

TERRESTRIAL IMPACT STUDIES OF MATACIL®
FLOWABLE FORMULATED IN VEGETABLE OIL,
QUEBEC 1982

File Report No. 41. November 1982.

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SUMMARY

The new flowable aminocarb formulation (MATACIL® 180F) applied in a vegetable oil (canola oil) carrier was field tested in Quebec in 1982. Bird populations were not seriously damaged but a single sick Tennessee warbler was recorded following the second application in an area receiving high spray deposits one evening, possibly followed by further deposits from a nearby application the following morning. Bumblebee populations and activity appear to have been affected by weather rather than insecticide affected.

Aminocarb residues as high as 8-9 µg/g were found in strawberry and pin cherry blossom, while lower residue levels were documented in samples of willow, elderberry, bunchberry and dandelion flowers.

ACKNOWLEDGEMENTS

The authors wish to thank Gilles Gaboury and Pierre-Martin Marotte of the Ministère de l'Energie et des Ressources, Service d'Entomologie et de Pathologie, Division Environment et Securite for their very valuable assistance and cooperation throughout the experimental programme. Also, our thanks to A. Farraway and I. Wypkema who collected and compiled the field data. Thank you to J. McAlpine for her typing of this report.

INTRODUCTION

Several new insecticide formulations are presently in the process of being field tested in order to gain registration for forestry use to combat spruce budworm infestations in Eastern Canada (Millikin 1982, McLeod 1982). One such product, an aminocarb flowable formulation (MAT-ACIL® 180F¹) mixed with a vegetable oil (canola oil) was field tested in Quebec in 1982. A double application was applied against a 4-5th instar budworm population in a spruce-fir forest approximately 30 km southwest of St. Pascal in the lower St. Lawrence region.

This report details the results of environmental impact monitoring programs involving forest bird and bumblebee populations carried out by personnel of the Forest Pest Management Institute's Environmental Impact Section.

INSECTICIDE FORMULATION AND APPLICATION

The insecticide formulation field tested in Block 213 in Quebec in 1982 was as follows:

MATACIL® 180F (aminocarb flowable)	- 20.8%	(volume)
vegetable oil (canola oil)	- 78.2%	(volume)
dye	1.0%	(volume)

The experimental formulation was sprayed over the 5000 ha block 213 of the Quebec Ministère de l'Energie et des Ressources 1982 budworm control program, at the dosage rate of 52 g/ha emitted at the rate of 1.4 L/ha. A DC-4G aircraft flying from the Riviere-du-Loup air base treated the experimental block on the evening of 4 June, and again in the evening of 6 June (spray lines 6, 5 and 3) and morning of 7 June (spray lines 1, 2 and 4). Equipment malfunction caused the split second application. The aircraft speed was 280 km/h at an altitude varying between 50 and 150 m over the hilly terrain. The distance between flight lines was 915 m.

¹ Chemagro Ltd., Mississauga, Ont.

METHODS

Weather

Air and soil temperatures were taken at the start of each monitoring session (bird census, bumblebee census) by means of dial thermometers located in a shaded location in each of the untreated and treated blocks. Air temperatures were recorded at the 1.5 m level and soil temperatures taken with the tip of the thermometer 7.5 cm below ground level. Wind speed and cloud cover was estimated.

Deposit

Spray deposit data for experimental block 213 was provided by the Ministère de l'Énergie et des Ressources from Kromekote card and aluminum plate samplers located throughout the experimental area. Aminocarb residue analysis of wild plant bloom collected by the FPMI monitoring crew was also provided by the Ministère.

Birds

The activity patterns of native forest bird populations inhabiting experimental spray block 213 and the untreated check block were monitored over a 13 day period between 30 May and 11 June, 1982. Two census points (control 1 and 2) were established in an untreated area approximately 4.0 km north of experimental block 213. Six census points designated 213-1 to 6 were located within treatment block 213 (Figure 1).

The singing male technique (Kendeigh 1944, 1947) was employed in monitoring forest bird populations. A variation in the plot or transect system was used where the census taker stayed more or less at a designated point (marked with flagging tape) and recorded all birds (by sight or sound) on a plot map in relation to the central point during a 10-15 minute time period. The numbers of birds recorded by this method results in a somewhat lower population per unit monitored than with the plot or transect methods, but greater coverage of the treated block was possible with the limited resources available. All birds were identified as to species, sex and activity at time of recording (flying, singing, fighting etc.). All males vocally defending a territory were assumed to have been mated and were counted as two birds, all others (observed but not singing) were counted as one. The numbers of birds recorded each day were used to determine activity trends and abundance.

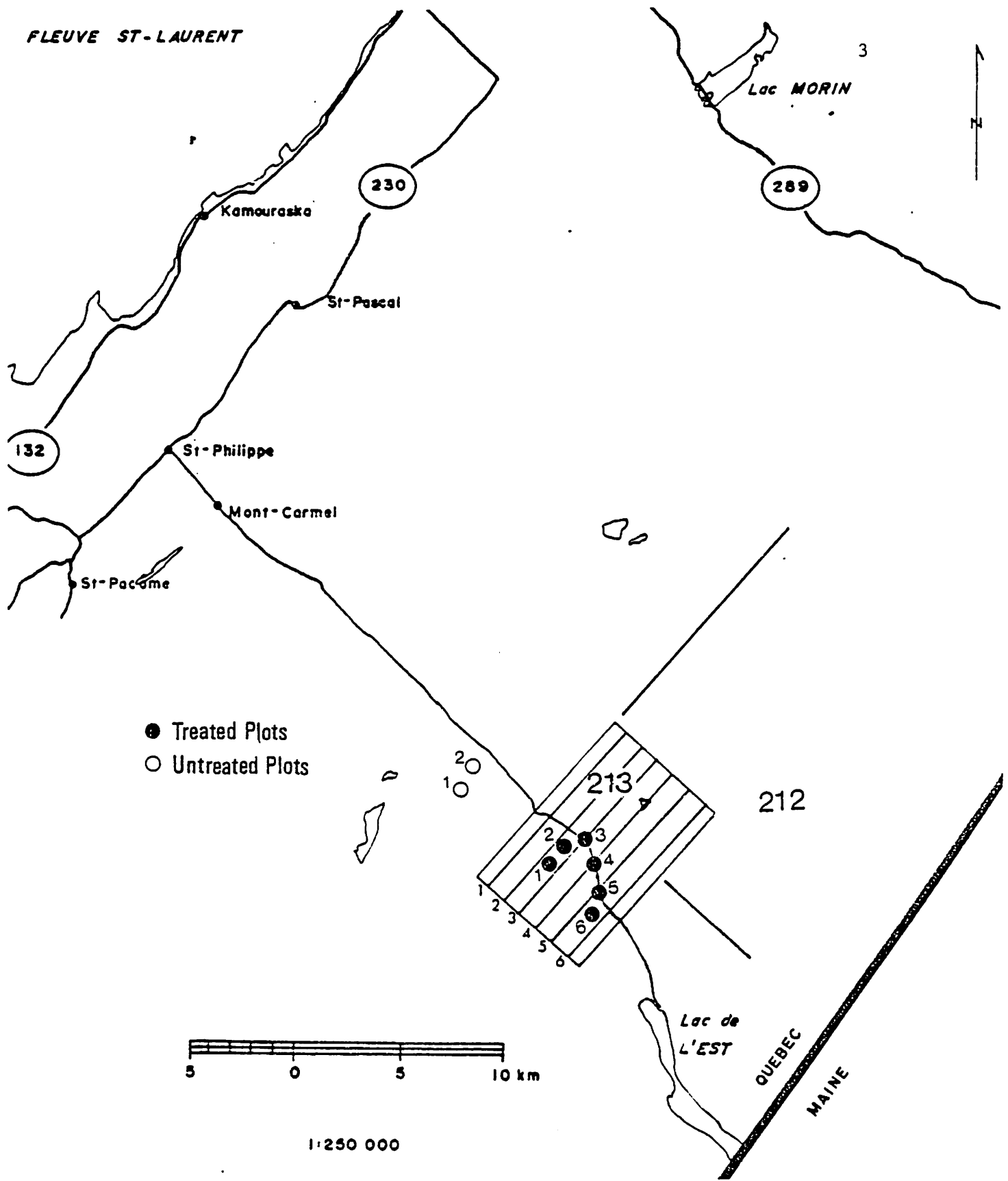


Figure 1. Location of Quebec spray block 213 and songbird census study plots. May-June 1982.

Bombus spp.

A survey was carried out to determine the activity and abundance of bumblebees inhabiting the untreated check area and experimental block 213. One half kilometer survey transects were marked (flagging tape) along side roads. One transect was located in an untreated area approximately 4.0 km north of block 213 and two transects established in block 213; one between spray lines 2 and 3 in the vicinity of bird plot 213-1 and 213-2, and the other between spray lines 5 and 6 in the vicinity of bird plot 213-6. The bumblebee census consisted of slowly walking down one side of the road disturbing the grasses, flowers and shrubs with a stick (approximately 1.5 m long) and then returning back the other side to the starting point in the same fashion (a total of 1 km). Two persons conducted this survey (starting about 15-20 minutes apart) for a total of 2 km per transect. Each site was monitored at three different time frames, early morning (0400-0600), mid-morning (0900-1100) and afternoon (1400-1600) for a total of 6 km of observations per transect per day.

