
Paridae	4	4	0	0	4	2.4	12	4	0	6	5.5	18	4	0	2	10	6.8	
Sittidae	2	0	2	0	2	1.2	2	2	0	2	1.5	0	0	0	0	2	0.4	
Certhiidae	0	0	0	0	0	0.0	0	4	0	0	1.0	0	0	0	0	0	0.0	
Troglodytidae	2	4	6	6	8	5.2	4	2	0	4	2.5	6	4	0	2	8	4.0	
Turdidae	44	44	32	26	52	39.6	40	33	41	38	38.1	38	31	26	29	41	33.0	
Sylviidae	12	4	0	0	2	3.6	4	4	0	2	2.5	6	2	2	2	4	3.2	
Vireonidae	6	6	4	6	8	6.0	8	8	4	7	6.8	8	9	2	8	9	7.2	
Parulidae	82	96	57	46	106	77.4	76	70	48	76	67.5	76	85	42	52	93	69.6	
Icteridae	7	2	6	0	10	5.0	6	6	0	6	4.5	6	2	0	0	2	2.0	
Fringillidae	24	24	15	14	17	18.8	24	14	5	11	13.5	19	16	12	17	26	18.0	
Total Birds	199	200	130	102	230	172.2	192	153	104	162	152.8	184	163	88	116	201	150.8	

Table 9
 Forest bird population census
 Phosphamidon treatment block 16, plot 4
 Northumberland County, New Brunswick
 9-24 July, 1974

Family	Pre-spray						Post-spray I						Pre-spray II						Post-spray II					
	July 9	July 10	July 11	July 12	July 13	Daily avg.	July 15	July 16	July 17	July 18	July 19	Daily avg.	July 16	July 17	July 18	July 19	July 20	Daily avg.	July 21	July 22	July 23	July 24	Daily avg.	
Tetraonidae	0	0	1	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Trochilidae	0	0	0	4	2	1.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	4	0	1	1.3	
Picidae	0	0	0	2	2	0.8	0	0	8	2	2	2.4	0	8	2	2	0	2.4	1	2	1	2	1.6	
Tyrannidae	2	4	2	0	2	2.0	0	0	2	0	0	0.4	0	2	0	0	0	0.4	0	0	2	0	0.5	
Paridae	0	5	0	4	6	3.0	0	3	4	2	0	1.8	3	4	2	0	0	1.8	2	8	10	8	7.0	
Sittidae	0	0	4	2	0	1.2	0	0	2	0	2	0.8	0	2	0	2	0	0.8	0	4	2	4	2.5	
Troglodytidae	8	12	4	6	8	7.6	6	6	6	12	10	8.0	6	6	12	10	4	7.6	2	8	8	5	5.8	
Turdidae	18	19	20	11	24	18.4	9	23	25	27	20	20.8	23	25	27	20	21	23.2	15	20	23	21	19.8	
Sylviidae	8	6	8	10	4	7.2	10	2	10	6	6	6.8	2	10	6	6	0	4.8	0	2	9	2	3.0	
Vireonidae	4	2	0	0	2	1.6	0	0	4	2	0	1.2	0	4	2	0	0	1.2	0	1	4	1	1.5	
Parulidae	62	58	62	59	66	61.4	28	42	52	46	36	40.8	42	52	46	36	37	42.6	22	43	43	54	40.6	
Fringillidae	19	16	16	14	28	18.6	16	14	16	16	16	15.6	14	16	16	16	8	14.0	7	29	27	16	19.8	
Total Birds	121	122	117	112	144	123.2	69	90	129	113	92	98.6	90	129	113	92	70	98.8	49	121	128	114	103.0	

Table 10
 Forest bird population census
 Phosphamidon treatment block 17, plot 5
 Northumberland County, New Brunswick
 11-24 July, 1974

Family	Pre-spray						Post-spray I						Post-spray II			
	July 11 -5	July 12 -4	July 13 -3	July 14 -2	July 15 -1	Daily avg.	July 17 +1	July 18 +2	July 19 +3	July 20 +4	July 21 +5	Daily avg.	July 22 +0	July 23 +1	July 24 +2	Daily avg.
Trochilidae	0	2	0	0	0	0.4	0	0	0	0	1	0.2	0	0	0	0.0
Picidae	2	2	2	0	0	1.2	0	2	0	2	1	1.0	0	0	0	0.0
Paridae	2	4	2	6	0	2.8	0	2	2	4	3	2.2	6	2	0	2.7
Sittidae	4	2	4	4	0	2.8	2	2	2	2	2	2.0	2	3	0	1.7
Certhiidae	0	2	0	0	0	0.4	2	0	2	0	0	0.8	0	0	0	0.0
Troglodytidae	8	8	6	2	2	5.2	10	4	8	4	4	6.0	4	2	2	2.7
Turdidae	14	12	16	17	11	14.0	28	21	11	11	17	17.6	22	1	4	9.0
Sylviidae	0	0	0	2	0	0.4	2	4	4	6	4	4.0	2	0	0	0.7
Vireonidae	4	6	4	2	0	3.2	2	4	2	6	2	3.2	0	2	0	0.7
Parulidae	44	62	38	50	26	44.0	44	34	38	22	52	38.0	42	10	2	17.9
Fringillidae	14	24	10	16	6	14.0	14	8	18	14	17	14.2	16	6	6	9.3
Total Birds	92	124	82	99	45	88.4	104	81	87	71	103	89.2	94	26	14	44.7

Table 11
 Forest bird population census
 Phosphamidon treatment plot 2
 Gloucester County, New Brunswick
 10-25 July, 1974.

Family	Pre-spray					Post-spray I					Pre-spray II					Post-spray II								
	July 10	July 11	July 12	July 13	July 14	Daily avg.	July 15	July 16	July 17	July 18	July 20	Daily avg.	July 16	July 17	July 18	July 20	July 21	Daily avg.	July 22	July 23	July 24	July 25	Daily avg.	
	-4	-3	-2	-1	-0		+1	+2	+3	+4	+6		-5	-4	-3	-1	-0		+1	+2	+3	+4		
Tetraonidae	0	0	1	0	0	0.2	0	0	0	0	6	1.2	0	0	0	6	0	1.2	0	3	0	0	0.8	
Caprimulgidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0	0.5
Apodidae	2	0	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Picidae	0	0	1	0	2	0.6	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	1	0	4	1.3	
Tyrannidae	2	0	0	0	2	0.8	2	2	2	2	0	1.6	2	2	2	0	2	1.6	2	4	6	2	3.5	
Bronchidae	0	0	0	0	0	0.0	0	0	0	8	0	1.6	0	0	8	0	0	1.6	1	0	1	4	1.5	
Corvidae	2	0	3	0	0	1.0	2	4	0	1	0	1.4	4	0	1	0	0	1.0	0	0	0	0	0.0	
Paridae	0	0	0	0	0	0.0	1	0	1	3	3	1.6	0	1	3	3	1	1.6	3	2	8	0	3.3	
Sittidae	0	0	0	0	2	0.4	0	0	2	0	0	0.4	0	2	0	0	2	0.8	2	0	2	2	1.5	
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	3	0.6	0	0	0	0	0.0	
Troglodytidae	2	4	6	0	6	3.6	0	4	8	10	2	4.8	4	8	10	2	7	6.2	4	2	4	4	3.5	
Turdidae	7	12	10	12	11	10.4	8	5	13	9	3	7.6	5	13	9	3	13	8.6	8	11	19	8	11.6	
Sylviidae	2	6	0	0	2	2.0	0	0	0	0	0	0.0	0	0	0	0	2	0.4	2	0	2	0	1.0	
Bombycillidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	3	0.8	
Vireonidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	2	0.4	0	2	0	0	0.5	
Parulidae	30	44	34	22	42	34.4	25	47	46	49	29	39.2	47	46	49	29	39	42.0	35	19	41	25	30.1	
Icteridae	0	0	2	0	0	0.4	0	0	0	5	0	1.0	0	0	5	0	6	2.2	2	2	2	4	2.5	
Thraupidae	0	0	0	0	0	0.0	2	0	0	0	0	0.4	0	0	0	0	1	0.2	0	0	0	0	0.0	
Fringillidae	10	19	11	8	11	11.8	4	18	19	20	15	15.2	18	19	20	15	18	18.0	14	14	12	6	11.6	
Unidentified Birds	0	0	0	0	2	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0.0	
Total Birds	57	85	68	42	80	66.4	44	80	91	107	58	76.0	80	91	107	58	96	86.4	73	60	99	62	73.5	

Table 12
 Forest bird population census
 Phosphamidon treatment plot 3
 Gloucester County, New Brunswick
 10-25 July, 1974

