

Impact of Experimental Spruce Budworm (*Choristoneura*
fumiferana Clemens) Suppression Trials upon Forest
Dwelling Birds in Newfoundland in 1977

by

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Résumé

Des études furent faites sur les conséquences immédiates et à court terme d'essais effectués dans la lutte contre la Tordeuse des bourgeons de l'Épinette (*Choristoneura fumiferana* Clemens) sur l'habitat des oiseaux. L'aminocarbène en doses de 0.070 kg AI/ha x 3 et de 0.087 kg AI/ha x 2 n'a pas nui aux populations d'oiseaux ni empêché leur reproduction. Deux applications de fenitrothion (0.210 kg AI/ha), suivies d'un traitement d'aminocarbène (0.070 kg AI/ha) ont causé un déclin de courte durée de l'activité des fauvettes (famille des Paurulidae). Deux applications d'acéphate (0.056 kg AI/ha) avec le *Bacillus thuringiensis* Berliner (8 BIU) diminuèrent les activités de la fauvette.

Des recherches dans les placettes après chaque expérience n'ont révélé la mort d'aucun oiseau, ni aucune maladie ou stress chez les oiseaux.

Abstract

Immediate and short-term consequences of experimental spruce budworm (*Choristoneura fumiferana* Clemens) suppression trials upon the forest dwelling bird complex were studied. A series of trials employing aminocarb at the emitted dosage rates of 0.070 kg AI/ha X 3 and 0.087 kg AI/ha X 2 did not damage bird populations or interrupt breeding activity. Trials involving two applications of fenitrothion (0.210 kg AI/ha) followed by aminocarb (0.070 kg AI/ha) caused a short-term decline in the activity of warblers (family Parulidae). Acephate (0.056 kg AI/ha) combined by *Bacillus thuringiensis* Berliner (19.8 BIU/ha) and applied twice caused a reduction of warbler activity.

Plot searches following each trial failed to recover any dead birds and no sick or stressed birds were observed.

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1. INTRODUCTION

A spruce budworm, C. fumiferana Clem., outbreak in Newfoundland has steadily increased in size and intensity since 1971 and now covers approximately 3.6 million hectares (Barnes pers. com.) In 1977 the Newfoundland Department of Forestry and Agriculture carried out a limited experimental programme over about 75,760 hectares employing several spray regimes using aminocarb (4-dimethylamino-m-tolyl methylcarbamate, fenitrothion 10, 0-dimethyl 0-(4 nitro-m-tolyl) phosphorothioate), acephate (0, 5 dimethyl acetylphos = phoramidothioate) and the bacterium Bacillus thuringiensis Berliner (B.t.). Aminocarb was applied in a series of trials either alone or in combination with fenitrothion, and the acephate was mixed with B.t.

The Newfoundland Department of Consumer Affairs and Environment was responsible for the overall monitoring of the effects of the various spray regimes on non-target organisms. The Environmental Impact group of the Forest Pest Management Institute played a lead role in assessing the impact of 4 spray regimes upon forest avifauna. Students were trained in the St. John's area then moved to the experimental sites where plots were selected and population data collected throughout the programme. The compilation and assessment of data was carried out at the Institute headquarters.

This report presents the results of studies carried out to determine the immediate and short-term effects of a series of experimental sprays upon forest dwelling birds exposed to the various treatment regimes.

II MATERIALS AND METHODS

The 1977 experimental spray programme was carried out with DC-6B aircraft equipped with the Litton LTN-51 inertial navigation system. The aircraft flew at approximately 150 - 300 m above the terrain with a spray swath of about 900 m.

Data pertaining to spray deposit recovered from the experimental blocks was supplied by the Environmental Division, Newfoundland Department of Consumer Affairs and Environment.

Forest songbird populations were assessed on 4 hectare plots located in treated and untreated areas employing methods similar to those described by Kendeigh (1944) and Buckner and Turnock (1965). All singing and sighted birds were recorded on plot maps while slowly traversing lines marked through the plot. Populations surveys commenced 5 days prior to the initial application of insecticide and continued throughout the experimental period, terminating approximately 5 days after the final application. On the day of each application, plot searches were carried out to recover sick or dead birds for insecticide residue analysis.

III RESULTS

1. Experimental Block 8, (Pinchgut Lake area)

1.1 Spray regime

June 17 - 21:00 hrs - aminocarb - 0.070 kg AI/ha in 1.46 l/ha
June 23 - 20:50 hrs - aminocarb - 0.070 kg AI/ha in 1.46 l/ha
July 1 - 21:00 hrs - aminocarb - 0.070 kg AI/ha in 1.46 l/ha

1.2 Deposit assessment

Average deposit of the formulated spray materials across experimental block 8 was; 1st application - 0.679 l/ha, 2nd application - 0.204 l/ha and 3rd application - no deposit assessment possible due to insufficient dye in spray formulation. No insecticide residues were detected from the untreated control area.

1.3 Impact on avian populations

A total of 33 species of forest dwelling birds representing 11 families were recorded on plots established in experimental block 8 and 32 species representing 12 families on the untreated control area (appendix tables I to X). The family Parulidae (warblers) was the most abundant with 10 species followed by the family Fringillidae (sparrows, finches, etc.) with 8 species and the family Turdidae (thrushes) with 4 species.

Three applications of aminocarb at the emitted dosage rate of 0.070 kg AI/ha applied in 1.46 l/ha with an interval of 6 days between applications did not prove harmful to the avian component.

Activity trends of birds on the experimental block following each application closely parallel those recorded from the untreated control and do not reflect any immediate or short-term impact of the insecticide (Fig. 1).

None of the family groups (examined separately because of differences in habitat preference or feeding habits) were adversely affected by this experiment (tables I to IV). No untoward impact following each application was indicated and activity (singing and foraging) trends of the more susceptible groups such as the warblers (family Parulidae), kinglets (family Sylviidae) or flycatchers (family Tyrannidae) compare favorably with those groups occupying a more sheltered niche such as the thrushes (family Turdidae).

The blackpoll warbler, *Dendroica striata* (Forster), and the white-throated sparrow, *Zonotrichia albicollis* (Gmelin), are two species common to all experimental and control blocks. These birds forage, feed and select "singing trees" in the upper canopy or open areas exposed to an aerial spray. Territories of these two species were delineated in experimental block 8 and the accompanying untreated control and are illustrated in figures 2 and 3. Some slight shifting of territories was recorded, however, this is a normal occurrence. Some territories lying along the perimeter of the plots appeared and disappeared throughout the course of the census period. No loss or vacating of territories is indicated for either species resulting from the experimental spraying.

Plot searches conducted following each application failed to recover any sick or dead birds, nor were any birds exhibiting the typical symptoms of insecticide poisoning or stress (erratic flying or perching, bill wiping, wing drooping, etc.) observed or recorded.

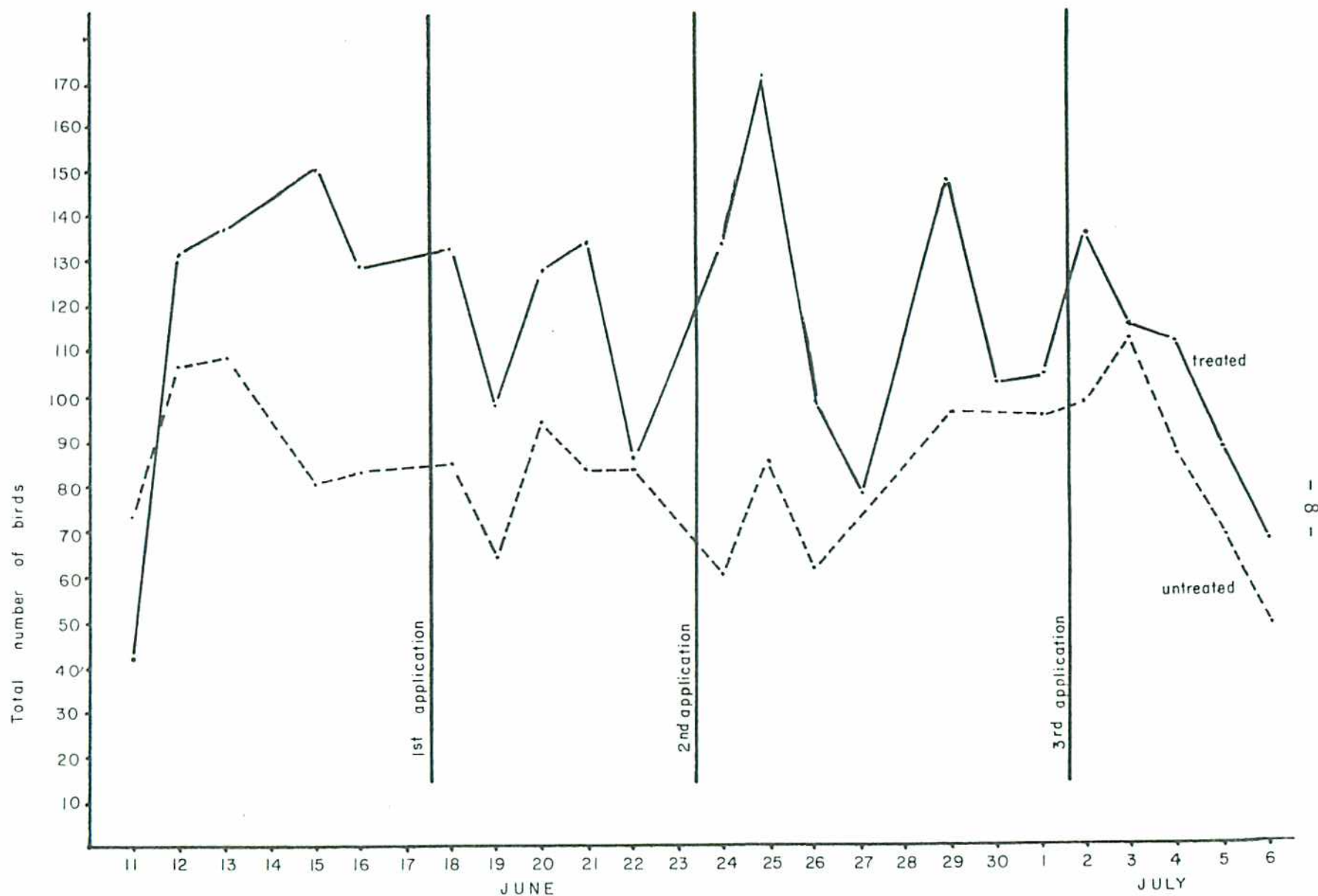


Fig. 1. Forest bird population trends on treated and untreated plots following three applications of aminocarb (0.070 kg AI/ha) on experimental block 8, Pinchgut Lake area, Newfoundland, 1977.

Table I

Forest Bird Population Census
 Aminocarb Experimental Block 8
 (first and second application)
 Pinchgut Lake, Newfoundland
 June-July 1977

Family	Pre-spray						Post spray No. 1						Post spray No. 2						Daily ave.
	June 11	June 12	June 13	June 15	June 16	Daily ave.	June 18	June 19	June 20	June 21	June 22	Daily ave.	June 24	June 25	June 26	June 27	June 29		
	-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+4	+6		
Picidae	0	0	0	0	0	0.0	0	1	0	0	2	0.6	1	1	0	0	0	0.4	
Tyrannidae	4	6	4	6	2	4.4	6	5	3	9	4	5.4	14	12	8	8	13	11.0	
Hirundinidae	4	1	0	0	1	1.2	2	1	3	3	0	1.8	2	1	2	0	0	1.0	
Corvidae	1	0	0	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0	
Paridae	0	2	2	1	4	1.8	1	0	0	0	1	0.4	1	3	0	0	0	0.8	
Certhiidae	0	0	0	0	1	0.2	1	0	0	0	0	0.2	0	0	0	1	0	0.2	
Troglodytidae	0	2	2	2	2	1.6	2	0	2	0	0	0.8	3	4	0	0	4	2.2	
Turdidae	5	5	7	10	12	7.8	7	5	11	9	3	7.0	8	14	8	12	17	11.8	
Sylviidae	4	4	1	0	2	2.2	2	2	2	0	0	1.2	2	0	2	2	0	1.2	
Parulidae	69	78	76	81	76	76.0	80	60	84	80	54	71.6	69	102	61	44	81	71.4	
Fringillidae	41	33	45	50	33	40.4	31	24	23	33	22	26.6	31	36	17	11	44	27.8	
Totals	128	131	137	150	133	135.8	132	98	128	134	86	115.6	131	173	98	78	159	127.8	

Table II

Forest Bird Poulation Census
 Aminocarb Experimental Block 8
 (third application)
 Pinchgut Lake, Newfoundland
 June-July 1977

Family	Pre-spray						Post spray No. 3					
	June 26	June 27	June 29	June 30	July 1	Daily ave.	July 2	July 3	July 4	July 5	July 6	Daily ave.
	-5	-4	-2	-1	-0		+1	+2	+3	+4	+5	
Picidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	8	8	13	4	6	7.8	9	7	7	5	2	6.0
Hirundinidae	2	0	0	1	0	0.6	1	0	0	0	0	0.2
Corvidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Paridae	0	1	0	0	1	0.4	3	2	2	0	0	1.4
Certhiidae	0	0	0	0	0	0.0	1	0	0	0	0	0.2
Troglodytidae	0	0	4	0	0	0.8	4	4	2	0	0	2.0
Turdidae	8	12	17	9	9	11.0	11	4	8	10	6	7.8
Sylviidae	2	2	0	0	0	0.8	0	2	2	0	0	0.8
Parulidae	61	44	81	66	58	61.6	72	47	56	43	31	49.8
Fringillidae	17	11	44	23	30	25.0	34	49	33	30	29	35.0
Totals	98	78	159	103	104	108.0	135	115	110	88	68	103.2

Table III

Forest Bird Population Census
 Untreated area
 (first and second applications on block 8)
 Spruce Brook, Newfoundland
 June, 1977

Family	Pre-spray						Post spray No. 1						Post spray No. 2					
	June 11	June 12	June 13	June 15	June 16	Daily ave.	June 18	June 19	June 20	June 21	June 22	Daily ave.	June 24	June 25	June 26	June 29	Daily ave.	
	-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+6		
Picidae	0	0	0	0	0	0.0	0	0	0	0	1	0.2	0	0	0	0	0.0	
Tyrannidae	3	10	6	6	4	5.8	2	5	6	6	4	4.6	6	4	4	4	4.5	
Hirundinidae	0	0	0	0	0	0.0	0	0	0	0	1	0.0	0	0	0	0	0.0	
Corvidae	0	0	0	0	1	0.2	0	0	0	0	0	0.0	0	0	0	0	0.0	
Paridae	0	0	0	0	1	0.2	0	0	2	2	2	1.2	1	2	1	1	1.3	
Sittidae	0	0	0	0	0	0.0	0	0	0	0	3	0.6	0	0	0	0	0.0	
Turdidae	9	8	12	7	7	8.6	4	6	6	7	10	6.6	2	6	10	14	8.0	
Sylviidae	2	6	8	8	11	7.0	7	3	9	8	3	6.0	4	6	6	4	5.0	
Parulidae	46	59	62	44	46	51.4	42	42	55	51	46	47.2	32	42	30	58	40.5	
Icteridae	0	0	0	2	0	0.4	0	0	0	1	0	0.2	0	0	0	0	0.0	
Fringillidae	12	23	21	15	15	17.2	29	8	15	10	14	15.2	15	26	10	15	16.5	
Totals	72	106	109	82	85	90.8	84	64	93	85	84	82.0	60	86	61	96	75.5	

Table IV

Forest Bird Population Census
 Untreated area
 (third application on Block 8)
 Spruce Brook, Newfoundland
 June - July, 1977

Family	Pre-spray						Post-spray 3					
	June 24	June 25	June 26	June 29	July 1	Daily ave.	July 2	July 3	July 4	July 5	July 6	Daily ave.
	-7	-6	-5	-2	-0		+1	+2	+3	+4	+5	
Picidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	6	4	4	4	6	4.8	2	2	3	0	0	1.4
Hirundinidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Corvidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Paridae	1	2	1	1	1	1.2	1	2	0	0	1	0.8
Sittidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	2	6	10	14	18	10.0	13	15	10	8	10	11.2
Sylviidae	4	6	6	4	9	5.8	8	6	6	6	1	5.4
Bombycillidae	0	0	0	0	0	0.0	1	1	0	0	0	0.4
Parulidae	32	42	30	58	44	41.2	45	52	44	33	24	39.6
Fringillidae	15	26	10	15	17	16.6	27	23	23	22	12	21.4
Totals	60	86	61	96	95	79.6	97	101	86	69	48	80.2

2. Experimental Block 9, (Spruce Brook area)

2.1 Spray regime

June 19 - 05:30 hrs - aminocarb - 0.087 kg AI/ha in 1.46 l/ha
June 24 - 10:10 hrs - aminocarb - 0.087 kg AI/ha in 1.46 l/ha

2.2 Deposit assessment

Average deposit of the formulated spray materials across the experimental block 9 was; 1st application - 0.219 l/ha, and the 2nd application - 0.708 l/ha. No insecticide residues were detected from the untreated control areas.

2.3 Impact on avian populations

A total of 26 species representing 8 families were recorded on plots established on experimental block 9 and 33 species representing 11 families recorded on the untreated control area (appendix tables XI to XIV). The family Parulidae was the most abundant (10 species recorded on the experimental block and 12 on the untreated control block) followed by the family Fringillidae with 5 and 8 species respectively and the family Turdidae with 3 and 4 species.

Two applications of aminocarb at the emitted dosage rate of 0.087 kg AI/ha in 1.46 l/ha with a 5 day interval did not result in any mortality to the avifauna inhabiting the experimental block. Population declines on plots in both the treated and untreated areas (22 - 23 and 26 June) resulted from adverse weather conditions recorded at the time population censuses were being carried out (Fig. 4).

Populations of the families Parulidae, Fringillidae and Turdidae remained fairly constant throughout the census period (tables V and VI) and no population or activity decline was recorded following either application of insecticide.