Only the bumblebee complex was recorded. Weather data was collected at each census time on both the untreated and treated blocks.

Flowers of native wild plants in bloom at the time of each spray application were collected at random for insecticide residue analysis from along the *Bombus* transect lines in both the treated and untreated check plots. Collections were made approximately one hour following each treatment and delivered to the Quebec residue monitoring crews for processing.

RESULTS

Weather

Reasonably good weather was experienced throughout most of the monitoring period. Heavy rains forced cancellation of the *Bombus* monitoring project on 2 June while high winds were experienced during the afternoon *Bombus* censuses on 4, 6, 8 and 9 June, and in the early morning of 11 June (Appendix Table 2). Frost was recorded during the night of 3-4 June when air temperatures of 0.5°C were recorded at 0545 EST in the untreated plot and -2.7°C at 0510 in block 213. A low temperature of 1.1°C was recorded in both areas at 0500 on 7 June. Both days subsequently warmed to the low 20's by early afternoon.

Deposit

Spray deposits collected on aluminum foil as analyzed by gas-liquid chromatography was provided by the Quebec Ministère de l'Energie et des Ressources and has been summarized in Dostie et Parent (1982). High spray deposits were recorded along flight lines 4 and 5 during the first application and along flight line 3 during the second treatment (Figure 2). Deposit data was also collected from actual monitoring areas on Kromekote cards, and showed that spray deposits varied between about 1 to 30 drops/cm² in census areas (Table 1). A surprisingly large number of spray droplets (5/cm²) were observed on Kromekote cards set out on the untreated control census area after the first part of the second application suggesting that substantial drift from the treatment block reached the control area some 4 km distant. Although no deposit data is available from the census areas for the second portion of the second application, deposits on Kromekote cards reported by Dostie et Parent (1982) and Major (1982) indicate further deposits occurred in the vicinity of plots 213-1, 2 and 3 after this application.

Aminocarb residues on blossoms:

Insecticide residues measured on blossoms of various flowering species are presented in Table 2. Pin cherry and strawberry collected the greatest levels of aminocarb residues of the blossoms sampled after both aminocarb treatments. Willow catkins, which hosted considerable numbers of hymenopterous pollinators around the period of the first application, collected lesser amounts of aminocarb while elderberry had even lower concentrations of residues. Residue levels in blossoms in the treated block were generally somewhat lower after the second application. Residues were found

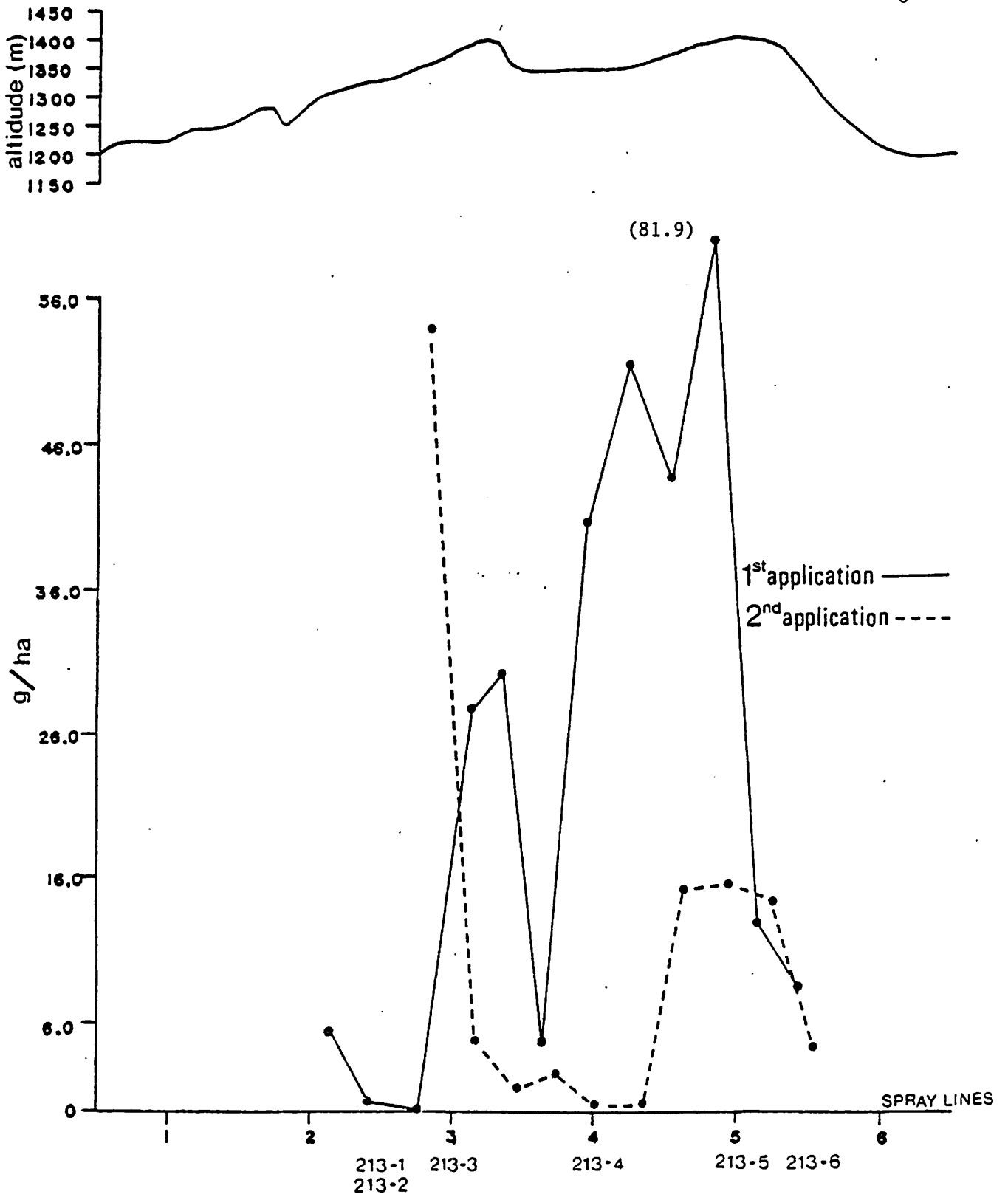


Figure 2. Topography of block 213 and aminocarb deposits measured on aluminum foil after each spray application (adapted from Dostie et Parent 1982).

Table 1. Spray deposits on Kromekote cards set out in songbird census areas of block 213.

	Control	213-1	213-2	213-3	213-4	213-5
1st application						
Drops/cm ²	0	3.8	15.4	1.2	4.6	28.0
Size of drop stains*	-	B	B	A	B	B
2nd application (first part, lines 3, 5 and 6)						
Drops/cm ²	5.0	1.0**	1.1**	10.8**	0.0**	5.4
Size of drop stains*	?	?	?	C	-	C

- * A - 100% of stains less than 300 μ
- B - 70-80% of stains larger than 300 μ .
- C - 97-100% of stains larger than 300 μ
- ? - not available.

** further deposit (not measured) probably occurred on these areas following completion of the second application with the treatment of lines 1, 2 and 4 the next morning.

Table 2. Aminocarb residues on wild-flower blossom. Experimental MATACIL® 180 Flowable spray trials. St. Pascal, Quebec, 1982.

Flower species	aminocarb residue* (µg/g)					
	untreated			treated		
	1st application	2nd application	1st application	1st application	2nd application	2nd application
Strawberry (<i>Fragaria</i> sp.)	0.150** (100)***	0.409 (100)	9.42 (100)	2.74 (42)		
Pin cherry (<i>Prunus pensylvanica</i> L.f.)	0.115 (77)	0.238 (58)	8.16 (86)	6.59 (100)		
Willow (<i>Salix</i> sp.)	0.064 (43)	-	3.43 (36)	-		
Elderberry (<i>Sambucus canadensis</i> L.)	0.028 (19)	-	0.925 (9)	-		
Bunchberry (<i>Cornus canadensis</i> L.)	-	0.129 (32)	-	1.98 (30)		
Dandelion (<i>Taraxacum officinale</i> Weber)	-	0.056 (14)	-	0.349 (5)		

* detection limit 0.005.

** detection limit of 0.150 for this sample due to small sample size.

*** figures in brackets below residue measurements give the percentage this represents of the highest residue found on that site for that treatment.

in all blossoms sampled in the untreated control area after both applications but were considerably higher after the second application when some deposit was documented on Kromekote cards on the untreated control. Whereas mean residues on the control were about 55 times lower than in the treatment block after the first application, they were only about 10 times lower than in the treatment block after the second. There was a fairly consistent pattern of different blossoms in the treatment and control areas collecting fairly similar proportionate residues relative to other blossoms in their area (e.g., after the first application relative residue levels were strawberry < pin cherry < willow < elderberry in both treatment and control areas).

Forest birds

The avian population structure of the treated and untreated check areas differed somewhat. The 2 plots in the untreated check area contained 33 species of birds representing 11 families and the 6 plots in the treated block contained 49 species represented 16 family groups. The difference probably resulted from the fact that plots in the treated block contained a larger component of conifers than the untreated plots and all of plot 213-6 and half of 213-5 were established in a cut over area, a habitat not represented in the untreated plots.

Overall activity patterns were very similar on treated and control plots throughout the monitoring period (Figure 3) with no noticeable reduction in activity apparent after either spray application.