Family	Pre-spray						Post-spray I						Post-spray II				
	July	July	July	July	July	Daily avg.	July	July	July	July	July	Daily avg.	July	July	July	July	Daily avg.
	10	11	12	13	14		17	18	19	20	21		22	23	24	25	
-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+1	+2	+3	+4				
Acciptridae	0	0	0	0	1	0.2	2	1	1	0	2	1.2	1	1	3	2	1.8
Caprimulgidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0.5
Picidae	0	0	0	1	2	0.6	0	0	0	0	0	0.0	0	0	0	0	0.0
Corvidae	0	0	0	0	1	0.2	2	1	0	0	1	0.8	0	1	1	0	0.5
Paridae	0	0	1	0	0	0.2	2	0	0	1	1	0.8	1	0	0	0	0.3
Sittidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	4	8	3.0
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	1	0.2	1	0	0	0	0.3
Troglodytidae	0	0	0	0	0	0.0	4	0	0	0	2	1.2	4	0	0	0	1.0
Turdidae	6	5	12	9	15	9.4	14	17	7	7	8	10.6	9	7	9	10	8.8
Sylviidae	0	0	0	0	0	0.0	2	0	2	0	0	0.8	0	2	0	0	0.5
Vireonidae	0	0	0	4	4	1.6	0	0	0	2	2	0.8	0	4	2	2	2.0
Parulidae	10	22	22	20	28	20.4	18	8	4	8	6	8.8	4	11	10	6	7.9
Fringillidae	4	15	7	20	17	12.6	16	9	10	7	9	10.2	21	13	7	20	15.3
Unidentified Birds	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	2	0	0.5
Total Birds	20	42	42	54	68	45.2	60	36	24	25	32	35.4	41	39	38	50	42.0

Table 13
 Forest bird population census
 Phosphamidon control for block I
 Northumberland County, New Brunswick
 9-23 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 9	July 10	July 11	July 12	July 13	Daily Avg.	July 14	July 15	July 16	July 19	Daily Avg.	July 21	July 22	July 23	Daily Avg.
Tetraonidae	0	0	1	0	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Columbidae	0	2	0	0	0	0.4	0	0	0	0	0.0	0	1	0	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0.3
Picidae	2	2	6	6	4	4.0	0	0	0	4	1.0	6	4	4	4.7
Tyrannidae	0	0	0	0	0	0.0	0	0	6	0	1.5	4	0	2	2.0
Corvidae	4	0	4	0	0	1.6	2	0	0	0	1.0	0	1	0	0.3
Paridae	14	3	22	8	6	10.6	10	5	14	10	9.8	26	4	4	11.3
Sittidae	4	0	4	2	4	2.8	0	2	2	0	1.0	6	1	2	3.0
Troglodytidae	6	6	10	8	8	7.6	4	2	4	2	3.0	4	2	6	4.0
Turdidae	54	44	44	62	62	53.2	28	12	47	31	29.5	44	21	21	28.7
Sylviidae	6	0	6	8	8	5.6	4	2	3	8	4.3	6	4	6	5.3
Vireonidae	6	4	4	4	9	5.4	6	10	6	8	7.5	8	2	2	4.0
Parulidae	108	76	113	89	125	102.2	70	60	60	78	67.0	72	50	46	56.0
Icteridae	4	4	4	8	13	6.6	8	4	5	2	4.8	4	4	6	4.7
Fringillidae	34	28	26	43	31	32.4	20	17	28	20	21.3	23	29	25	25.7
Unidentified Birds	0	0	2	0	0	0.4	2	0	0	0	0.5	0	0	0	0.0
Total birds	242	169	246	238	270	233.0	154	114	175	163	151.5	203	123	125	150.3

Table 14
 Forest bird population census
 Phosphamidon control for block 7
 Gloucester County, New Brunswick
 12-25 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 12	July 13	July 14	July 16	July 17	Daily Avg.	July 18	July 19	July 20	July 21	Daily Avg.	July 23	July 24	July 25	Daily Avg.
Picidae	1	0	0	0	1	0.4	0	0	2	1	0.8	0	0	0	0.0
Tyrannidae	0	0	0	0	0	0.0	0	0	0	0	0.0	2	2	2	2.0
Corvidae	0	0	0	0	0	0.0	0	0	2	1	0.8	2	0	0	0.7
Paridae	0	0	0	0	0	0.0	0	1	0	1	0.5	2	1	4	2.3
Sittidae	0	0	0	0	2	0.4	0	0	0	0	0.0	4	0	0	1.3
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	0.0	2	0	0	0.7
Troglodytidae	2	4	0	2	4	2.4	2	4	0	6	3.0	2	2	2	2.0
Turdidae	8	9	10	11	7	10.8	8	15	7	11	10.3	44	7	5	8.7
Sylviidae	0	0	4	0	0	0.8	2	0	0	0	0.5	2	0	2	1.3
Bombycillidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	3	1.0
Parulidae	12	22	14	10	4	12.4	0	6	4	10	5.0	6	6	4	5.3
Fringillidae	12	12	10	14	8	11.2	8	12	12	8	10.0	11	9	12	10.7
Total birds	35	47	38	37	26	36.6	20	38	27	38	30.8	47	27	34	36.0

Table 15
 Forest bird population census
 Phosphamidon control for Block 8, Canoe Lake and Block 9
 Gloucester County, New Brunswick
 11-25 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 11	July 12	July 13	July 14	July 16	Daily Avg.	July 17	July 18	July 20	July 21	Daily Avg.	July 23	July 24	July 25	Daily Avg.
Picidae	2	1	0	0	0	0.6	1	0	2	1	1.0	0	0	0	0.0
Tyrannidae	0	0	0	0	0	0.0	0	0	0	0	0.0	2	2	2	2.0
Corvidae	0	0	0	0	0	0.0	0	0	2	1	0.8	2	0	0	0.7
Paridae	1	0	0	0	0	0.2	0	0	0	1	0.3	2	1	4	2.3
Sittidae	2	0	0	0	0	0.4	2	0	0	0	0.5	4	0	0	1.3
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	0.0	2	0	0	0.7
Troglodytidae	4	2	4	0	2	2.4	4	2	0	6	3.0	2	2	2	2.0
Turdidae	10	8	9	10	11	9.6	7	8	7	11	8.3	14	7	5	8.7
Sylviidae	0	0	0	4	0	0.8	0	2	0	0	0.5	2	0	2	1.3
Bombycillidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	3	1.0
Parulidae	18	12	22	14	10	15.2	4	0	4	10	4.5	6	6	4	5.3
Fringillidae	16	12	12	10	14	12.8	8	8	12	8	9.0	11	9	12	10.7
Total birds	53	35	47	38	37	42.0	26	20	27	38	27.8	47	27	34	36.0

Table 16
 Forest bird population census
 Phosphamidon control for Block 8, Bowser Lake
 Gloucester County, New Brunswick
 11-24 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 11	July 12	July 13	July 14	July 16	Daily Avg.	July 17	July 18	July 19	July 20	Daily Avg.	July 22	July 23	July 24	Daily Avg.
Picidae	0	0	2	0	1	0.6	2	0	0	0	0.5	0	0	0	0.0
Corvidae	0	0	0	4	3	1.4	4	0	0	4	2.0	0	2	0	0.7
Paridae	0	0	0	0	7	1.4	3	1	3	4	2.8	2	1	1	1.3
Mimidae	0	2	0	0	0	0.4	0	0	0	0	0.0	0	0	0	0.0
Turdidae	8	8	11	8	10	9.0	4	0	6	6	4.0	4	7	3	4.7
Sylviidae	0	2	2	5	0	1.8	2	0	0	0	0.5	0	0	0	0.0
Parulidae	2	2	8	6	8	5.2	8	4	2	2	4.0	3	4	2	3.0
Icteridae	0	0	1	2	2	1.0	5	2	0	1	2.0	2	2	0	1.3
Fringillidae	2	6	12	10	12	8.4	10	6	8	0	6.0	12	6	14	10.7
Total birds	12	20	36	35	43	29.2	38	13	19	17	21.8	23	22	20	21.7

Table 17
 Forest bird population census
 Phosphamidon control for Block 11
 Northumberland County, New Brunswick
 11-23 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 11	July 12	July 13	July 14	July 15	Daily Avg.	July 16	July 17	July 18	July 19	Daily Avg.	July 21	July 22	July 23	Daily Avg.
Tetraonidae	1	0	0	0	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Columbidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0.3
Picidae	6	6	4	0	0	3.2	0	6	3	4	3.3	6	4	4	4.7
Tyrannidae	0	0	0	0	0	0.0	6	0	2	0	1.5	4	0	2	2.0
Corvidae	4	0	0	2	0	1.2	0	0	4	0	1.3	0	1	0	0.3
Paridae	22	8	6	10	5	10.2	14	2	18	10	11.0	26	4	4	11.3
Sittidae	4	2	4	0	2	2.4	2	4	2	0	2.0	6	1	2	3.0
Troglodytidae	10	8	8	4	2	6.4	4	4	4	2	3.5	4	2	6	4.0
Turdidae	44	62	62	28	12	41.6	47	49	31	31	39.5	44	21	21	28.7
Sylviidae	6	8	8	4	2	5.6	3	9	7	8	6.8	6	4	6	5.3
Vireonidae	4	4	9	6	10	6.6	16	10	5	8	7.3	8	2	2	4.0
Parulidae	113	89	125	70	60	91.4	60	83	73	78	73.5	72	50	46	56.0
Icteridae	4	8	13	8	4	7.4	5	8	10	2	6.3	4	4	6	4.7
Fringillidae	26	43	31	20	17	27.4	28	17	25	20	22.5	23	29	25	25.7
Unidentified birds	2	0	0	2	0	0.8	0	0	0	0	0.0	0	0	0	0.0
Total birds	246	238	270	154	114	204.4	175	192	184	163	178.5	203	123	125	150.3

