TERRESTRIAL IMPACT STUDIES ON EXPERIMENTAL AQUEOUS FORMULATIONS OF SPRUCE BUDWORM, *CHORISTONEURA FUMIFERANA* CLEM., CONTROL AGENTS CONTAINING TRITON® X-100, NEW BRUNSWICK 1982.

File Report No. 37. October 1982.

B.B. McLeod

Forest Pest Management Institute
Canadian Forestry Service
Sault Ste. Marie, Ontario

SUMMARY

New formulations of aminocarb and fenitrothion containing TRITON® X-100 were field tested in budworm infested forests of New Brunswick to determine their impact upon native forest avifauna and terrestrial invertebrates under operational conditions.

Forest songbird populations did not suffer any measurable impact and no mortality was recorded. Terrestrial invertebrates were affected in both plots, knockdown of both winged and larval forms being immediate and lasting over the 5 days post spray period. A knockdown of winged insects on the untreated check plot was probably caused by insecticide drift from operational sprays in the general area.

ACKNOWLEDGEMENTS

The authors wish to thank Mr. E. Ketella of the Maritimes Forest Research Centre for his very valuable assistance throughout the experimental program in New Brunswick and Forest Protection Limited for the provision of accommodations, transportation and pointer records of various operational treatments. Our thanks also to Mr. Bert Zylstra of the Forest Pest Management Institute who mixed the experimental formulations at the Charlo airstrip and to the following persons who collected and processed the field data - C. Appleby, G. Aiudi, A. Farraway, S. Trevredyn Tait and I. Wypkema. Mrs. J. McAlpine's skillful typing of this report is acknowledged with appreciation.

INTRODUCTION

In the search for more effective and environmentally acceptable insecticide formulations for use in combating spruce budworm, *Choristoneura fumiferana* Clemens, infestations of eastern Canada, two new formulations were field tested in 1982. Aminocarb (MATACIL® 180F)and fenitrothion (NOVATHION®) formulated with TRITON® X-100 and water were applied to test plots in severely infested forests in north-central New Brunswick. This report details the results of a single application of each formulation upon native forest avifauna and terrestrial invertebrates.

INSECTICIDE FORMULATION AND APPLICATION

The two insecticide formulations tested in New Brunswick were as follows:

MATACIL® 180F (aminocarb flowable)[1]	26.7% (vol.)
TRITON® X-100[2]	3.0% (vol.)
water	70.3% (vol.)

and

NOVATHION® Technical (fenitrothion)[3]	10.9% (vol.)
Cyclosol 63[4]	24.0% (vol.)
TRITON® X-100	3.0% (vol.)
water	62.1% (vol.)

Both experimental plots were treated at approximately 07:00 (A.D.T.) on 17 June. The materials were applied by Forest Protection Limited using Gruman AgCat aircraft equipped with the MICRONAIR®[5] emission system. Both operations were supervised by spotter aircraft to ensure an even application to the sites. MATACIL® 180F was applied at the rate of 70 g AI/ha and fenitrothion at the dosage rate of 210 g AI/ha. Both materials were applied at emitted volumes of 1.46 L/ha and good spray coverage was achieved on both plots.

---

[1]Chemagro Ltd., Mississauga, Ontario
[2]Rohm and Haas, Canada Inc., West Hill, Ontario
[3]Cheminova, Lemvig, Denmark
[4]Shell Canada Chemical Co., Toronto, Ontario
[5]Micronair (Aerial) Ltd., Sandown, England.

METHODS

Plot Selection

Two treatment and one untreated check plot were established in ecologically similar sites within the Nepisiguit River watershed (Figure 1). Both treatment blocks were originally intended to be approximately 5000 ha in area but were later reduced to approximately 500 ha. Balsam fir, *Abies balsamea* (L.) Mill, was the most dominant conifer with red spruce, *Picea rubens* Sarg., and white spruce, *Picea glauca* (Moench) Voss, also common in all areas. Trembling aspen, *Populus tremuloides* Michx., was the dominant hardwood followed by the birches, *Betula spp.*, and maples, *Acer spp.* The shrub layer was predominantely speckled Alder, *Alnus rugosa* (Du Roi) Spreng., and willows, *Salix spp.*

Terrestrial Invertebrate Knockdown

Terrestrial invertebrate knockdown was monitored on all three plots by placing plastic containers (39 cm x 33 cm x 15 cm) under the canopy of balsam fir trees within each plot. Seven containers partly filled with a solution of water and liquid detergent were used on each plot. Collections commenced on 13 June and were made daily (early a.m.) until 23 June (except for 22 June when heavy rain precluded sampling), providing 5 day pre- and post-spray sampling periods. All collections were preserved in a methanol solution and returned to the laboratory for counting and identification to order.

Birds

The activity of native forest avifauna was monitored over an eleven day period between the 13th and 23rd June. One day (22 June) was lost to rain. Transect lines were established along old narrow abandoned logging trails and were marked with surveyor's plastic flagging tape at 2 chain (40 m) intervals for a distance of 22 chains (440 m). Avian populations were censused daily shortly after dawn with a census taker slowly walking each line recording all birds (by sight or sound) on a plot map. All birds were identified as to species, sex and activity at time of recording (singing, flying, fighting, etc.). All males vocally defending a territory were assumed to have been mated and were recorded as 2 birds, all others (sighted but not singing etc.) were recorded as one.

At the conclusion of the field program the daily census maps covering pre- and post-spray periods were compiled separately for each species to delineate breeding territories. Numbers of birds recorded each day were used to determine activity trends and abundance.

RESULTS

Terrestrial arthropod knockdown

A dramatic knockdown of wingless insects (mainly spruce budworm larvae) from balsam fir and spruce immediately followed the applications of MATACIL® 180F and fenitrothion (Figure 2B, Appendix tables 1, 2, and 3). Spruce budworm larvae were observed spinning out of the trees shortly after each treatment and by the third day (20 June) silken threads covered most of the coniferous canopy. Budworm larvae were observed still moving out of the upper crowns as late as 23 June. No such activity was recorded or observed in the untreated check plot.