No observations of effects on songbirds in the treatment area were made after the first treatment on the evening of 3 June or the second application to spray lines 6, 5 and 3 on the evening of 6 June. Within an hour of the completion of the second application with the treatment of spray lines 1, 2 and 4 on the morning of 7 June a single male Tennessee warbler was observed between census plots 213-1 and 213-2 exhibiting classical symptoms of pesticide stress. The bird was flushed from the side of a road and fluttered about exhibiting tremors and wing and head drooping, but was active enough to escape capture despite vigorous pursuit. Following the discovery of this distressed individual, intensive searches were carried out in the treatment block concentrating on areas in the vicinity of census plots 213-1, 2 and 3, but no other stressed birds were found or observed on that date or throughout the remainder of the census program.

Tennessee warbler territories on each of the 8 census plots were defined (Figure 4), and the data indicated that all established Tennessee warbler territories on the treatment census plots remained occupied throughout the post-spray periods with the single exception of one

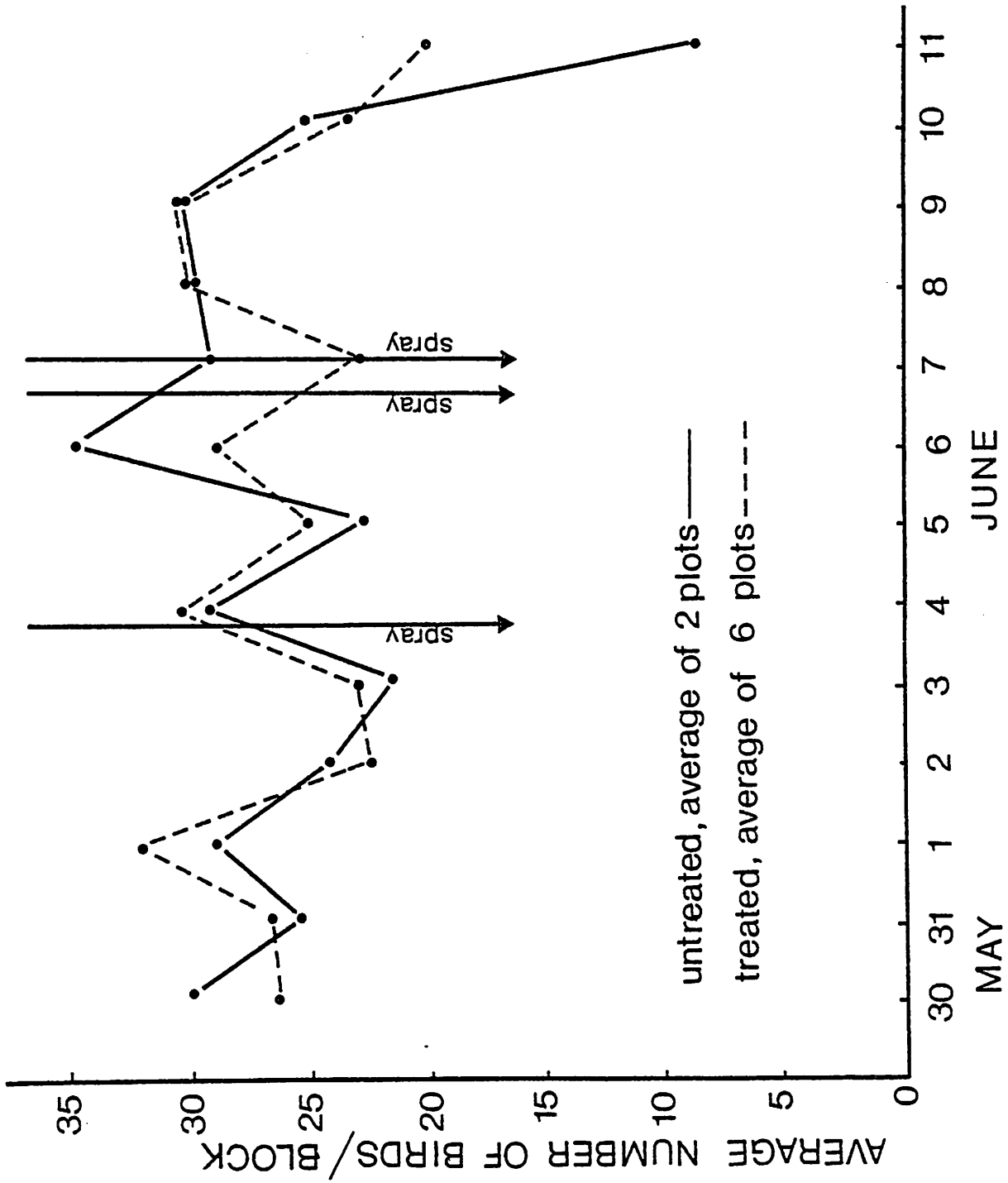


Figure 3. Songbird activity on census plots within block 213 and untreated control plots over the study period. May-June 1982.

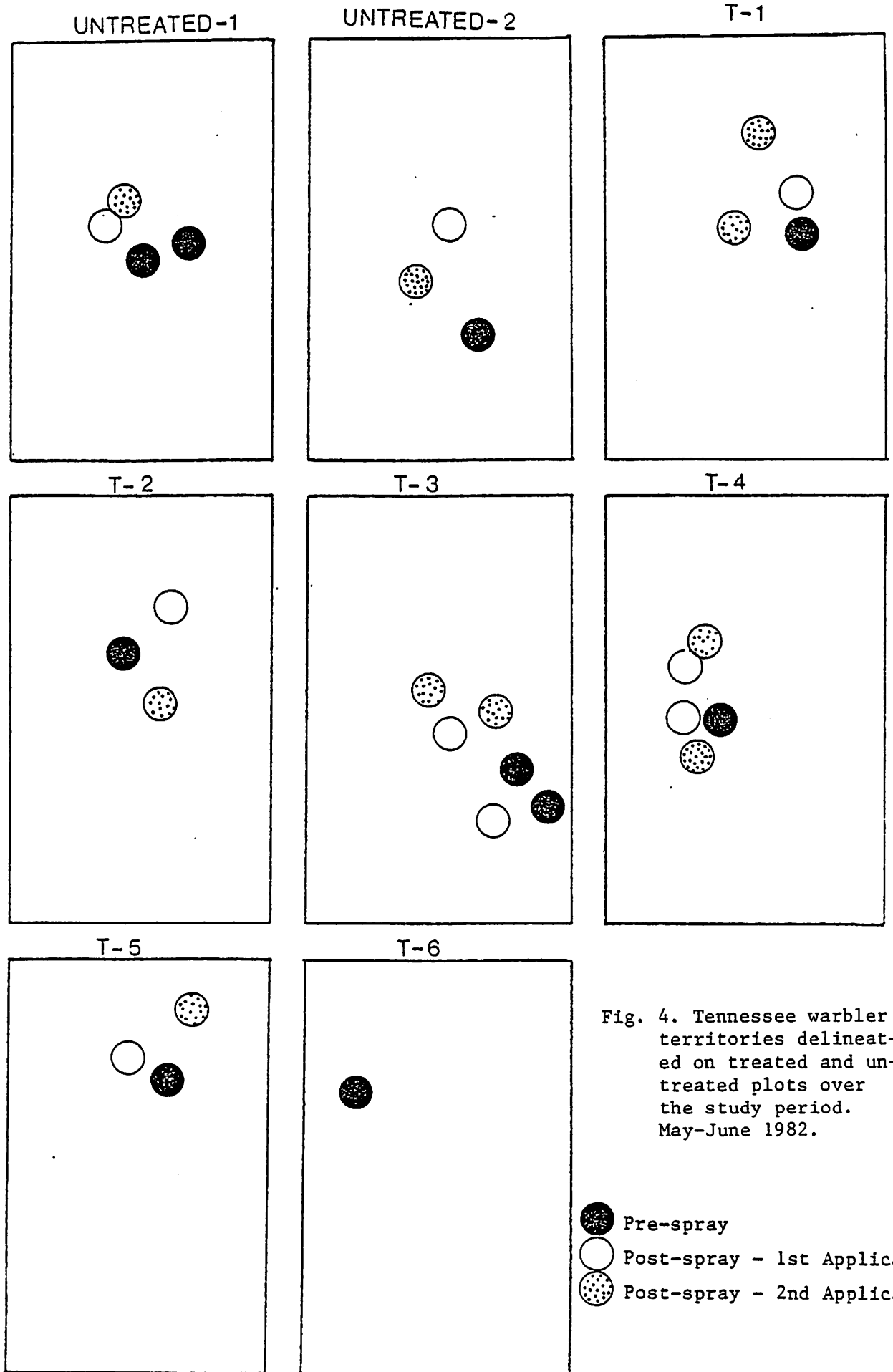





Fig. 4. Tennessee warbler territories delineated on treated and untreated plots over the study period. May-June 1982.

-  Pre-spray
-  Post-spray - 1st Application
-  Post-spray - 2nd Application

territory on 213-6 (between spray lines 5 and 6) which disappeared following the initial application. A single territory disappeared from untreated control plot 1 at the same time (Figure 4).

The net loss or gain of territories from census plots over the monitoring period for 22 species of birds common to both the treated and untreated plots is presented in Table 3. A general loss of territories of all species during the latter portion of the program on the census plots is apparent with the exception of the American robin, wood thrush, Tennessee warbler and chestnut-sided warbler. There does not seem to be any firm evidence that the losses are related to pesticide applications as the overall proportion of territories disappearing from the control plots (38%) was greater than on the treatment plots (22%) and territorial losses occurred among all groups of birds, not just those considered pesticide sensitive or inhabiting high-exposure habitats.