Table 18
 Forest bird population census
 Phosphamidon control for Block 12
 Northumberland County, New Brunswick
 8-24 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 8	July 9	July 11	July 12	July 13	Daily Avg.	July 15	July 16	July 17	July 18	Daily Avg.	July 22	July 23	July 24	Daily Avg.
Tetraonidae	0	0	1	0	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Columbidae	0	0	0	0	0	0.0	0	0	0	0	0.0	1	0	0	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0.3
Picidae	8	2	6	6	4	5.2	0	0	6	3	2.3	6	4	4	4.7
Tyrannidae	0	0	0	0	0	0.0	0	6	0	2	2.0	4	0	2	2.0
Corvidae	2	4	4	0	0	2.0	0	0	0	4	1.0	0	1	0	0.3
Paridae	18	14	22	8	6	13.6	5	14	2	18	9.8	26	4	4	11.3
Sittidae	0	4	4	2	4	2.8	2	2	4	2	2.5	6	1	2	3.0
Troglodytidae	4	6	10	8	8	7.2	2	4	4	4	3.5	4	2	6	4.0
Turdidae	52	54	44	62	62	54.8	12	47	49	31	34.8	44	21	21	28.7
Sylviidae	6	6	6	8	8	6.8	2	3	9	7	5.3	6	4	6	5.3
Vireonidae	4	6	4	4	9	5.4	10	6	10	5	7.8	8	2	2	4.0
Parulidae	97	108	113	89	125	105.8	60	60	83	73	69.0	72	50	46	56.0
Icteridae	10	4	4	8	13	7.8	4	5	8	10	6.8	4	4	6	4.7
Fringillidae	40	34	26	43	31	34.8	17	28	17	25	21.5	23	29	25	25.7
Unidentified birds	0	0	2	0	0	0.4	0	0	0	0	0.0	0	0	0	0.0
Total birds	238	242	246	238	270	246.8	114	175	192	184	166.3	203	123	125	150.3

Table 19
 Forest bird population census
 Phosphamidon control for Block 13
 Northumberland County, New Brunswick
 8-19 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 8	July 9	July 10	July 11	July 12	Daily Avg.	July 13	July 14	July 15	July 16	Daily Avg.	July 17	July 18	July 19	Daily Avg.
Tetraonidae	0	0	0	1	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Columbidae	0	0	2	0	0	0.4	0	0	0	0	0.0	0	0	0	0.0
Picidae	8	2	2	6	6	4.8	4	0	0	0	1.0	6	3	4	4.3
Tyrannidae	0	0	0	0	0	0.0	0	0	0	6	1.5	0	2	0	0.7
Corvidae	2	4	0	4	0	2.0	0	2	0	0	0.5	0	4	0	1.3
Paridae	18	14	3	22	8	13.0	6	10	5	14	8.8	2	18	10	10.0
Sittidae	0	4	0	4	2	2.0	4	0	2	2	2.0	4	2	0	2.0
Troglodytidae	4	6	6	10	8	6.8	8	4	2	4	4.5	4	4	2	3.3
Turdidae	52	54	44	44	62	51.2	62	28	12	47	37.3	49	31	31	37.0
Sylviidae	6	6	0	6	8	5.2	8	4	2	3	4.3	9	7	8	8.0
Virgonidae	4	6	4	4	4	4.4	9	6	10	6	7.8	10	5	8	7.7
Parulidae	94	108	76	113	89	96.0	125	70	60	60	78.8	83	73	78	78.0
Icteridae	10	4	4	4	8	6.0	13	8	4	5	7.5	8	10	2	6.7
Fringillidae	40	34	28	26	43	34.2	31	20	17	28	24.0	17	25	20	20.7
Unidentified birds	0	0	0	2	0	0.4	0	2	0	0	0.5	0	0	0	0.0
Total birds	238	242	169	246	238	226.6	270	154	114	175	178.5	192	184	163	179.7

Table 20
 Forest bird population census
 Phosphamidon control for Block 16
 Northumberland County, New Brunswick
 9-23 July, 1974

Family	Pre-spray						Post-spray I						Post-spray II			
	July 9	July 10	July 11	July 12	July 13	Daily Avg.	July 15	July 16	July 17	July 18	July 19	Daily Avg.	July 21	July 22	July 23	Daily Avg.
Tetraonidae	0	0	1	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0.0
Columbidae	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	1	0	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	1	0.3
Picidae	2	2	6	6	4	4.0	0	0	6	3	4	2.6	6	4	4	4.7
Tyrannidae	0	0	0	0	0	0.0	0	6	0	2	0	1.6	4	0	2	2.0
Corvidae	4	0	4	0	0	1.6	0	0	0	4	0	0.8	0	1	0	0.3
Paridae	14	3	22	8	6	10.6	5	14	2	18	10	9.8	26	4	4	11.3
Sittidae	4	0	4	2	4	2.8	2	2	4	2	0	2.0	6	1	2	3.0
Troglodytidae	6	6	10	8	8	7.6	2	4	4	4	2	3.2	4	2	6	4.0
Turdidae	54	44	44	62	62	53.2	12	47	49	31	31	34.0	44	21	21	28.7
Sylviidae	6	0	6	8	8	5.6	2	3	9	7	8	5.8	6	4	6	5.3
Vireonidae	6	4	4	4	9	5.4	10	6	10	5	8	7.8	8	2	2	4.0
Parulidae	108	76	113	89	125	102.2	60	60	83	73	78	70.8	72	50	46	56.0
Icteridae	4	4	4	8	13	6.6	4	5	8	10	2	5.8	4	4	6	4.7
Fringillidae	34	28	26	43	31	32.4	17	28	17	25	20	21.4	23	29	25	25.7
Unidentified Birds	0	0	2	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0.0
Total birds	242	169	246	238	270	233.0	114	175	192	184	163	165.6	203	123	125	150.3

Table 21
 Forest bird population census
 Phosphamidon control for Block 17 and plot 3
 Gloucester County, New Brunswick
 11-24 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 11	July 12	July 13	July 14	July 15	Daily Avg.	July 17	July 18	July 19	July 20	Daily Avg.	July 22	July 23	July 24	Daily Avg.
Picidae	0	0	2	0	0	0.4	2	0	0	0	0.5	0	0	0	0.0
Corvidae	0	0	0	4	0	0.8	4	0	0	4	2.0	0	2	0	0.7
Paridae	0	0	0	0	2	0.4	3	1	3	4	2.8	2	1	1	1.3
Mimidae	0	2	0	0	0	0.4	0	0	0	0	0.0	0	0	0	0.0
Turdidae	8	8	11	8	2	7.4	4	0	6	6	4.0	4	7	3	4.7
Sylviidae	0	2	2	5	2	2.2	2	0	0	0	0.5	0	0	0	0.0
Parulidae	2	2	8	6	2	4.0	8	4	2	2	4.0	3	4	2	3.0
Icteridae	0	0	1	2	0	0.6	5	2	0	1	2.0	2	2	0	1.3
Fringillidae	2	6	12	10	4	6.8	10	6	8	0	6.0	12	6	14	10.7
Total birds	12	20	36	35	12	23.0	38	13	19	17	21.8	23	22	20	21.7

Table 22
 Forest bird population census
 Phosphamidon control for Block 2
 Northumberland County, New Brunswick
 10-24 July, 1974