Winged insects (mainly adult forms) were apparently not affected by these direct applications as collections remained at near pre-treatment levels throughout the post-spray period. However, a large knockdown was recorded on 17 June and throughout the rest of the post-spray period on the untreated check plot (Figure 2A). Comparable large numbers of winged insects (mainly Diptera spp.) as collected from the untreated plot were not recorded from either of the two treatment plots.

Operational spray blocks 241 and 249, adjacent to the untreated plot were last treated on 15 June, 2 days prior to the knockdown experienced ("Pointer Reports" from Forest Protection Limited).

Forest Birds

The population structure of the two treatment plots were quite similar with a total of 35 species representing 13 families recorded on the fenitrothion plot and 36 species representing 12 families on the MATACIL® 180F plot. The untreated check plot contained a somewhat lower density of forest birds with 23 species representing 8 families recorded (Appendix tables 4, 5, and 6).

Overall avian activity was quite similar on all three plots throughout the experimental period (Figure 3) with no noticeable reductions following the applications on 17 June.

The warbler group (family Parulidae) were unaffected in the immediate post-spray period but activity declined near the end of the monitoring as breeding territories started to break up (Figure 4A). The sparrow group (family Fringillidae) recorded a slight decline only on the day following the insecticide applications (Figure 4B). The thrushes (family

Figure 1. Location of experimental treated and untreated blocks in north-central New Brunswick.

M - MATACIL® 180F treatment plot
F - fenitrothion treatment plot
U - untreated check plot

Portions of the 1982 operational spruce budworm control program are shown and spray block numbers closest to study plots are given.

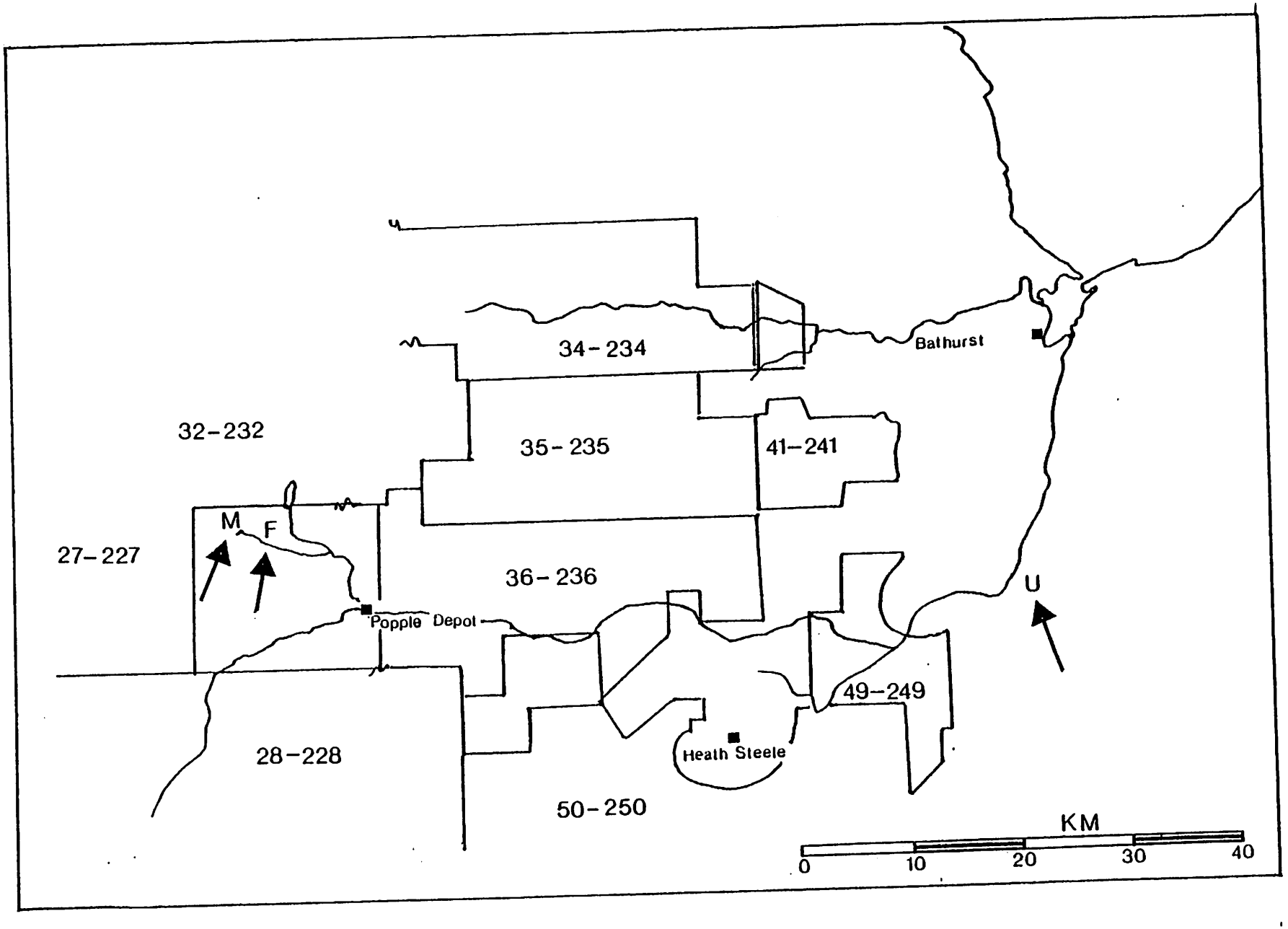
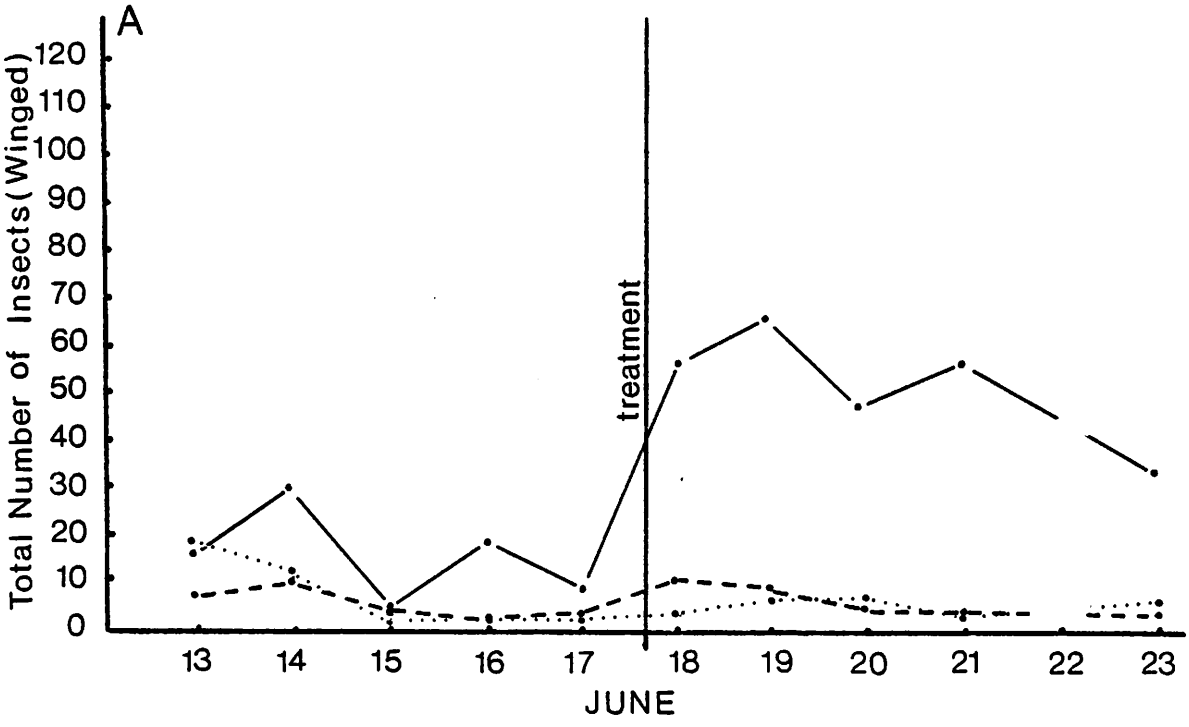