Bombus spp.

Activity patterns of *Bombus spp.* appear to be more weather-related than reflecting any impact of the MATACIL® 180 flowable applications. The activity patterns (numbers of bees counted on 6 km transects per day at each monitoring site) on the untreated site were quite similar to those recorded on the two treated transects in block 213 (Table 4, Figure 5). Declining activity at all stations coincided with rainy conditions and low temperatures experienced on 23 June (Appendix Table 2). Some recovery took place on 5 and 6 June but low temperatures and declining activity occurred again on 7 June. No subsequent increase in activity was recorded by 10 June when monitoring was terminated. High spray deposits recorded on flight line 5 during the initial application and along flight line 3 during the second application (Figure 2) did not appear to have a detrimental impact upon *Bombus spp.* as census results from those areas after those treatments were similar to results from the other treatment and the control transects.

Table 3. Avian territorial net loss or gain on MATACIL® 180F treated and untreated plots, St. Pascal, Quebec, 1982.

Species	untreated (2 plots)			treated block 213 (6 plots)		
	pre-spray	post-spray	net loss or gain	pre-spray	post-spray	net loss or gain
Least Flycatcher	2	0	- 2	5	3	- 2
Winter Wren	2	0	- 2	4	3	- 1
American Robin	3	2	- 1	6	8	+ 2
Wood Thrush	2	0	- 2	2	4	+ 2
Hermit Thrush	2	1	- 1	2	2	0
Swainson's Thrush	6	5	- 1	12	10	- 2
Veery	3	3	0	2	1	- 1
Ruby-crowned Kinglet	2	2	0	3	2	- 1
Red-eyed Vireo	1	2	+ 1	7	4	- 3
Tennessee Warbler	3	2	- 1	7	8	+ 1
Nashville Warbler	1	1	0	4	0	- 4
Parula Warbler	2	1	- 1	8	6	- 2
Magnolia	3	1	- 2	8	6	- 2
Black-throated Green Warbler	2	1	- 1	7	5	- 2
Blackburnian Warbler	1	0	- 1	1	0	- 1
Chestnut-sided Warbler	2	0	- 2	2	4	+ 2
Ovenbird	4	3	- 1	5	5	0
Mourning Warbler	1	2	+ 1	6	2	- 4
Yellowthroat	2	0	- 2	7	4	- 3
Rose-breasted Grosbeak	3	2	- 1	7	5	- 2
Chipping Sparrow	2	2	0	6	4	- 2
White-throated Sparrow	3	2	- 1	15	12	- 3
Totals	52	32	-20	126	98	-28

Table 4. Bumblebee census results, MATACIL® 180F experimental plots, St. Pascal, Quebec, 31 May - 10 June, 1982.

Date	Pre-spray census											
	untreated check plot				treatment line 2-3				treatment line 5			
	5-7 am	9-11 am	2-4 pm	daily totals	5-7 am	9-11 am	2-4 pm	daily totals	5-7 am	9-11 am	2-4 pm	daily totals
31 May	2	27	21	50	25	19	20	59	12	6	26	44
1 June	0	1	10	11	5	10	10	25	0	10	11	21
2 June	RAIN											
3 June	0	0	6	6	0	0	2	2	0	1	2	3
averages	0.6	9.3	12.3	22.3	8.3	9.6	10.6	28.6	4.0	5.6	13.0	22.6
Post-spray 1 census												
4 June	0	9	0	9	0	2	0	2	0	0	2	2
5 June	0	5	5	10	0	5	4	9	7	3	3	13
6 June	2	10	0	12	2	5	3	10	2	3	4	9
averages	0.6	9.0	1.6	10.3	0.6	4.0	2.3	7.0	3.0	2.0	3.0	8.0
Post-spray 2 census												
7 June	0	2	2	4	1	0	3	4	0	1	0	1
8 June	0	3	0	3	0	1	0	1	0	1	3	4
9 June	0	0	0	0	1	0	0	1	0	1	3	4
10 June	0	0	2	2	2	0	0	2	0	0	0	0
averages	0.0	1.3	1.0	2.3	1.0	0.3	0.8	2.0	0.0	0.8	1.5	2.3

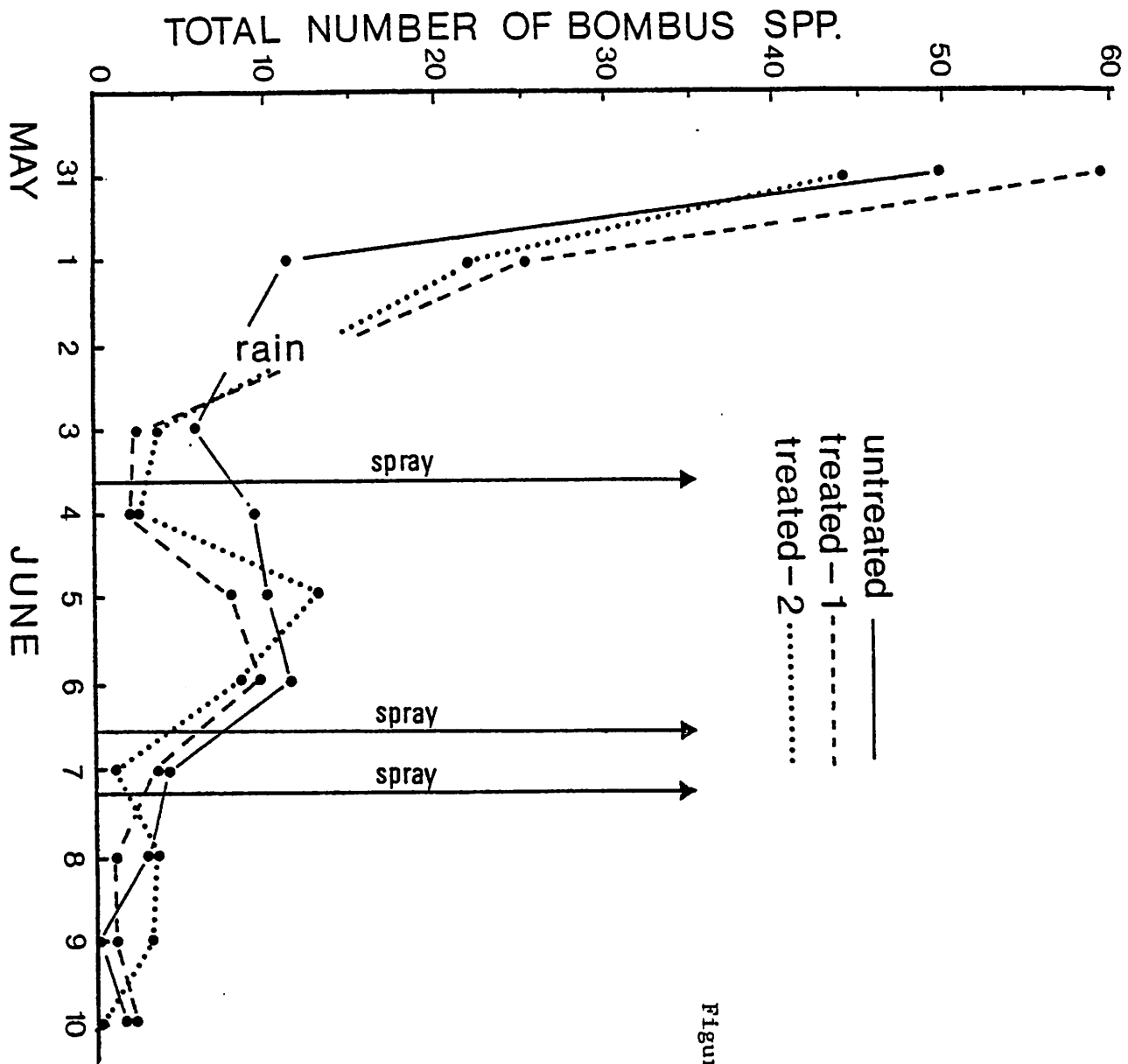


Figure 5. Bumblebee counts on treated and untreated census transects over the study period. May-June 1982.

DISCUSSION

The data collected shows that the applications of MATAFIL® 180F in vegetable oil did not cause significant damage to bird populations. Songbird activity and territorial occupancy trends on the treatment and control plots were similar over the study period. The observation of an apparently pesticide-stressed Tennessee warbler within the treatment block after completion of the second application may reflect a high exposure to aminocarb resulting from the location and movement of this bird in relation to the spray application pattern and resultant spray deposition. A very high deposit of aminocarb (measured as 56 g/ha) on line 3 on the evening of 6 June, followed by further (unquantified) deposits from treatment of spray line 2 less than 10 hours later, may have exposed this bird, found between these two lines, to two sequential exposures to aminocarb residues in a relatively short time period, causing aminocarb intoxication. The only other reported observation of an aminocarb intoxicated songbird following spruce budworm spraying also resulted from abnormally closely spaced spray applications. Buckner et al. (1977) reported observing an immature purple finch exhibiting symptoms of poisoning following two successive applications of 70 g aminocarb/ha within a two day interval in a forest block treated in an attempt to suppress spruce budworm moth populations. There is no indication in the data collected in the rest of the study or in the study in the same area reported by Major (1982) to suggest that songbird populations in the area of the block where the affected individual was found or in the area of the block (line 5) receiving very high deposits after the first spray application suffered losses attributable to the aminocarb spray program. Activity and territorial monitoring on the six point census plots (this study) and three 8 hectare plots (Major's study) located in the block consistently reveal no discernible effects of the treatments.