Family	Pre-spray						Post-spray I					Post-spray II			
	July 10	July 11	July 12	July 13	July 14	Daily Avg.	July 15	July 16	July 17	July 18	Daily Avg.	July 22	July 23	July 24	Daily Avg.
Tetraonidae	0	1	0	0	0	0.2	0	0	0	0	0.0	0	0	0	0.0
Columbidae	2	0	0	0	0	0.4	0	0	0	0	0.0	1	0	0	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0.3
Picidae	2	6	6	4	0	3.6	0	0	6	3	2.3	4	4	7	5.0
Tyrannidae	0	0	0	0	0	0.0	0	6	0	2	2.0	0	2	10	4.0
Corvidae	0	4	0	0	2	1.2	0	0	0	4	1.0	1	0	0	0.3
Paridae	3	22	8	6	10	9.8	5	14	2	18	9.8	4	4	11	6.3
Sittidae	0	4	2	4	0	2.0	2	2	4	2	2.5	1	2	5	2.7
Certhiidae	0	0	0	0	0	0.0	0	0	0	0	0.0	0	0	2	0.7
Troglodytidae	6	10	8	8	4	7.2	2	4	4	4	3.5	2	6	4	4.0
Turdidae	44	44	62	62	28	48.0	12	47	49	31	34.8	21	21	36	26.0
Sylviidae	0	6	8	8	4	5.2	2	3	9	7	5.3	4	6	2	4.0
Vireonidae	4	4	4	9	6	5.4	10	6	10	5	7.8	2	2	5	3.0
Parulidae	76	113	89	125	70	94.6	60	60	83	73	69.0	50	46	95	63.7
Icteridae	4	4	8	13	8	7.4	4	5	8	10	6.8	4	6	0	3.3
Fringillidae	28	26	43	31	20	29.6	17	28	17	25	21.8	29	25	26	26.7
Unidentified Birds	0	2	0	0	2	0.8	0	0	0	0	0.0	0	0	0	0.3
Total birds	169	246	238	270	154	215.4	114	175	192	184	166.3	123	125	203	150.3

APPENDIX III

Population structure of bird communities on treatment and control plots; Phosphamidon - triple application.

Table 1
 Forest bird population census
 Phosphamidon treatment plot 1
 Sunbury County, New Brunswick
 28 June-12 July, 1976

Family	Pre-spray					Post-spray I			Post-spray II			Post-spray III			Daily avg.		
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	Daily avg.	July 10		July 11	July 12
Trochilidae	0	0	0	1	0	0.2	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Picidae	4	2	4	4	2	3.2	4	2	3.0	3	2	2	2.3	2	4	2	2.7
Tyrannidae	6	4	4	6	6	5.2	6	6	6.0	4	6	6	5.3	12	8	4	8.0
Corvidae	0	0	0	0	0	0.0	0	0	0.0	0	0	2	0.7	0	3	0	1.0
Paridae	0	0	0	0	0	0.0	0	2	1.0	0	2	0	0.7	2	2	0	1.3
Sittidae	0	0	0	0	0	0.0	0	0	0.0	2	0	0	0.7	0	0	0	0.0
Troglodytidae	0	0	0	0	0	0.0	0	0	0.0	2	0	0	0.7	0	0	0	0.0
Turdidae	18	8	18	16	12	14.4	16	19	17.5	14	19	16	16.3	23	20	15	19.3
Sylviidae	0	0	2	0	2	0.8	2	2	2.0	0	2	2	1.3	2	2	2	2.0
Vireonidae	2	6	6	4	4	4.4	5	2	3.5	4	4	2	3.3	4	2	0	2.0
Parulidae	38	44	51	48	49	46.0	65	47	56.0	45	44	55	48.0	67	41	39	49.0
Fringillidae	10	9	10	8	11	9.6	12	11	11.5	16	8	17	13.7	15	17	17	16.3
Unidentified Birds	4	4	2	4	4	3.6	2	2	2.0	2	2	2	2.0	4	0	4	2.6
Total Birds	82	77	97	91	90	87.4	112	93	102.5	92	89	104	95.0	131	99	83	104.3

Table 2
 Forest bird population census
 Phosphamidon treatment plot 2
 Sunbury County, New Brunswick
 28 June-12 July, 1976

Family	Pre-spray					Post-spray I			Post-spray II			Post-spray III			Daily avg.		
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	Daily avg.	July 10		July 11	July 12
Tetraonidae	0	0	0	0	0	0.0	0	0	0.0	0	0	0	0.0	0	0	1	0.3
Trochilidae	0	0	0	0	0	0.0	0	0	0.0	0	0	0	0.0	1	0	0	0.3
Picidae	0	0	0	0	2	0.4	0	0	0.0	0	0	0	0.0	2	0	0	0.7
Tyrannidae	0	0	0	0	0	0.0	2	2	2.0	0	0	2	0.7	4	0	4	2.7
Hirundinidae	0	0	0	0	7	1.4	5	2	3.5	4	0	0	1.3	0	0	0	0.0
Corvidae	0	0	0	0	0	0.0	0	0	0.0	0	1	0	0.3	4	3	3	3.3
Sittidae	2	0	0	0	0	0.4	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Turdidae	6	4	2	12	5	5.8	16	16	16.0	19	11	18	16.0	29	22	15	22.0
Sylviidae	9	10	6	14	12	10.2	8	12	10.0	8	8	10	8.7	8	6	10	8.0
Vireonidae	0	1	2	0	0	0.6	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Parulidae	34	29	31	50	70	42.8	48	45	46.5	33	27	47	35.7	60	36	32	42.7
Fringillidae	20	16	18	24	30	21.6	33	18	25.5	23	18	21	20.7	24	17	29	23.3
Total Birds	71	60	59	100	126	83.2	112	95	103.5	87	65	98	83.3	132	84	94	103.3

Table 3
 Forest bird population census
 Phosphamidon treatment plot 3
 Sunbury County, New Brunswick
 28 June-12 July, 1976

Family	Pre-spray					Post-spray I			Post-spray II			Post-spray III			Daily avg.		
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	Daily avg.	July 10		July 11	July 12
	-6	-5	-4	-1	-0		+1	+2		+1	+2	+3		+1	+2	+3	
Trochilidae	0	0	0	0	0	0.0	0	0	0.0	0	0	0	0.0	1	0	0	0.3
Picidae	0	0	0	0	0	0.0	2	0	1.0	3	0	1	1.3	4	0	0	1.3
Tyrannidae	8	13	8	4	10	8.6	16	11	13.5	11	2	7	6.7	8	8	5	7.0
Paridae	0	0	0	0	0	0.0	2	2	2.0	2	0	0	0.7	0	0	0	0.0
Sittidae	0	0	0	0	0	0.0	0	0	0.0	2	0	0	0.7	2	2	0	1.3
Troglodytidae	0	0	0	2	0	0.4	0	0	0.0	0	2	2	1.3	0	2	0	0.7
Turdidae	4	6	4	6	4	4.8	6	4	5.0	8	9	9	8.7	15	14	6	11.7
Sylviidae	6	6	5	0	2	3.8	2	2	2.0	3	0	2	6.7	0	2	0	0.7
Bombycillidae	0	0	0	0	0	0.0	0	0	0.0	1	0	0	0.3	0	0	1	0.3
Vireonidae	4	4	2	0	2	2.4	2	4	3.0	6	1	2	3.0	2	6	1	3.0
Parulidae	43	41	44	20	63	42.2	74	62	68.0	66	54	65	61.7	66	68	38	57.3
Fringillidae	42	32	27	8	31	28.0	37	24	30.5	35	16	32	27.7	27	33	6	22.0
Total Birds	107	102	90	40	112	90.2	141	109	125.0	137	84	120	113.7	125	135	57	105.7

Table 4
 Forest bird population census
 Phosphamidon treatment plot 4
 Sunbury County, New Brunswick
 28 June-13 July, 1976

Family	Pre-spray					Post-spray I		Post-spray II					Post-spray III					
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	Daily avg.	July 6	July 7	July 8	July 9	July 10	Daily avg.	July 11	July 12	July 13	Daily avg.
	-6	-5	-4	-1	-0		+1		+0	+1	+2	+3	+4		+1	+2	+3	
Trochilidae	0	0	0	0	0	0.0	0	0.0	0	0	0	0	1	0.2	0	0	0	0.0
Tyrannidae	6	10	4	7	4	6.2	0	0.0	0	4	8	6	4	4.4	7	4	9	6.7
Corvidae	2	0	0	0	2	0.8	1	1.0	1	0	1	0	1	0.6	0	0	1	0.3
Sittidae	0	0	0	0	0	0.0	0	0.0	0	0	0	1	2	0.6	0	0	0	0.0
Troglodytidae	0	0	0	0	0	0.0	0	0.0	0	0	0	0	0	0.0	0	0	2	0.7
Turdidae	12	10	16	8	5	10.2	6	6.0	12	18	17	16	17	16.0	14	8	7	9.7
Sylviidae	10	9	6	11	7	8.6	11	11.0	7	7	8	8	8	7.6	7	5	7	6.3
Bombycillidae	0	0	0	0	0	0.0	0	0.0	0	0	0	0	3	0.6	0	0	0	0.0
Virconidae	0	2	0	2	2	1.2	2	2.0	2	4	4	2	0	2.4	0	0	0	0.0
Parulidae	56	65	53	39	46	51.8	52	52.0	55	57	61	56	58	57.4	43	37	34	38.0
Icteridae	0	0	0	0	0	0.0	0	0.0	0	0	0	0	36	7.2	1	0	0	0.3
Thraupidae	0	0	0	0	0	0.0	0	0.0	0	0	0	2	0	0.4	0	0	0	0.0
Fringillidae	24	22	26	33	17	24.4	15	15.0	22	22	28	29	28	25.8	15	16	13	14.7
Total Birds	110	118	105	100	83	103.2	89	89.0	99	112	127	120	158	123.2	87	70	75	77.3