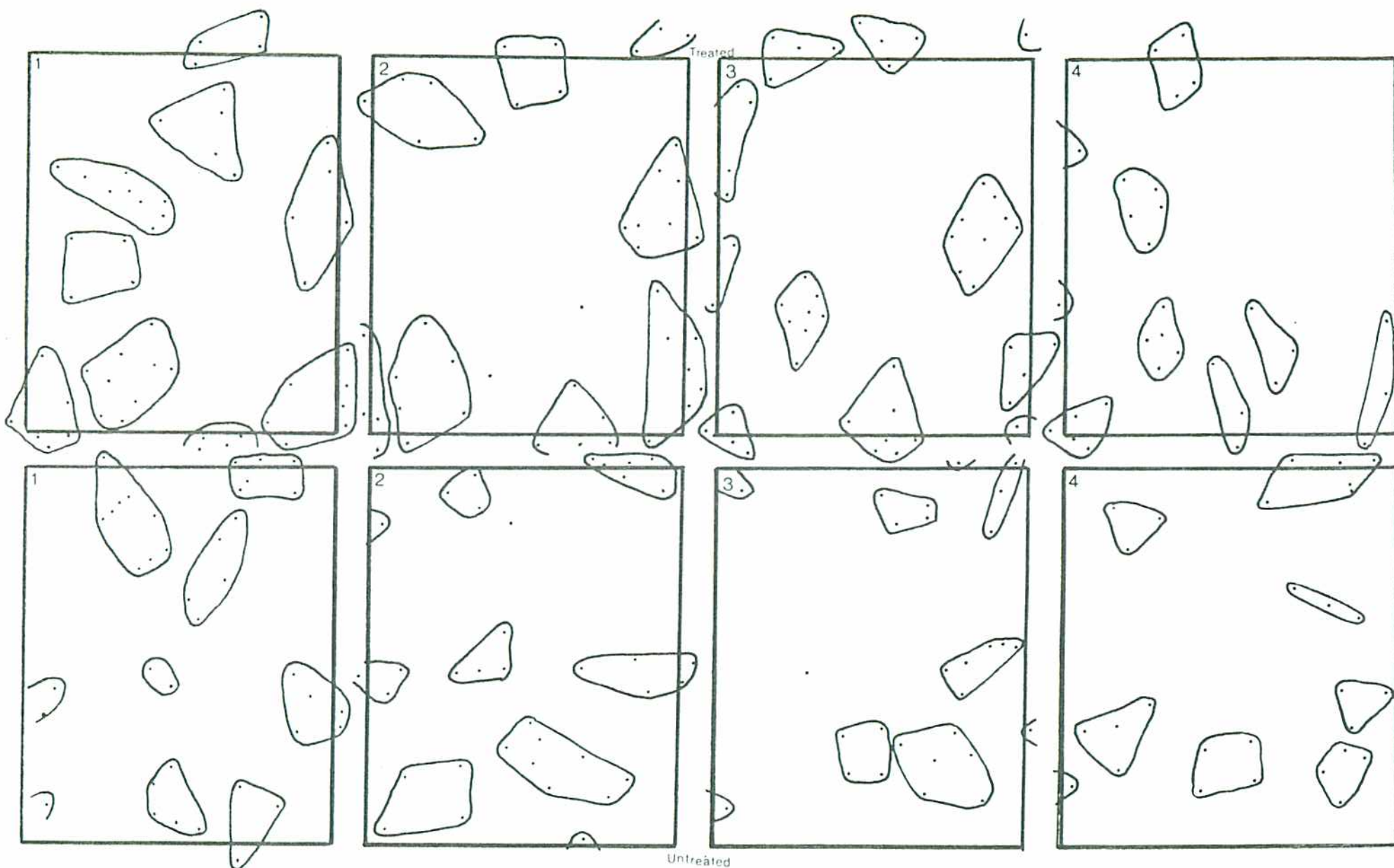


Fig. 2. Territories of the blackpoll warbler, *D. striata* (Forster), following the pre-spray census (No. 1), the first application (No. 2), the second application (No. 3) and the third application (No. 4) of aminocarb at 0.070 kg AI/ha on treated and untreated plots. Pinchgut Lake area, Newfoundland 1977.

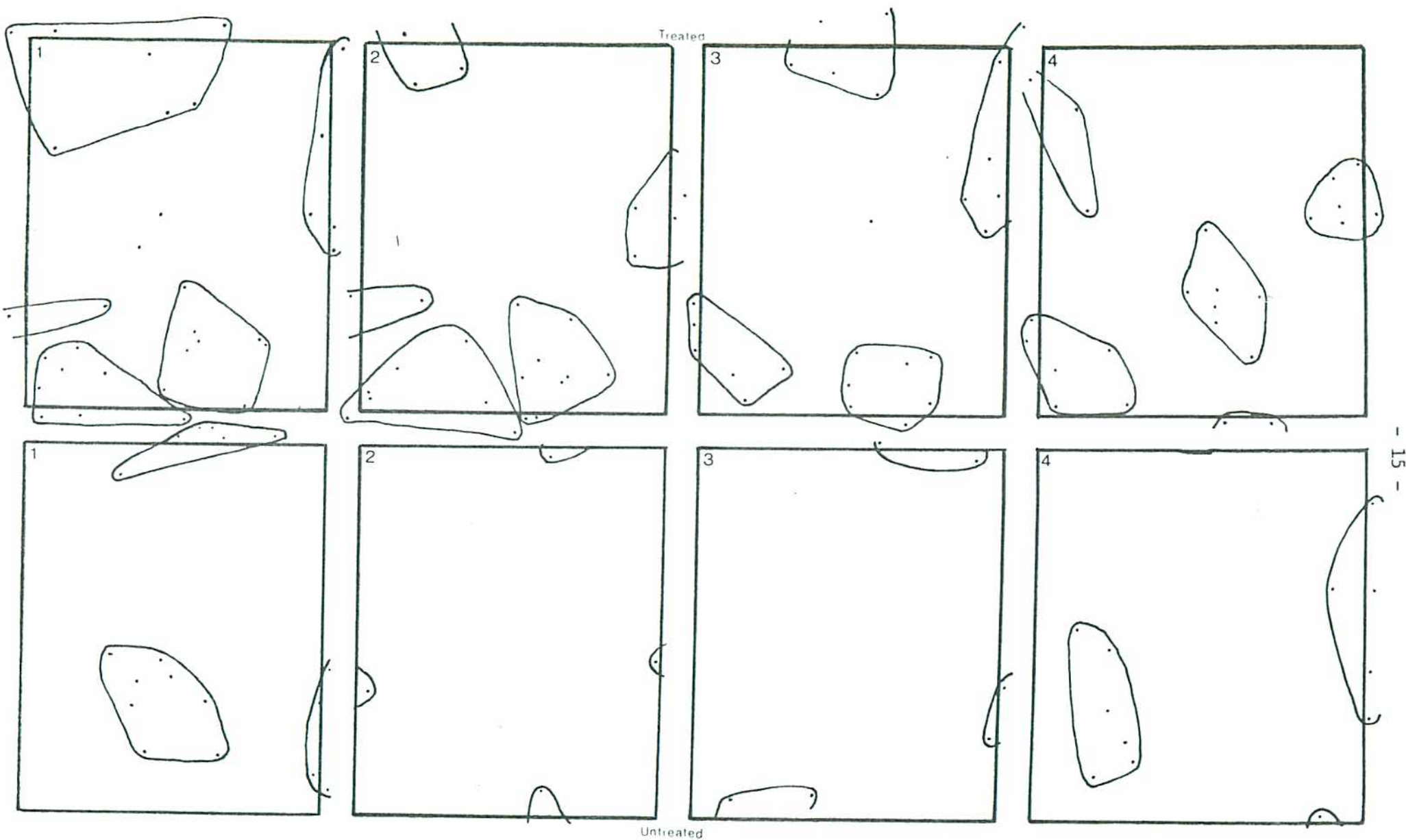


Fig. 3. Territories of the white-throated sparrow, *Z. albicollis* (Gmelin), following the pre-spray census (No. 1), the first application (No. 2), the second application (No. 3) and the third application (No. 4) of aminocarb at 0.070 kg AI/ha on treated and untreated plots, Pinchgut Lake area, Newfoundland, 1977.

Table V

Forest Bird Population Census
Aminocarb Experimental Block 9
Spruce Brook, Newfoundland
June - July 1977

Family	Pre-spray						Post spray No. 1						Post spray No. 2					
	June 13	June 15	June 16	June 18	June 19	Daily ave.	June 20	June 21	June 22	June 23	June 24	Daily ave.	June 25	June 26	June 29	July 1	July 2	Daily ave.
	-6	-4	-3	-1	-0		+1	+2	+3	+4	+5		+1	+2	+5	+7	+8	
Picidae	1	0	0	0	1	0.4	0	1	1	0	0	0.4	0	0	0	0	0	0.0
Tyrannidae	6	4	3	10	4	5.4	4	4	4	4	6	4.4	6	2	9	6	4	5.4
Hirundinidae	2	0	1	0	0	0.6	0	3	2	1	2	1.6	0	0	0	0	0	0.0
Paridae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	1	0	0	0	0.2
Turdidae	2	0	2	4	4	2.4	6	6	5	4	2	4.6	0	0	2	2	2	1.2
Sylviidae	2	2	2	0	2	1.6	2	4	0	0	0	1.2	0	2	2	0	0	0.8
Parulidae	66	70	60	38	71	61.0	81	90	62	56	90	75.8	64	64	85	61	41	63.0
Fringillidae	34	24	19	9	18	20.8	29	22	28	15	26	24.0	22	7	30	35	15	21.8
Totals	113	100	87	61	100	92.2	122	130	102	80	126	112.0	92	76	128	104	62	92.4

Table VI

Forest Bird Population Census
 Untreated area
 (for treatment block 9)
 Spruce Brook, Newfoundland
 June - July, 1977

Family	Pre-spray						Post spray No. 1						Post spray No. 2					
	June 13	June 15	June 16	June 18	June 19	Daily ave.	June 20	June 21	June 22	June 23	June 24	Daily ave.	June 25	June 26	June 29	July 1	July 2	Daily ave.
	-6	-4	-3	-1	-0		+1	+2	+3	+4	+5		+1	+2	+5	+7	+8	
Picidae	0	0	0	0	0	0.0	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Tyrannidae	4	0	0	0	2	1.2	4	2	4	4	2	3.2	2	0	2	2	0	1.2
Corvidae	0	0	1	0	0	0.2	2	2	2	1	1	1.6	2	1	1	1	1	1.2
Sittidae	0	0	0	0	0	0.0	0	0	3	0	0	0.6	0	0	0	0	0	0.0
Turdidae	12	5	5	3	2	5.4	6	5	10	2	2	5.0	5	10	11	17	12	11.0
Sylviidae	8	8	11	7	3	7.4	9	8	12	4	4	7.4	6	6	4	9	8	6.6
Bombycillidae	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	0	0.2
Parulidae	46	30	32	28	30	33.2	41	37	38	35	14	33.0	30	26	42	34	36	33.6
Acteridae	0	2	0	0	0	0.4	0	1	0	0	0	0.2	0	0	0	0	0	0.0
Fringillidae	21	16	13	23	4	15.4	11	10	9	10	9	9.8	17	5	12	13	16	12.6
Totals	91	61	62	61	41	63.2	73	65	78	58	32	61.2	62	48	72	76	74	66.4

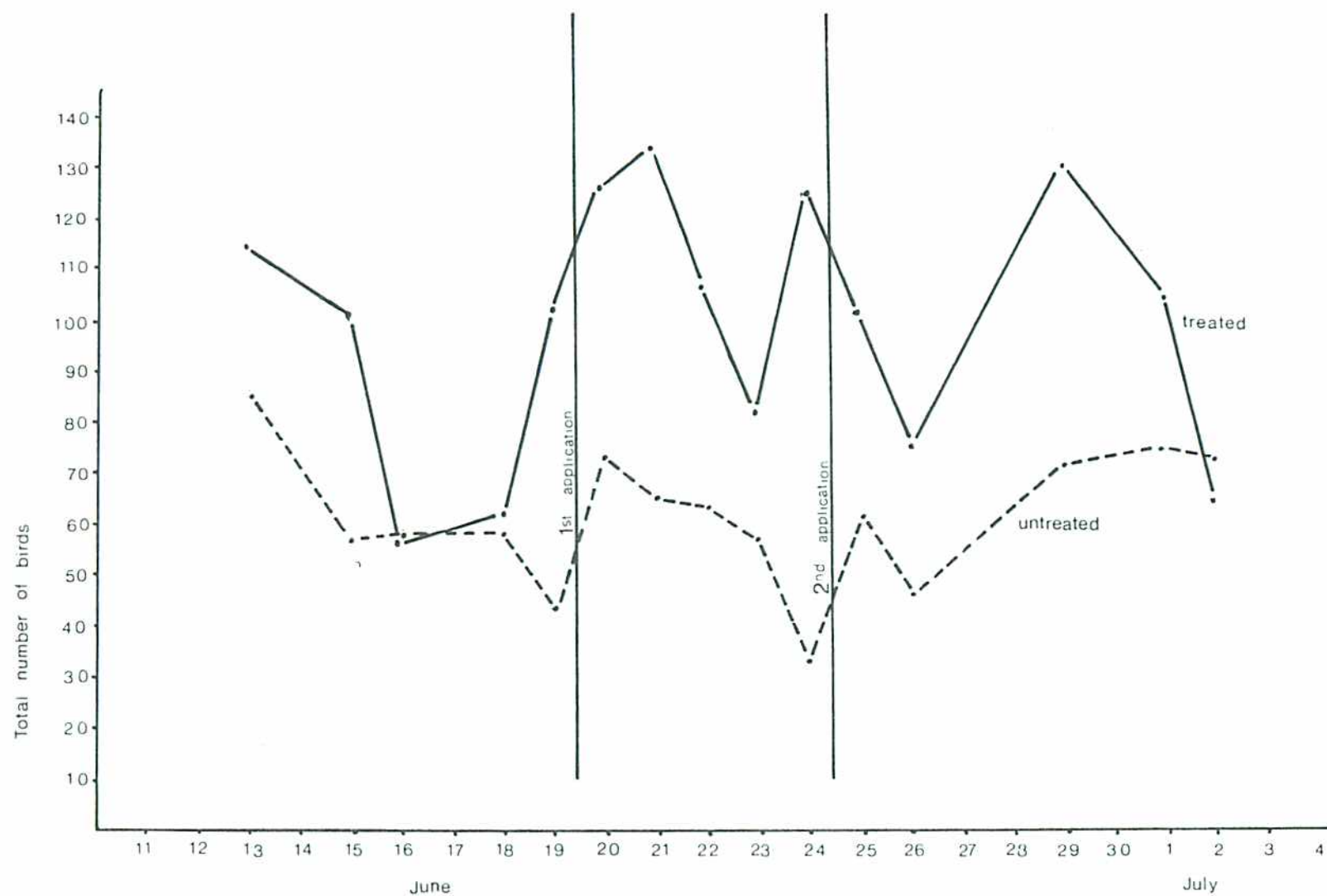


Fig. 4. Forest bird population trends on treated and untreated plots following two applications of aminocarb (0.087 kg AI/ha) on experimental block 9, Spruce Brook area, Newfoundland, 1977.

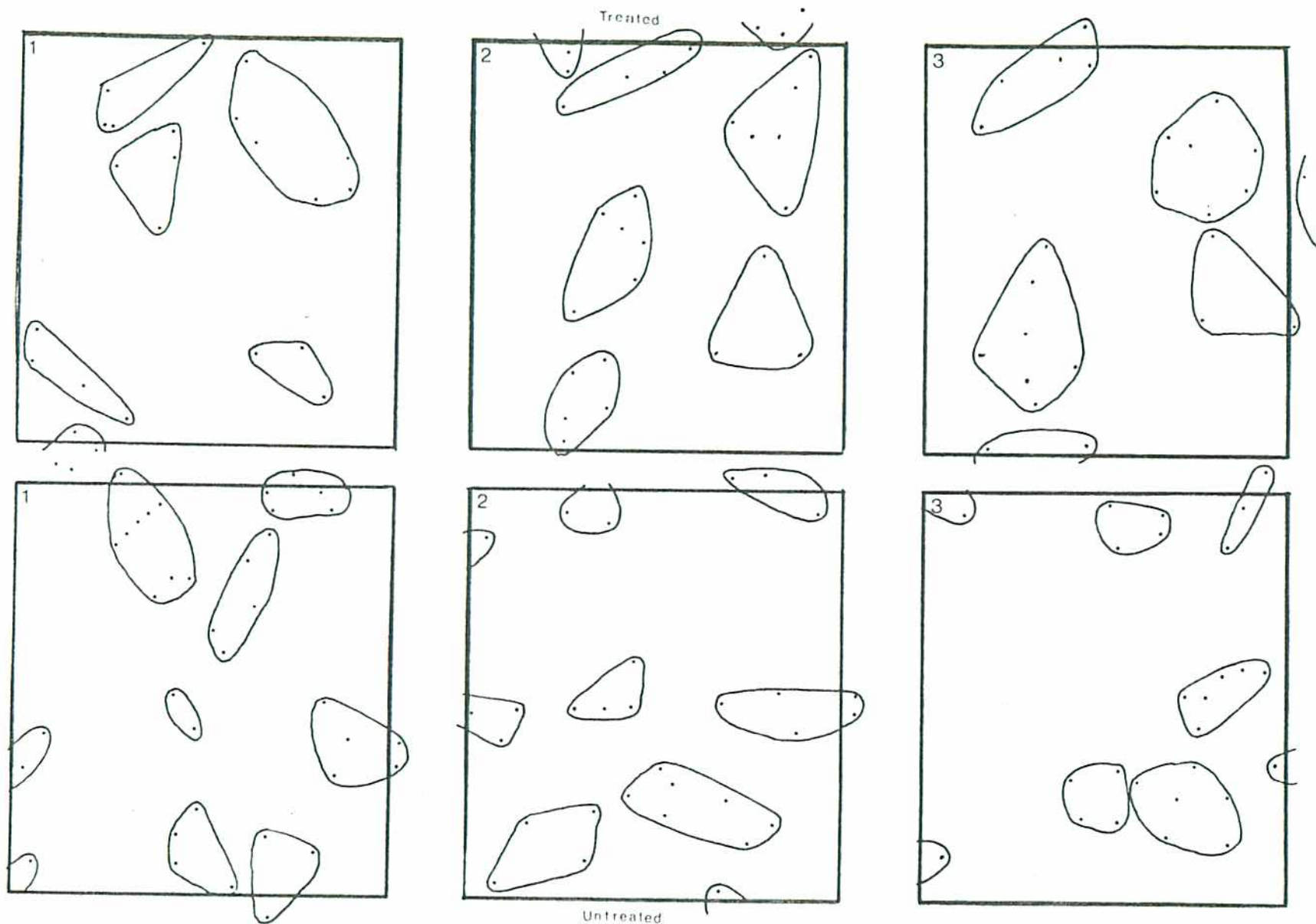


Fig. 5. Territories of the blackpoll warbler, *D. striata* (Forster), following the pre-spray census (No. 1), the first application of aminocarb (No. 2) and the second application of aminocarb (No. 3) on experimental block 9 and the untreated control, Spruce Brook, Newfoundland, 1977.