34-234
Bathurst
32-232
35-235
41-241
M
F
27-227
36-236
U
Popple Depot
49-249
28-228
Heath Steele
50-250
KM
0
10
20
30
40

Figure 2. Terrestrial insect knockdown on two insecticide treated plots and one untreated check plot, north-central New Brunswick, 13-20 June, 1982.

Figure A - winged insects
Figure B - wingless insects


A
Total Number of Insects (Winged)
120
110
100
90
80
70
60
50
40
30
20
10
0
treatment
13
14
15
16
17
18
19
20
21
22
23
JUNE

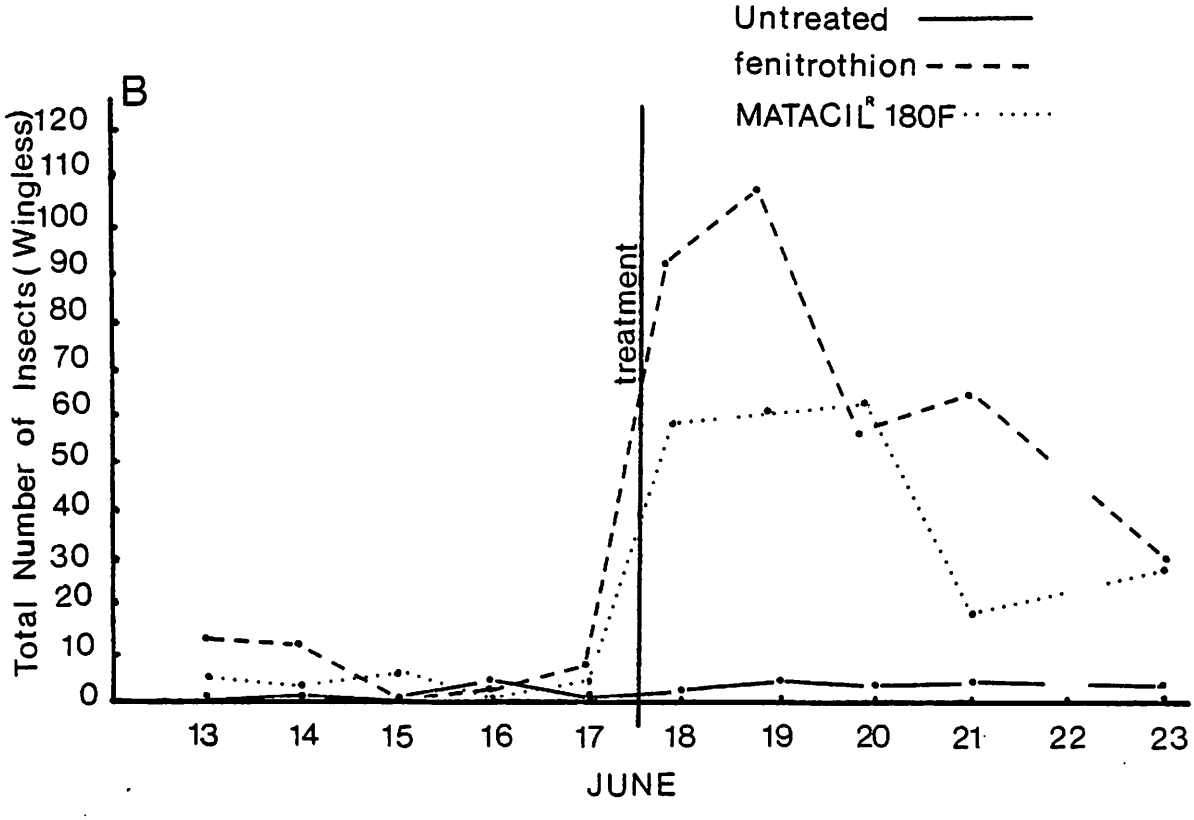

Untreated
fenitrothion
MATACIL® 180F
B
Total Number of Insects (Wingless)
120
110
100
90
80
70
60
50
40
30
20
10
0
treatment
13
14
15
16
17
18
19
20
21
22
23
JUNE

Figure 3. Forest avifauna activity on an untreated and two insecticide treated treatment plots in north-central New Brunswick, 13-22 June, 1982.