Table 5
 Forest bird population census
 Phosphamidon control plot (for plots 1, 2 and 3)
 Sunbury County, New Brunswick
 28 June-12 July, 1976

Family	Pre-spray					Post-spray I			Post-spray II			Post-spray III			Daily avg.		
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	Daily avg.	July 10		July 11	July 12
	-6	-5	-4	-1	-0		+1	+2		+1	+2	+3		+1	+2	+3	
Columbidae	2	0	0	0	2	0.8	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Strigidae	0	0	0	0	0	0.0	1	0	0.5	0	0	0	0.0	0	0	0	0.0
Trochilidae	1	1	1	0	1	0.8	1	2	1.5	1	2	2	1.7	1	0	0	0.3
Picidae	8	3	6	3	2	4.4	5	5	5.0	6	1	4	3.7	10	4	7	7.0
Tyrannidae	10	8	2	3	4	5.4	4	2	3.0	4	4	2	3.3	2	4	4	3.3
Corvidae	1	0	0	1	1	0.6	4	0	2.0	0	0	1	0.3	0	1	0	0.3
Paridae	0	0	1	0	0	0.2	0	0	0.0	0	0	1	0.3	1	1	1	1.0
Sittidae	1	1	0	0	1	0.6	0	0	0.0	0	1	0	0.3	0	0	0	0.0
Troglodytidae	2	0	0	2	2	1.2	0	2	1.0	2	2	2	2.0	2	2	2	2.0
Turdidae	11	18	14	14	11	13.6	13	18	15.5	15	10	9	11.3	12	15	11	12.7
Sylviidae	5	2	2	4	5	3.6	1	3	2.0	2	3	1	2.0	4	0	2	2.0
Vireonidae	5	2	2	4	5	3.6	1	3	2.0	2	3	1	2.0	4	0	2	2.0
Parulidae	6	4	2	0	0	2.4	0	4	2.0	2	2	0	1.3	2	0	0	0.7
Thraupidae	66	60	69	59	65	63.8	65	67	66.0	61	58	55	58.0	75	48	50	57.7
Fringillidae	2	0	2	0	0	0.8	0	0	0.0	2	0	0	0.7	0	0	2	0.7
	29	17	20	34	25	25.0	12	22	17.0	33	24	23	26.7	36	25	26	29.0
Total Birds	144	114	119	120	119	123.2	105	125	115.0	128	107	100	111.7	145	100	105	116.7

Table 6
 Forest bird population census
 Phosphamidon control plot (for plot 4)
 Sunbury County, New Brunswick
 28 June-13 July, 1976

Family	Pre-spray					Post-spray I		Post-spray II					Post-spray III			Daily avg.		
	June 28	June 29	June 30	July 3	July 4	July Daily avg.	July 5	July Daily avg.	July 6	July 7	July 8	July 9	July 10	July Daily avg.	July 11		July 12	July 13
	-6	-5	-4	-1	-0	+1	+0	+1	+2	+3	+4	+1	+2	+3				
Columbidae	2	0	0	0	2	0.8	0	0.0	0	0	0	0	0	0.0	0	0	0	0.0
Trochilidae	1	1	1	0	1	0.8	1	1.0	2	1	2	2	1	1.6	0	0	0	0.0
Picidae	8	3	6	3	2	4.4	5	5.0	5	6	1	4	10	5.2	4	7	1	4.0
Tyrannidae	10	8	2	3	4	5.4	4	4.0	2	4	4	2	2	2.8	4	4	4	4.0
Corvidae	1	0	0	1	1	0.6	4	4.0	0	0	0	1	0	0.2	1	0	0	0.3
Paridae	0	0	1	0	0	0.2	0	0.0	0	0	1	0	0	0.2	0	0	0	0.0
Sittidae	1	1	0	0	1	0.6	0	0.0	0	0	0	1	1	0.4	1	1	0	0.7
Troglodytidae	2	0	0	2	2	1.2	0	0.0	2	2	2	2	2	2.0	2	2	2	2.0
Turdidae	11	18	14	14	11	13.6	13	13.0	18	15	10	9	12	12.8	15	11	4	10.0
Sylviidae	5	2	2	4	5	3.6	1	1.0	3	2	3	1	4	2.6	0	2	3	1.7
Virgonidae	6	4	2	0	0	2.4	0	0.0	4	2	2	0	2	2.0	0	0	0	0.0
Parulidae	66	60	69	59	65	63.8	65	65.0	67	61	58	55	75	63.2	48	50	39	45.7
Thraupidae	2	0	2	0	0	0.8	0	0.0	0	2	0	0	0	0.4	0	2	0	0.7
Fringillidae	29	17	20	34	25	25.0	12	12.0	22	33	24	23	36	27.6	25	26	14	21.7
Total Birds	144	114	119	120	119	123.2	105	105.0	125	128	107	100	145	121.0	100	105	67	90.7

Table 7
 Forest bird population census
 Phosphamidon treatment plot CP3
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray II	Post-spray III					Daily avg.		
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 15	Daily avg.	July 17	July 18	July 19		July 20	July 21
	-6	-5	-3	-2	-1		+1	+3		+1		+1	+2	+3		+4	+5
Picidae	0	0	1	0	0	0.2	0	1	0.5	0	0.0	1	0	0	0	1	0.4
Paridae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	2	2	1	2	0	1.4
Troglodytidae	0	0	2	2	0	0.8	2	2	2.0	0	0.0	2	2	0	2	0	1.2
Turdidae	9	3	6	6	8	6.4	7	5	6.0	7	7.0	2	4	4	1	0	2.2
Vireonidae	0	0	0	2	2	0.8	2	2	2.0	2	2.0	0	0	2	0	2	0.8
Parulidae	6	11	14	6	8	9.0	6	8	7.0	6	6.0	4	2	7	2	4	3.8
Fringillidae	1	0	0	2	0	0.6	4	4	4.0	2	2.0	1	0	6	0	0	1.4
Total Birds	16	14	23	18	18	17.8	21	22	21.5	17	17.0	12	10	20	7	7	11.2

Table 8
 Forest bird population census
 Phosphamidon treatment plot CP4
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray II	Post-spray III					Daily avg.		
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 15	Daily avg.	July 17	July 18	July 19		July 20	July 21
	-6	-5	-3	-2	-1		+1	+3		+1		+1	+2	+3		+4	+5
Caprimulgidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	1	0	1	0	0	0.4
Trochilidae	0	0	0	0	0	0.0	1	1	1.0	0	0.0	0	0	1	2	0	0.6
Picidae	0	2	0	2	0	0.8	0	0	0.0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	0	0	2	0	0	0.4	0	0	0.0	0	0.0	2	0	2	0	0	0.8
Corvidae	1	0	0	0	0	0.2	0	0	0.0	0	0.0	0	0	0	0	0	0.0
Paridae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	0	0	0	0	2	0.4
Sittidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	0	0	0	0	2	0.4
Troglodytidae	0	0	0	2	0	0.4	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Turdidae	4	0	6	7	6	4.6	6	8	7.0	4	4.0	4	2	0	4	0	2.0
Bombycillidae	0	0	0	0	0	0.0	0	2	1.0	0	0.0	0	0	0	0	0	0.0
Parulidae	10	2	8	6	8	6.8	12	6	9.0	4	4.0	8	2	4	0	4	3.6
Fringillidae	6	4	9	10	6	7.0	12	13	12.5	10	10.0	6	8	8	8	2	6.4
Total Birds	21	8	25	27	20	20.2	31	30	30.5	18	18.0	23	12	16	14	10	15.0

Table 9
 Forest bird population census
 Phosphamidon treatment plot 11
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I				Post-spray III			
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 17	July 20	July 21	Daily avg.
Strigidae	0	1	0	0	0	0.2	0	0	0.0	0	0	0	0.0
Trochilidae	0	1	0	0	1	0.4	0	0	0.0	1	0	0	0.3
Picidae	0	0	6	4	2	2.4	0	0	0.0	1	0	0	0.3
Corvidae	3	0	0	0	0	0.6	0	2	1.0	2	0	0	0.7
Paridae	4	5	0	0	0	1.8	2	2	2.0	4	2	0	2.0
Sittidae	4	4	4	0	2	2.8	1	6	3.5	3	0	0	1.0
Turdidae	9	7	4	11	1	6.4	6	10	8.0	10	9	0	6.3
Sylviidae	4	4	4	2	2	3.2	2	2	2.0	0	0	0	0.0
Vireonidae	0	0	4	2	4	2.0	2	2	2.0	0	2	0	0.7
Parulidae	6	25	18	19	9	15.4	24	29	26.5	23	12	3	12.7
Icteridae	0	0	0	0	0	0.0	1	0	0.5	0	0	0	0.0
Fringillidae	9	11	14	19	15	13.6	8	15	11.5	7	10	7	8.0
Unidentified Birds	0	0	0	0	0	0.0	3	0	1.5	1	0	0	0.3
Total Birds	39	58	54	57	36	48.8	49	68	58.5	52	35	10	32.3