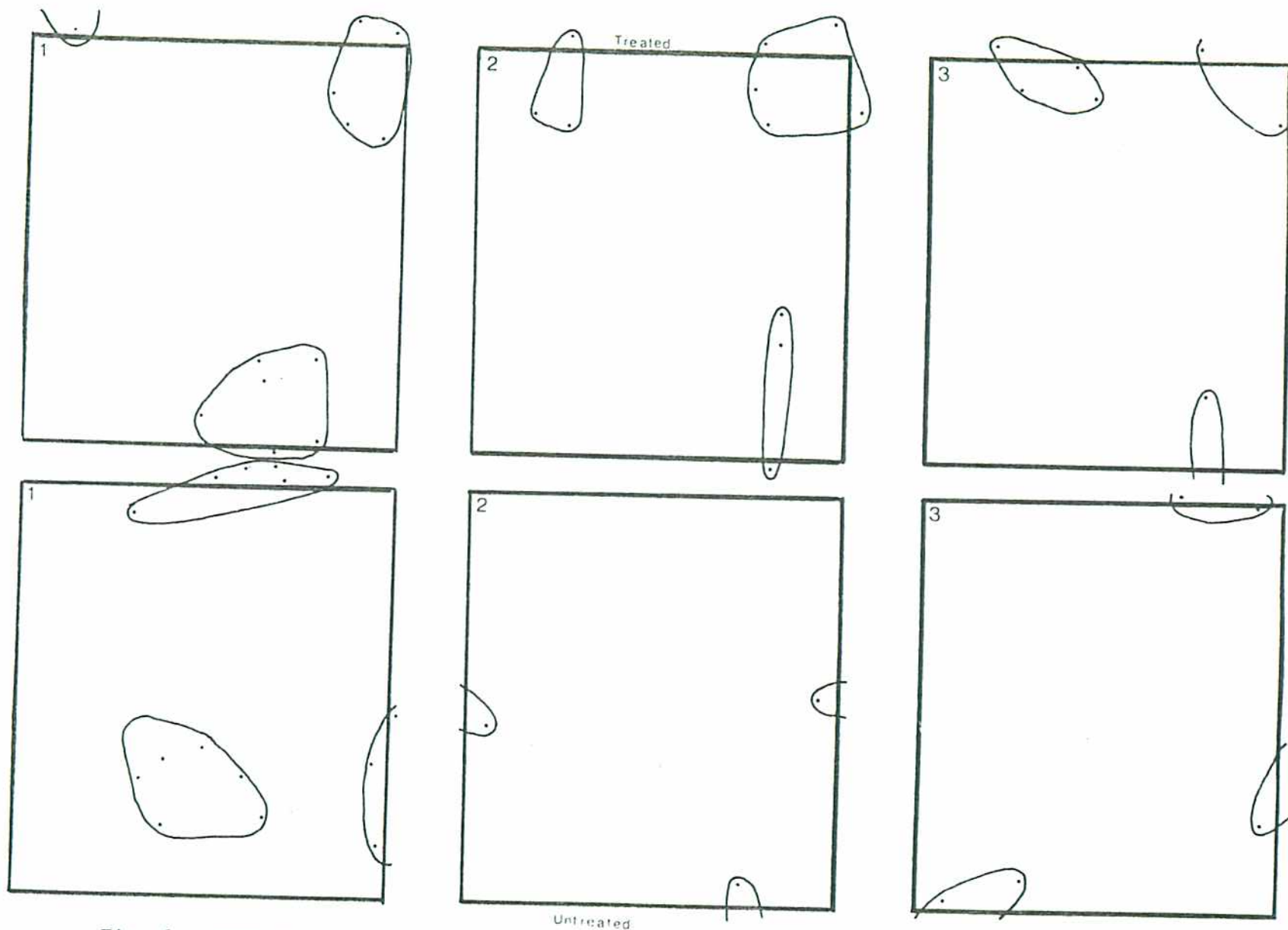


Fig. 6. Territories of the white-throated sparrow, *Z. albicollis* (Gmelin), following the pre-spray census (No. 1), the first application of aminocarb (No. 2) and second application of aminocarb (No. 3) on experimental block 9 and the untreated control, Spruce Brook area, Newfoundland, 1977.

Breeding territories of the blackpoll warbler, *D. striata* (Forster), and white-throated sparrow, *Z. albicollis* (Gmelin), remained occupied throughout the census period (Figures 5 and 6) indicating that neither treatment interrupted breeding activities of these species.

Kinglet populations (family Sylviidae) were recorded in low numbers in both the treated and untreated blocks and were not affected by either application as their numbers remained steady throughout the experimental period (appendix tables XI to XIV).

Plot searches were conducted after each application but no dead or sick birds were recovered or recorded.

3. Experimental Block 6, (Hampton area)

3.1 Spray regime

June 19 - 06:00 hrs - fenitrothion - 0.210 kg AI/ha in 1.46 l/ha
June 25 - 06:00 hrs - fenitrothion - 0.210 kg AI/ha in 1.46 l/ha
July 2 - 06:10 hrs - aminocarb - 0.070 kg AI/ha in 1.46 l/ha

3.2 Deposit assessment

Average deposit of the formulated spray across experimental block 6 was; 1st application - 0.409 l/ha, 2nd application - 0.394 l/ha and the 3rd application - 0.905 l/ha. No insecticide residues were detected from the untreated area.

3.3 Impact on avian populations

The bird species composition of experimental block 6 and the accompanying untreated control were similar to that recorded in blocks 8 and 9. A total of 24 species representing 8 families were recorded on the control. The families Parulidae, Fringillidae and Turdidae represent the majority of the birds recorded with the blackpoll warbler

D. striata (Forster) and the white-throated sparrow, *Z. albicollis* (Gmelin) the most commonly recorded species (appendix tables XV to XXII).

The bird complex inhabiting experimental block 6 did not suffer any immediate or short-term impact resulting from the initial application of fenitrothion but activity was affected by the second fenitrothion treatment (Fig. 7). The third application employing aminocarb did not affect populations or activity. Sharp declines on both the treated and untreated control plots recorded on 5 July resulted when heavy rains interrupted the census.

A sharp decline in warbler (family Parulidae) activity was recorded on 26 June following the second application of fenitrothion. The reduced activity was confined to the warbler group with activity patterns of the more robust thrushes (family Turdidae) and the predominately plant and seed eating sparrows, finches, etc. (family Fringillidae) recorded at near pre-spray levels (tables VII and VIII). The third application (aminocarb) did not affect the warblers or other family groups.

Breeding territories of the blackpoll warbler, *D. striata* (Forster), were reduced by two following the second application (fenitrothion) and increased by one following the third application (aminocarb). This light fluctuation in populations and territory shift caused by the second treatment is not considered serious as similar trends are often recorded in untreated plots. White-throated sparrow, *Z. albicollis* (Gmelin), populations were not affected by the experiment carried out on block 6 and the numbers of territories increased throughout the

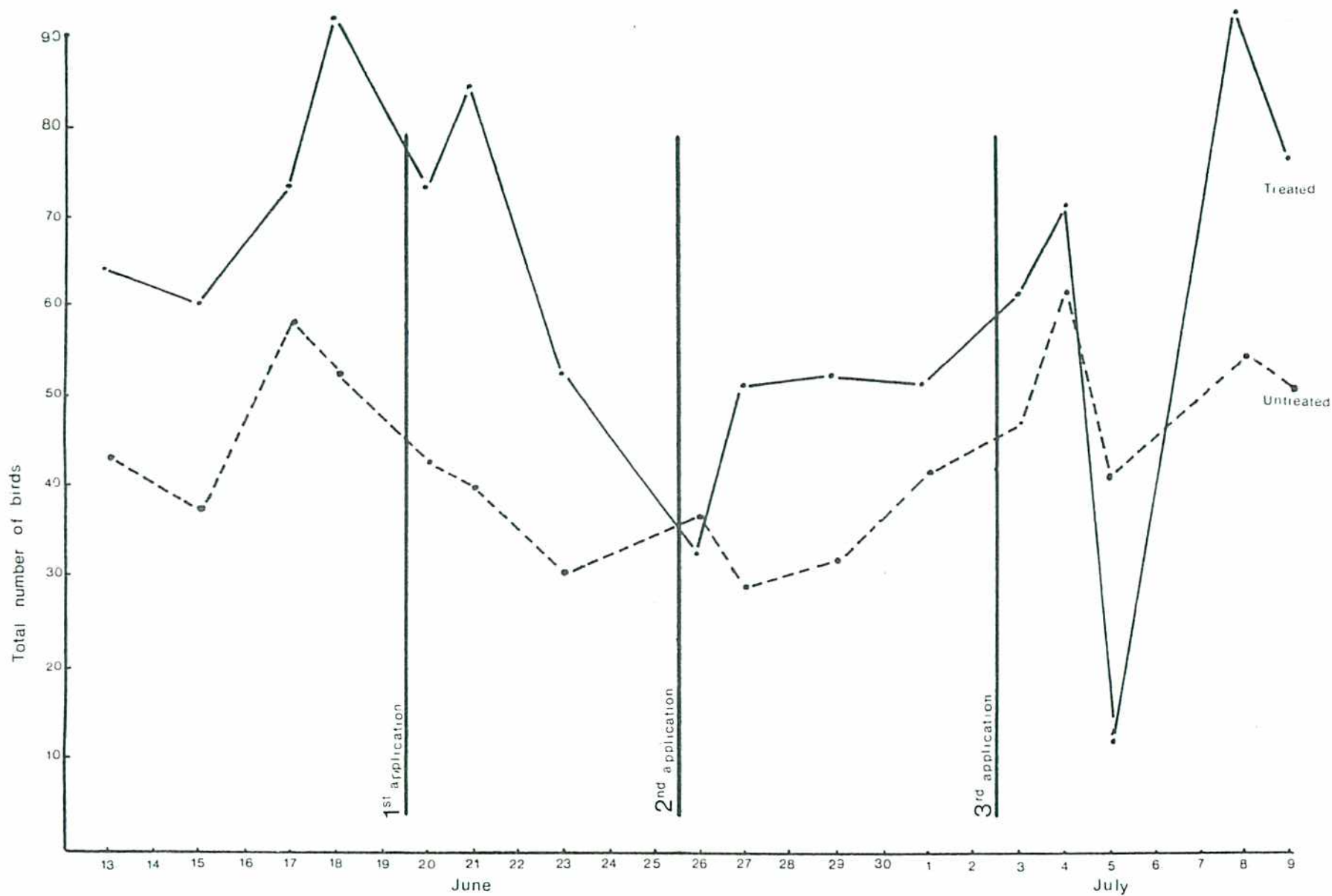


Fig. 7. Forest bird population trends on treated and untreated plots following two applications of fenitrothion (0.210 kg AI/ha) and a single application of aminocarb (0.070 kg AI/ha) on experimental block 6, Hampton area, Newfoundland, 1977.

Table VII

Forest Bird Population Census
Fenitrothion and aminocarb Experimental Block 6
Hampton, Newfoundland
June - July, 1977

Family	Pre-treatment					Post treatment 1				Post treatment 2					Post treatment 3					Daily ave.
	June 13	June 15	June 17	June 18	Daily ave.	June 20	June 21	June 23	Daily ave.	June 26	June 27	June 29	July 1	Daily ave.	July 3	July 4	July 5	July 8	July 9	
	-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Picidae	4	4	4	3	3.8	4	6	0	3.3	2	2	0	1	1.3	3	4	0	4	1	2.4
Tyrannidae	0	0	0	0	0.0	0	3	2	1.6	0	0	0	1	0.3	1	1	0	1	0	0.6
Paridae	0	0	0	2	0.5	5	0	0	1.6	0	0	0	0	0.0	2	2	0	2	2	1.6
Turdidae	10	16	14	8	12.0	14	13	7	11.3	5	9	12	8	8.5	17	26	6	14	11	14.8
Sylviidae	1	2	0	7	2.5	4	7	4	5.0	2	1	0	0	0.8	1	0	0	1	1	0.6
Parulidae	29	20	34	41	31.0	20	28	20	22.6	7	17	21	18	15.8	9	10	0	19	18	11.2
Icteridae	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	1	0	0	0	0	0.2
Fringillidae	20	17	19	25	20.3	22	23	15	20.0	15	22	18	22	19.3	25	26	6	46	39	28.4
Unknown species	0	1	1	6	2.0	4	4	4	4.0	1	0	1	1	0.8	2	2	0	6	4	2.8
Totals	64	60	73	92	72.3	73	84	52	69.6	32	51	52	51	46.5	61	71	12	93	76	62.6

Table VIII

Forest Bird Population Census
 Untreated area
 (for experimental block 6)
 Hampton, Newfoundland
 June - July, 1977

Family	Pre-treatment					Post ₁ treatment					Post treatment 2					Post treatment 3				
	June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily
	13	15	17	18		20	21	23		26	27	29	1		3	4	5	8	9	
	-6	-4	-2	-1	ave.	+1	+2	+4	ave.	+1	+2	+4	+6	ave.	+1	+2	+3	+6	+7	ave.
Picidae	0	2	2	3	1.8	0	0	0	0.0	1	0	0	2	0.8	0	0	1	1	2	0.8 ²⁵
Tyrannidae	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0	0.2 ¹
Hirundinidae	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0	0.2
Paridae	0	0	2	1	0.8	1	0	2	1.0	0	0	0	0	0.0	0	4	0	0	1	1.0
Turdidae	5	5	8	5	5.8	2	5	3	3.3	7	6	5	7	6.3	8	14	9	9	11	10.2
Sylviidae	6	1	5	1	3.3	2	5	1	2.6	4	3	1	1	2.3	3	4	0	4	2	2.6
Parulidae	16	18	20	20	18.5	21	16	10	15.6	13	7	14	13	11.8	17	16	14	20	19	17.2
Icteridae	1	0	0	1	0.5	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0
Fringillidae	15	8	18	19	15.0	14	12	13	13.0	10	13	12	18	13.3	17	19	16	18	14	16.8
Unidentified species	0	3	2	3	2.0	3	2	1	2.0	1	0	0	1	0.5	2	3	1	3	2	2.2
Totals	43	37	58	53	47.8	43	40	30	37.6	36	29	32	42	34.8	47	62	41	55	51	51.2

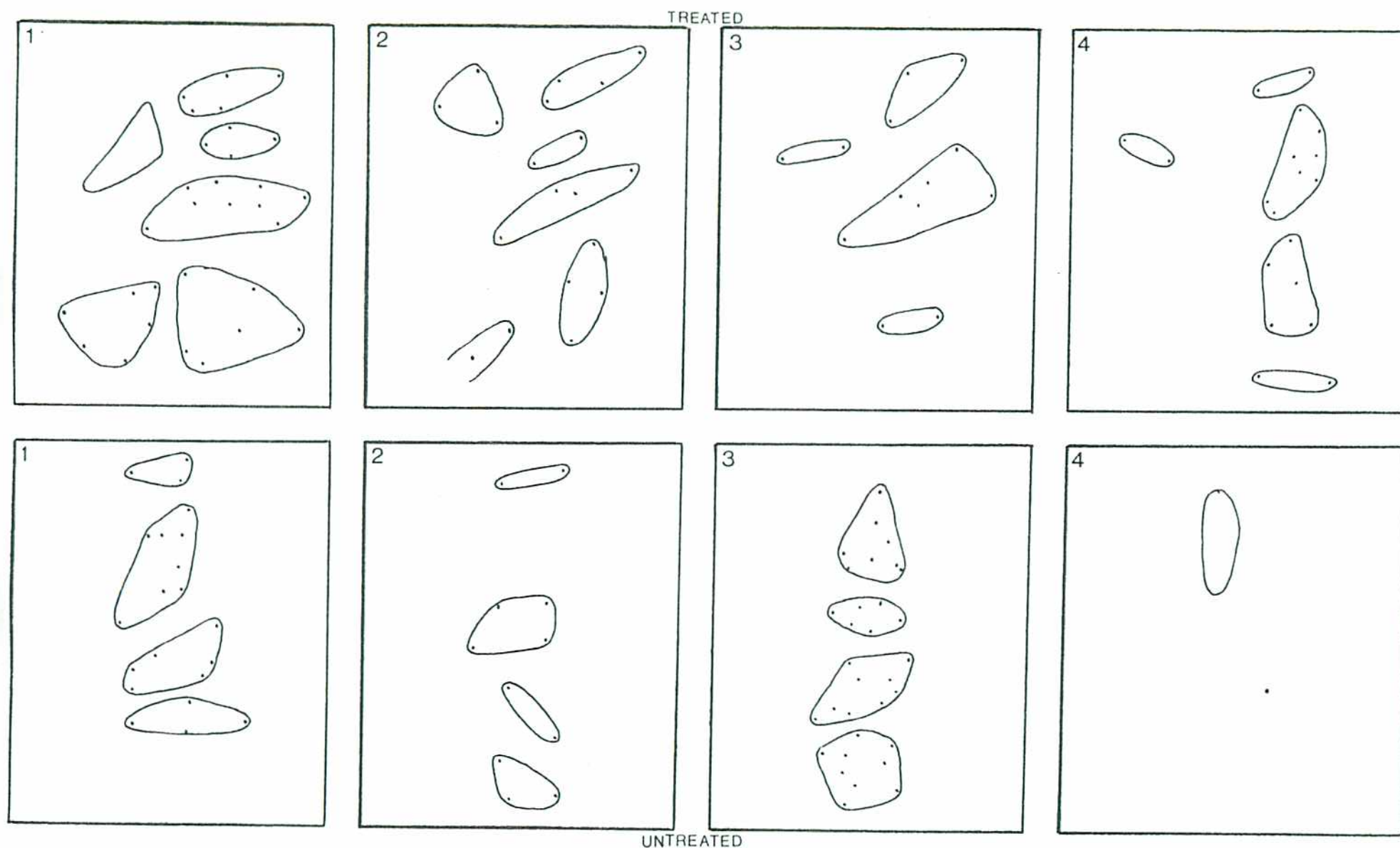


Fig. 8. Territories of the blackpoll warbler *D. striata* (Forster) on treated and untreated plots following the pre-spray census (No. 1) the first application of fenitrothion (0.210 kg AI/ha) (No. 2), the second application of fenitrothion (0.210 kg AI/ha) (No. 3) and the third application of aminocarb (0.070 kg AI/ha) (No. 4), Hampton area, Newfoundland, 1977.

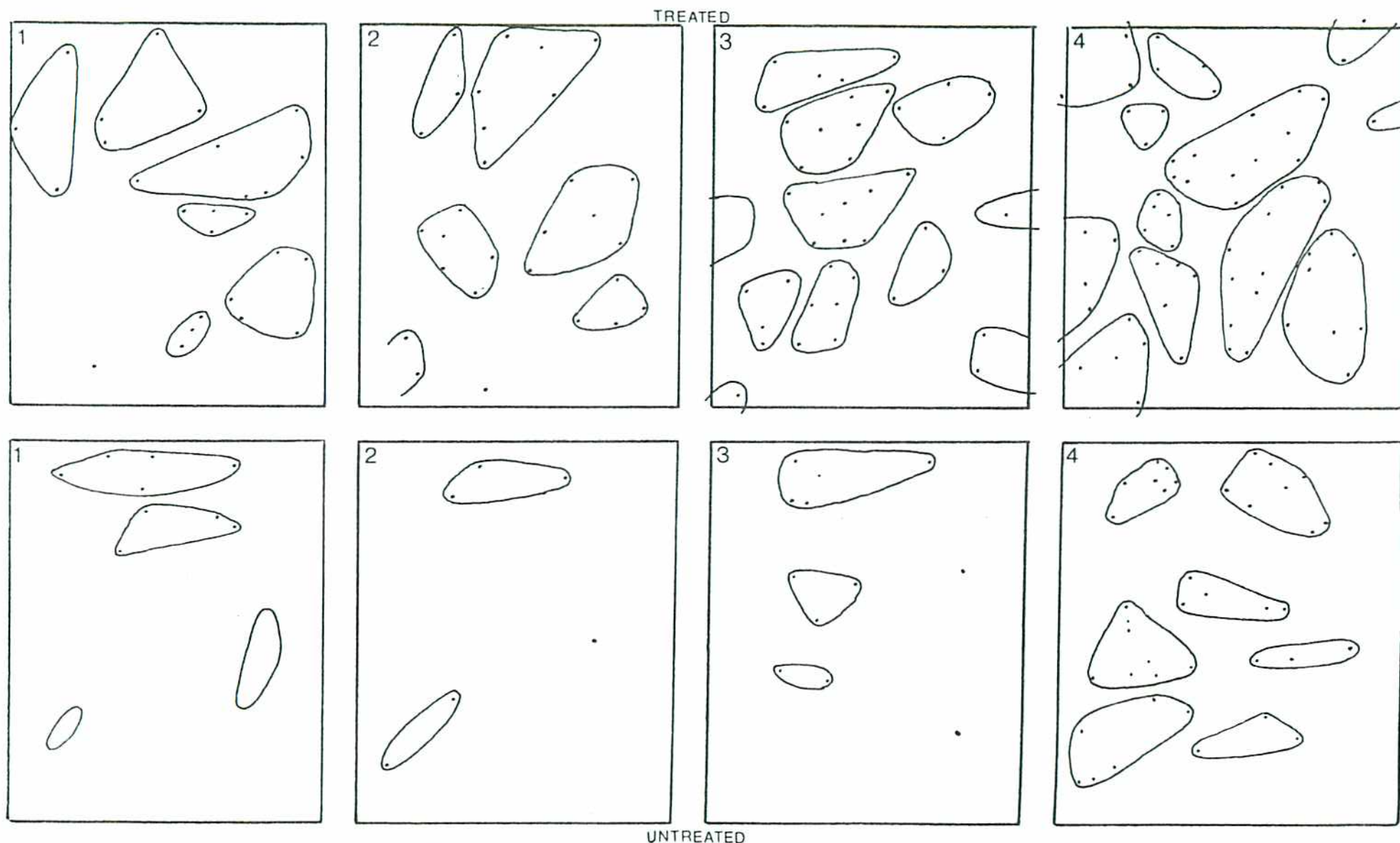


Fig. 9. Territories of the white-throated sparrow *Z. albicollis* Gmelin on treated and untreated plots following the pre-spray census (No. 1) the first application of fenitrothion (0.210 kg AI/ha) (No. 2), the second application of fenitrothion (0.210 kg AI/ha) (No. 3) and the third application of aminocarb (0.070 kg AI/ha) (No. 4), Hampton area, Newfoundland, 1977.

experimental period on both the treated and untreated plots.