The aminocarb residues found in various blossoms following the MATAFIL® 180F in vegetable oil applications are quite comparable to those reported by Bouchard (1981) following MATAFIL® 1.8D in insecticide diluent 585 applications to Quebec forests. Comparisons between the residues on different blossoms within treated and control areas receiving widely different deposits of insecticide reveal a fairly consistent pattern suggesting some blossoms (strawberry and pin cherry) collected substantially higher aminocarb residues than others (willow, elderberry, bunchberry and dandelion). This may be due to their different efficiencies as spray drop-let collectors or result from their particular micro-habitat preference and location within the forest environment.

There are no suggestions in the census data collected of impact on overall bumblebee densities within the MATAFIL® 180F treated block. This is in agreement with the findings of other more extensive studies carried out in MATAFIL® 1.8D treated forest areas (Bouchard 1981, Plowright and Pendrel 1978, Thaler and Plowright 1980).

In conclusion, a double application of MATACIL® 180F at 52 g AI/ha in a vegetable oil carrier did not cause significant discernible impact to either forest songbird or bumblebee communities.

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Appendix Table 1
Common and scientific names used in text of file report 41.

Common name	Scientific name
	Vegetation
Pin cherry	<i>Prunus pensylvanica</i> L.f.
Strawberry	<i>Fragaria</i> sp.
Bunchberry	<i>Cornus canadensis</i> L.
Dandelion	<i>Taraxacum officinale</i> Webster
Willow	<i>Salix</i> sp.
Elderberry	<i>Sambucus canadensis</i> L.
	Birds
Least Flycatcher	<i>Empidonax minimus</i> (Baird and Baird)
Winter Wren	<i>Troglodytes troglodytes</i> (Linnaeus)
American Robin	<i>Turdus migratorius</i> Linnaeus
Wood Thrush	<i>Hylocichla mustelina</i> (Gmelin)
Hermit Thrush	<i>Hylocichla guttat</i> (Pallus)
Swainson's Thrush	<i>Hylocichla ustulata</i> (Nuttall)
Veery	<i>Hylocichla fuscescens</i> (Stephens)
Ruby-crowned Kinglet	<i>Regulus calendula</i> (Linnaeus)
Red-eyed Vireo	<i>Vireo olivaceus</i> (Linnaeus)
Tennessee Warbler	<i>Vermivora peregrina</i> (Wilson)
Nashville Warbler	<i>Vermivora ruficapilla</i> (Wilson)
Parula Warbler	<i>Parula americana</i> (Linnaeus)
Magnolia Warbler	<i>Dendroica magnolia</i> (Wilson)
Black-throated Green Warbler	<i>Dendroica virens</i> (Gmelin)
Blackburnian Warbler	<i>Dendroica fusca</i> (Muller)
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i> (Linnaeus)
Ovenbird	<i>Seiurus auracapillus</i> (Linnaeus)
Mourning Warbler	<i>Oporornis philadelphia</i> (Wilson)
Yellowthroat	<i>Geothlypis trichas</i> (Linnaeus)
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i> (Linnaeus)
Purple Finch	<i>Carpodacus purpureus</i> (Gmelin)
Chipping Sparrow	<i>Spizella passerina</i> (Bechstein)
White-throated Sparrow	<i>Zonotrichia albicollis</i> (Gmelin)

Appendix Table 2
 Weather data from Experimental treated and untreated check blocks
 St. Pascal, Quebec
 31 May - 11 June, 1982.

Date	untreated check block					treated block				
	Time (E.S.T.)	Temperature °C		Cloud cover 1/10's	Wind speed (K.P.H.) est.	Time (E.S.T.)	Temperature °C		Cloud cover (est.)	Wind speed (K.P.H.) est.
		air	soil				air	soil		
31 May	0400-0500	14.4	10.0	8	0-5	0500-0600	15.5	12.2	10	0-5
	1100-1200	23.3	12.2	10	0-5	1100-1200	24.4	15.5	10	0-5
	1400-1500	25.5	12.7	9	0-5	1510-1530	25.0	15.5	10	0-5
1 June	0715-0730	10.0	10.0	3	0	0530-0540	11.1	11.6	10	0
	1040-1100	16.6	10.0	10	0-5	1015-1035	18.3	13.3	7	0
	1445-1555	22.7	15.5	10	5-10	1420-1430	22.7	12.2	10	5-10
2 June	0400-0420	15.5	11.1	10	5-15	0540-0555	15.0	13.3	10	5-20
3 June	0530-0540	4.4	8.3	0	0-5	0505-0515	3.3	10.0	0	0-10
	0940-0950	7.7	5.5	0	0-15	0915-0930	8.3	9.4	0	0-20
	1405-1420	13.3	7.7	3	15-20	1440-1450	12.7	14.4	3	15-25
4 June	0545-0600	-0.5	4.4	0	0-5	0510-0520	-2.7	10.0	0	0-5
	1000-1015	16.1	6.6	0	15-25	0930-0950	15.5	12.7	0	15-25
	1300-1315	23.3	9.4	2	10-25	1440-1455	23.8	20.0	1	20-30
5 June	0420-0430	8.8	8.3	7	0-5	0500-0510	10.5	10.5	6	0-5
	0815-0900	17.7	8.3	0	0-15	0915-0939	20.0	11.1	1	0-10
	1215-1225	22.2	9.4	2	0-10	1240-1250	24.4	15.5	0	0-10
6 June	0555-0610	8.8	7.7	5	0-5	0515-0525	7.2	10.0	4	0-5
	1100-1115	20.0	9.4	7	5-10	0915-0930	18.8	12.7	7	5-20
	1445-1500	20.0	11.1	6	5-25	1410-1425	21.1	15.5	5	0-15
7 June	0500-0510	1.1	6.5	6	0-5	0540-0550	1.1	3.3	10	0-5
	1045-1100	20.5	7.7	1	5-10	1010-1030	21.1	13.3	1	5-20
	1315-1325	25.5	8.8	2	5-10	1245-1300	23.3	15.5	1	0-15
8 June	0415-0430	4.4	7.7	4	0-5	0455-0505	3.3	10.0	4	0-5
	0835-0855	16.6	7.7	4	0-5	0905-0920	20.0	10.0	4	5-15
	1245-1300	24.4	10.0	8	5-20	1315-1325	24.4	16.6	9	5-25
9 June	0550-0605	10.0	8.3	7	0	0520-0530	8.8	11.1	6	0
	0950-1005	22.7	10.0	4	0-5	0925-0935	23.3	13.3	5	0-15
	1440-1450	27.7	12.2	4	5-25	1405-1420	25.5	21.1	5	5-20
10 June	0420-0435	4.4	8.8	3	0-5	0500-0510	5.5	10.0	2	0-5
	0830-0850	21.1	9.4	2	0-5	0900-0915	25.5	13.3	2	0-15
	1325-1335	24.4	12.2	4	0-15	1405-1415	27.7	17.7	7	5-15
11 June	0555-0605	11.6	9.4	4	20-35	0500-0510	10.5	12.2	5	10-30

Appendix Table 3
 Forest Bird Population Census
 MATACIL® 180F - Vegetable Oil Experimental Spray Trials
 Control Plot - 1
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pro-spray					Post-spray 1				Post-spray 2						
		May 30	May 31	June 1	June 2	June 3	June 4	June 5	June 6	June 7	June 8	June 9	June 10	June 11			
		-4	-3	-2	-1	0	Daily ave.	+1	+2	+3	Daily ave.	+0	+1	+2	+3	+4	Daily ave.
Trogonidae	Ruffed Grouse	2	2	2	2	2	2.0	2	2	2	2.0	2	2	2	2	0	1.6
Tyrannidae	Least Flycatcher	0	2	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Corvidae	Blue Jay	2	2	2	0	0	1.2	2	2	2	2.0	2	2	2	2	0	1.6
Sittidae	Red-breasted Nuthatch	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	0	0	0	2	0.4	0	2	0	0.7	0	0	0	0	0	0.0
Turdidae	American Robin	1	0	1	2	2	1.2	2	2	0	1.3	0	0	0	0	0	0.0
	Wood Thrush	0	0	0	0	0	0.0	0	0	0	0.0	2	2	0	0	2	1.2
	Horned Thrush	1	0	0	2	0	0.6	2	0	0	0.7	2	0	0	0	0	0.4
	Swainson's Thrush	4.5	2	2	0	0	1.7	0	0	2	0.7	2	0	4	2	0	1.6
	Veery	0	0	0	0	0	0.0	0	0	4	1.3	4	6	4	2	0	3.2
Sylviidae	Ruby-crowned Kinglet	2	0	2	2	0	1.2	4	0	2	2.0	0	0	2	0	2	0.8
Parulidae	Tennessee Warbler	3.5	2	2	2	2	2.3	2	2	2	2.0	2	2	2	2	0	1.6
	Nashville Warbler	1	2	2	2	0	1.4	2	2	2	2.0	2	2	2	2	0	1.6
	Parula Warbler	1	2	0	2	2	1.4	0	0	2	0.7	0	0	2	0	0	0.4
	Magnolia Warbler	2	2	0	0	0	0.8	0	0	0	0.0	0	0	0	0	0	0.0
	Black-throated Green Warbler	2	0	0	0	2	0.8	2	0	2	1.3	0	2	0	0	2	0.8
	Blackburnian Warbler	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
	Chestnut-sided Warbler	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	2	0.0
	Ovenbird	0	0	0	2	0	0.4	4	2	4	3.3	4	2	2	2	0	2.0
	Common Yellowthroat	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	2	0	0.4
Fringillidae	Rose-breasted Grosbeak	4	4	0	4	2	2.8	6	2	2	3.3	2	4	2	2	0	2.0
	Purple Finch	0	0	2	0	2	0.8	2	0	2	1.3	2	2	2	2	0	1.6
	Chipping Sparrow	1	2	2	0	0	1.0	2	0	2	1.3	0	0	2	2	0	0.8
	White-throated Sparrow	2	2	4	2	4	2.8	0	0	4	1.3	4	2	4	2	0	2.4
	Unidentified Species	0	2	2	0	0	0.8	0	0	2	0.7	0	0	4	2	2	1.6
Totals		30	26	29	22	20	25.4	30	16	36	27.3	30	28	36	26	8	25.6