Table 10
 Forest Bird Population Census
 Phosphamidon treatment plot 12
 Northumberland County, New Brunswick
 4-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray III					
	July 4	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 17	July 19	July 20	July 21	Daily avg.
Picidae	2	0	4	2	1	1.8	1	1	1.0	1	0	0	0	0.3
Tyrannidae	0	0	2	0	0	0.4	0	0	0.0	0	0	0	0	0.0
Corvidae	0	0	1	0	0	0.2	1	0	0.5	0	2	0	0	0.5
Paridae	0	2	4	0	2	1.6	2	2	2.0	6	2	0	15	5.8
Sittidae	0	0	2	2	0	0.8	2	0	1.0	2	0	2	2	1.5
Troglodytidae	2	2	2	2	2	2.0	2	2	2.0	2	0	0	2	1.0
Turdidae	10	6	11	9	5	8.2	8	17	12.5	22	4	2	8	9.0
Sylviidae	4	0	0	0	0	0.8	0	0	0.0	0	0	0	0	0.0
Bombycillidae	0	0	0	0	0	0.0	0	0	0.0	0	0	5	0	1.3
Vireonidae	2	2	2	0	0	1.2	4	0	2.0	4	2	4	2	3.0
Parulidae	26	12	34	23	22	23.4	27	22	24.5	24	4	10	14	13.0
Fringillidae	4	6	10	4	15	7.8	13	4	8.5	1	2	11	4	4.5
Unidentified Birds	0	0	0	0	0	0.0	0	0	0.0	0	1	0	0	0.3
Total Birds	50	30	72	42	47	48.2	60	48	54.0	62	17	34	47	40.0

Table 11
 Forest bird population census
 Phosphamidon control plot CPl
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray II	Post-spray III					Daily avg.		
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 15	Daily avg.	July 17	July 18	July 19		July 20	July 21
	-5	-4	-3	-2	-1		+1	+3		+1		+1	+2	+3		+4	+5
Picidae	0	0	1	0	1	0.4	0	0	0.0	0	0.0	0	0	0	0	0	0.0
Turdidae	9	2	4	2	6	4.6	4	8	6.0	6	6.0	4	4	6	2	0	3.2
Sylviidae	0	2	0	0	0	0.4	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Vireonidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Parulidae	8	8	4	8	10	7.6	8	6	7.0	6	6.0	10	6	4	6	5	6.2
Icteridae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	0	0	2	0	0	0.4
Fringillidae	6	2	4	8	2	4.4	4	4	4.0	2	2.0	1	0	5	3	4	2.6
Total Birds	23	14	13	18	19	17.4	16	18	17.0	14	14.0	19	10	17	11	9	13.2

Table 12
 Forest bird population census
 Phosphamidon control plot CP2
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray II	Post-spray III					Daily avg.		
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 15	Daily avg.	July 17	July 18	July 19		July 20	July 21
	-5	-4	-3	-2	-1		+1	+3		+1		+1	+2	+3		+4	+5
Trochilidae	0	0	0	0	0	0.0	0	0	0.0	1	1.0	0	0	0	0	0	0.0
Picidae	0	0	4	0	4	1.6	2	0	1.0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	0	0	0	2	0	0.4	2	2	2.0	2	2.0	2	0	2	2	0	1.2
Corvidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Paridae	0	0	0	0	0	0.0	2	0	1.0	0	0.0	0	0	0	0	0	0.0
Sittidae	0	2	0	0	0	0.4	0	0	0.0	0	0.0	0	0	0	0	0	0.0
Troglodytidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	0	2	0	0	2	0.8
Turdidae	5	0	3	9	6	4.6	4	6	5.0	6	6.0	3	3	5	1	1	2.6
Sylviidae	0	0	2	0	0	0.4	0	0	0.0	0	0.0	0	0	0	0	0	0.0
Bombycillidae	0	0	0	0	0	0.0	0	0	0.0	0	0.0	0	0	0	3	0	0.6
Vireonidae	0	2	0	0	2	0.8	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Parulidae	6	4	6	6	4	5.2	8	6	7.0	14	14.0	8	4	4	10	4	6.0
Icteridae	0	2	0	2	0	0.8	0	0	0.0	0	0.0	2	0	0	0	0	0.4
Fringillidae	12	8	12	6	4	8.4	12	4	8.0	6	6.0	10	2	6	6	9	6.6
Total Birds	23	18	27	25	20	22.6	30	18	24.0	29	29.0	29	11	17	24	14	19.0

Table 13
 Forest bird population census
 Phosphamidon control plot for plot 11
 Northumberland County, New Brunswick
 5-21 July, 1977

Family	Pre-spray					Post-spray I				Post-spray III			
	July 5	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 17	July 20	July 21	Daily avg.
	-6	-5	-3	-2	-1		+1	+3		+1	+4	+5	
Tetraonidae	0	0	0	0	0	0.0	2	0	1.0	0	0	0	0.0
Picidae	2	0	0	0	0	0.4	1	0	0.5	1	1	0	0.7
Corvidae	0	0	0	0	0	0.0	0	0	0.0	1	0	0	0.3
Paridae	0	2	0	0	0	0.4	0	0	0.0	2	9	0	3.7
Troglodytidae	0	0	2	0	2	0.8	2	0	1.0	2	2	0	1.3
Turdidae	0	0	6	8	3	3.4	11	2	6.5	11	8	0	6.3
Sylviidae	0	0	2	0	2	0.8	2	0	1.0	0	2	0	0.7
Bombycillidae	0	0	0	0	0	0.0	0	0	0.0	0	4	0	1.3
Vireonidae	0	0	4	0	2	1.2	4	6	5.0	6	2	0	2.7
Parulidae	24	20	36	16	18	22.8	33	20	26.5	22	17	4	14.4
Fringillidae	6	6	8	6	8	6.8	5	11	8.0	7	2	4	4.3
Total Birds	32	28	58	30	35	36.6	60	39	49.5	52	47	8	35.7

Table 14
 Forest bird population census
 Phosphamidon control plot for plot 12
 Northumberland County, New Brunswick
 4-21 July, 1977

Family	Pre-spray					Post-spray I			Post-spray III			Daily avg.	
	July 4	July 6	July 8	July 9	July 10	Daily avg.	July 12	July 14	Daily avg.	July 17	July 20		July 21
Tetraonidae	0	0	0	0	0	0.0	2	0	1.0	0	0	0	0.0
Picidae	6	0	0	0	0	1.2	1	0	0.5	1	1	0	0.7
Corvidae	0	0	0	0	0	0.0	0	0	0.0	1	0	0	0.3
Paridae	2	2	0	0	0	0.8	0	0	0.0	2	9	0	3.7
Sittidae	4	0	0	0	0	0.8	0	0	0.0	0	0	0	0.0
Troglodytidae	0	0	2	0	2	0.8	2	0	1.0	2	2	0	1.3
Turdidae	8	0	6	8	3	5.0	11	2	6.5	11	8	0	6.3
Sylviidae	0	0	2	0	2	0.8	2	0	1.0	0	2	0	0.7
Bombycillidae	0	0	0	0	0	0.0	0	0	0.0	0	4	0	1.3
Vireonidae	0	0	4	0	2	1.2	4	6	5.0	6	2	0	2.7
Parulidae	35	20	36	16	18	25.0	33	20	26.5	22	17	4	14.4
Fringillidae	7	6	8	6	8	7.0	5	11	8.0	7	2	4	4.3
Total Birds	62	28	58	30	35	42.6	60	39	49.5	52	47	8	35.7

APPENDIX IV

Population structure of bird communities on treatment and control plots; Phosphamidon - five application.

Table 1
 Forest bird population census
 Phosphamidon treatment block 12 (Dungarvon River plot)
 Blackville area, Northumberland County, New Brunswick, 7-17 July, 1975.