4. Experimental Block 5, (Noel Paul's Brook area)

4.1 Spray regime

June 21 - 20:30 hrs - acephate (0.056 kg) + Bt (19.8 BIU) AI/ha
in 5.85 l/ha

July 2 - 20:45 hrs - acephate (0.056 kg) + Bt (19.8 BIU) AI/ha
in 5.85 l/ha

4.2 Deposit assessment

Average deposit of formulated spray across experimental block 5 was; 1st application - 0.847 l/ha and 2nd application - 1.329 l/ha. No insecticide residues were detected from the untreated control areas.

4.3 Impact on avian populations

A total of 20 species of birds representing 9 families were recorded from experimental block 5 and 23 species representing 9 families from the untreated control block. The families Parulidae and Fringillidae accounted for the majority of the species. Blackpoll warblers, *D. striata* (Forster), yellow-rumped warblers, *Dendroica coronata* (Linnaeus), and white-throated sparrows, *Z. albicollis* (Gmelin) were the species most commonly recorded (appendix tables XXIII and XXIV).

Two applications of acephate combined with Bt and sprayed at an 11 day interval did not result in any mortality to the bird complex and population trends on the treated block closely parallel those recorded on the untreated control (Figure 10). Plot searches carried out following each application failed to recover any dead birds. Rain showers during the census periods on the 19 and 27 June resulted in a reduction in the numbers of birds recorded.

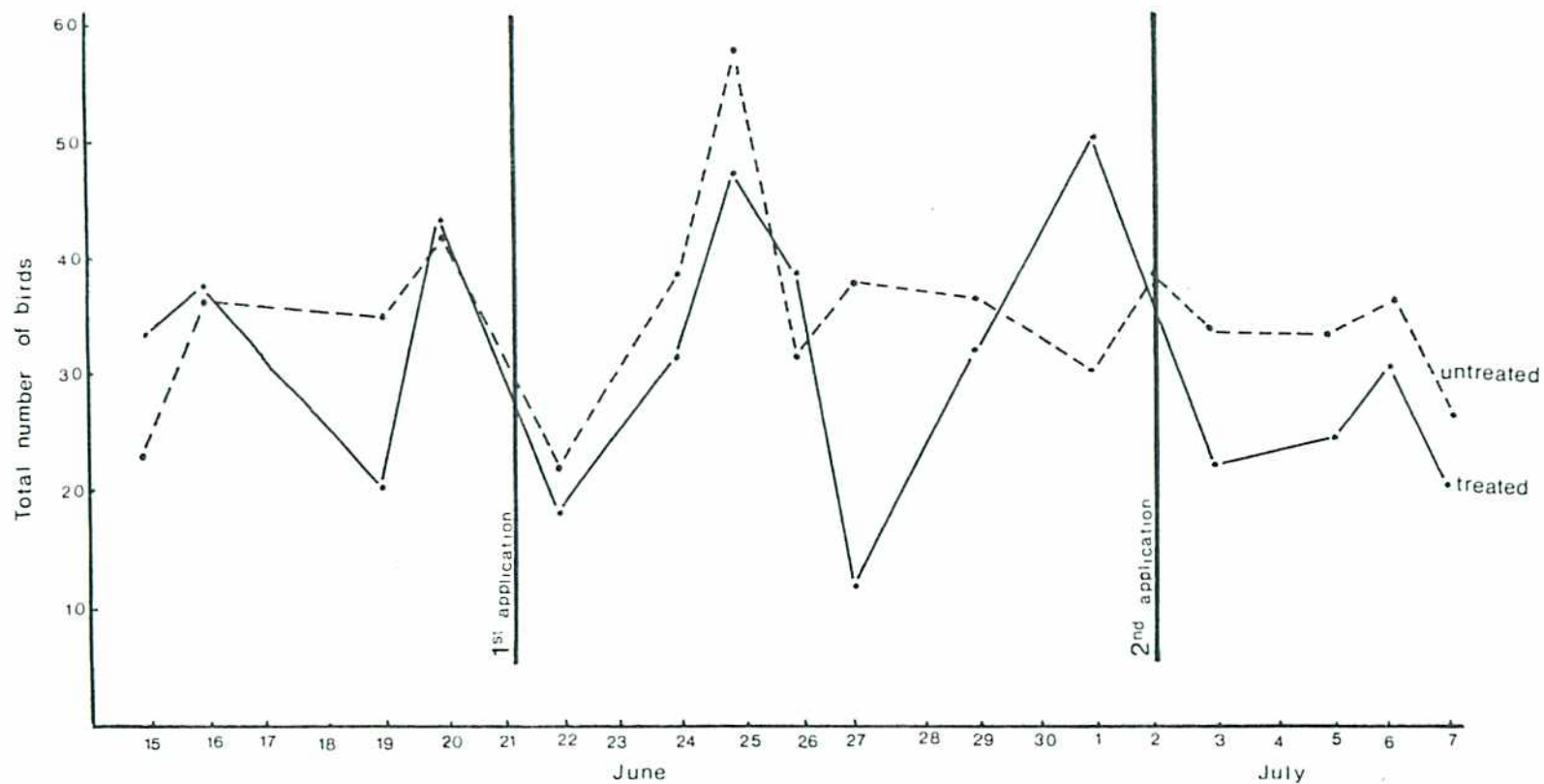


Fig. 10. Forest bird population trends on treated and untreated plots following two applications of acephate (0.056 kg) mixed with Bt (19.8 BIU) AI/ha on experimental block 5, Noel Paul's brook area, Newfoundland, 1977.

Table IX

Forest Bird Population Census
 Acephate + Bt Experimental Block 5 (first application)
 Noel Paul's, Newfoundland
 June 1977

Family	Pre-treatment					Post treatment					Daily ave.
	June 15	June 16	June 19	June 20	Daily ave.	June 22	June 24	June 25	June 26	June 27	
	-6	-5	-2	-1		+1	+3	+4	+5	+6	
Tyrannidae	0	0	2	2	1.0	4	4	4	4	2	3.6
Corvidae	0	0	0	0	0.0	0	0	0	4	0	0.8
Paridae	2	4	0	4	2.5	0	2	5	0	0	1.4
Turdidae	6	4	10	4	6.0	4	6	10	6	6	6.4
Sylviidae	0	4	0	2	1.5	0	0	0	2	0	0.4
Vireonidae	0	0	0	0	0.0	0	0	0	2	0	0.4
Parulidae	20	16	4	19	14.8	2	15	14	18	2	10.2
Fringillidae	6	9	4	12	7.8	8	4	14	2	2	6.0
Totals	34	37	20	43	33.5	18	31	47	38	12	29.2

Table X
Forest Bird Population Census
Acephate + B.t. Experimental Block 5
(second application)
Noel Paul's Brook, Newfoundland
June - July, 1977

Family	Pre-treatment					Daily Ave.	Post treatment				Daily Ave.
	June 26	June 27	June 29	July 1	July 2		July 3	July 5	July 6	July 7	
	-6	-5	-3	-1	-0		+1	+3	+4	+5	
Picidae	0	0	0	0	1	0.2	0	0	0	0	0.0
Tyrannidae	4	2	4	4	4	3.6	4	0	0	0	1.0
Corvidae	4	0	0	0	1	1.0	0	0	0	0	0.0
Paridae	0	0	0	0	0	0.0	0	2	0	0	0.5
Turdidae	6	6	4	4	6	5.2	4	2	10	10	6.5
Sylviidae	2	0	0	2	2	1.2	2	0	6	0	2.0
Parulidae	18	2	14	16	10	12.0	2	4	7	6	4.8
Fringillidae	2	2	7	24	12	9.4	10	16	7	4	9.3
Unidentified species	1	0	3	0	1	1.0	0	0	0	0	0.0
Totals	37	12	32	50	37	33.6	22	24	30	20	24.0

Table XI
Forest Bird Population Census
Untreated area
(first application, experimental block 5)
Noel Paul's brook, Newfoundland
June, 1977

Family	Pre-treatment				Daily Ave.	Post treatment					Daily Ave.
	June 15	June 16	June 19	June 20		June 22	June 24	June 25	June 26	June 27	
	-6	-5	-2	-1		+1	+3	+4	+5	+6	
Picidae	0	0	0	2	0.5	0	1	0	0	0	0.2
Tyrannidae	0	0	0	6	1.5	0	4	2	2	0	1.6
Corvidae	0	0	0	0	0.0	0	0	9	2	0	2.2
Paridae	0	0	0	2	0.5	0	2	0	0	8	2.0
Turdidae	2	8	2	10	5.5	6	4	6	6	6	5.6
Sylviidae	4	2	8	2	4.0	0	0	2	0	4	1.2
Parulidae	12	22	18	12	16.0	12	16	27	10	12	15.4
Fringillidae	4	4	6	8	5.5	4	12	10	11	8	9.0
Unidentified species	1	0	1	0	0.5	0	0	1	0	0	0.2
Totals	23	36	35	42	34.0	22	39	57	31	38	37.4

Table XII
Forest Bird Population Census
Untreated area
(second application, experimental block 5)
Noel Paul's brook, Newfoundland
June - July, 1977

Family	Pre-treatment					Daily Ave.	Post treatment				Daily Ave.
	June 26	June 27	June 29	July 1	July 2		July 3	July 5	July 6	July 7	
	-6	-5	-3	-1	-0		+1	+3	+4	+5	
Picidae	0	0	0	0	0	0.0	0	0	0	0	0.0
Tyrannidae	2	0	4	2	8	3.2	0	0	2	0	0.4
Corvidae	2	0	2	0	0	0.8	0	1	0	0	0.3
Paridae	0	3	0	0	0	1.6	2	4	0	0	1.5
Turdidae	6	6	3	2	0	3.4	4	8	10	6	7.0
Sylviidae	0	4	2	0	6	2.4	4	0	0	0	1.0
Parulidae	10	12	17	22	12	14.6	14	12	16	13	13.8
Icteridae	0	0	0	0	0	0.0	2	2	2	0	1.5
Fringillidae	11	3	3	4	12	8.6	8	6	5	8	6.8
Unidentified species	0	0	0	0	0	0.0	0	0	1	0	0.3
Totals	31	38	36	30	38	34.6	34	33	36	27	32.5

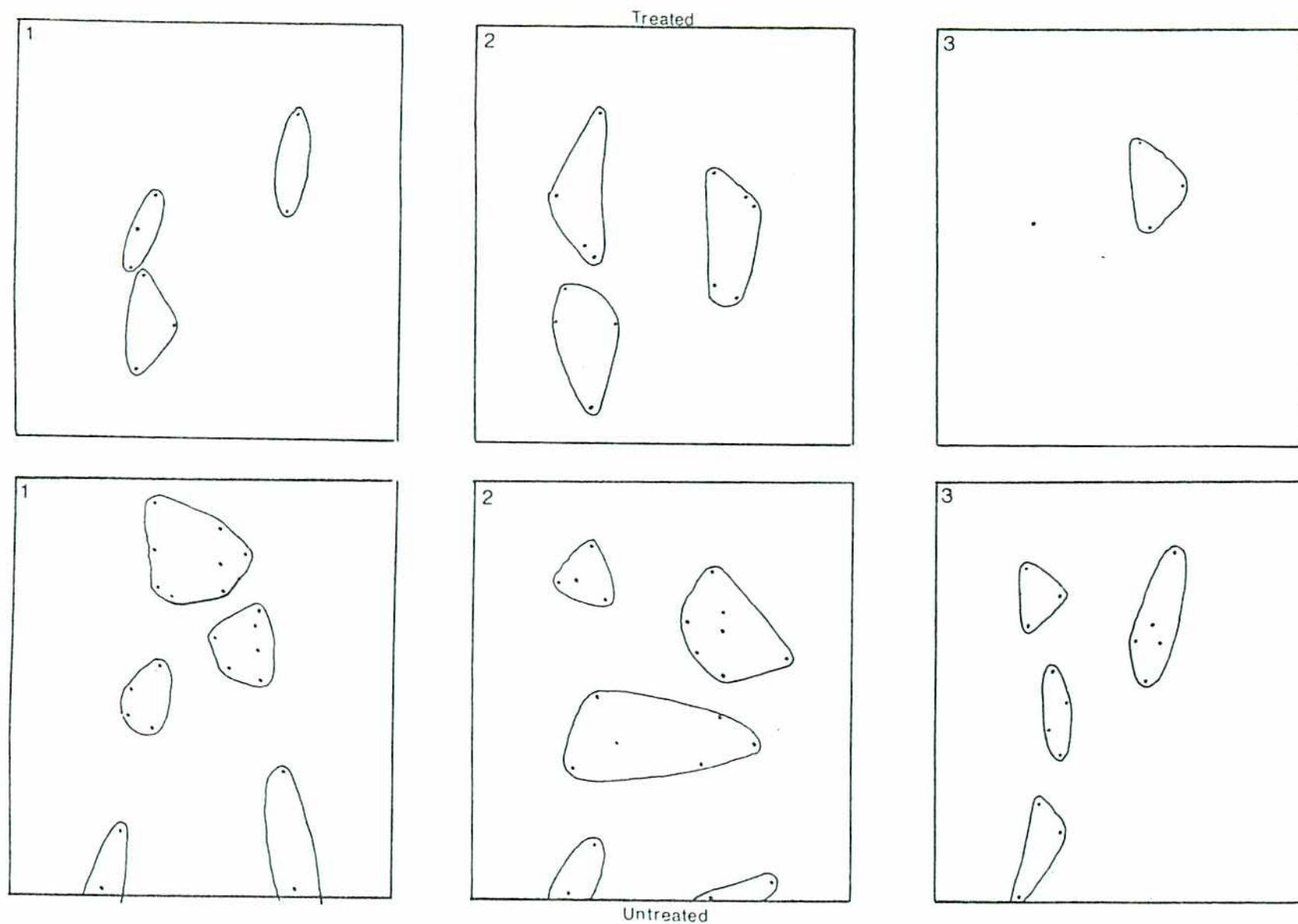


Fig. 11. Territories of the blackpoll warbler, *D. striata* (Forster), on treated and untreated plots following the pre-spray census (No. 1) and the first (No. 2) and second (No. 3) applications of acephate (0.056 kg) mixed with Bt (19.8 BIU) AI/ha on experimental block 5, Noel Paul's brook area, Newfoundland, 1977.

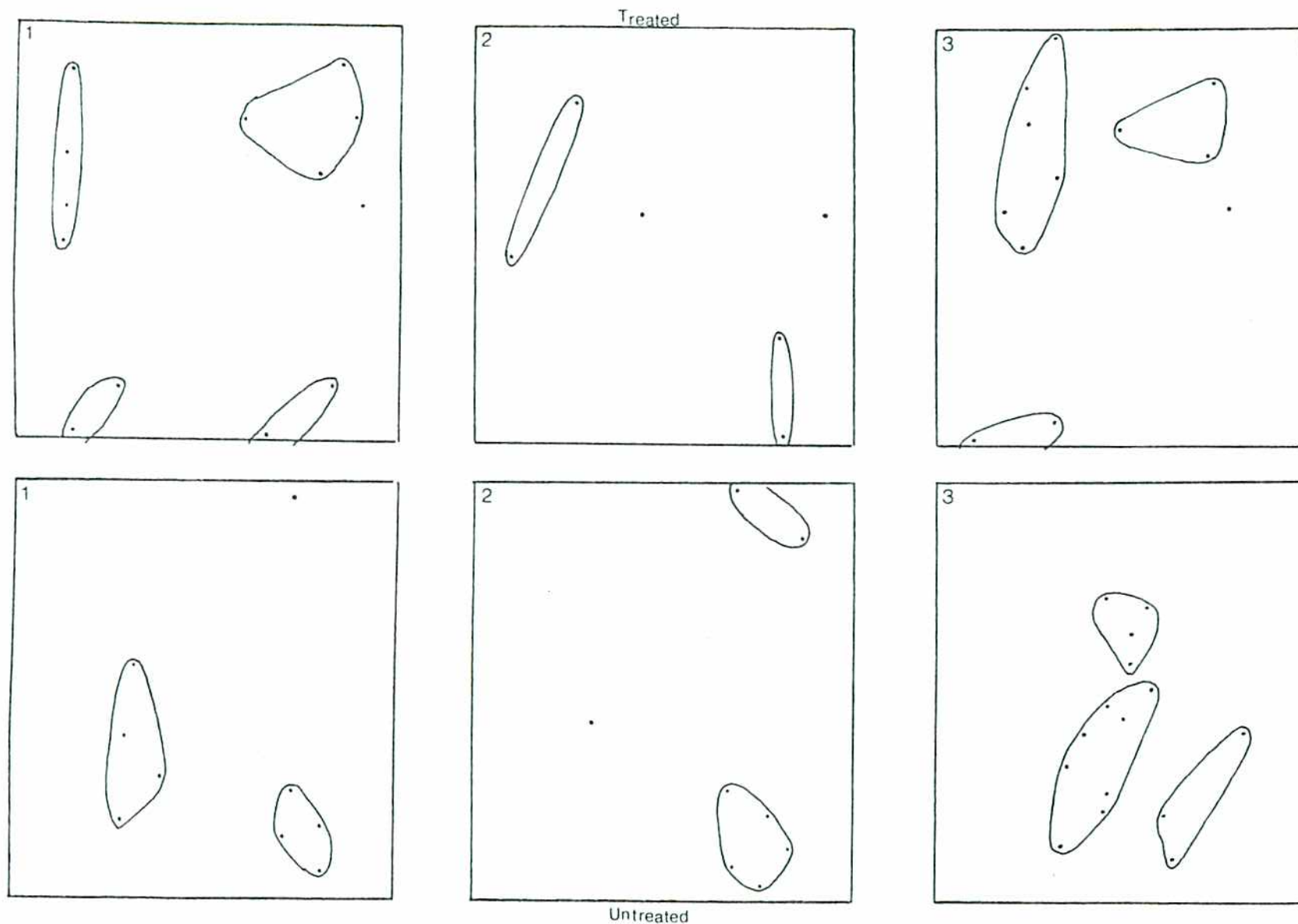


Fig. 12. Territories of the white-throated sparrow *Z. albicollis* (Gmelin) on treated and untreated plot following the pre-spray census (No. 1) and the first (No. 2) and second (No. 3) applications of acephate (0.056 kg) mixed with Bt (19.8 BIU) AI/ha on experimental block 5, Noel Paul's brook area, Newfoundland, 1977.