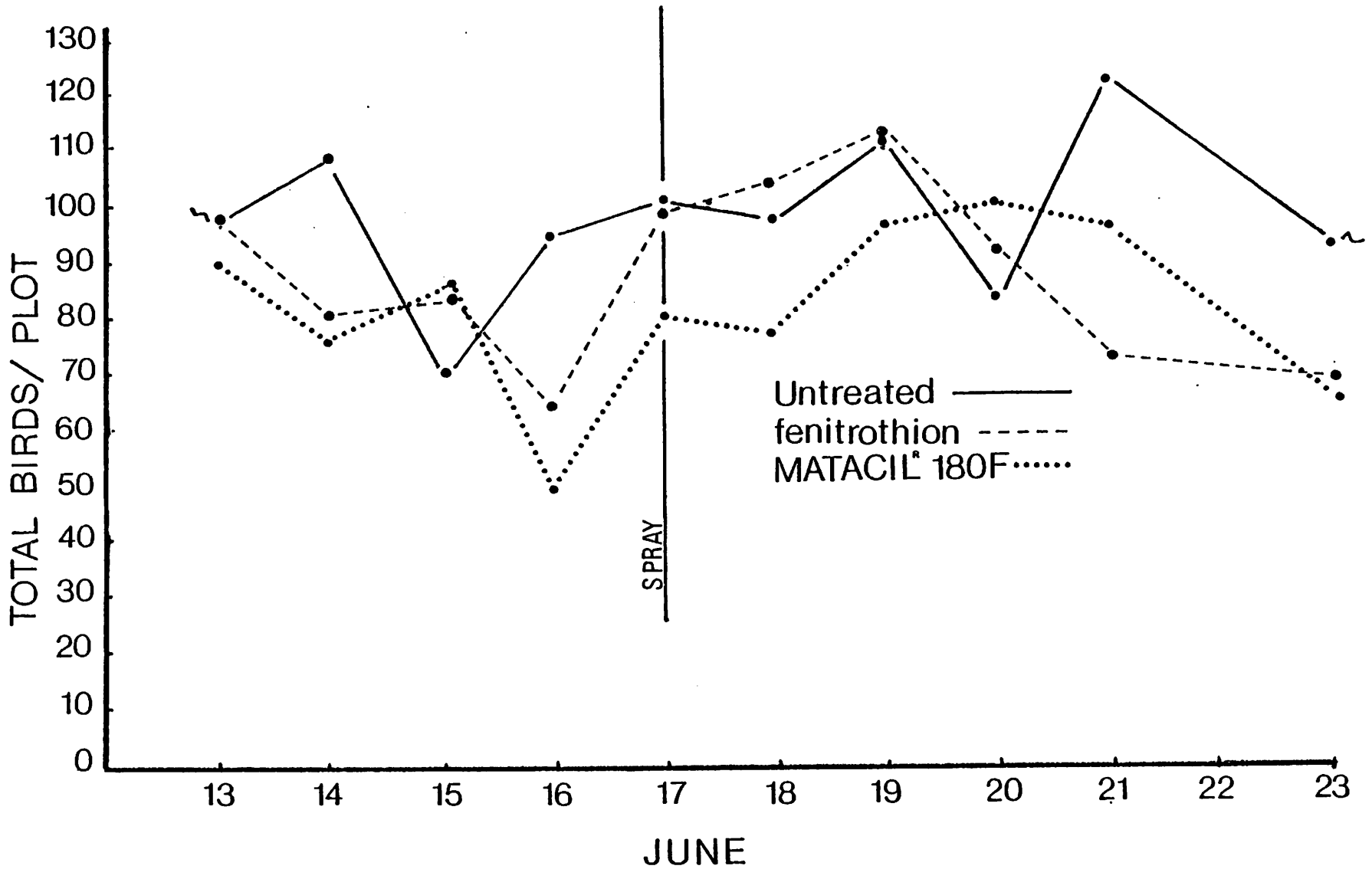

TOTAL BIRDS/ PLOT
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
14
15
16
17
18
19
20
21
22
23
JUNE
SPRAY
Untreated
fenitrothion
MATACIL® 180F

Figure 4. Activity patterns of four family groups of small forest avifauna on an untreated and two insecticide treated plots in north-central New Brunswick, 13-23 June, 1982.