Family	Species	First Post-spray period					Second Post-spray period				
		July 7	July 8	July 9	July 10	Daily Avg.	July 14	July 15	July 16	July 17	Daily Avg.
Picidae	Yellow-bellied Sapsucker	1	1	4	0	1.5	1	0	0	0	0.3
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	0	2	0	0.5
	Eastern Wood Peewee	2	0	0	0	0.5	0	2	0	0	0.5
Paridae	Black-capped Chickadee	0	1	0	0	0.3	0	7	7	0	3.5
Troglodytidae	Winter Wren	0	0	0	0	0.0	2	2	0	0	1.0
Mimidae	Catbird	2	0	0	0	0.5	0	0	0	0	0.0
Turdidae	American Robin	0	3	0	0	0.8	1	0	0	0	0.3
	Wood Thrush	2	4	6	4	4.0	0	0	0	0	0.0
	Hermit Thrush	0	0	0	1	0.3	0	0	0	0	0.0
	Swainson's Thrush	2	0	8	4	3.5	4	7	12	4	6.8
	Veery	8	4	10	16	9.5	12	5	6	6	7.3
Sylviidae	Ruby-crowned Kinglet	0	0	0	0	0.0	0	0	2	4	1.5
Bombycillidae	Cedar Waxwing	10	4	0	0	3.5	6	4	0	0	2.5
Vireonidae	Red-eyed Vireo	2	0	0	2	1.0	2	0	0	0	0.5
Parulidae	Black-and-white Warbler	0	0	0	0	0.0	2	4	2	2	2.5
	Tennessee Warbler	0	2	2	2	1.5	0	0	0	0	0.0
	Parula Warbler	4	4	6	0	3.5	4	0	2	6	3.0
	Magnolia Warbler	4	4	6	6	5.0	6	8	2	6	5.5
	Cape May Warbler	6	2	4	0	3.0	0	0	0	0	0.0
	Yellow-rumped Warbler	0	0	0	0	0.0	4	0	0	0	1.0
	Chestnut-sided Warbler	2	2	2	2	2.0	2	4	2	0	2.0
	Bay-breasted Warbler	0	0	0	2	0.5	0	0	0	0	0.0
	Ovenbird	0	2	0	8	2.5	2	2	4	2	2.5
	Northern Waterthrush	10	4	2	2	4.5	4	4	6	6	5.0
	Yellowthroat	2	0	2	2	1.5	2	4	4	0	2.5
	Canada Warbler	2	2	0	2	1.5	2	2	2	8	3.5
	American Redstart	4	0	4	0	2.0	4	2	4	2	3.0
Icteridae	Brown-headed Cowbird	10	0	0	0	2.5	0	0	0	0	0.0
Fringillidae	Rose-breasted Grosbeak	2	0	0	0	0.5	0	0	1	0	0.3
	Evening Grosbeak	20	10	15	8	13.3	20	10	0	4	8.5
	Purple Finch	12	10	15	7	9.0	12	5	0	0	4.3
	Pine Siskin	12	6	10	6	8.5	8	5	5	0	4.5
	American Goldfinch	2	0	1	1	1.0	0	0	1	0	0.3
	Slate-coloured Junco	0	0	2	4	1.5	2	0	0	0	0.5
	Chipping Sparrow	0	0	2	0	0.5	0	0	0	2	0.5
	White-throated Sparrow	2	2	2	2	2.0	4	4	2	4	3.5
	Song Sparrow	4	4	4	4	4.0	6	2	4	2	3.5
Totals		127	71	107	85	97.5	110	83	70	58	80.3

Table 2
 Forest bird population census
 Untreated control plot (Morse Brook plot)
 Blackville area, Northumberland County, New Brunswick, 8-17 July, 1975.

Family	Species	First Post-spray period				Second Post-spray period				
		July 8	July 9	July 10	Daily Avg.	July 14	July 15	July 16	July 17	Daily Avg.
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0.0	0	0	2	0	0.5
	Olive-sided Flycatcher	0	0	0	0.0	0	2	2	0	1.0
Corvidae	Gray Jay	0	0	0	0.0	0	4	0	0	1.0
Paridae	Black-capped Chickadee	0	0	0	0.0	0	10	4	4	4.5
Sittidae	Red-breasted Nuthatch	0	0	0	0.0	0	0	0	2	0.5
Troglodytidae	Winter Wren	0	0	2	0.7	2	4	4	2	3.0
Turdidae	American Robin	0	3	0	1.0	0	1	1	0	0.5
	Swainson's Thrush	6	6	10	7.3	8	9	12	10	9.8
	Veery	2	4	2	2.7	2	0	4	2	2.0
Sylviidae	Ruby-crowned Kinglet	0	0	0	0.0	0	0	0	4	1.0
Bombycillidae	Cedar Waxwing	0	0	0	0.0	2	0	0	0	0.5
Vireonidae	Solitary Vireo	0	0	0	0.0	0	0	0	2	0.5
	Red-eyed Vireo	0	0	0	0.0	0	0	0	4	1.0
Parulidae	Tennessee Warbler	0	0	0	0.0	0	12	4	0	4.0
	Parula Warbler	4	2	4	3.3	2	4	4	2	3.0
	Magnolia Warbler	0	6	6	4.0	6	6	6	2	5.0
	Yellow-rumped Warbler	0	0	0	0.0	0	2	2	0	1.0
	Bay-breasted Warbler	2	10	4	5.3	4	4	6	4	4.5
	Ovenbird	2	6	4	4.0	4	2	4	2	3.0
Parulidae	Northern Waterthrush	0	0	0	0.0	0	0	2	0	0.5
	Yellowthroat	6	4	6	5.3	4	4	6	6	5.0
	Canada Warbler	1	0	0	0.3	2	2	2	2	2.0
	American Redstart	0	0	2	0.7	0	2	4	2	2.0
	Unidentified Warblers	0	0	0	0.0	0	10	4	10	6.0
Icteridae	Red-winged Blackbird	0	0	0	0.0	2	2	2	2	2.0
Fringillide	Rose-breasted Grosbeak	0	0	0	0.0	0	1	2	2	1.3
	Evening Grosbeak	0	0	0	0.0	4	0	0	0	1.0
	Purple Finch	0	0	0	0.0	0	2	0	0	0.5
	American Goldfinch	0	0	1	0.3	0	0	0	0	0.0
	Chipping Sparrow	0	0	0	0.0	2	2	2	2	2.0
	White-throated Sparrow	2	2	0	1.3	0	4	4	4	3.0
Totals		25	43	41	36.3	44	89	83	70	71.5

APPENDIX V

Population structure of bird communities on treatment and control plots; Phosphamidon - plus motor stimulants, double application.

Table 1
 Forest bird population census
 Phosphamidon plus motor stimulant treatment block 1, plot 1
 Sunbury County, New Brunswick
 5-19 July, 1977.

Family	Pre-spray					Daily avg.	Post-spray I			Daily avg.	Post-spray II					Daily avg.
	July 5	July 6	July 7	July 8	July 9		July 11	July 13	July 14		July 15	July 16	July 17	July 18	July 19	
	-5	-4	-3	-2	-1		+1	+3	+4		+1	+2	+3	+4	+5	
Accipitridae	0	2	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Trochilidae	0	2	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Picidae	0	1	2	0	1	0.8	0	0	0	0.0	0	0	1	0	0	0.2
Tyrannidae	0	2	4	4	2	2.4	2	0	3	1.7	2	2	4	3	3	2.8
Corvidae	0	0	1	0	0	0.2	2	0	0	0.7	0	1	1	0	1	0.6
Paridae	0	2	2	0	0	0.8	0	0	2	0.7	2	0	2	3	0	1.4
Sittidae	0	1	0	0	0	0.2	0	0	0	0.0	0	0	2	0	0	0.4
Turdidae	9	10	14	6	20	11.8	12	12	10	11.3	11	10	12	9	6	9.6
Sylviidae	2	0	0	0	0	0.4	2	0	0	0.7	0	0	0	0	0	0.0
Vireonidae	6	2	8	6	2	4.8	2	4	0	2.0	1	0	4	2	4	2.2
Parulidae	79	79	71	79	67	75.0	78	60	45	61.0	48	45	56	44	33	45.2
Fringillidae	16	14	17	11	8	13.2	11	12	8	10.4	7	10	16	5	12	10.0
Unidentified Birds	0	0	0	0	2	0.4	0	0	0	0.0	0	0	1	1	1	0.6
Total Birds	112	115	119	106	102	110.8	109	88	68	88.3	71	68	99	67	60	73.0

Table 2
 Forest bird population census
 Phosphamidon plus motor stimulant treatment block 1, plot 3
 Sunbury County, New Brunswick
 5-19 July, 1977.