Appendix Table 4
 Forest Bird Population Census
 NATACIL® 180F - Vegetation Oil Experimental Spray Trials
 Control Plot - 2
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pro-spray					Post-spray 1				Post-spray 2						
		May	May	June	June	June	Daily	June	June	June	Daily	June	June	June	June	June	Daily
		30	31	1	2	3		4	5	6		7	8	9	10	11	
		-4	-3	-2	-1	-0	ave.	+1	+2	+3	ave.	+0	+1	+2	+3	+4	ave.
Tetraonidae	Ruffed Grouse	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0.4
Tyrannidae	Least Flycatcher	0	1	0	0	0	0.2	0	0	2	0.7	0	0	0	0	0	0.0
Corvidae	Blue Jay	1	4	2	0	0	1.4	0	0	0	0.0	0	0	0	0	0	0.0
Sittidae	Red-breasted Nuthatch	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	American Robin	2	4	2	0	0	1.6	3	0	4	2.3	4	3	3	2	2	2.8
	Wood Thrush	0	0	0	0	0	0.0	0	0	0	0.0	2	0	2	2	0	1.2
	Hermit Thrush	2	2	0	2	0	1.2	0	0	0	0.0	0	0	0	0	0	0.0
	Swainson's Thrush	2	4	4	6	6	4.4	2	2	2	2.0	4	2	2	4	0	2.4
	Veery	0	0	0	2	0	0.4	0	2	2	1.3	2	2	2	2	0	1.6
Sylviidae	Ruby-crowned Kinglet	2	0	2	0	4	1.6	2	2	2	2.0	2	0	0	0	0	0.4
Vireonidae	Red-eyed Vireo	0	0	0	0	2	0.4	2	2	4	2.7	2	4	4	4	2	3.2
Parulidae	Tennessee Warbler	2	2	2	2	2	2.0	2	2	0	1.3	2	2	2	0	2	1.6
	Parula Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0.4
	Magnolia Warbler	2	0	4	2	2	2.0	2	2	0	1.3	2	0	0	2	0	0.8
	Cape May Warbler	5	0	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0
	Black-throated Green Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	0	2	0	0	0.4
	Chestnut-sided Warbler	2	0	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
	Ovenbird	5	4	4	2	2	3.4	4	6	6	5.3	4	4	2	2	0	2.4
	Northern Waterthrush	1	0	2	0	0	0.6	2	2	0	1.3	3	0	0	0	0	0.0
	Mourning Warbler	2	2	2	2	2	2.0	2	2	0	1.3	0	4	0	0	0	0.8
	Common Yellowthroat	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0
	Canada Warbler	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Icteridae	Red-winged Blackbird	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0
Fringillidae	Rose-breasted Grosbeak	1	0	2	2	0	1.0	0	0	0	0.0	0	0	0	2	0	0.4
	American Goldfinch	0	2	0	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0
	Chipping Sparrow	0	0	0	2	2	0.8	2	2	2	2.0	2	2	2	2	2	2.0
	White-throated Sparrow	2	0	0	2	2	1.2	2	2	2	2.0	0	2	2	2	0	1.2
	Song Sparrow	1	0	0	2	0	0.6	2	0	2	1.3	0	0	0	0	0	0.0
	Unidentified Species	0	0	0	0	0	0.0	0	4	1	1.7	0	1	1	0	1	0.6
Totals		29.5	25.0	28.0	26.0	24.0	26.5	27.0	30.0	33.0	30.0	26.0	30.0	24.0	24.0	9.0	22.6

Appendix Table 5
 Forest Bird Population Census
 NATACIL® 180F - Vegetative Oil Experimental Spray Trials
 Treatment Plot 213 - 1
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pre-spray					Post-spray 1					Post-spray 2					
		May 30	May 31	June 1	June 2	June 3	June 4	June 5	June 6	June 7	June 8	June 9	June 10	June 11	Daily ave.		
		-4	-3	-2	-1	0	+1	+2	+3	+0	+1	+2	+3	+4	Daily ave.		
Tetraonidae	Ruffed Grouse	2	2	0	2	2	0.8	2	2	0	1.3	2	2	0	2	0	1.2
Trochilidae	Ruby-throated Hummingbird	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0
Picidae	Common Flicker	0	0	2	0	0	0.4	0	2	2	1.3	0	0	0	0	0	0.0
Turdidae	American Robin	3	4	2	0	0	1.8	0	4	0	1.3	6	0	4	2	0	2.4
	Swainson's Thrush	1	4	2	2	4	2.6	4	2	6	4.0	4	4	4	2	4	3.6
	Veery	1	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0.0
Vireonidae	Red-eyed Vireo	2	4	4	2	2	2.8	2	0	0	0.7	0	0	0	0	2	0.4
Parulidae	Tennessee Warbler	2	0	2	2	0	1.2	2	0	2	1.3	2	0	4	2	2	2.0
	Nashville Warbler	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0
	Parula Warbler	0	0	0	0	0	0.0	2	2	0	1.3	0	0	2	2	2	1.2
	Magnolia Warbler	1	0	4	2	2	1.8	4	3	4	3.7	2	2	2	2	2	2.0
	Black-throated Blue Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0.4
	Black-throated Green Warbler	2.5	2	2	0	2	1.7	4	2	2	2.7	2	2	0	0	2	1.2
	Bay-breasted Warbler	0.5	0	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0
	Ovenbird	2	2	0	0	0	0.8	2	2	2	2.0	2	4	2	2	4	2.8
	Mourning Warbler	0	0	0	2	0	0.4	0	0	0	0.0	4	2	2	2	2	2.4
	American Redstart	0.5	0	0	0	0	0.1	0	0	0	0.0	0	0	2	2	2	1.2
Fringillidae	Rose-breasted Grosbeak	0	2	2	0	0	0.8	2	0	2	1.3	0	6	0	0	0	1.2
	Purple Finch	0	0	0	0	0	0.0	2	0	0	0.7	0	0	2	0	0	0.4
	American Goldfinch	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0
	Chipping Sparrow	0	0	0	0	0	0.0	0	0	0	0.0	0	0	0	2	2	0.8
	White-throated Sparrow	4	2	2	1	2	2.2	4	2	2	2.7	0	4	2	2	2	2.0
Unidentified Species		0.5	0	0	0	0	0.1	0	0	0	0.0	0	0	0	1	0	0.2
Totals		23.0	22.0	22.0	13.0	14.0	18.8	30.0	21.0	26.0	25.7	24.0	28.0	26.0	23.0	26.0	25.4