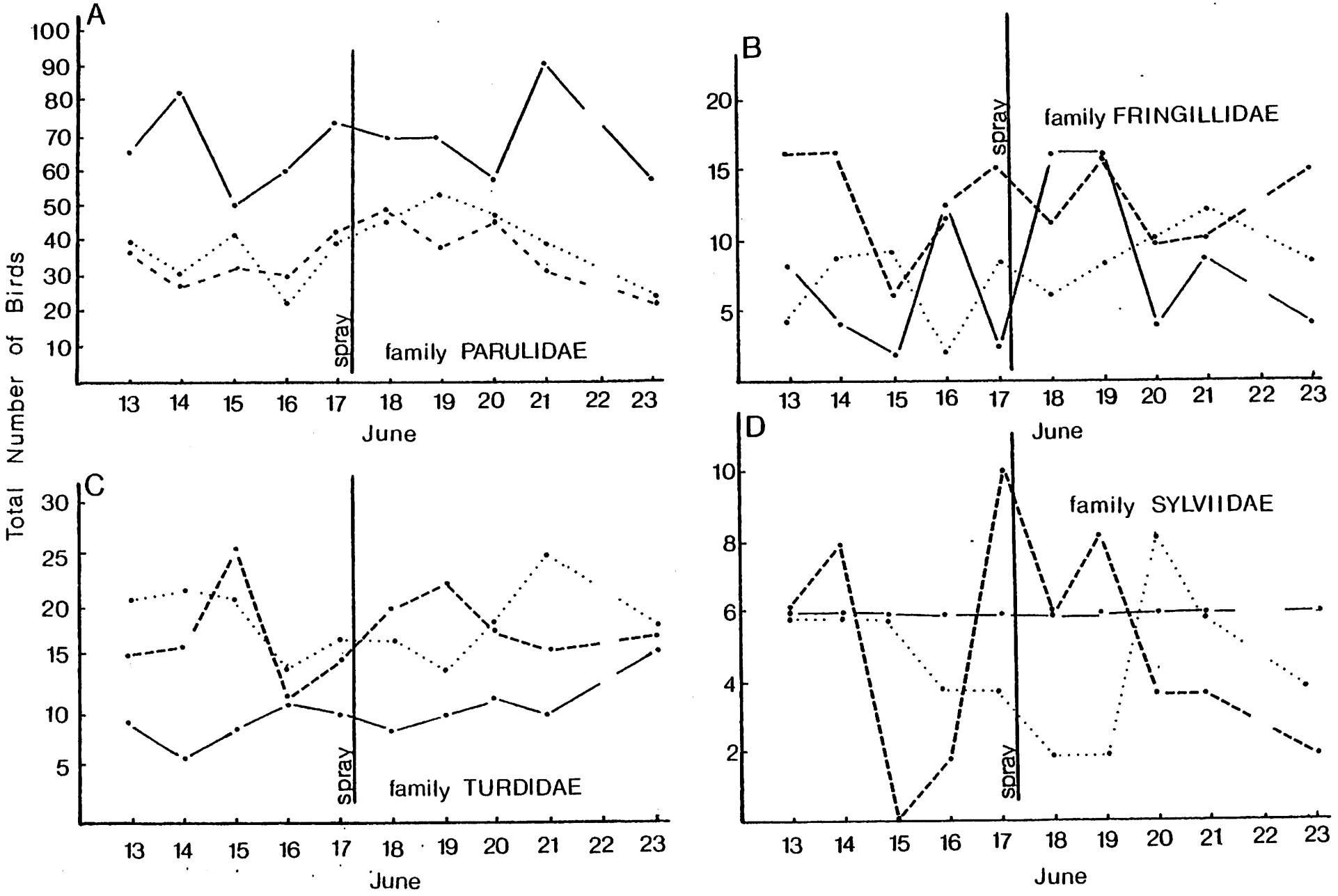
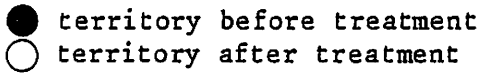
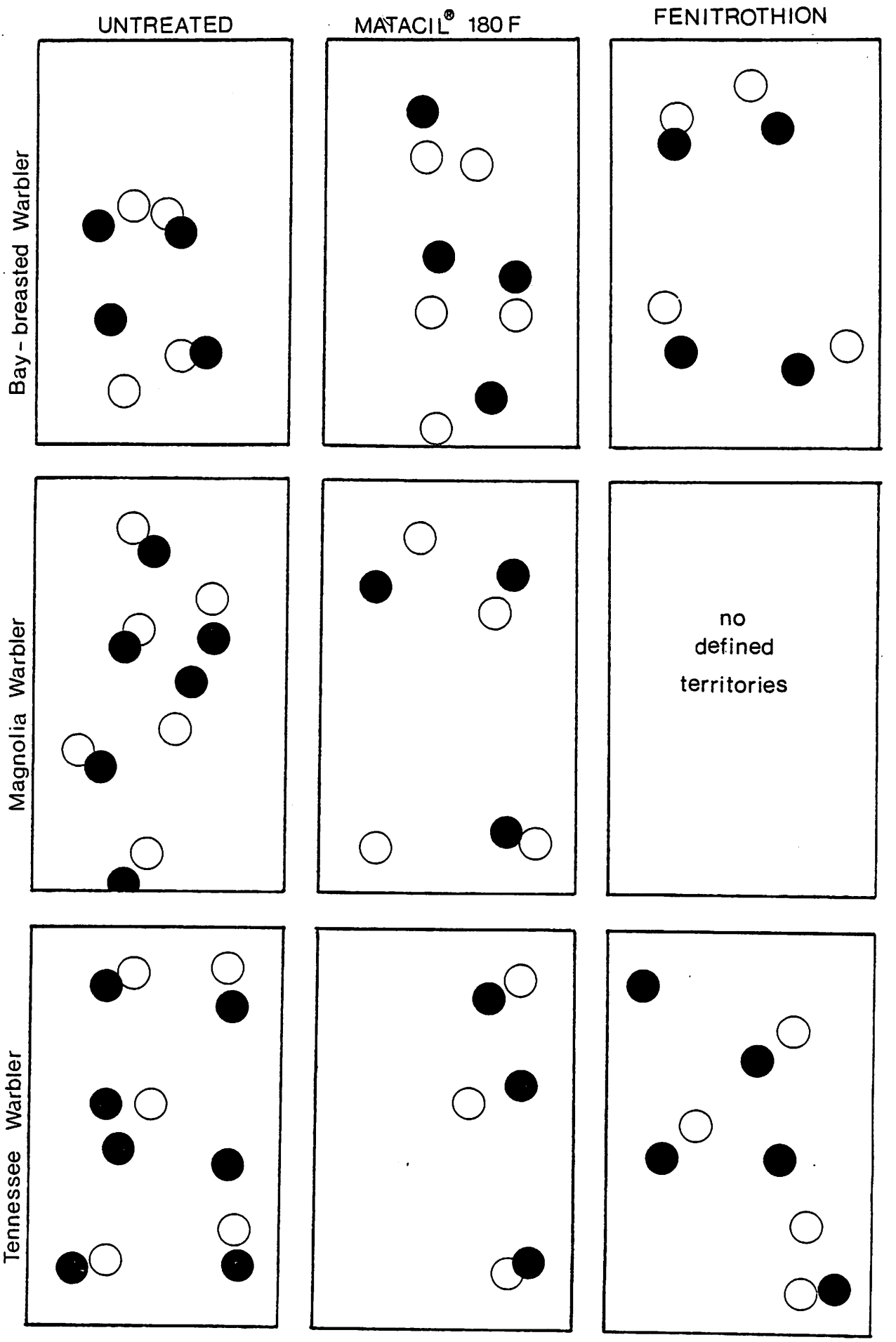

A
B
C
D
Total Number of Birds
family PARULIDAE
family FRINGILLIDAE
family TURDIDAE
family SYLVIIDAE
spray
June
13 14 15 16 17 18 19 20 21 22 23

Figure 5. Breeding territories of three species of warbler before and after applications of fenitrothion and MATACIL® 180F.