Family	Pre-spray					Post-spray I					Post-spray II					Daily avg.
	July 5	July 6	July 7	July 8	July 9	Daily avg.	July 11	July 13	July 14	Daily avg.	July 15	July 16	July 17	July 18	July 19	
	-5	-4	-3	-2	-1		+1	+3	+4		+1	+2	+3	+4	+5	
Picidae	0	5	0	0	2	1.4	0	3	3	2.0	2	5	2	1	0	2.0
Tyrannidae	2	0	0	0	4	1.2	0	0	0	0.0	0	0	4	0	0	0.8
Hirundinidae	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0.4
Corvidae	0	2	0	0	0	0.4	0	0	0	0.0	0	0	1	0	0	0.2
Paridae	2	2	0	0	2	1.2	4	2	6	4.0	6	8	4	8	2	5.6
Sittidae	0	0	0	0	0	0.0	2	0	2	1.3	2	0	0	0	0	0.4
Certhiidae	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	4	10	10	9	17	10.0	16	17	25	19.3	17	24	16	8	14	15.8
Sylviidae	0	4	0	6	0	2.0	0	0	0	0.0	4	0	0	4	0	1.6
Bombycillidae	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0.0
Vireonidae	0	4	2	8	0	2.8	3	4	4	3.7	4	1	2	6	4	3.4
Parulidae	54	74	35	65	53	56.2	54	66	51	57.0	49	58	49	43	30	45.8
Icteridae	2	0	0	0	0	0.4	0	0	0	0.0	0	3	0	0	0	0.6
Fringillidae	12	23	16	21	24	19.2	20	20	15	18.3	16	16	27	15	18	18.4
Unidentified Birds	0	1	0	0	1	0.4	2	1	0	1.0	0	0	5	0	2	1.4
Total Birds	76	125	65	109	103	95.6	101	115	106	107.3	100	117	110	85	70	96.4

Table 3
 Forest bird population census
 Control block, plot 5
 Sunbury County, New Brunswick
 5-19 July, 1977

Family	Pre-spray					Daily avg.	Post-spray I			Daily avg.	Post-spray II					Daily avg.
	July 5	July 6	July 7	July 8	July 9		July 11	July 13	July 14		July 15	July 16	July 17	July 18	July 19	
Accipitridae	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0.0
Picidae	0	1	0	1	1	0.6	0	0	0	0.0	0	0	0	0	1	0.2
Tyrannidae	0	5	2	4	2	2.6	3	2	2	2.4	2	2	2	2	0	1.6
Corvidae	2	0	1	2	1	1.2	1	0	0	0.3	0	0	0	0	0	0.0
Paridae	0	0	0	0	0	0.0	0	2	0	0.7	0	0	4	0	2	1.2
Sittidae	0	0	2	2	0	0.8	2	0	0	0.7	2	0	0	0	0	0.4
Troglodytidae	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	2	0	0.8
Turdidae	13	21	12	14	12	14.4	13	10	8	10.4	4	14	7	8	8	8.2
Sylviidae	0	0	2	2	4	1.6	2	0	0	0.7	0	0	0	0	0	0.0
Vireonidae	4	4	6	4	4	4.4	2	4	4	3.4	0	6	6	0	4	3.2
Parulidae	61	55	52	71	44	56.6	57	9	23	29.9	19	33	29	17	27	25.0
Fringillidae	16	16	13	17	12	14.8	13	5	6	8.0	7	13	10	9	11	10.0
Unidentified Birds	0	1	1	0	2	0.8	1	0	0	0.3	1	2	2	0	0	1.0
Total Birds	96	103	91	117	82	97.8	94	34	43	57.0	35	72	60	38	53	51.6

APPENDIX VI

Population structure of bird communities on treatment and control plots; Aminocarb - double application.

Table 1
 Forest bird population census
 Aminocarb treatment plot 6
 Sunbury County, New Brunswick
 28 June-11 July, 1976.

Family	Pre-spray					Post-spray I			Post-spray II					Daily avg.	
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	July 10		July 11
	-7	-6	-5	-2	-1		+0	+1		+0	+1	+2	+3		+4
Trochilidae	2	0	2	2	0	1.2	0	0	0.0	0	0	0	0	0	0.0
Picidae	0	0	0	2	0	0.4	2	0	1.0	2	2	3	2	3	2.4
Tyrannidae	4	3	3	2	2	2.8	2	12	7.0	6	7	12	7	8	8.0
Hirundinidae	0	1	0	0	0	0.2	2	2	2.0	1	0	0	1	0	0.4
Corvidae	0	0	1	0	0	0.2	0	0	0.0	4	0	1	3	3	2.2
Sittidae	2	0	0	0	0	0.4	2	0	1.0	0	0	0	0	2	0.4
Troglodytidae	0	2	2	0	0	0.8	0	2	1.0	2	6	2	4	2	3.2
Turdidae	8	9	8	9	7	8.2	13	7	10.0	10	12	17	15	20	14.8
Sylviidae	11	6	8	4	4	6.6	4	8	6.0	6	5	8	6	8	6.6
Bombycillidae	2	1	2	3	0	1.6	0	3	1.5	0	1	0	1	1	0.6
Vireonidae	0	2	2	2	0	1.2	2	0	1.0	4	0	0	4	2	2.0
Parulidae	42	55	41	46	32	43.2	48	64	56.0	53	48	57	65	67	58.0
Fringillidae	37	46	31	36	12	32.4	41	23	32.0	34	26	18	21	25	24.8
Total Birds	108	125	100	106	57	99.2	116	121	118.5	122	107	118	129	141	123.4

Table 2
 Forest bird population census
 Aminocarb control plot
 Sunbury County, New Brunswick
 28 June-11 July 1976

Family	Pre-spray					Post-spray I			Post-spray II					Daily avg.	
	June 28	June 29	June 30	July 3	July 4	Daily avg.	July 5	July 6	Daily avg.	July 7	July 8	July 9	July 10		July 11
	-7	-6	-5	-2	-1		+0	+1		+0	+1	+2	+3		+4
Accipitridae	0	1	0	0	0	0.2	0	0	0.0	0	0	0	0	0	0.0
Falconidae	0	0	0	0	0	0.0	1	0	0.5	0	0	0	0	0	0.0
Strigidae	0	0	0	0	1	0.2	0	0	0.0	0	0	0	0	0	0.0
Caprimulgidae	0	0	0	0	0	0.0	0	0	0.0	0	0	1	0	0	0.2
Tyrannidae	2	0	0	2	2	1.2	0	1	0.5	0	3	2	0	3	1.6
Corvidae	2	3	0	1	0	1.2	1	4	2.5	0	1	0	0	4	1.0
Paridae	0	0	0	0	0	0.0	0	0	0.0	0	0	0	4	1	1.0
Sittidae	0	0	0	0	2	0.4	4	2	3.0	2	2	2	2	2	2.0
Turdidae	12	7	8	16	9	10.4	12	15	13.5	6	12	16	18	22	14.8
Sylviidae	8	4	2	4	2	4.0	9	3	6.0	4	2	4	10	8	5.6
Vireonidae	0	0	0	0	0	0.0	2	0	1.0	0	0	0	0	0	0.0
Parulidae	30	22	16	36	34	27.6	25	18	21.5	34	26	23	48	35	33.2
Fringillidae	16	35	7	29	17	20.8	15	9	12.0	15	18	9	15	21	15.6
Total Birds	70	72	33	88	67	66.0	69	52	60.5	61	64	57	97	96	75.0

APPENDIX VII

Population structure of bird communities on treatment and control plots; Aminocarb - triple application.

Table 2. Forest bird population census, Aminocarb control plot, Sunbury County, New Brunswick, 28 June-12 July, 1976.

	Pre-spray					Post-spray I					Post-spray II					Post-spray III															
	June	June	June	July	July	July	July	July	July	July	July	July	July	July	July	July	July	July	July	July	Daily	Daily	Daily	Daily	Daily	Bally	Bally	Bally	Bally	Bally	
	28	29	30	31	1	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	avg.	avg.	avg.	avg.	avg.	10	11	12	13	14	
Accipitridae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Falconidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Strigidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Caprimulgidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Tyrannidae	2	0	0	2	2	2	2	2	2	1	4	2	3	2	2	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0	3	2	2	2	1.7
Corvidae	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	2.5	2.5	2.5	2.5	0	4	4	4	4	2.7
Paridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Sittidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Turdidae	12	7	8	16	9	9	10	4	2	4	4	2	2	2	2	2	2	2	2	2	3.0	3.0	3.0	3.0	3.0	2	2	2	2	2	2.0
Sylviidae	8	4	2	4	2	4	2	2	2	3	6	4	2	4	2	2	2	2	2	2	6.0	6.0	6.0	6.0	6.0	8	8	1	1	1	6.3
Vireonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0.0
Parulidae	30	22	16	36	34	34	27	6	18	25	18	21	5	34	26	23	27	7	48	35	27.6	27.6	27.6	27.6	27.6	22	22	22	22	22	35.0
Fringillidae	16	35	7	29	17	20	8	15	9	12	0	8	15	18	9	14	0	15	21	17	12.0	12.0	12.0	12.0	12.0	15	15	17	17	17	17.7
Total Birds	70	72	33	88	67	66	0	69	52	60	5	61	64	57	60	7	60	7	55	82	60.5	60.5	60.5	60.5	60.5	96	96	97	96	96	82.7