Appendix Table 6
 Forest Bird Population Census
 MATACIL® 180F - Vegetative Oil Experimental Spray Trials
 Treatment Plot 213 - 2
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pre-spray					Daily ave.	Post-spray 1				Daily ave.	Post-spray 2					Daily ave.
		May 30	May 31	June 1	June 2	June 3		June 4	June 5	June 6	June 7		June 8	June 9	June 10	June 11		
		-4	-3	-2	-1	-0		+1	+2	+3	+0		+1	+2	+3	+4		
Tetraonidae	Ruffed Grouse	3	2	0	2	2	1.6	2	2	2	2.0	0	2	2	0	2	1.2	
Tyrannidae	Least Flycatcher	0	0	0	0	0	0.0	0	0	0	0.0	0	2	4	0	2	1.6	
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	0	0.0	0	0	0	2	0	0.4	
Corvidae	Blue Jay	0	0	0	0	3	0.6	0	0	2	0.7	0	0	0	4	0	0.8	
Turdidae	American Robin	1	2	0	0	0	0.6	0	2	2	1.3	2	0	0	2	3	1.4	
	Wood Thrush	0	0	2	0	0	0.4	0	0	2	0.7	0	0	0	2	2	0.8	
	Hermit Thrush	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0	
	Sveinsson's Thrush	6	4	4	0	0	2.0	4	2	2	2.6	2	0	2	4	0	1.6	
	Veery	0	0	0	0	0	0.0	0	0	2	0.7	0	0	0	0	0	0.0	
Sylviidae	Ruby-crowned Kinglet	1	0	4	0	2	1.0	2	2	0	1.3	0	0	0	0	0	0.0	
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0.0	0	0	2	0.7	0	2	0	0	0	0.4	
Vireonidae	Rud-eyed Vireo	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
Parulidae	Tennessee Warbler	3	2	4	2	2	2.6	2	2	4	2.6	0	2	2	2	2	1.6	
	Nashville Warbler	1	0	0	0	0	0.2	2	0	0	0.7	0	0	0	0	0	0.0	
	Parula Warbler	0	0	0	8	4	2.4	0	2	2	1.3	0	0	2	0	0	0.4	
	Magnolia Warbler	3	0	0	0	0	0.6	0	0	0	0.0	2	0	4	2	2	2.0	
	Black-throated Blue Warbler	1	2	2	2	0	1.4	0	0	2	0.7	0	0	0	2	0	0.4	
	Black-throated Green Warbler	1.5	4	0	0	0	1.1	2	0	0	0.7	0	2	2	0	0	0.8	
	Blackburnian Warbler	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
	Chestnut-sided Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0.4	
	Baybreasted Warbler	4	4	4	4	4	4.0	4	4	4	4.0	4	0	0	0	0	0.8	
	Ovenbird	0	0	0	0	4	0.8	2	2	0	1.3	0	2	2	2	0	1.2	
	Mourning Warbler	0	0	1	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0	
	Common Yellowthroat	0	0	0	2	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
Fringillidae	Rose-breasted Grosbeak	4.5	4	2	2	2	2.9	4	4	0	2.6	2	4	2	0	2	2.0	
	Purple Finch	0	0	0	0	0	0.0	0	0	0	0.0	2	0	0	0	0	0.0	
	Chipping Sparrow	1	2	2	2	0	1.4	2	2	0	1.3	0	0	0	2	0	0.4	
	White-throated Sparrow	2	4	2	2	2	2.4	4	4	2	3.3	0	3	4	4	6	3.4	
Unidentified Species		3	4	4	2	0	2.6	0	2	0	0.7	2	0	2	4	2	2.0	
Totals		36	34	35	28	25	31.6	30	30	28	29.3	14	21	28	32	23	23.6	

Appendix Table 7
 Forest Bird Population Census
 MATACIL® 180F - Vegetable Oil Experimental Spray Trials
 Treatment Plot 213 - 3
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pre-spray					Daily ave.	Post-spray 1				Daily ave.	Post-spray 2					Daily ave.
		May 30	May 31	June 1	June 2	June 3		June 4	June 5	June 6	June 7		June 8	June 9	June 10	June 11		
		-4	-3	-2	-1	-0		+1	+2	+3	+0		+1	+2	+3	+4		
Picidae	Common Flicker	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0	0.0
Tyrannidae	Least Flycatcher	0	0	2	0	0	0.4	2	0	0	0.7	0	0	0	0	0	0	0.0
	Eastern Wood Pewee	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0	0.4
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0	0.0
Corvidae	Blue Jay	0	0	0	0	0	0.0	0	0	2	0.7	0	0	4	0	0	0	0.8
Paridae	Black-capped Chickadee	0	0	0	2	0	0.4	0	0	0	0.0	0	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	1	2	2	2	0	1.4	0	0	2	0.7	2	2	1	0	2	0	1.2
Turdidae	American Robin	0	0	2	4	0	1.2	2	2	2	2.0	2	0	2	4	0	0	1.6
	Wood Thrush	0	0	0	0	0	2.0	0	0	0	0.0	0	0	2	0	0	0	0.4
	Hermit Thrush	0	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0	0	0.4
	Swinson's Thrush	2	0	4	2	4	2.4	2	2	4	2.7	0	4	2	4	2	2	2.0
Sylviidae	Ruby-crowned Kinglet	1	0	1	0	0	0.4	0	0	0	0.0	0	2	2	0	0	0	0.8
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0.0	0	0	0	0.0	0	0	2	0	0	0	0.4
Vireonidae	Red-eyed Vireo	2	2	0	0	0	0.0	2	0	0	0.7	2	2	0	0	0	0	0.8
Parulidae	Tennessee Warbler	1	6	4	2	2	3.0	4	2	2	2.7	0	2	0	2	2	2	1.2
	Nashville Warbler	0	0	2	2	2	1.2	0	0	0	0.0	0	0	0	0	0	0	0.0
	Parula Warbler	1	0	2	2	0	1.0	0	0	4	1.3	0	0	0	0	0	0	0.0
	Magnolia Warbler	0	0	2	0	0	0.4	0	2	4	2.0	2	2	0	0	0	0	0.8
	Capo May Warbler	0	1	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0	0.0
	Yellow-rumped Warbler	0	0	0	0	0	0.0	0	0	0	0.0	0	0	2	0	0	0	0.4
	Black-throated Green Warbler	0	2	2	0	0	0.8	0	0	0	0.0	0	0	0	0	0	0	0.0
	Baybreasted Warbler	0	1	0	0	4	1.0	4	0	0	0.7	2	0	0	0	0	0	0.4
	Blackpoll Warbler	0	0	4	0	0	0.8	0	0	0	0.0	0	0	0	2	0	0	0.4
	Ovenbird	1	0	0	0	0	0.2	0	0	0	0.0	2	0	0	0	0	0	0.4
	Hourning Warbler	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0	0.0
	Common Yellowthroat	2	0	2	2	4	2.0	0	0	4	1.3	4	0	2	2	0	0	1.6
Fringillidae	Rose-breasted Grosbeak	1	2	0	0	2	1.0	0	0	4	1.3	0	2	0	0	0	0	0.4
	Purple Finch	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0	0.0
	Pine Siskin	0	0	0	0	0	0.0	0	0	0	0.0	0	7	0	0	0	0	1.4
	American Goldfinch	1	0	0	0	0	0.2	2	0	0	0.7	2	0	0	0	0	0	0.4
	Dark-eyed Junco	1	0	2	2	0	1.0	2	0	2	1.3	0	0	0	0	0	0	0.0
	Chipping Sparrow	1	2	0	0	0	0.6	2	2	0	1.3	0	2	0	0	0	0	0.4
	White-throated Sparrow	3	6	6	4	6	5.0	4	6	4	4.7	6	6	4	4	4	4	4.8
	Unidentified Species	0	0	0	0	0	0.0	1	0	0	0.3	4	2	2	0	0	0	1.6
Totals		19	24	39	24	24	26.0	25	20	34	26.3	28	37	24	20	8	23.4	

Appendix Table 8
 Forest Bird Population Census
 MATACIL® 180F - Vegetative Oil Experimental Spray Trials
 Treatment Plot 213 - 4
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pro-spray					Daily ave.	Post-spray 1				Daily ave.	Post-spray 2					Daily ave.
		May 30	May 31	June 1	June 2	June 3		June 4	June 5	June 6	June 7		June 8	June 9	June 10	June 11		
		-4	-3	-2	-1	0		+1	+2	+3	+0		+1	+2	+3	+4		
Tetraonidae	Ruffed Grouse	1	0	0	0	0	0.2	0	0	0	0.0	0	2	0	0	0	0.4	
Apodidae	Chimney Swift	.5	0	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0	
Picidae	Common Flicker	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
Tyrannidae	Olive-sided Flycatcher	1	2	2	2	0	1.4	2	0	0	0.7	0	0	2	2	0	0.8	
Corvidae	Grey Jay	0	0	0	2	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
	Blue Jay	0	0	0	0	0	0.0	0	0	0	0.0	2	0	0	0	0	0.4	
Sittidae	Rod-breasted Nuthatch	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0.0	
Troglodytidae	Winter Wren	1	0	2	2	2	1.4	0	0	0	0.0	0	0	2	0	2	0.8	
Turdidae	American Robin	2	0	0	0	2	0.8	0	0	2	0.0	2	0	0	0	0	0.4	
	Wood Thrush	0	0	0	0	0	0.0	0	0	0	0.0	0	0	0	4	0	0.8	
	Hermit Thrush	1	0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0	0.0	
	Swallow's Thrush	1	4	4	4	4	3.4	0	0	4	1.3	0	4	4	2	4	2.8	
Sylviidae	Golden-crowned Kinglet	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0	
	Ruby-crowned Kinglet	1	0	4	0	2	1.4	4	2	0	2.0	2	0	2	0	0	0.8	
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0.0	0	0	2	0.7	0	0	2	0	0	0.4	
Vireonidae	Red-eyed Vireo	0	0	0	0	0	0.0	2	0	0	0.7	0	2	0	2	0	0.8	
Parulidae	Tennessee Warbler	2	2	0	4	0	1.6	4	4	6	4.7	4	4	6	4	4	4.4	
	Nashville Warbler	0	0	0	0	0	0.0	0	0	0	0.0	2	0	0	0	0	0.4	
	Parula Warbler	1	0	0	0	0	0.2	0	0	0	0.0	0	2	0	0	0	0.4	
	Magnolia Warbler	.5	0	2	0	0	.5	0	2	0	0.7	0	0	0	0	0	0.0	
	Black-throated Blue Warbler	1	0	0	0	0	0.2	0	0	0	0.0	0	0	0	0	0	0.0	
	Black-throated Green Warbler	2	1	0	0	0	0.6	0	0	2	0.7	2	0	0	0	0	0.4	
	Blackburnian Warbler	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
	Chestnut-sided Warbler	.5	0	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0	
	Baybreasted Warbler	0	0	0	0	2	0.4	2	0	0	0.7	0	0	0	0	0	0.0	
	Blackpoll Warbler	1	0	2	0	0	0.6	4	0	0	0.0	0	0	0	0	0	0.0	
	Northern Waterthrush	0	0	2	0	0	0.4	0	0	0	0.0	0	0	0	0	0	0.0	
	Common Yellowthroat	1	0	2	2	0	1.0	2	2	2	2.0	2	2	0	2	0	1.2	
Fringillidae	Rose-breasted Grosbeak	0	2	0	0	2	0.8	2	0	0	0.7	0	2	0	0	0	0.4	
	Purple Finch	0	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0.0	
	Pine Siskin	0	0	0	0	0	0.0	0	0	0	0.0	0	0	6	0	0	1.2	
	American Goldfinch	1	2	0	2	0	2.2	0	2	0	0.7	0	0	3	0	0	0.6	
	Dark-eyed Junco	.5	1	0	0	4	1.1	0	0	0	0.0	0	0	2	0	0	0.4	
	Chipping Sparrow	2	2	0	0	0	0.8	4	0	0	1.3	0	0	2	0	0	0.0	
	White-throated Sparrow	4	4	10	6	2	5.2	4	4	6	4.7	2	4	6	0	2	2.4	
Unidentified Species		.5	2	0	0	0	0.5	0	0	0	0.0	0	4	0	0	0	0.8	
Totals		26.5	22	34	24	26	21.3	30	20	22	17.5	18	26	37	16	12	21.8	