Warbler activity was much reduced on the morning following each application (tables IX, X, XI and XII) but similar reductions in activity were not as evident among other bird families and did not occur on the untreated control. These reductions in warbler activity following the initial application was short-lived but continued for a much longer period following the second application. Populations of thrushes (family Turdidae) remained relatively stable throughout the experimental period. Small flocks of pine grosbeaks, *Pinicola enucleator* (Linnaeus) foraged throughout the area in fluctuating numbers but populations of other species of the family Fringillidae remained relatively constant.

A slight decline in blackpoll warbler, *D. striata* (Forster), territories was indicated following the second application when occupants of one previously defined territory could not be relocated (Fig. 11). Both territories of the white-throated sparrow, *Z. albicollis* (Gmelin), lying wholly within the census plot remained occupied while one partial territory lying on the border of the plot was not identified following the treatments (Fig. 12).

IV DISCUSSION AND CONCLUSIONS

Three applications of aminocarb at the emitted dosage rate of 0.070 kg AI/ha at an interval of 6 days between sprays on experimental block 8 did not cause any mortality to the bird complex of the area. The experiment did not interrupt normal activity and no sick birds were observed exhibiting symptoms typical of pesticide stress.

Experimental block 9 received two applications of aminocarb at the emitted dosage rate of 0.087 kg AI/ha with a 5 day interval between sprays. Bird populations did not suffer any mortality and activity was not interrupted. Breeding territories of the blackpoll warbler, *D. striata* (Forster), and white-throated sparrow, *Z. albicollis* (Gmelin), remained occupied throughout the experimental period. The ruby-crowned kinglet, a small insecticide sensitive species, was present on block 9 in low numbers and was not affected by the experimental treatments.

Experimental block 6 received 2 applications of fenitrothion at the emitted dosage rate of 0.210 kg AI/ha followed by a single application of aminocarb at the emitted rate of 0.070 kg AI/ha. The initial application did not affect bird populations or activity patterns and territories of the blackpoll warbler, *D. striata* (Forster), and white-throated sparrow remained occupied. The second application which followed 6 days later caused a noticeable decline of activity (singing and sightings) of the warbler species. Similiar declines in activity did not occur with the thrush or sparrow and finch families. The third application of aminocarb did not further affect bird populations or activity. No dead birds were recovered during plot searches following each treatment and no sick birds were observed. The effects resulting from the 2nd application were short-lived and activity returned to pre-spray levels the following day.

Experimental block 5 received 2 applications of acephate (0.056 kg) combined with Bt (19.8 BIU) AI/ha with an 11 day interval between

treatments. Both applications resulted in reduced warbler activity on the morning following each treatment which lasted one day following the initial treatment but continued to the end of the census period following the 2nd spary. A loss of at least 1 blackpoll warbler, *D. striata* (Forster), territory resulted from the second application.

In summary, it is concluded that the experimental budworm suppression trials carried out in Newfoundland in 1977 did not present a significant danger to the avifauna of the various experimental blocks. Some reduction in activity was experienced in blocks 5 and 6 with the possible loss of territories. The impact recorded is regarded as minimal and is comparable to normal population and activity changes encountered in untreated environments.

V Acknowledgements

The authors wish to acknowledge the assistance of the many people associated with the experimental program carried out in Newfoundland. Special thanks to Dr. David Barnes of the Research and Assessment Branch, Environment Division of the Department of Consumer Affairs and Environment, to Dr. G. Bennett of Memorial University and to Dr. David J. Lewis who supervised the teams.

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VII Appendix

Forest bird populations censuses of plots
established in experimental spray blocks 5, 6, 7, 8 and 9
and plots in untreated control areas

Table I
Forest Bird Populaton Census
Untreated Area, Plot 1
(control for first and second application of experimental block 8)
Spruce Brook, Newfoundland,
June, 1977.

Family	Species	Pre-spray treatment 1						Post-treatment 1						Post-spray treatment 2					
		June 11	June 12	June 13	June 15	June 16	Daily	June 18	June 19	June 20	June 21	June 22	Daily	June 24	June 25	June 26	June 29	Daily	
		-6	-5	-4	-2	-2	Ave.	+1	+2	+3	+4	+6	Ave.	+1	+2	+3	+6	Ave.	
Tyrannidae	Yellow-bellied Flycatcher	2	7	4	0	0	2.6	0	2	4	2	4	2.4	2	2	0	2	1.5	
Corvidae	Blue Jay	0	0	0	0	1	0.2	0	0	0	0	0	0.0	0	0	0	0	0.0	
Paridae	Boreal Chickadee	0	0	0	0	1	0.2	0	0	2	2	2	1.2	1	2	1	1	1.3	
Sittidae	Red-breasted Nuthatch	0	0	0	0	0	0.0	0	0	0	0	3	0.6	0	0	0	0	0.0	
Turdidae	American Robin	4	7	10	2	3	5.2	2	1	6	5	8	4.4	2	5	8	8	6.8	
	Hermit Thrush	1	0	0	2	0	0.6	1	0	0	0	2	0.6	0	0	0	3	0.9	
	Swainson's Thrush	2	0	0	1	2	1.0	0	2	0	0	0	0.4	0	0	2	0	0.5	
	Veery	0	0	2	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0	
Sylviidae	Golden-crowned Kinglet	2	4	4	4	5	3.8	4	3	7	6	3	4.6	4	4	4	2	3.5	
	Ruby-crowned Kinglet	0	2	4	4	6	3.2	3	0	2	2	0	1.4	0	2	2	2	1.5	
Parulidae	Black and White Warbler	0	2	0	0	2	0.8	0	0	0	0	0	0.0	0	0	2	2	1.0	
	Magnolia Warbler	4	4	4	2	0	2.8	2	2	3	4	0	2.2	0	4	0	0	1.0	
	Yellow-rumped Warbler	6	4	6	6	4	5.2	4	4	8	8	8	6.4	6	4	6	4	5.0	
	Black-throated Green Warbler	4	2	4	4	6	4.0	6	2	4	4	2	3.6	0	4	2	6	2.4	
	Blackpoll Warbler	12	12	14	12	12	12.4	8	14	14	12	12	12.0	2	4	8	14	7.0	
	Ovenbird	4	2	4	2	4	3.2	2	2	4	4	4	3.2	2	4	2	4	3.0	
	Northern Waterthrush	8	10	12	2	0	6.4	4	4	4	4	4	4.0	2	10	6	12	7.5	
	Mourning Warbler	0	2	0	0	0	0.4	0	0	2	0	0	0.4	0	0	0	0	0.0	

Table I cont'd.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June	June	June	June	June	Daily	June	June	June	June	June	Daily	June	June	June	June	Daily	
		11	12	13	15	16		18	19	20	21	22		24	25	26	29		
		-6	-5	-4	-2	-1		Ave.	+1	+2	+3	+4	+5	Ave.	+1	+2	+3	+6	Ave.
Parulidae	Wilson's Warbler	0	2	2	0	2	1.2	0	0	0	0	0	0.0	0	0	0	0	0.0	
(cont'd.)	American Redstart	0	2	0	2	2	1.2	2	2	2	1	2	1.8	2	0	0	0	0.5	
Icteridae	Rusty Blackbird	0	0	0	2	0	0.4	0	0	0	1	0	0.2	0	0	0	0	0.0	
Fringillidae	Evening Grosbeak	0	1	2	2	2	1.4	2	0	2	2	2	1.6	2	1	2	1	1.5	
	Purple Finch	2	0	0	0	0	0.4	0	2	2	0	0	0.8	0	0	0	0	0.0	
	Pine Grosbeak	0	0	0	0	0	0.0	2	0	0	0	2	0.8	0	2	0	2	1.0	
	Pine Siskin	0	4	3	0	2	1.8	3	0	2	3	2	2.0	1	6	0	1	2.0	
	White-winged	0	0	0	0	0	0.0	7	0	0	0	0	1.4	0	0	0	2	0.5	
	Grossbill																		
	White-throated	4	7	6	4	4	5.0	2	2	0	0	3	1.4	2	2	0	4	2.0	
	Sparrow																		
	Fox Sparrow	0	4	0	4	0	1.6	0	0	4	0	0	0.8	2	2	2	2	2.0	
	Lincoln's Sparrow	2	0	4	2	1	1.8	5	0	1	5	0	2.2	2	4	1	0	1.8	
Total Birds		57	78	85	57	59	67.2	59	42	73	65	63	60.4	32	62	48	72	53.4	

Table II
Forest Bird Population Census
Untreated area plot 1
(control third application of experimental block 8)
Spruce Brook, Newfoundland
June - July, 1977

Family	Species	Pre-spray treatment 3					Daily Ave.	Post-spray treatment 3					Daily Ave.
		June 24	June 25	June 26	June 29	July 1		July 2	July 3	July 4	July 5	July 6	
		-7	-6	-5	-2	-0		+1	+2	+3	+4	+5	
Tyrannidae	Yellow-bellied Flycatcher	2	2	0	2	2	1.6	0	2	2	0	0	0.8
Paridae	Boreal Chickadee	1	2	1	1	1	1.2	1	2	0	0	1	0.8
Turdidae	American Robin	2	5	8	8	14	7.4	11	9	7	5	6	7.6
	Hermit Thrush	0	0	0	3	1	0.8	0	2	1	0	0	0.6
	Swainson's Thrush	0	0	2	0	2	0.8	1	2	2	2	2	1.8
Sylviidae	Golden-crowned Kinglet	4	4	4	2	5	3.8	4	2	4	4	1	3.0
	Ruby-crowned Kinglet	0	2	2	2	4	2.0	4	4	2	2	0	2.4
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0.0	1	1	0	0	0	0.4
Parulidae	Black and White Warbler	0	0	2	2	0	0.8	0	0	2	2	0	0.8
	Yellow Warbler	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Magnolia Warbler	0	4	0	0	0	0.8	2	2	3	2	2	2.2
	Yellow-rumped Warbler	6	4	6	4	6	5.2	6	6	4	6	4	5.2
	Black-throated Green Warbler	0	4	2	6	4	3.2	4	5	2	4	2	3.4
	Blackpoll Warbler	2	4	8	14	10	7.6	14	16	10	6	6	10.4
	Ovenbird	2	4	2	4	2	2.8	0	2	2	2	0	1.2
	Northern Waterthrush	2	10	6	12	8	7.6	6	8	6	4	4	5.6
	Mourning Warbler	0	0	0	0	0	0.0	2	0	2	0	0	0.8

Table II cont'd.

Family	Species	Pre-spray treatment 3					Daily Ave.	Post-spray treatment 3					Daily Ave.
		June 24	June 25	June 26	June 29	July 1		July 2	July 3	July 4	July 5	July 6	
		-7	-6	-5	-2	-0		+1	+2	+3	+4	+5	
Parulidae	American Redstart	2	0	0	0	2	0.8	2	2	2	0	0	1.2
cont'd.													
Fringillidae	Evening Grosbeak	2	1	2	1	1	1.4	2	0	2	0	0	0.8
	Purple Finch	0	0	0	0	3	0.6	4	6	3	4	0	3.4
	Pine Grosbeak	0	2	0	2	2	1.2	0	0	2	2	0	0.8
	Pine Siskin	1	6	0	1	2	2.0	3	6	3	2	4	3.6
	White-winged Crossbill	0	0	0	2	0	0.4	0	0	0	0	0	0.0
	White-throated Sparrow	2	2	0	4	1	1.8	4	4	6	4	3	4.2
	Fox Sparrow	2	2	2	2	0	1.6	0	0	0	2	2	0.8
	Lincoln's Sparrow	2	4	1	0	2	1.8	3	3	2	2	0	2.0
Total birds		32	62	48	72	74	57.6	74	84	69	55	37	63.8

Table III
Forest Bird Population Census
Untreated Area, plot 2
(control for first and second application on experimental block 8)
Spruce Brook, Newfoundland,
June, 1977

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2				
		June	June	June	June	June	Daily	June	June	June	June	June	Daily	June	June	June	June	Daily
		11	12	13	15	16		18	19	20	21	22		24	25	26	29	
		-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+6	
Picidae	Hairy Woodpecker	0	0	0	0	0	0.0	0	0	0	0	1	0.2	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	1	3	2	6	4	3.2	2	3	2	4	0	2.2	4	2	4	2	3.0
Hirundinidae	Tree Swallow	0	0	0	0	0	0.0	0	0	0	0	1	0.2	0	0	0	0	0.0
Turdidae	American Robin	2	1	0	2	2	1.4	1	3	0	2	0	1.2	0	1	0	3	1.0
Parulidae	Black and White Warbler	0	2	2	2	2	1.6	0	2	0	2	0	0.8	2	0	0	0	0.5
	Magnolia Warbler	0	0	0	2	2	0.8	0	0	0	0	0	0.0	0	0	2	0	0.5
	Yellow-rumped Warbler	0	2	0	0	0	0.4	0	0	0	0	0	0.0	2	1	2	0	1.3
	Black-throated Green Warbler	2	4	4	2	2	2.8	4	2	2	2	2	2.4	4	2	2	2	2.5
	Blackpoll Warbler	4	6	4	4	2	4.0	4	2	6	4	4	4.0	6	3	4	6	4.8
	Ovenbird	0	0	0	0	0	0.0	0	0	2	0	0	0.4	0	0	0	0	0.0
	Northern Waterflush	2	2	4	4	6	3.6	4	4	4	4	6	4.4	2	2	2	4	2.5
	Mourning Warbler	2	1	2	0	0	1.0	2	0	0	0	2	0.8	2	4	2	2	2.5
	Wilson's Warbler	0	0	0	0	0	0.0	0	2	0	2	0	0.8	0	0	0	2	0.5
Fringillidae	Pine Grosbeak	0	0	0	2	0	0.4	2	0	0	0	0	0.4	2	2	2	0	1.5
	Pine Siskin	1	0	0	0	0	0.2	1	2	0	0	0	0.6	2	1	0	0	0.8
	White-throated Sparrow	1	3	2	1	2	1.8	1	0	0	0	1	0.4	0	2	1	1	1.0
	Fox Sparrow	2	2	4	0	4	2.4	2	2	4	0	4	2.4	2	4	2	2	2.5
	Lincoln's Sparrow	0	2	0	0	0	0.4	2	0	2	0	0	0.8	0	0	0	00	0.0
Total Birds:		17	28	24	25	26	24.0	25	22	22	20	21	22.0	28	24	23	24	24.8

Table IV

Forest Bird Population Census
 Untreated area,
 (control for third application of experimental block 8)
 Spruce Brook, Newfoundland,
 June-July, 1977.

Family	Species	Pre-spray treatment 3						Post-spray treatment 3					
		June 24 -7	June 25 -6	June 26 -5	June 29 -2	July 1 -0	Daily Ave.	July 2 +1	July 3 +2	July 4 +3	July 5 +4	July 6 +5	Daily Ave.
Tyrannidae	Yellow-bellied Flycatcher	4	2	4	2	4	3.2	2	0	1	0	0	0.6
Turdidae	American Robin	0	1	0	3	1	1.0	1	2	0	1	2	1.2
Parulidae	Black and White Warbler	2	0	0	0	0	0.4	0	0	2	0	0	0.4
	Yellow-rumped Warbler	2	1	2	0	0	1.0	1	0	1	0	0	0.4
	Magnolia Warbler	0	0	2	0	0	0.4	0	0	0	0	0	0.0
	Black-throated Green Warbler	4	2	2	2	2	2.4	4	2	2	2	2	2.4
	Blackpoll Warbler	6	3	4	6	4	4.6	2	1	2	0	2	1.4
	Ovenbird	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Northern Water-thrush	2	2	2	4	0	2.0	2	4	4	2	2	2.8
	Mourning Warbler	2	4	2	2	0	2.0	0	2	0	1	0	0.6
	Wilson's Warbler	0	0	0	2	2	0.8	0	2	0	2	0	0.8
Fringillidae	Pine Grosbeak	2	2	2	0	0	1.2	2	0	0	0	0	0.4
	Pine Siskin	2	1	0	0	0	0.6	1	0	0	0	0	0.2
	White-throated Sparrow	0	2	1	1	2	1.2	3	2	1	2	2	2.0
	Fox Sparrow	2	4	2	2	2	2.4	4	0	2	4	1	2.2
	Lincoln's Sparrow	0	0	0	0	2	0.4	1	2	2	0	0	1.0
Total Birds:		28	24	23	24	21	24.0	23	17	17	14	11	16.4

Table V
Forest Bird Population Census
Experimental Block 8
(first and second applications (aminocarb at 0.070 kg AI/ha))
Pinchgut Lake, Newfoundland
June, 1977

Family	Species	Pre-spray treatment 1					Daily ave.	Post-spray treatment 1					Daily ave.	Post-spray treatment 2					Daily ave.
		June 11	June 12	June 13	June 15	June 16		June 18	June 19	June 20	June 21	June 22		June 24	June 25	June 26	June 27	June 29	
		-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+4	+6	
Picidae	Common Flicker	0	0	0	0	0	0.0	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Downy Woodpecker	0	0	0	0	0	0.0	0	1	0	0	0	0.2	1	0	0	0	0	0.2
Tyrannidae	Yellow-bellied Flycatcher	4	6	4	6	2	4.4	6	5	3	7	2	4.6	8	8	4	4	9	6.6
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	2	2	2	2	1.6
Hirundinidae	Tree Swallow	1	0	0	0	1	0.4	2	1	3	2	0	1.6	2	1	2	0	0	1.0
Corvidae	Gray Jay	1	0	0	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Paridae	Black-capped Chickadee	0	0	2	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Boreal Chickadee	0	2	0	1	4	1.4	1	0	0	0	1	0.4	1	3	0	1	0	1.0
Certhiidae	Brown Creeper	0	0	0	0	1	0.2	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	2	2	2	2	1.6	2	0	2	0	0	0.8	2	2	0	0	2	1.2
Turdidae	American Robin	5	4	3	3	5	4.0	3	3	5	5	1	3.4	4	7	4	4	7	5.2
	Hermit Thrush	0	0	0	1	1	0.4	2	2	2	1	1	1.6	3	0	1	0	0	1.2
	Swainson's Thrush	0	0	3	6	6	3.0	2	0	2	3	1	1.6	1	3	3	2	8	3.4
	Veery	0	1	0	0	0	0.2	0	0	0	0	0	0.0	0	0	0	4	0	0.8
Sylviidae	Golden-crowned Kinglet	0	0	1	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Ruby-crowned Kinglet	4	4	0	0	2	2.0	2	2	2	0	0	1.2	2	0	2	2	0	1.2
Parulidae	Black and White Warbler	2	2	6	6	0	3.2	4	4	0	4	2	2.8	4	2	4	4	0	2.8
	Magnolia Warbler	5	4	2	4	2	3.4	4	4	6	4	4	4.4	4	6	5	2	6	4.6
	Yellow-rumped Warbler	2	4	2	4	6	3.6	2	2	6	6	2	3.6	8	4	8	4	8	6.4
	Black-throated Green Warbler	2	6	2	2	4	3.2	7	4	6	2	4	4.6	2	4	4	2	4	3.2

Table V cont'd.