UNTREATED
MATACIL® 180 F
FENITROTHION
Bay-breasted Warbler
Magnolia Warbler
Tennessee Warbler
no
defined
territories

Turdidae) were unaffected (Figure 4C) but ruby-crowned kinglet (family Sylviidae) activity dropped slightly following the treatments (Figure 4D).

Warblers were observed feeding on insects infesting both deciduous as well as coniferous trees and shrubs throughout the experimental period. The territories of three species of warbler, the baybreasted, *Dencroica castanea* (Wilson), the magnolia, *Dendroica magnolia* (Wilson), and the Tennessee, *Vermivora peregrina* (Wilson) were defined. Data presented in Figure 5 indicate that territories for these small insectivorous birds remained occupied throughout the census period. A Tennessee warbler hatched five eggs on the MATACIL® 180F plot on treatment day and all nestlings were observed being fed insects gleaned from nearby conifers (infested with budworm). All nestlings were alive and apparently healthy and had a well developed coat of down and feathers at the end of the census period six days later.

Plot searches were initiated immediately following both treatments and continued each morning until the end of the monitoring period without result. No behavioral changes were noticed in the avifauna and none of the usual pesticide stress symptoms such as tremors, excessive bill wiping or erratic perching or flying were observed.

CONCLUSIONS

Single applications of MATACIL® 180F and fenitrothion formulated in TRITON® X-100 and water as delivered to the 500 ha treatment blocks did not result in any obvious or measurable damage to the forest avifauna inhabiting the area. Daily post-spray plot searches failed to recover any mortality, none of the usual pesticide-induced stress symptoms in birds were observed and breeding territories remained occupied.

Insect knockdown in each treatment block was immediate and considerable and continued throughout the five day post-treatment census period. The knockdown in the MATACIL® 180F plot was somewhat lighter than that experienced on the fenitrothion treated plot, possibly because last minute plot boundary changes placed the already established insect knockdown monitoring site very close to the new block boundary.

The winged insect knockdown experienced on the untreated check plot was probably the result of fairly long range drift from operational spraying of very small droplets which did not affect 5th or 6th instar spruce budworm or other larval forms inhabiting conifer foliage. Operations on adjacent spray blocks 241 and 249 were completed on 15 June, 2 days prior to the recorded impact on the untreated check plot. Occurrence of a natural emergence of Diptera spp. around 17 June on the untreated plot (and trapped naturally in the knockdown containers) was not supported by

observation of a similar event at any time throughout the program period on either of the insecticide treated experimental plots. In the absence of evidence of natural knockdown of Diptera or operational spraying in the immediate vicinity of the untreated check plot, it can only be speculated that the knockdown of Diptera occurring on the untreated check plot may have been caused by long distance drift of aerosol size spray droplets from operational sprays fairly distant from the site.

Appendix Table 1
Terrestrial invertebrate knockdown
untreated check plot
North-central New Brunswick
13-23 June, 1982

Orders	13 June		14 June		15 June		16 June		17 June		18 June		19 June		20 June		21 June		23 June		Totals
	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	
Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Araneae	-	-	1	-	-	-	2	-	-	-	2	-	4	-	-	-	3	-	4	-	16
Coleoptera	-	-	-	1	-	1	-	-	-	1	-	5	-	3	-	2	-	2	-	-	15
Collembola	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Diptera	-	13	-	27	-	3	-	17	-	6	-	44	-	52	-	39	-	47	-	22	270
Ephemeroptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Hemiptera	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	2
Homoptera	-	2	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	1	-	1	8
Hymenoptera	-	1	-	1	-	1	-	1	-	1	-	6	-	7	-	1	-	3	-	2	24
Lepidoptera	-	-	-	1	-	-	3	-	1	-	-	-	2	1	3	-	1	-	1	2	15
Mecoptera	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	3
Plecoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Trichoptera	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	2	5
Misc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2
Totals	0	17	1	30	0	5	6	18	1	8	2	57	6	66	4	47	6	54	5	32	365

L - larvae
A - adults

Appendix Table 2
Terrestrial invertebrate knockdown
fenitrothion treatment plot
North-central New Brunswick
13-23 June, 1982

Orders	13 June		14 June		15 June		16 June		17 June		18 June		19 June		20 June		21 June		23 June		Totals
	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	
Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0
Araneae	1	-	-	-	-	-	-	-	1	-	1	-	2	-	-	-	-	-	-	-	5
Coleoptera	-	2	-	4	-	-	-	-	-	3	-	5	-	1	-	-	-	2	-	1	18
Collembola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Diptera	-	4	-	7	-	6	-	1	-	1	-	8	-	7	-	4	-	4	-	2	44
Ephemeroptera	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	2
Hemiptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Homoptera	-	-	-	1	-	-	-	-	-	1	-	-	-	3	-	-	-	-	-	-	5
Hymenoptera	-	-	-	2	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	6
Lepidoptera	13	1	11	1	-	-	3	1	6	1	92	2	106	2	56	3	63	-	30	-	391
Mecoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Plecoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Trichoptera	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Misc.	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Totals	14	7	13	15	0	7	3	2	7	6	93	17	108	17	56	8	63	6	30	4	476

L - larvae
A - adults

Appendix Table 3
Terrestrial invertebrate knockdown
MATACIL® 180F treatment plot
North-central New Brunswick
13-23 June, 1982