Appendix Table 9
 Forest Bird Population Census
 MATACIL® 180F - Vegetable Oil Experimental Spray Trials
 Treatment Plot 213 - 5
 St. Pascal, Quebec
 30 May - 11 June, 1982

Family	Species	Pre-spray					Post-spray 1					Post-spray 2				
		May 30	June 1	June 2	June 3	Daily ave.	June 4	June 5	June 6	Daily ave.	June 7	June 8	June 9	June 10	June 11	Daily ave.
		-4	-2	-1	-0		+1	+2	+3		+0	+1	+2	+3	+4	
Tetraonidae	Ruffed Grouse	0	0	0	0	0.0	0	2	0	0.7	0	0	0	0	0	0.0
Picidae	Yellow-bellied Sapsucker	0	0	0	0	0.0	0	0	0	0.0	0	0	0	2	0	0.4
	Hairy Woodpecker	1	0	0	0	0.3	0	0	0	0.0	0	0	2	0	0.4	
Tyrannidae	Least Flycatcher	1	0	2	0	1.3	2	2	2	2.0	2	2	2	2	2	2.0
	Olive-sided Flycatcher	0	2	2	0	1.0	2	2	2	2.0	2	4	2	0	2	2.0
Corvidae	Grey Jay	1	0	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
Sittidae	Red-breasted Nuthatch	0	0	0	0	0.0	0	0	0	0.0	0	2	0	0	0.4	
Troglodytidae	Winter Wren	0	2	0	2	1.0	4	2	2	2.7	0	0	0	0	0.0	
Turdidae	American Robin	1	0	0	2	1.3	0	0	0	0.0	2	2	0	2	0	1.2
	Wood Thrush	1	0	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
	Swainson's Thrush	1	4	2	0	1.8	0	0	2	0.7	0	2	2	2	0	1.2
Bombycillidae	Cedar Waxwing	0	0	0	0	0.0	0	0	2	0.7	0	0	3	2	0	1.0
Vireonidae	Red-eyed Vireo	1	0	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
Parulidae	Tennessee Warbler	0	0	4	2	1.5	0	0	2	0.7	0	0	0	2	0.4	
	Parula Warbler	0	0	0	6	1.5	2	6	2	3.3	2	4	4	2	4	3.2
	Magnolia Warbler	2	4	0	2	2.0	0	0	0	0.0	2	2	2	0	4	2.0
	Black-throated Green Warbler	0	0	0	0	0.0	0	2	2	1.3	2	0	0	0	0.4	
	Blackburnian Warbler	0	1	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
	Choptnut-sided Warbler	0	0	0	0	0.0	2	0	0	0.7	0	0	0	2	0.4	
	Mourning Warbler	0	1	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
	Common Yellowthroat	6	2	4	2	3.5	2	4	2	2.7	4	2	2	2	2	2.4
Fringillidae	Rose-breasted Grosbeak	0	0	2	2	1.0	2	0	4	2.0	0	0	0	0	0.0	
	Purple Finch	0	0	0	0	0.0	2	0	0	0.7	0	2	0	0	0.4	
	Pine Siskin	0	0	0	0	0.0	0	0	0	0.0	0	0	0	2	0.8	
	American Goldfinch	1	0	0	0	0.3	0	0	0	0.0	0	0	0	0	0.0	
	Dark-eyed Junco	0	0	2	0	0.5	2	0	0	0.7	0	2	2	0	0.8	
	Chipping Sparrow	0	0	4	4	2.0	4	4	4	3.3	2	2	2	2	2.0	
	White-throated Sparrow	8	8	8	6	7.5	8	4	6	6.0	4	2	6	2	3.2	
Unidentified Species		4	8	0	0	3.0	0	0	0	0.0	0	4	4	2	2	2.6
Totals		28	32	30	28	29.5	32	28	30	30.0	22	32	33	24	24	27.0

Appendix Table 10
 Forest Bird Population Census
 MATACIL® 180F - Vegetable Oil Experimental Spray Trials
 Treatment Plot 213 - 6
 St. Pascal, Quebec
 31 May - 11 June, 1982

Family	Species	Pre-spray					Post-spray 1					Post-spray 2				
		May 31	June 1	June 2	June 3	Daily ave.	June 4	June 5	June 6	Daily ave.	June 7	June 8	June 9	June 10	June 11	Daily ave.
		-3	-2	-1	-0		+1	+2	+3		+0	+1	+2	+3	+4	
Apodidae	Chimney Swift	0	0	0	0	0.0	0	0	0	0.0	2	0	0	0	0	0.4
Trochilidae	Ruby-throated Hummingbird	0.3	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0
Picidae	Hairy Woodpecker	0.6	2	0	0	2.6	0	0	0	0.0	1	0	0	0	0	0.2
Tyrannidae	Great Crested Flycatcher	0	0	2	2	1.0	0	0	0	0.0	0	0	0	0	0	0.0
	Least Flycatcher	6.3	2	0	2	2.6	4	2	2	2.6	2	4	2	2	2	2.4
	Eastern Wood Pewee	0	0	0	0	0.0	0	2	0	0.6	0	0	0	0	0	0.0
	Olive-sided Flycatcher	1.3	2	4	0	1.8	2	0	2	1.3	0	2	0	0	0	0.4
Hirundinidae	Troop Swallow	0.3	0	0	0	0.1	0	0	0	0.0	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0.6	0	2	0	0.7	0	0	0	0.0	0	2	0	0	0	0.4
Turdidae	American Robin	0.6	0	0	2	0.7	2	4	2	2.6	0	2	4	2	2	2.0
	Swainson's Thrush	1.3	2	0	0	0.8	2	0	4	2.0	4	2	2	2	2	2.4
Sylviidae	Ruby-crowned Kinglet	0	0	0	2	0.5	2	0	0	0.6	0	0	0	0	3	0.6
Bombycillidae	Cedar Waxwing	0	0	0	0	0.0	0	5	2	2.3	5	2	2	0	0	1.8
Vireonidae	Red-eyed Vireo	1.3	2	4	2	2.3	2	0	2	1.3	2	2	2	2	4	2.4
Parulidae	Tennessee Warbler	0.6	0	0	2	0.7	0	0	0	0.0	0	0	0	0	0	0.0
	Parula Warbler	0	0	0	0	0.0	2	2	4	2.6	2	2	2	2	2	2.0
	Magnolia Warbler	2.6	2	0	0	1.2	0	2	2	1.3	2	0	2	0	2	1.2
	Black-throated Green Warbler	0	0	0	2	0.5	2	2	2	2.0	0	0	2	0	0	0.4
	Blackburnian Warbler	0.6	2	0	0	0.7	0	0	0	0.0	0	0	0	0	0	0.0
	Chestnut-sided Warbler	0	0	2	2	1.0	2	2	2	2.0	2	4	2	2	2	2.4
	Ovenbird	1.3	2	0	2	1.3	4	2	2	2.6	2	0	2	0	0	0.8
	Mourning Warbler	2.0	2	2	2	2.0	2	2	2	2.0	2	2	2	2	2	2.0
	Common Yellowthroat	0.3	0	0	0	0.1	2	2	0	1.3	0	0	0	0	0	0.0
	Wilson's Warbler	0.6	0	0	0	0.2	2	0	0	0.6	0	0	0	2	0	0.4
Fringillidae	Rose-breasted Grosbeak	3.3	2	0	0	1.3	2	0	2	1.3	0	0	0	0	0	0.0
	Purple Finch	2.3	0	0	2	1.1	0	0	0	0.0	0	0	0	0	0	0.0
	American Goldfinch	1.3	0	0	0	0.3	2	0	0	0.6	0	0	0	0	0	0.0
	Chipping Sparrow	0	0	0	0	0.0	0	0	0	0.0	0	0	2	0	0	0.4
	White-throated Sparrow	7.0	6	2	2	4.3	4	6	4	4.6	4	4	4	6	2	4.0
	Unidentified Species	2.7	6	0	0	2.2	0	0	0	0.0	3	5	3	3	2	3.2
Totals		37	32	18	24	27.8	38	33	34	35.0	33	33	33	25	25	29.8