Family	Species	Pre-spray treatment 1					Daily ave.	Post-spray treatment 1					Daily ave.	Post-spray treatment 2					Daily ave.
		June 11	June 12	June 13	June 15	June 16		June 18	June 19	June 20	June 21	June 22		June 24	June 25	June 26	June 27	June 29	
		-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+4	+6	
Parulidae cont'd.	Blackpoll Warbler	17	18	19	19	20	18.6	16	16	18	14	14	15.6	18	22	14	10	16	16.0
	Northern Waterthrush	4	6	4	2	2	3.6	4	2	0	2	0	1.6	2	4	2	4	2	2.8
	Mourning Warbler	4	2	2	6	4	3.6	8	2	4	6	4	4.8	5	10	2	6	4	5.4
	Wilson's Warbler	2	4	2	4	4	3.2	6	0	4	2	4	3.2	4	2	2	2	7	3.4
Fringillidae	Purple Finch	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	2	0.45
	Pine Grosbeak	0	0	0	0	0	0.0	2	0	0	0	0	0.4	0	0	0	0	0	0.0
	Pine Siskin	0	0	1	0	1	0.4	2	0	0	0	0	0.4	0	2	1	0	4	1.4
	White-winged Crossbill	0	0	0	2	1	0.6	0	0	0	0	0	0.0	2	0	0	0	0	0.4
	White-throated Sparrow	12	5	12	5	9	8.6	10	5	4	8	4	6.2	12	10	2	3	11	7.6
	Fox Sparrow	4	2	2	2	2	2.4	4	2	2	2	0	2.0	4	4	2	0	0	2.0
	Lincoln's Sparrow	2	6	2	4	0	2.8	4	0	2	2	4	2.4	2	2	2	2	2	2.0
Total Birds		71	78	71	79	79	75.6	94	55	71	70	50	68.0	91	98	66	58	94	81.4

Table VI

Forest Bird Population Census
 Experimental Block 8, plot 1
 (third application (aminocarb at 0.070 Kg AI/ha))
 Pinchgut Lake, Newfoundland,
 June-July, 1977

Family	Species	Pre-spray treatment 3					Daily Ave.	Post-spray treatment 3					Daily Ave.
		June 26	June 27	June 29	June 30	July 1		July 2	July 3	July 4	July 5	July 6	
		-5	-4	-2	-1	-0		+1	+2	+3	+4	+5	
Tyrannidae	Yellow-bellied Flycatcher	4	4	9	2	4	4.6	5	3	3	1	0	2.4
	Olive-sided Flycatcher	2	2	2	0	2	1.6	2	2	2	2	2	2.0
Hirundinidae	Tree Swallow	2	0	0	1	0	0.6	1	0	0	0	0	0.1
Paridae	Boreal Chickadee	0	1	0	0	1	0.4	3	2	2	0	0	1.4
Certhiidae	Brown Creeper	0	0	0	0	0	0.0	1	0	0	0	0	0.2
Troglodytidae	Winter Wren	0	0	2	0	0	0.4	2	2	2	0	0	1.2
Turdidae	American Robin	4	4	7	7	4	5.2	5	1	5	5	4	4.0
	Hermit Thrush	1	0	0	2	2	1.0	2	1	0	1	0	0.8
	Swainson's Thrush	3	2	8	0	3	3.2	4	2	3	4	2	3.0
	Veery	0	4	0	0	0	0.8	0	0	0	0	0	0.0
Sylviidae	Ruby-crowned Kinglet	2	2	0	0	0	0.8	0	2	2	0	0	0.8
Parulidae	Black-and-white Warbler	4	4	0	0	2	2.0	2	2	2	2	0	1.6

Table VI (cont'd)

Family	Species	Pre-spray treatment 3					Daily Ave.	Post-spray treatment 3					Daily Ave.
		June	June	June	June	July		July	July	July	July	July	
		26	27	29	30	1		2	3	4	5	6	
		-5	-4	-2	-1	-0		+1	+2	+3	+4	+5	
Parulidae	Magnolia Warbler	5	2	6	2	4	3.8	4	8	4	2	2	4.0
	Yellow-rumped Warbler	8	4	8	2	2	4.8	4	4	6	1	2	3.4
	Black-throated Green Warbler	4	2	4	4	4	3.6	4	2	4	2	2	2.8
	Blackpoll Warbler	14	10	16	10	14	12.8	16	16	14	8	4	11.6
	Northern Waterthrush	2	4	2	4	4	3.2	5	4	6	4	2	4.2
	Mourning Warbler	2	6	4	6	4	4.4	6	2	4	2	2	3.2
	Wilson's Warbler	2	2	7	2	4	3.4	4	4	4	4	4	3.6
Fringillidae	Purple Finch	0	0	2	0	0	0.4	0	2	0	0	0	0.4
	Pine Siskin	1	0	4	0	0	1.0	2	4	0	0	0	1.2
	White-winged Crossbill	0	0	0	0	0	0.0	0	0	2	0	0	0.4
	White-throated Sparrow	2	3	11	7	8	6.2	9	11	9	8	5	8.4
	Fox Sparrow	2	0	0	4	6	2.4	0	4	2	2	4	2.4
	Lincoln's Sparrow	2	2	2	2	2	2.0	2	2	2	1	0	1.4
Total Birds		66	58	94	55	70	68.6	83	78	78	49	35	64.6

Table VII

Forest Bird Population Census
Experimental Block 8, plot 2
(first and second application (aminocarb at 0.070 Kg AI/ha))
Pinchgut Lake, Newfoundland
June, 1977

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2				
		June 11	June 12	June 13	June 15	June 16	Daily Ave.	June 18	June 19	June 20	June 21	June 22	Daily Ave.	June 24	June 25	June 26	June 29	Daily Ave.
		-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+6	
Picidae	Downy Woodpecker	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	1	0	0	0.3
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0	0.0	0	0	0	0	0	0.0	4	2	2	0	2.0
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0.5
Troglodytidae	Winter Wren	0	0	0	0	0	0.0	0	0	0	0	0	0.0	1	0	0	0	0.3
Turdidae	Swainson's Thrush	0	0	0	0	0	0.0	0	0	2	0	0	0.4	0	2	0	0	0.5
	American Robin	0	0	1	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0.0
Parulidae	Black and White Warbler	2	0	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0
	Yellow Warbler	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0
	Magnolia Warbler	2	2	0	0	0	0.8	2	0	6	6	0	2.8	2	6	0	4	3.0
	Yellow-rumped Warbler	4	0	0	0	0	0.8	0	0	0	0	0	0.0	0	2	0	2	1.0
	Black-throated Green Warbler	4	2	2	0	2	2.0	2	2	0	0	0	0.8	0	0	0	0	0.0
	Blackpoll Warbler	5	8	8	6	6	6.6	4	4	8	4	4	4.8	4	4	2	4	3.5
	Northern Waterthrush	0	0	0	0	2	0.4	0	0	0	2	0	0.4	0	0	2	0	0.5
	Mourning Warbler	0	2	2	6	2	2.4	4	2	2	6	4	3.6	4	4	2	6	4.0
	Common Yellowthroat	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0.0

Table VII (cont'd)

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2				
		June 11	June 12	June 13	June 15	June 16	Daily Ave.	June 18	June 19	June 20	June 21	June 22	Daily Ave.	June 24	June 25	June 26	June 29	Daily Ave
		-6	-5	-4	-2	-1		+1	+2	+3	+4	+5		+1	+2	+3	+6	
Parulidae	Wilson's Warbler	0	0	2	4	4	2.0	2	4	4	2	2	2.8	0	4	2	2	2.0
Fringillidae	White-throated sparrow	4	6	6	6	2	4.8	0	3	1	3	2	1.8	1	6	4	2	3.3
	Fox Sparrow	7	4	8	9	8	7.2	2	6	6	6	4	4.8	4	4	2	13	5.8
	Lincoln's Sparrow	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0.5
Total Birds		28	28	29	31	26	28.4	16	21	29	29	16	22.2	20	35	16	37	27.0

Table VIII

Forest Bird Population Census
 Experimental Block 8, plot 2
 (third application (aminocarb at 0.070 Kg AI/ha))
 Pinchgut Lake, Newfoundland,
 June-July, 1977

Family	Species	Pre-spray treatment 3					Post-spray treatment 3					
		June	June	June	July	Daily Ave.	July	July	July	July	July	Daily Ave.
		26	29	30	1		2	3	4	5	6	
		-5	-2	-1	-0		+1	+2	+3	+4	+5	
Picidae	Downy Woodpecker	0	0	0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	2	0	0	0	0.5	2	0	2	2	0	1.2
	Olive-sided Flycatcher	0	2	0	0	0.5	0	2	0	0	0	0.4
Turdidae	Swainson's Thrush	0	0	0	0	0.0	0	0	0	0	0	0.0
Parulidae	Magnolia Warbler	0	4	2	2	2.0	4	0	0	4	2	2.0
	Yellow-rumped Warbler	0	2	2	0	1.0	0	0	0	2	0	0.4
	Blackpoll Warbler	2	4	6	4	4.0	4	4	2	4	2	3.2
	Northern Waterthrush	2	0	2	0	1.0	0	0	0	0	2	0.4
	Mourning Warbler	2	6	6	2	4.0	3	0	2	2	1	1.6
	Wilson's Warbler	2	2	2	2	2.0	2	0	2	2	2	1.6
Fringillidae	White-throated Sparrow	4	2	4	6	4.0	2	6	4	3	4	3.8
	Fox Sparrow	2	13	0	7	5.5	7	5	4	4	3	4.6
	Lincoln's Sparrow	0	2	2	0	0.1	2	5	2	2	0	2.2
Totals		16	37	26	23	25.5	26	22	18	25	16	21.4

Table IX
Forest Bird Population Census
Experimental Block 8, plot 3
(first and second application, (aminocarb at 0.70 kg AI/ha))
Pinchgut Lake, Newfoundland,
June-July, 1977.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 11	June 12	June 13	June 15	June 16	Daily	June 18	June 19	June 20	June 21	June 22	Daily	June 24	June 25	June 26	June 27	June 29	Daily
		-6	-5	-4	-2	-1	Ave.	+1	+2	+3	+4	+5	Ave.	+1	+2	+3	+4	+6	Ave.
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0	0.0	0	0	0	2	2	0.8	2	0	0	2	0	0.8
Hirundinidae	Tree Swallow	3	1	0	0	0	0.8	0	0	0	1	0	0.2	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	2	0	0	2	0.8
Turdidae	Swainson's Thrush	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	2	0	2	2	1.2
Parulidae	Black and White Warbler	0	0	3	0	0	0.6	0	0	0	0	0	0.0	0	4	0	0	0	0.8
	Magnolia Warbler	2	2	2	0	2	1.6	2	4	4	0	2	2.4	0	4	0	2	6	2.4
	Yellow-rumped Warbler	0	0	0	0	0	0.0	0	0	0	2	0	0.4	2	0	0	0	0	0.4
	Black-throated Green Warbler	0	0	2	0	0	0.4	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Blackpoll Warbler	4	6	6	4	4	4.8	4	4	4	6	4	4.4	4	10	6	4	4	5.6
	Northern Waterthrush	0	0	0	2	2	0.8	2	0	0	0	0	0.4	0	0	0	0	0	0.0
	Mourning Warbler	8	6	4	6	4	5.6	6	4	6	6	2	4.8	4	2	4	2	2	2.8
	Wilson's Warbler	0	0	6	6	2	2.8	0	2	6	6	2	3.2	2	8	2	4	4	4.0
Fringillidae	White-throated Sparrow	8	6	4	14	4	7.2	3	2	4	4	4	3.4	2	2	2	4	4	2.8
	Fox Sparrow	4	4	10	8	6	6.4	4	4	4	8	4	4.8	6	8	2	2	4	4.4
	Lincoln's Sparrow	0	0	0	0	0	0.0	0	2	0	0	0	0.4	0	0	0	0	0	0.0
Total Birds:		29	25	37	40	24	31.0	22	22	28	35	20	25.4	22	42	16	22	28	26.0

Table X

Forest Bird Population Census
 Experimental Block 8, plot 3
 (third application (aminocarb at 0.070 Kg AI/ha))
 Pinchgut Lake, Newfoundland,
 June-July, 1977

Family	Species	Pre-spray treatment 3						Post-spray treatment 3					
		June 26	June 27	June 29	June 30	July 1	Daily Ave.	July 2	July 3	July 4	July 5	July 6	Daily Ave.
		-5	-4	-2	-1	-0		+1	+2	+3	+4	+5	
Tyrannidae	Yellow-bellied Flycatcher	0	2	0	0	0	0.4	0	0	0	0	0	0.0
	Olive-sided Flycatcher	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	0	2	0	0	0.4	2	2	0	0	0	0.8
Turdidae	Swainson's Thrush	0	2	2	0	0	0.8	0	0	0	0	0	0.0
Parulidae	Magnolia Warbler	0	2	6	6	2	3.2	6	0	2	2	0	2.0
	Yellow-rumped Warbler	0	0	0	2	0	0.4	0	0	0	0	0	0.0
	Blackpoll Warbler	6	4	4	4	2	4.0	0	2	2	2	2	1.6
	Northern Waterthrush	0	0	0	0	0	0.0	2	0	0	0	0	0.4
	Mourning Warbler	4	2	2	2	0	2.0	6	0	0	0	2	1.6
	Wilson's Warbler	2	4	4	2	6	3.6	0	1	2	0	0	0.6
Fringillidae	White-throated Sparrow	2	4	4	0	2	2.4	4	4	4	4	4	4.0
	Fox Sparrow	2	2	4	4	1	2.6	6	6	4	5	6	5.4
	Lincoln's Sparrow	0	0	0	0	0	0.0	0	0	0	1	3	0.8
Total Birds		16	22	28	22	13	20.2	26	15	14	14	17	17.2

Table XI

Forest Bird Population Census
 Untreated Plot 1
 (control for first and second application of experimental block 9)
 Spruce Brook, Newfoundland,
 June-July, 1977.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 13	June 15	June 16	June 18	June 19	Daily Ave.	June 20	June 21	June 22	June 23	June 24	Daily Ave.	June 25	June 26	June 29	July 1	July 2	Daily Ave.
		-6	-4	-3	-1	-0		+1	+2	+3	+4	+5		+1	+2	+5	+7	+8	
Picidae	Common Flicker	0	0	0	0	0	0.0	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	4	0	0	0	2	1.2	4	2	4	4	2	3.2	2	0	2	2	0	1.2
Corvidae	Blue Jay	0	0	1	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Paridae	Boreal Chickadee	0	0	1	0	0	0.2	2	2	2	1	1	1.6	2	1	1	1	1	1.2
Sittidae	Red-breasted Nuthatch	0	0	0	0	0	0.0	0	0	3	0	0	0.6	0	0	0	0	0	0.0
Turdidae	American Robin	10	2	3	2	1	3.6	6	5	8	2	2	4.6	5	8	8	14	11	9.2
	Hermit Thrush	0	2	0	1	0	0.6	0	0	2	0	0	0.4	0	0	3	1	0	0.8
	Swainson's Thrush	0	1	2	0	2	1.0	0	0	0	0	0	0.0	0	2	0	2	1	1.0
	Veery	2	0	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Sylviidae	Golden-crowned Kinglet	4	4	5	4	3	4.0	7	6	3	2	4	4.4	4	4	2	5	4	3.8
	Ruby-Crowned Kinglet	4	4	6	3	0	3.4	2	2	9	2	0	3.0	2	2	2	4	4	2.8
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	1	0.2
Parulidae	Black and White Warbler	0	0	2	0	0	0.4	0	0	0	3	0	0.6	0	2	2	0	0	0.8

Table XI (cont'd)

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 13	June 15	June 16	June 18	June 19	Daily	June 20	June 21	June 22	June 23	June 24	Daily	June 25	June 26	June 29	July 1	July 2	Daily
		-6	-4	-3	-1	-0	Ave.	+1	+2	+3	+4	+5	Ave.	+1	+2	+5	+7	+8	Ave.
Parulidae	Tennessee Warbler	0	0	0	0	0	0.0	0	0	0	2	0	0.4	0	0	0	0	0	0.0
	Yellow Warbler	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	0	0.4
	Magnolia Warbler	4	2	0	2	2	2.0	3	4	0	0	0	1.4	4	0	0	0	2	1.2
	Yellow-rumped Warbler	6	6	4	4	4	4.8	8	8	8	8	6	7.6	4	6	4	6	6	5.2
	Black-throated Green Warbler	4	4	6	6	2	4.4	4	4	2	2	0	2.4	4	2	6	4	4	4.0
	Blackpoll Warbler	14	12	12	8	14	12.0	14	12	12	12	2	10.4	4	8	14	10	14	10.0
	Ovenbird	4	2	4	2	2	2.8	4	4	4	4	2	3.6	4	2	4	2	0	2.4
	Northern Waterthrush	2	2	0	4	4	4.4	4	4	4	2	2	3.2	10	6	12	8	6	8.4
	Mourning Warbler	0	0	0	0	0	0.0	2	0	0	0	0	0.4	0	0	0	0	2	0.4
	Wilson's Warbler	2	0	2	0	0	0.8	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	American Redstart	0	2	2	2	2	1.6	2	1	2	2	2	1.8	0	0	0	2	2	0.8
Icteridae	Rusty Blackbird	0	2	0	0	0	0.4	0	1	0	0	0	0.2	0	0	0	0	0	0.0
Fringillidae	Evening Grosbeak	2	2	2	2	0	1.6	2	2	2	2	2	2.0	1	2	1	3	2	1.8
	Purple Finch	0	0	0	0	2	0.4	2	0	0	0	0	0.4	0	0	0	3	4	1.4
	Pine Grosbeak	0	0	0	2	0	0.4	0	0	2	0	0	0.4	2	0	2	2	0	1.2
	Pine Siskin	3	0	2	3	0	1.6	2	3	2	4	1	2.4	6	0	1	2	3	2.4
	White-winged Crossbill	0	0	0	7	0	1.4	0	0	0	0	0	0.0	0	0	2	0	0	0.4
	White-throated Sparrow	6	4	4	2	2	3.6	0	0	3	2	2	1.4	2	0	4	1	4	2.2
	Fox Sparrow	0	4	0	0	0	0.8	4	0	0	0	2	1.2	2	2	2	0	0	1.2
	Lincoln's Sparrow	4	2	1	5	0	2.4	1	5	0	2	2	2.0	4	1	0	2	3	2.0
Total Birds:		85	47	59	59	42	60.4	73	65	72	58	32	59.8	62	48	72	76	74	66.4