Orders	13 June		14 June		15 June		16 June		17 June		18 June		19 June		20 June		21 June		23 June		Totals
	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	L	A	
Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Araneae	1	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	4
Coleoptera	-	1	-	3	-	1	-	1	-	-	-	-	-	3	-	1	-	1	-	4	15
Collembola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Diptera	-	15	-	7	-	2	-	2	-	3	-	2	-	4	-	8	-	1	-	5	49
Ephemeroptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Hemiptera	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Homoptera	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	4
Hymenoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Lepidoptera	3	-	1	-	6	-	-	-	4	-	57	-	56	-	57	-	18	-	27	-	229
Mecoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Plecoptera	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2
Trichoptera	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	3
Misc.	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
Totals	4	19	2	12	6	3	0	3	4	3	57	4	58	7	61	12	18	3	27	9	312

L - larvae
A - adults

Appendix Table 4
Forest Bird Population Census
Experimental Untreated Check Plot
Bathurst, New Brunswick
13-23 June, 1982

		Pre-Spray						Post-Spray					
		June 13	June 14	June 15	June 16	June 17	Daily	June 18	June 19	June 20	June 21	June 23	Daily
Family	Species	-4	-3	-2	-1	-0	Ave	+1	+2	+3	+4	+5	Ave
Picidae	Common Flicker	2	2	0	0	0	0.8	2	0	0	0	0	0.4
Corvidae	Blue Jay	0	0	0	1	0	0.2	0	1	1	1	1	0.8
	Common Raven	0	0	0	0	0	0.0	1	0	0	0	2	0.6
Paridae	Black-capped Chickadee	0	4	0	2	2	1.6	0	2	2	0	2	1.2
Turdidae	Hermit Thrush	5	6	6	9	6	6.4	6	6	8	10	13	8.6
	Swainson's Thrush	4	0	2	2	4	2.4	2	4	4	0	4	2.8
Sylviidae	Ruby-crowned Kinglet	6	6	6	6	6	6.0	6	6	6	6	6	6.0
Vireonidae	Solitary Vireo	2	0	0	0	0	0.4	0	0	0	0	0	0.0
Parulidae	Tennessee Warbler	12	23	14	16	18	16.6	18	18	14	16	18	16.8
	Nashville Warbler	6	4	2	0	4	3.2	4	6	4	2	0	3.2
	Parula Warbler	0	0	0	0	0	0.0	2	2	0	0	0	0.8
	Magnolia Warbler	16	20	16	16	22	18.0	12	16	22	20	14	16.8
	Cape May Warbler	14	18	12	16	12	14.4	20	16	14	26	16	18.4
	Yellow-rumped Warbler	0	0	0	0	0	0.0	1	0	0	0	0	0.2
	Blackburnian Warbler	0	4	0	0	4	1.6	4	2	0	2	0	1.6
	Bay-breasted Warbler	12	8	2	4	8	6.8	4	6	0	14	6	6.0
	Ovenbird	4	4	4	8	6	5.2	6	4	2	8	4	4.8
	Common Yellowthroat	0	0	0	0	0	0.0	0	2	0	0	0	0.4
	American Redstart	0	0	0	0	0	0.0	0	0	0	2	0	0.4
Fringillidae	Rose-breasted Grosbeak	0	0	0	0	0	0.0	0	2	0	2	0	0.8
	Dark-eyed Junco	4	2	0	4	0	2.0	2	6	4	2	0	4.4
	Chipping Sparrow	0	0	0	2	0	0.4	0	0	0	0	0	0.0
	White-throated Sparrow	4	2	2	6	2	3.2	4	8	0	4	4	4.0
Unidentified Species		6	4	3	1	4	3.6	4	1	0	6	2	2.6
Totals		97	107	69	93	98	92.8	97	109	81	121	92	100.0

Appendix Table 5
Forest Bird Population Census
Fenitrothion + TRITON® X-100 + water Experimental Spray Trials
Bathurst, New Brunswick
13-23 June, 1982

		Pre-Spray						Post-Spray					
		June 13	June 14	June 15	June 16	June 17	Daily	June 18	June 19	June 20	June 21	June 23	Daily
Family	Species	-4	-3	-2	-1	-0	Ave	+1	+2	+3	+4	+5	Ave
Tetraonidae	Ruffed Grouse	0	0	0	0	2	0.4	0	2	0	0	0	0.4
Scolopacidae	American Woodcock	0	0	0	0	1	0.2	0	0	0	0	0	0
Picidae	Common Flicker	2	0	0	0	0	0.4	0	0	2	0	0	0.4
Tyrannidae	Great Crested Flycatcher	4	0	0	2	0	1.2	2	2	0	2	2	1.6
	Eastern Phoebe	0	0	0	2	2	0.8	2	2	2	2	0	1.6
	Least Flycatcher	6	2	4	0	2	2.8	6	8	4	2	2	4.4
	Eastern Wood Pewee	0	2	2	0	0	0.8	0	0	0	0	0	0
Corvidae	Gray Jay	0	0	0	0	0	0	2	2	0	0	0	0.8
	Blue Jay	0	1	0	0	0	0.2	0	0	0	0	0	0
Paridae	Boreal Chickadee	4	2	8	0	4	3.6	0	0	0	2	6	1.6
Sittidae	Red-breasted Nuthatch	0	0	0	0	0	0	0	2	2	0	0	0.8
Turdidae	American Robin	3	4	4	2	0	2.6	0	9	6	4	4	4.4
	Hermit Thrush	0	0	0	2	2	0.8	2	0	0	0	0	0.4
	Swainson's Thrush	12	12	22	8	14	13.6	18	14	12	12	12	13.6
Sylvidae	Ruby-crowned Kinglet	6	8	0	2	10	5.2	6	8	4	4	2	4.8
Bombycillidae	Cedar Waxwing	0	0	0	0	0	0	0	2	0	0	0	0.4
Vireonidae	Red-eyed Vireo	0	0	0	0	0	0	0	2	0	0	0	0.4
	Philadelphia Vireo	2	2	2	2	2	2.0	4	0	4	2	5	3.2
Parulidae	Black-and-white Warbler	0	0	0	0	0	0	4	2	2	0	0	1.6
	Tennessee Warbler	16	10	12	10	14	12.4	8	10	8	2	0	5.6
	Nashville Warbler	0	2	0	0	0	0.8	2	0	6	6	2	3.2
	Magnolia Warbler	4	0	7	4	8	4.6	9	6	4	5	4	5.8
	Yellow-rumped Warbler	0	2	2	2	2	1.6	1	0	0	0	2	0.6
	Black-throated Green Warbler	0	0	0	0	4	0.8	0	0	8	2	0	2.0
	Blackburnian Warbler	6	0	0	0	0	1.2	0	0	0	0	0	0
	Bay-breasted Warbler	2	12	8	12	10	8.8	18	16	12	12	8	13.2
	Blackpoll Warbler	8	2	2	2	4	3.6	0	2	4	2	4	2.4
	Ovenbird	0	0	0	0	2	0.4	4	2	2	2	2	2.4
	Canada Warbler	2	0	0	0	0	0.4	2	0	0	0	0	0.4
Fringillidae	Evening Grosbeak	2	0	2	4	4	2.4	0	1	4	0	2	1.4
	Pine Siskin	4	2	0	0	2	1.6	2	4	0	2	0	1.6
	American Goldfinch	0	0	0	0	1	0.2	0	0	0	0	0	0
	Dark-eyed Junco	6	4	4	4	4	4.4	0	6	4	2	8	4.0
	Chipping Sparrow	0	0	0	0	0	0	2	0	0	0	0	0.4
	White-throated Sparrow	5	11	0	4	4	4.8	8	5	2	6	5	5.2
Unidentified Species		3	2	3	0	0	1.6	1	3	0	0	0	0.8
Totals		97	80	84	62	98	84.2	103	109	92	72	71	89.4

Appendix Table 6
Forest Bird Population Census
MATACIL 180F + TRITON® X-100 + water Experimental Spray Trials
Bathurst, New Brunswick
13-23 June, 1982

		Pre-Spray						Post-Spray					
		June 13	June 14	June 15	June 16	June 17	Daily	June 18	June 19	June 20	June 21	June 23	Daily
Family	Species	-4	-3	-2	-1	-0	Ave	+1	+2	+3	+4	+5	Ave
Tetraonidae	Ruffed Grouse	2	0	0	0	0	0.4	0	0	0	0	0	0
Trochilidae	Ruby-throated Humming bird	1	1	0	0	0	0.4	0	1	0	0	0	0.2
Tyrannidae	Eastern Phoebe	0	0	0	0	0	0	0	0	2	2	0	0.8
	Least Flycatcher	2	0	0	0	0	0.4	2	4	4	2	6	3.6
	Eastern Wood Pewee	0	0	0	0	0	0	0	0	2	0	0	0.4
	Olive-sided Flycatcher	0	0	0	0	2	0.4	0	2	0	0	0	0.4
Hirundinidae	Tree Swallow	0	0	0	0	0	0	0	1	0	0	0	0.2
Corvidae	Gray Jay	0	0	0	0	0	0	0	0	1	0	0	0.2
	Blue Jay	1	0	0	0	0	0.2	0	0	0	0	0	0
Paridae	Black-capped Chickadee	0	0	0	0	0	0	0	0	0	2	0	0.4
	Boreal Chickadee	4	4	0	2	0	2.0	0	1	0	0	0	0.2
Troglodytidae	Winter Wren	2	0	0	0	0	0.4	0	0	0	0	2	0.4
Turdidae	American Robin	5	5	4	6	6	5.4	5	4	9	11	8	7.4
	Swainson's Thrush	16	16	18	8	12	14.0	12	10	10	14	10	11.2
Sylviidae	Ruby-crowned Kinglet	5	6	6	4	4	5.2	2	2	8	6	4	4.4
Vireonidae	Red-eyed Vireo	2	0	2	2	6	2.4	0	0	0	2	2	0.8
	Philadelphia Vireo	4	0	2	2	2	2.0	4	6	4	2	0	3.2
Parulidae	Black-and-white Warbler	0	4	0	0	2	1.2	0	2	0	0	0	0.4
	Tennessee Warbler	5	6	8	6	4	6.0	4	6	8	8	2	5.6
	Nashville Warbler	0	3	2	0	0	1.0	2	2	2	2	0	1.6
	Parula Warbler	2	0	0	0	0	0.4	0	0	0	0	0	0
	Magnolia Warbler	2	8	4	0	6	4.0	8	8	6	6	8	7.2
	Cape May Warbler	5	0	0	0	0	1.2	0	2	2	0	0	0.8
	Yellow-rumped Warbler	0	1	0	2	2	1.0	4	4	2	2	0	2.4
	Black-throated Green Warbler	4	2	6	4	8	4.8	6	2	10	2	4	4.8
	Bay-breasted Warbler	10	2	14	6	14	9.2	15	14	14	16	8	13.4
	Blackpoll Warbler	6	4	2	0	0	2.4	0	4	0	0	0	0.8
	Ovenbird	0	2	2	4	4	2.4	6	8	2	2	2	4.0
	Northern Waterthrush	2	0	4	0	0	1.2	0	2	2	2	0	1.2
	Common Yellowthroat	2	0	0	0	0	0.4	0	0	0	0	0	0
Fringillidae	Rose-breasted Grosbeak	0	0	0	0	0	0	0	2	0	2	0	0.8
	Evening Grosbeak	2	1	5	2	4	2.8	0	1	2	2	2	1.4
	Pine Siskin	0	2	0	0	0	0.4	0	5	0	6	0	2.2
	American Goldfinch	0	0	0	0	0	0	0	0	0	0	2	0.4
	Dark-eyed Junco	2	0	4	0	2	1.6	2	0	0	2	2	1.2
	White-throated Sparrow	0	5	0	0	2	1.4	4	1	8	0	2	3.0
Unidentified Species		1	2	3	0	0	1.2	1	1	1	0	0	0.6
Totals		90	75	86	48	80	75.8	77	95	99	97	66	86.8