Forest Bird Population Census
Experimental Block 9, plot 1
(first and second application - aminocarb at 0.0875 kg AI/ha)
Spruce Brook, Newfoundland,
June-July, 1977.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 13	June 15	June 16	June 18	June 19	Daily	June 20	June 21	June 22	June 23	June 24	Daily	June 25	June 26	June 29	July 1	July 2	Daily
		-6	-4	-3	-1	-0	Ave.	+1	+2	+3	+4	+5	Ave.	+1	+2	+5	+7	+8	Ave.
Picidae	Hairy Woodpecker	1	0	0	0	0	0.2	0	1	0	0	0	0.2	0	0	0	0	0	0.0
	Downy Woodpecker	0	0	1	0	0	0.2	0	2	0	1	0	0.6	0	0	1	0	0	0.2
Tyrannidae	Yellow-bellied Flycatcher	6	2	3	6	2	3.8	2	2	0	2	0	1.2	2	0	2	2	0	1.2
	Oliver-sided Flycatcher	0	0	0	0	0	0.0	0	0	0	0	2	0.4	0	0	2	0	0	0.4
Hirundinidae	Tree Swallow	2	0	1	0	0	0.6	0	0	0	0	2	0.4	0	0	0	0	0	0.0
Paridae	Boreal Chickadee	0	0	0	0	2	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	American Robin	0	0	0	0	0	0.0	0	2	1	2	0	1.0	0	0	1	1	0	0.4
	Hermit Thrush	2	0	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Swainson's Thrush	0	0	2	4	4	2.0	4	4	4	2	2	3.2	0	0	2	2	2	1.2
Sylviidae	Ruby-crowned Kinglet	2	2	2	0	2	1.6	2	2	0	0	0	0.8	0	2	2	0	0	0.8
Parulidae	Black and White Warbler	0	0	0	0	2	0.4	4	4	0	0	4	2.4	10	2	6	0	0	3.6
	Yellow Warbler	2	0	0	0	3	1.0	2	0	0	0	0	0.4	0	0	2	0	0	0.4
	Magnolia Warbler	1	0	2	0	8	2.2	14	14	4	12	10	10.8	12	18	11	6	8	11.0
	Yellow-rumped Warbler	0	0	0	0	0	0.0	0	0	0	0	0	0.0	2	0	2	0	0	0.8

Table XII (cont'd)

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June	June	June	June	June	Daily	June	June	June	June	June	Daily	June	June	June	July	July	Daily
		13	15	16	18	19		20	21	22	23	24		25	26	29	1	2	
		-6	-4	-3	-1	-0		+1	+2	+3	+4	+5		+1	+2	+5	+7	+8	
Parulidae	Black-throated Green Warbler	4	4	4	2	2	3.2	6	3	4	4	0	3.4	6	0	2	4	2	2.8
	Blackpoll Warbler	10	15	12	8	12	11.4	14	14	12	14	24	15.6	6	14	11	13	8	10.4
	Northern Waterthrush	4	4	0	0	2	2.0	2	0	0	2	2	1.2	0	12	4	3	2	4.4
	Mourning Warbler	10	16	12	6	8	10.4	12	9	8	2	10	8.2	8	4	9	10	4	6.8
	Common Yellow-throat	0	0	0	0	2	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Wilson's Warbler	12	4	8	8	6	7.6	4	20	6	6	10	9.2	10	4	10	10	2	7.2
Fringillidae	Purple Finch	0	0	0	0	0	0.0	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Pine Grosbeak	1	0	0	0	0	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	White-throated Sparrow	6	2	3	2	4	3.4	2	1	6	3	5	3.4	6	2	2	4	2	3.2
	Fox Sparrow	13	6	3	4	2	5.6	8	5	4	2	6	5.0	6	2	6	11	4	5.8
	Lincoln's Sparrow	2	3	1	0	0	1.4	2	2	0	2	2	1.6	2	2	5	4	0	2.6
Total Birds:		78	58	55	40	61	58.4	78	86	49	54	79	69.2	70	62	79	71	34	63.2

Table XIII
Forest Bird Population Census
Experimental Block 9, plot 2
(first and second application-fenitrothion at 0.0875 kg AI/ha)
Spruce Brook, Newfoundland,
June-July, 1977.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 13	June 15	June 16	June 18	June 19	Daily Ave.	June 20	June 21	June 22	June 23	June 24	Daily Ave.	June 25	June 26	June 29	July 1	July 2	Daily Ave.
		-6	-4	-3	-1	-0		+1	+2	+3	+4	+5		+1	+2	+5	+7	+8	
Picidae	Common Flicker	0	0	0	0	1	0.2	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	2	0	0.4	2	2	2	2	2	2.0	2	2	2	2	2	2.0
Hirundinidae	Tree Swallow	0	0	0	0	0	0.0	0	3	2	1	0	1.2	0	0	0	0	0	0.0
Paridae	Boreal Chickadee	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	1	0	0	0	0.2
Turdidae	Swainson's Thrush	0	0	0	0	0	0.0	2	0	0	0	0	0.4	0	0	0	0	0	0.0
Sylviidae	Ruby-crowned Kinglet	0	0	0	0	0	0.0	0	2	0	0	0	0.4	0	0	0	0	0	0.0
Parulidae	Black and White Warbler	0	0	0	0	2	0.4	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Magnolia Warbler	6	6	4	2	4	4.4	2	2	2	2	4	2.4	4	0	6	2	2	2.8
	Black-throated Green Warbler	0	2	4	2	0	1.6	2	2	2	2	0	1.6	2	0	2	4	4	2.4
	Blackpoll Warbler	6	4	2	2	0	2.8	2	4	6	2	4	3.6	2	4	4	4	4	3.6
	Northern Waterthrush	2	2	0	0	0	0.8	2	2	4	0	2	2.0	2	0	0	0	0	0.4
	Mourning Warbler	2	0	0	0	4	1.2	2	4	2	0	2	2.0	2	0	4	0	0	1.2
	Wilson's Warbler	0	3	2	0	2	1.4	3	2	2	0	0	1.4	0	0	1	1	1	0.6
Fringillidae	White-throated Sparrow	2	4	5	1	2	2.8	4	4	6	2	1	3.4	2	0	4	4	4	2.8
	Fox Sparrow	4	4	4	0	4	3.2	4	2	2	4	4	3.2	2	0	2	4	2	2.0
Total Birds:		22	25	21	9	19	19.2	25	29	30	15	21	24.0	18	7	25	21	19	18.0

Table XIV

Forest Bird Population Census
Experimental Block 9, plot 3
(first and second applications aminocarb at 0.0875 kg AI/ha)
Spruce Brook, Newfoundland,
June-July, 1977.

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 13	June 15	June 16	June 18	June 19	Daily	June 20	June 21	June 22	June 23	June 24	Daily	June 25	June 26	June 29	July 1	July 2	Daily
		-6	-4	-3	-1	-0	Ave.	+1	+2	+3	+4	+5	Ave.	+1	+2	+5	+7	+8	Ave.
Picidae	Downy Woodpecker	0	0	0	0	0	0.0	0	0	1	0	0	0.2	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	0	2	0	2	2	1.2	0	0	2	0	2	0.8	2	0	3	2	2	1.8
Parulidae	Black and White Warbler	0	2	0	0	2	0.8	0	4	0	0	2	1.6	2	0	2	2	2	1.6
	Magnolia Warbler	3	0	2	2	4	2.2	4	2	2	4	2	2.8	2	0	2	0	0	0.8
	Yellow-rumped Warbler	0	0	0	0	0	0.0	0	0	2	0	0	0.4	0	0	0	0	0	0.0
	Black-throated Green Warbler	0	0	2	0	2	0.8	0	0	0	0	0	0.0	0	0	2	0	0	0.4
	Blackpoll Warbler	4	4	4	4	4	4.0	4	4	4	2	2	3.2	2	2	2	2	2	2.0
	Mourning Warbler	0	2	2	2	2	1.6	4	4	2	4	4	3.6	2	4	4	0	2	2.4
	Common Yellowthroat	0	0	0	0	0	0.0	0	0	0	0	4	1.2	0	0	0	0	0	0.0
	Wilson's Warbler	0	2	0	0	0	0.4	0	0	0	0	4	1.2	0	0	0	0	0	0.0
Fringillidae	Pine Grosbeak	0	0	0	0	2	0.4	2	0	0	0	2	0.8	0	0	0	0	0	0.0
	White-throated Sparrow	2	3	0	0	0	1.0	4	4	6	2	4	4.0	2	1	5	2	0	2.0
	Fox Sparrow	4	2	2	2	4	2.8	2	4	4	0	2	2.4	2	0	6	4	2	2.8
	Lincoln's Sparrow	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	1	0.6
Total Birds:		13	17	12	12	22	15.2	24	18	29	12	24	21.4	14	7	26	14	11	14.4

Table XV
Forest bird population census
(control for experimental block 6)
Hampden, Newfoundland
June - July, 1977

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3					Daily ave.
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily	
		13	15	17	18	ave.	20	21	23	ave.	26	27	29	1	ave.	3	4	5	8	9	ave.	
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7		
Picidae	Common Flicker	0	1	1	3	1.3	0	0	0	0.0	0	0	0	2	0.5	0	0	0	1	1	0.4	
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0	0.2	
Paridae	Boreal Chickadee	0	0	2	0	0.5	1	0	1	0.7	0	0	0	0	0.0	0	3	0	0	1	0.8	
Turdidae	American Robin	0	1	4	2	1.8	0	0	1	0.3	1	1	1	1	1.0	1	6	1	3	4	3.0	
	Hermit Thrush	0	0	0	0	0.0	0	2	0	0.7	2	2	2	3	2.3	3	4	3	2	1	2.6	
	Gray-cheeked Thrush	1	0	0	0	0.3	0	3	0	1.0	0	0	1	0	0.3	0	0	1	0	0	0.2	
Sylviidae	Ruby-crowned Kinglet	4	0	2	1	1.8	2	2	1	1.7	2	1	1	1	1.3	0	2	0	3	0	1.0	
Parulidae	Black and White Warbler	2	1	1	4	2.0	4	2	2	2.7	1	1	2	0	1.0	2	0	1	0	0	0.6	
	Tennessee Warbler	0	2	2	4	2.0	3	1	1	1.7	2	2	1	3	2.0	1	2	2	3	3	2.2	
	Magnolia Warbler	0	0	0	0	0.0	0	1	0	0.3	0	0	0	0	0.0	0	0	0	1	1	0.4	
	Yellow-rumped	0	3	0	0	0.8	2	4	1	2.0	1	0	1	1	0.8	2	3	3	3	4	3.0	

Table XV
Forest bird population census
(control for experimental block 6)
Hampden, Newfoundland
June - July, 1977

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily
		13	15	17	18	ave.	20	21	23	ave.	26	27	29	1	ave.	3	4	5	8	9	ave.
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Picidae	Common Flicker	0	1	1	3	1.3	0	0	0	0.0	0	0	0	2	0.5	0	0	0	1	1	0.4
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0	0.2
Paridae	Boreal Chickadee	0	0	2	0	0.5	1	0	1	0.7	0	0	0	0	0.0	0	3	0	0	1	0.8
Turdidae	American Robin	0	1	4	2	1.8	0	0	1	0.3	1	1	1	1	1.0	1	6	1	3	4	3.0
	Hermit Thrush	0	0	0	0	0.0	0	2	0	0.7	2	2	2	3	2.3	3	4	3	2	1	2.6
	Gray-cheeked Thrush	1	0	0	0	0.3	0	3	0	1.0	0	0	1	0	0.3	0	0	1	0	0	0.2
Sylviidae	Ruby-crowned Kinglet	4	0	2	1	1.8	2	2	1	1.7	2	1	1	1	1.3	0	2	0	3	0	1.0
Parulidae	Black and White Warbler	2	1	1	4	2.0	4	2	2	2.7	1	1	2	0	1.0	2	0	1	0	0	0.6
	Tennessee Warbler	0	2	2	4	2.0	3	1	1	1.7	2	2	1	3	2.0	1	2	2	3	3	2.2
	Magnolia Warbler	0	0	0	0	0.0	0	1	0	0.3	0	0	0	0	0.0	0	0	0	1	1	0.4
	Yellow-rumped Warbler	0	3	0	0	0.8	2	4	1	2.0	1	0	1	1	0.8	2	3	3	3	4	3.0
	Blackpoll Warbler	4	3	6	6	4.8	3	5	2	3.3	3	1	4	4	3.0	6	6	4	4	4	4.8

Table XVI
Forest bird population census
Untreated area, plot 2
(control for experimental block 6)
Hampden, Newfoundland
June - July, 1977

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily
		13	15	17	18	ave.	20	21	23	ave.	26	27	29	1	ave.	3	4	5	8	9	ave.
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Picidae	Common Flicker	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0	0	0.2
Paridae	Black-capped Chickadee	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0	0.2
	Boreal Chickadee	0	0	0	1	0.3	0	0	1	0.3	0	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	American Robin	0	1	0	0	0.3	0	0	0	0.0	1	1	0	1	0.8	2	2	0	2	2	1.6
	Hermit Thrush	1	0	1	0	0.5	0	0	0	0.0	1	1	0	1	0.3	0	0	2	1	0	0.6
Sylviidae	Ruby-crowned Kinglet	2	0	2	0	1.0	0	3	0	1.0	2	1	0	0	0.8	1	0	0	0	2	0.6
Parulidae	Black and White Warbler	2	0	1	0	0.8	1	0	0	0.3	0	0	0	0	0.0	0	0	0	0	0	0.0
	Tennessee Warbler	0	1	0	1	0.5	1	0	0	0.3	1	0	1	0	0.5	0	1	1	1	1	0.8
	Yellow-rumped Warbler	0	0	0	0	0.0	0	0	0	0.0	0	1	1	0	0.5	0	1	0	1	0	0.4
	Blackpoll Warbler	2	2	2	2	2.0	3	2	0	1.7	1	1	1	0	0.8	1	1	0	2	1	1.0
	Northern Waterthrush	0	1	1	0	0.5	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0

Table XVI cont'd.

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3					Daily ave.
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily	
		13	15	17	18	ave.	20	21	23	ave.	26	27	29	1	ave.	3	4	5	8	9	ave.	
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7		
Icteridae	Rusty Blackbird	1	0	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0	
Fringillidae	Purple Finch	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0	
	White-throated Sparrow	3	0	2	3	2.0	4	2	3	3.0	2	2	1	3	2.0	3	2	1	2	2	2.0	
	Fox Sparrow	1	1	1	1	1.0	1	1	1	1.0	0	1	1	1	0.8	0	0	0	0	0	0.0	
	Song Sparrow	1	0	1	1	0.8	1	1	1	1.0	0	1	1	1	0.8	0	1	1	0	1	0.6	
Unidentified birds:		0	0	0	1	0.3	1	1	1	1.0	0	0	0	0	0.0	0	0	0	0	0	0.0	
Total birds:		13	6	13	10	10.5	12	10	7	9.6	9	9	6	7	7.8	7	9	6	9	9	8.0	

Table XVII
Forest bird population census
Untreated area, plot 3
(control for experimental block 6)
Hampden, Newfoundland
June - July, 1977

Family	Species	Pre-treatment 1				Post-treatment 1			Post-treatment 2					Post-treatment 3					
		June	June	June	June	Daily	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July
		13	15	17	18	ave.	20	23	ave.	26	27	29	1	ave.	3	4	5	8	9
		-6	-4	-2	-1		+1	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7
Picidae	Common Flicker	0	1	0	0	0.3	0	1	0.5	1	0	0	0	0.3	0	0	0	0	0.0
	Black-backed	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.2
	Three-toed																		
	Woodpecker																		
Hirundinidae	Tree Swallow	0	0	1	0	0.3	0	0	0.0	0	0	0	0	0.0	0	1	0	0	0.2
Turdidae	American Robin	0	0	0	1	0.3	0	2	1.0	2	0	0	0	0.5	1	1	1	0	1.0
	Hermit Thrush	0	0	0	1	0.3	0	0	0.0	0	1	0	1	0.5	1	0	1	1	1.0
	Swainson's	0	1	0	0	0.3	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.0
	Thrush																		
	Gray-cheeked	1	2	3	1	1.8	2	0	1.0	0	1	1	0	0.5	0	1	0	0	0.2
	Thrush																		
Sylviidae	Ruby-crowned	0	1	1	0	0.5	0	0	0.0	0	1	0	0	0.3	2	2	0	1	1.0
	Kinglet																		
Parulidae	Black and White	1	1	1	2	1.3	1	2	1.5	1	0	1	2	1.0	1	1	1	0	0.8
	Warbler																		
	Tennessee	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.2
	Warbler																		
	Yellow Warbler	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.2
	Magnolia	1	0	0	0	0.3	0	0	0.0	1	1	1	1	1.0	0	0	0	2	0.4
	Warbler																		
	Yellow-rumped	0	0	0	0	0.0	0	1	0.5	0	0	0	0	0.0	0	0	0	1	0.2
	Warbler																		

Table XVII cont'd.

Family	Species	Pre-treatment 1					Post-treatment 1			Post-treatment 2					Post-treatment 3					Daily ave.
		June	June	June	June	Daily	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	
		13	15	17	18	ave.	20	23	ave.	26	27	29	1	ave.	3	4	5	8	9	
		-6	-4	-2	-1		+1	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Parulidae cont'd.	Black-throated Green Warbler	0	1	1	0	0.5	0	0	0.0	0	0	0	0	0.0	1	1	0	0	0	0.4
	Blackpoll Warbler	1	1	1	0	0.8	1	0	0.5	1	0	0	0	0.3	1	1	1	0	1	0.8
	Ovenbird	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0.0	1	0	0	0	0	0.2
	Northern Waterthrush	1	1	1	0	0.8	0	0	0.0	0	0	0	1	0.3	0	0	0	0	2	0.4
Fringillidae	Pine Siskin	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0
	White-throated Sparrow	5	3	2	4	3.5	2	3	2.5	3	4	2	4	3.3	4	3	3	2	2	2.8
	Fox Sparrow	1	1	2	0	1.0	1	1	1.0	0	0	0	0	0.0	1	0	1	1	0	0.6
	Song Sparrow	0	0	0	0	0.0	0	0	0.0	0	0	1	0	0.3	0	0	0	0	0	0.0
Unidentified birds:		0	0	0	1	0.3	1	0	0.5	0	0	0	1	0.3	0	0	0	2	0	0.4
Total birds:		11	13	14	11	12.3	9	11	10.0	10	9	7	10	9.0	15	12	8	11	19	13.0

Table XVIII
Forest bird population census
Experimental Block 6, plot 1
(first and second fenitrothion at 0.210 kg AI/ha
and third (aminocarb at 0.070 kg AI/ha) applications)
Hampton, Newfoundland
June - July, 1977

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3				
		June 13	June 15	June 17	June 18	Daily ave.	June 20	June 21	June 23	Daily ave.	June 26	June 27	June 29	July 1	Daily ave.	July 3	July 4	July 5	July 8	July 9	Daily ave.
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Picidae	Common Flicker	2	1	3	1	1.8	3	3	0	2.0	2	2	0	1	1.3	3	2	0	4	1	2.0
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	2	1	1.0	0	0	0	1	0.3	1	1	0	1	0	0.6
Paridae	Black-capped Chickadee	0	0	0	1	0.3	2	0	0	0.7	0	0	0	0	0.0	0	0	0	0	0	0.0
	Boreal Chickadee	0	0	0	1	0.3	3	0	0	1.0	0	0	0	0	0.0	2	2	0	1	2	1.4
Turdidae	American Robin	1	2	3	3	2.3	4	2	4	3.3	2	4	3	4	3.3	5	9	3	6	2	5.0
	Hermit Thrush	2	1	3	2	2.0	3	3	0	2.0	0	2	3	1	1.5	4	3	2	3	3	3.0
	Swainson's Thrush	0	0	1	1	0.5	0	0	0	0.0	0	0	0	0	0.0	0	0	0	1	1	0.4
	Gray-cheeked Thrush	2	4	3	1	2.5	4	4	1	3.0	1	0	3	2	1.5	2	3	1	0	0	1.2
Sylviidae	Ruby-crowned Kinglet	1	2	0	6	2.3	3	5	3	3.7	1	1	0	0	0.5	0	0	0	1	1	0.4
Parulidae	Balck and White Warbler	3	5	8	9	6.3	3	6	1	3.3	0	0	3	2	1.3	0	0	0	0	0	0.0
	Tennessee Warbler	3	1	5	5	3.5	2	5	4	3.7	3	5	4	4	4.0	2	1	0	1	1	1.0
	Magnolia Warbler	3	1	1	3	2.0	2	1	0	1.0	0	2	1	3	1.5	0	0	0	2	2	0.8
	Yellow-rumped Warbler	1	0	0	4	1.3	0	0	2	0.7	1	0	0	3	1.0	3	4	0	6	2	3.0

Table XVIII cont'd.

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	July	Daily
		13	15	17	18	ave.	20	21	23	ave.	26	27	29	1	ave.	3	4	5	8	9	ave.
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+3	+6	+7	
Parulidae	Black-throated	0	0	0	0	0.0	0	1	0	0.1	0	0	0	0	0.0	0	0	0	0	0	0.0
	Green warbler																				
	Blackpoll	9	4	11	10	8.5	5	8	5	6.0	0	5	5	2	3.0	1	4	0	5	4	3.0
	Warbler																				
	Ovenbird	1	0	0	1	0.5	1	1	0	0.7	0	0	1	0	2.5	1	0	0	0	1	0.4
	Northern	0	0	0	0	0.0	1	0	0	0.4	0	0	0	0	0.0	0	0	0	0	0	0.0
	Waterthrush																				
Icteridae	Rusty Blackbird	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	1	0	0	0	0	0.2
Fringillidae	Pine Grosbeak	0	0	2	2	1.0	1	2	1	1.4	1	1	0	1	0.8	2	0	0	0	0	0.4
	Pine Siskin	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	1	0	11	14	5.2
	Dark-eyed	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Junco																				
	White-throated	5	9	6	11	7.8	12	12	6	10.0	9	11	9	11	10.0	14	13	6	21	13	13.4
	Sparrow																				
	Fox Sparrow	5	3	3	3	3.5	3	2	1	2.0	0	4	1	3	2.0	1	1	0	1	2	1.0
	Song Sparrow	0	0	0	0	0.0	0	0	0	0.0	0	0	1	0	0.3	1	2	0	3	1	1.4
Unknown Species		0	1	1	3	1.3	3	4	3	3.4	1	0	1	1	0.8	2	1	0	5	4	2.4
Total birds:		38	34	52	66	47.5	55	62	32	49.6	21	37	35	39	33.0	45	47	12	72	54	46.0

Table XIX

Forest Bird Population Census
 Experimental Block 6, plot 2
 (first and second fenitrothion at 0.21 kg AI/ha)
 and third aminocarb at 0.07 kg AI/ha applications
 Hampton, Newfourdland,
 June-July, 1977.

Family	Species	Pre-treatment 1					Post-treatment 1					Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily Ave.	June	June	June	Daily Ave.	June	June	June	July	Daily Ave.	July	July	July	July	Daily Ave.	
		13	15	17	18		20	21	23		26	27	29	1		3	4	8	9		
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+6	+7		
Picidae	Common Flicker	1	1	1	1	1.0	1	3	0	1.3	0	0	0	0	0.0	0	2	0	0	0.5	
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	0	1	0.3	0	0	0	0	0.0	0	0	0	0	0.0	
Turdidae	American Robin	0	1	1	0	0.5	2	1	1	1.3	0	1	0	1	0.5	3	4	1	1	2.3	
	Gray-cheeked Thrush	1	2	1	0	1.0	1	0	0	0.3	1	0	0	0	0.3	0	1	0	0	0.3	
	Hermit Thrush	3	2	0	0	1.3	0	0	0	0.0	0	1	1	0	0.5	1	0	0	1	0.5	
Sylviidae	Ruby-crowned Kinglet	0	0	0	1	0.3	0	1	0	0.3	1	0	0	0	0.3	0	0	0	0	0.0	
Parulidae	Black and White Warbler	0	0	1	1	0.5	0	0	0	0.0	0	0	0	0	0.0	0	0	0	1	0.3	
	Yellow-rumped Warbler	0	0	0	0	0.0	0	0	1	0.3	0	0	0	0	0.0	0	0	1	1	0.5	
	Tennessee Warbler	2	1	1	0	1.0	1	1	1	1.0	1	2	1	1	1.3	0	0	0	1	0.3	
	Blackpoll Warbler	2	3	2	4	2.8	2	1	2	1.6	1	1	2	2	1.5	2	1	1	1	1.3	
	Magnolia Warbler	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	0	0	2	0.5	
	Northern Waterthrush	0	2	0	0	0.5	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.0	

Table XIX

Forest Bird Population Census
 Experimental Block 6, plot 2
 (first and second fenitrothion at 0.21 kg AI/ha
 and third aminocarb at 0.07 kg AI/ha applications
 Hampton, Newfoundland,
 June-July, 1977.

Family	Species	Pre-treatment 1					Post-treatment 1				Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	Daily
		13	15	17	18		20	21	23		26	27	29	1		3	4	8	9	
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+6	+7	
					Ave.				Ave.					Ave.					Ave.	
Fringillidae	Dark-eyed Junco	0	0	1	0	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0.0
	Pine Grosbeak	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	0	2	1	0.8
	White-throated Sparrow	2	2	3	3	2.5	2	4	1	2.3	2	3	2	3	2.5	3	4	3	3	3.3
	Fox Sparrow	2	1	1	2	1.5	1	1	0	0.6	0	0	1	1	0.5	0	0	1	1	0.5
	Song Sparrow	0	0	0	0	0.0	0	0	0	0.0	0	0	1	1	0.3	0	1	1	0	0.5
Unidentified Birds:		0	0	0	2	0.5	0	0	0	0.0	0	0	0	0	0.0	0	1	1	0	0.5
Total Birds		13	16	12	14	14.0	10	12	7	9.3	6	8	8	8	7.7	10	14	10	13	12.2

Table XX

Forest Bird Population Census
 Experimental Block 6, plot 3
 (first and second fenitrothion at 0.21 kg. AI/ha)
 and third aminocarb at 0.07 kg AI/ha applications
 Hampton, Newfoundland,
 June-July, 1977.

Family	Species	Pre-treatment 1					Post-treatment 1				Post-treatment 2					Post-treatment 3				
		June 13	June 15	June 17	June 18	Daily Ave.	June 20	June 21	June 23	Daily	June 26	June 27	June 29	July 1	Daily Ave.	July 3	July 4	July 8	July 9	Daily Ave.
		-6	-4	-2	-1		+1	+2	+4		+1	+2	+4	+6		+1	+2	+6	+7	
Picidae	Common Flicker	1	2	0	1	1.0	0	0	0	0.0	0	0	0	1	0.3	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	0	0.0	0	1	0	0.3	0	0	0	0	0.0	0	0	0	0	0.0
Paridae	Black-capped Chickadee	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0	0.3
Turdidae	American Robin	1	1	1	1	1.0	0	1	0	0.3	0	1	1	0	0.5	1	1	1	0	0.8
	Hermit Thrush	0	0	0	0	0.0	0	0	0	0.0	0	0	1	0	0.3	1	3	2	2	2.0
	Swainson's Thrush	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0.0	0	0	0	1	0.3
	Gray-cheeked Thrush	0	3	1	0	1.0	0	2	1	1.0	1	0	0	0	0.3	0	2	0	0	0.5
Sylviidae	Ruby-crowned Kinglet	0	0	0	0	0.0	1	1	1	1.0	0	0	0	0	0.0	1	0	0	0	0.3
Parulidae	Black and White Warbler	2	1	2	1	1.5	2	0	0	0.7	0	1	2	0	0.8	0	0	0	0	0.0
	Tennessee Warbler	2	0	2	0	1.0	0	0	1	0.3	0	1	1	1	0.8	0	0	1	2	0.8
	Yellow-rumped Warbler	0	0	0	1	0.3	0	0	0	0.0	0	0	0	0	0.0	0	0	1	0	0.3

Table XX (cont'd)

Family	Species	Pre-treatment 1					Post-treatment 1				Post-treatment 2					Post-treatment 3				
		June	June	June	June	Daily	June	June	June	Daily	June	June	June	July	Daily	July	July	July	July	Daily
		13	15	17	18		20	21	23		26	27	29	1		3	4	8	9	
		-6	-4	-2	-1	Ave.	+1	+2	+4	Ave.	+1	+2	+4	+6	Ave.	+1	+2	+6	+7	Ave.
Parulidae	Black-throated	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0.0	0	0	0	0	0.0
	Green Warbler																			
	Blackpoll Warbler	1	2	1	2	1.5	1	2	2	1.7	1	0	1	0	0.5	0	0	1	0	0.3
	Ovenbird	0	0	0	0	0.0	0	0	1	0.3	0	0	0	0	0.0	0	0	0	0	0.0
Fringilliade	Pine Grosbeak	2	0	0	1	0.8	1	0	1	0.7	0	0	0	0	0.0	0	1	0	0	0.3
	Pine Siskin	0	0	1	0	0.3	0	0	1	0.3	0	0	0	0	0.0	0	0	0	0	0.0
	White-throated	3	1	0	3	1.8	2	1	2	1.7	2	2	3	2	2.3	3	2	2	3	2.5
	Sparrow																			
	Fox Sparrow	1	1	1	0	0.8	0	1	1	0.7	1	0	0	1	0.5	0	0	1	0	0.3
	Song Sparrow	0	0	0	0	0.0	0	0	1	0.3	0	1	0	0	0.3	1	1	0	1	0.8
Unidentified Birds:		0	0	0	1	0.3	1	0	1	0.7	0	0	0	0	0.0	0	0	0	0	0.0
Total Bird		13	11	9	11	11.0	8	11	13	10.7	5	6	9	5	6.3	7	9	10	9	8.8

Table XXI

Forest Bird Population Census
 Untreated Area
 (control for first application of experimental block 5)
 Noel Paul's Brook, Newfoundland
 June, 1977

Family	Species	Pre-spray treatment 1				Daily Ave.	Post-spray treatment 1					Daily Ave.
		June 15	June 16	June 19	June 20		June 22	June 24	June 25	June 26	June 27	
		-6	-5	-2	-1		+1	+3	+4	+5	+6	
Picidae	Downy Woodpecker	0	0	0	2	0.5	0	1	0	0	0	0.2
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	6	1.5	0	4	2	2	0	1.6
Corvidae	Gray Jay	0	0	0	0	0.0	0	0	6	2	0	1.6
	Common Raven	0	0	0	0	0.0	0	0	2	0	0	0.4
	Common Crow	0	0	0	0	0.0	0	0	1	0	0	0.2
Paridae	Boreal Chickadee	0	0	0	2	0.5	0	2	0	0	8	2.0
Turdidae	American Robin	2	6	2	6	4.0	6	4	6	6	2	4.8
	Swainson's Thrush	0	2	0	4	1.5	0	0	0	0	4	0.8
Sylviidae	Ruby-crowned Kinglet	4	2	8	2	4.0	0	0	2	0	4	1.2
Parulidae	Tennessee Warbler	0	0	0	0	0.0	0	0	2	0	0	0.4
	Yellow-rumped Warbler	4	12	4	4	6.0	8	4	14	4	2	6.4
	Blackpoll Warbler	6	10	14	8	9.5	4	8	11	6	10	7.8
	Northern Waterthrush	2	0	0	0	0.5	0	4	0	0	0	0.8
Fringillidae	Purple Finch	0	0	0	0	0.0	0	0	2	0	0	0.4
	Pine Grosbeak	0	0	0	2	0.5	0	10	4	2	4	4.0

Table XXI (cont'd)

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Daily Ave.
		June 15	June 16	June 19	June 20	Daily Ave.	June 22	June 24	June 25	June 26	June 27	
		-6	-5	-2	-1		+1	+3	+4	+5	+6	
Fringillidae	White-winged Crossbill	0	0	4	0	1.0	0	0	0	0	0	0.0
	White-throated Sparrow	4	4	2	4	3.5	4	2	4	5	4	3.8
	Fox Sparrow	0	0	0	2	0.5	0	0	0	4	0	0.8
Unidentified Birds		1	0	1	0	0.5	0	0	1	0	0	0.2
Total Birds		23	36	35	42	34.0	22	39	57	31	38	37.4

Table XXII

Forest Bird Population Census
 Untreated Area
 (control for second application of experimental block 5)
 Noel Pauls Brook, Newfoundland,
 June-July, 1977

Family	Species	Pre-spray treatment 2					Daily ave.	Post-spray treatment 2				Daily ave.
		June 26	June 27	June 29	July 1	July 2		July 3	July 5	July 6	July 7	
		-6	-5	-3	-1	-0		+1	+3	+4	+5	
Tyrannidae	Yellow-bellied Flycatcher	2	0	4	2	8	3.2	0	0	2	0	0.5
Corvidae	Gray Jay	2	0	2	0	0	0.8	0	0	0	0	0.9
	Common Crow	0	0	0	0	0	0.0	0	1	0	0	0.3
Paridae	Boreal Chickadee	0	8	0	0	0	1.6	2	4	0	0	1.5
Turdidae	American Robin	6	2	0	2	0	2.0	4	4	2	6	4.0
	Swainson's Thrush	0	4	3	0	0	1.4	0	4	8	0	3.0
Sylviidae	Golden-crowned Kinglet	0	0	0	0	2	0.4	0	0	0	0	0.0
	Ruby-crowned Kinglet	0	4	2	0	4	2.0	4	0	0	0	1.0
Parulidae	Black and White Warbler	0	0	0	0	0	0.0	0	0	2	0	0.5
	Tennessee Warbler	0	0	0	0	2	0.4	0	0	0	0	0.0
	Yellow-rumped Warbler	4	2	5	14	0	5.0	4	8	4	5	5.3
	Blackpoll Warbler	6	10	10	6	10	8.4	10	2	8	8	7.0
	Northern Waterthrush	0	0	2	2	0	0.8	0	2	2	0	1.0
Icteridae	Rusty Blackbird	0	0	0	0	0	0.0	2	2	2	0	1.5
Fringillidae	Pine Grosbeak	2	4	2	4	4	3.2	0	0	0	2	0.5
	Pine Siskin	0	0	0	0	5	1.0	2	0	0	0	0.5
	White-throated Sparrow	5	4	6	0	3	3.6	6	6	5	6	5.8
	Fox Sparrow	4	0	0	0	0	0.8	0	0	0	0	0.0
Unidentified Birds		0	0	0	0	0	0.0	0	0	1	0	0.3
Total Birds		31	38	36	30	38	34.6	34	33	36	27	32.5

Table XXIII
Forest Bird Population Census
Experimental Block 5
(first application B.t. plus acephate)
Noel Pauls Brook, Newfoundland
June, 1977

Family	Species	Pre-spray treatment 1				Daily ave.	Post-spray treatment 1					Daily ave.
		June 15	June 16	June 19	June 20		June 22	June 24	June 25	June 26	June 27	
		-6	-5	-2	-1		+1	+3	+4	+5	+6	
Tyrannidae	Yellow-bellied Flycatcher	0	0	2	2	1.0	4	4	4	4	2	3.6
Corvidae	Gray Jay	0	0	0	0	0.0	0	0	0	2	0	0.4
	Common Raven	0	0	0	0	0.0	0	0	0	2	0	0.4
Paridae	Boreal Chickadee	2	4	0	4	2.5	0	2	5	0	0	1.4
Turdidae	American Robin	6	4	10	4	6.0	4	6	10	6	6	6.4
Sylviidae	Ruby-crowned Kinglet	0	4	0	2	1.5	0	0	0	2	0	0.4
Vireonidae	Red-eyed Vireo	0	0	0	0	0.0	0	0	0	2	0	0.4
Parulidae	Black and White Warbler	0	2	0	0	0.5	0	0	0	4	0	0.8
	Yellow-rumped Warbler	4	4	2	6	4.0	0	3	2	2	2	1.8
	Black-throated Green Warbler	12	4	0	3	4.8	0	0	4	4	0	1.6
	Blackpoll Warbler	2	4	2	10	4.5	2	10	4	6	0	4.4
	Ovenbird	2	2	0	0	1.0	0	2	2	0	0	1.0
	Northern Waterthrush	0	0	0	0	0.0	0	0	2	2	0	0.8
Fringillidae	Pine Grosbeak	0	5	0	0	1.5	6	0	4	0	0	2.0
	Pine Siskin	0	0	0	0	0.0	0	0	3	0	0	0.6
	White-throated Sparrow	6	4	4	12	6.5	0	2	7	2	2	2.6
	Fox Sparrow	0	0	0	0	0.0	2	2	0	0	0	0.8
Total Birds		34	37	20	43	33.5	18	33	47	38	12	29.6

Table XXIV
Forest Bird Population Census
Experimental Block 5
(second application, B.t. plus acephate)
Noel Pauls Brook, Newfoundland
June-July, 1977

Family	Species	Pre-spray treatment 2					Daily Ave.	Post-sprau treatment 2					Daily Ave.
		June 26	June 27	June 29	July 1	July 2		July 3	July 5	July 6	July 7		
		-6	-5	-3	-1	-0		+1	+3	+4	+5		
Picidae	Common Flicker	0	0	0	0	1	0.2	0	0	0	0	0.0	
Tyrannidae	Yellow-bellied Flycatcher	4	2	4	4	4	3.6	4	0	0	0	1.0	
Corvidae	Gray Jay	2	0	0	0	0	0.4	0	0	4	0	1.0	
	Common Raven	2	0	0	0	1	0.6	0	0	0	0	0.0	
Paridae	Boreal Chickadee	0	0	0	0	0	0.0	0	2	0	0	0.5	
Turdidae	American Robin	6	6	4	4	2	4.4	4	0	2	8	3.5	
	Swainson's Thrush	0	0	0	0	4	0.8	0	2	8	2	3.0	
Sylviidae	Golden-crowned Kinglet	0	0	0	2	2	0.8	2	0	2	0	1.0	
	Ruby-crowned Kinglet	2	0	0	0	0	0.4	0	0	4	0	1.0	
Parulidae	Black and White Warbler	4	0	0	0	0	0.8	0	0	0	0	0.0	
	Yellow-rumped Warbler	2	2	0	2	1	1.4	0	0	4	0	1.0	
	Black-throated Green Warbler	4	0	4	3	6	3.4	0	2	0	2	1.0	
	Blackpoll Warbler	6	0	10	5	3	4.8	2	2	0	2	1.5	
	Ovenbird	0	0	0	1	0	0.2	0	0	0	0	0.0	
	Northern Waterthrush	2	0	0	5	0	1.4	0	0	3	2	1.3	
Fringillidae	Pine Grosbeak	0	0	0	2	0	0.4	0	2	0	0	0.5	
	Pine Siskin	0	0	0	18	0	3.6	0	4	0	0	1.0	
	White-winged Crossbill	0	0	0	0	0	0.0	2	2	0	0	1.0	
	White-throated Sparrow	2	2	7	4	10	5.0	6	8	7	4	6.3	
	Fox Sparrow	0	0	0	0	2	0.4	2	0	0	0	0.5	

Table XXIV (cont'd)

Family	Species	Pre-spray treatment 2					Daily Ave.	Post-spray treatment 2				Daily Ave.
		June	June	June	July	July		July	July	July	July	
		26	27	29	1	2		3	5	6	7	
		-6	-5	-3	-1	-0		+1	+3	+4	+5	
Unidentified Birds		1	0	3	0	1	1.0	0	0	0	0	0.0
Total Birds		37	12	32	50	37	33.6	22	24	34	20	25.0