



EFFECTS OF EXPERIMENTAL APPLICATIONS OF
ORTHENE^R ON FOREST SONG BIRDS AND AQUATIC
FAUNA IN NEW BRUNSWICK AND BRITISH COLUMBIA

by

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INTRODUCTION

Experimental applications of the chemical insecticide Orthene^R in New Brunswick and British Columbia were studied to determine possible ecological disturbances to forest dwelling birds and aquatic invertebrates. In New Brunswick, Orthene was applied as a larvacide against the spruce budworm, *Choristoneura fumiferana* Clemens. at the following dosage rates;

- (i) 0.280 kg AI/ha (4 oz AI/ac) in a single application (Plot I)
- (ii) 0.560 kg AI/ha (8 oz AI/ac) applied in 2 consecutive applications (Plot 2)
- (iii) Plot I received an additional application of 0.280 kg AI/ha approximately 7 days after the initial treatment.

Forest dwelling bird populations were assessed and monitored throughout these trials.

In British Columbia, Orthene was applied in a single application of 1.121 kg AI/ha (16 oz AI/ac) as a larvacide against an outbreak of Douglas fir tussock moth *Orygia pseudotsugata* (McDunnough) in the Kamloops area. Forest bird populations were monitored on 4 treatment plots, an open cattail marsh and on one untreated check plot. Aquatic invertebrates were sampled from a pond located in treated and untreated areas.

METHODS

Birds: Four hectare (10 acre) plots were established in treated and untreated check areas. Bird populations were assessed daily beginning several days prior to the first treatment and continued throughout the experimental period, terminating about 5 days after the treatment. All

singing and sighted birds were recorded on plot maps while traversing the plot along parallel lines established 40 meters (2 chains) apart. Census data collected over a period of several days resulted in the identification of breeding territories of resident birds as well as the migrant species or non-breeding birds foraging through the areas. On the day of the application trials, plot searches were conducted to identify and recover any sick or dead birds for chemical residue analysis.

Aquatic invertebrates: Aquatic insects and associated bottom fauna were collected from a pond located in the treated and untreated areas. Three bottom samples were collected from different locations in the pond, combined, preserved and returned to the laboratory for sorting, identification and assessment. Samples were collected twice prior to treatment (the second sample was taken because of a delay in the operation) and once after the treatment.

RESULTS

New Brunswick: Bird populations on the two treated and the one untreated check plot showed a marked decline in activity (songs and sightings) prior to the first treatment (Tables I, II and III). Populations on the untreated check plot increased throughout the first post-spray period and declined after the 2nd application until post-spray + 2 (June 17th) then increased. Plot 2, which received the 2 applications of Orthene at 0.280 kg AI/ha remained nearly stable throughout both treatment periods with small daily fluctuations being recorded. Populations on treatment plot I (0.560 kg AI/ha) also showed a significant decline prior to the first treatment and remained near this level for 3 days before increasing (similar to the untreated check plot) (Fig. 1). This depression in

activity (starting the morning prior to application) is attributed to increased human activity on the plot such as foliage sampling, mortality searches and population censusing rather than a direct result of the application of the insecticide. Plot searches failed to identify or locate any sick or dead birds.

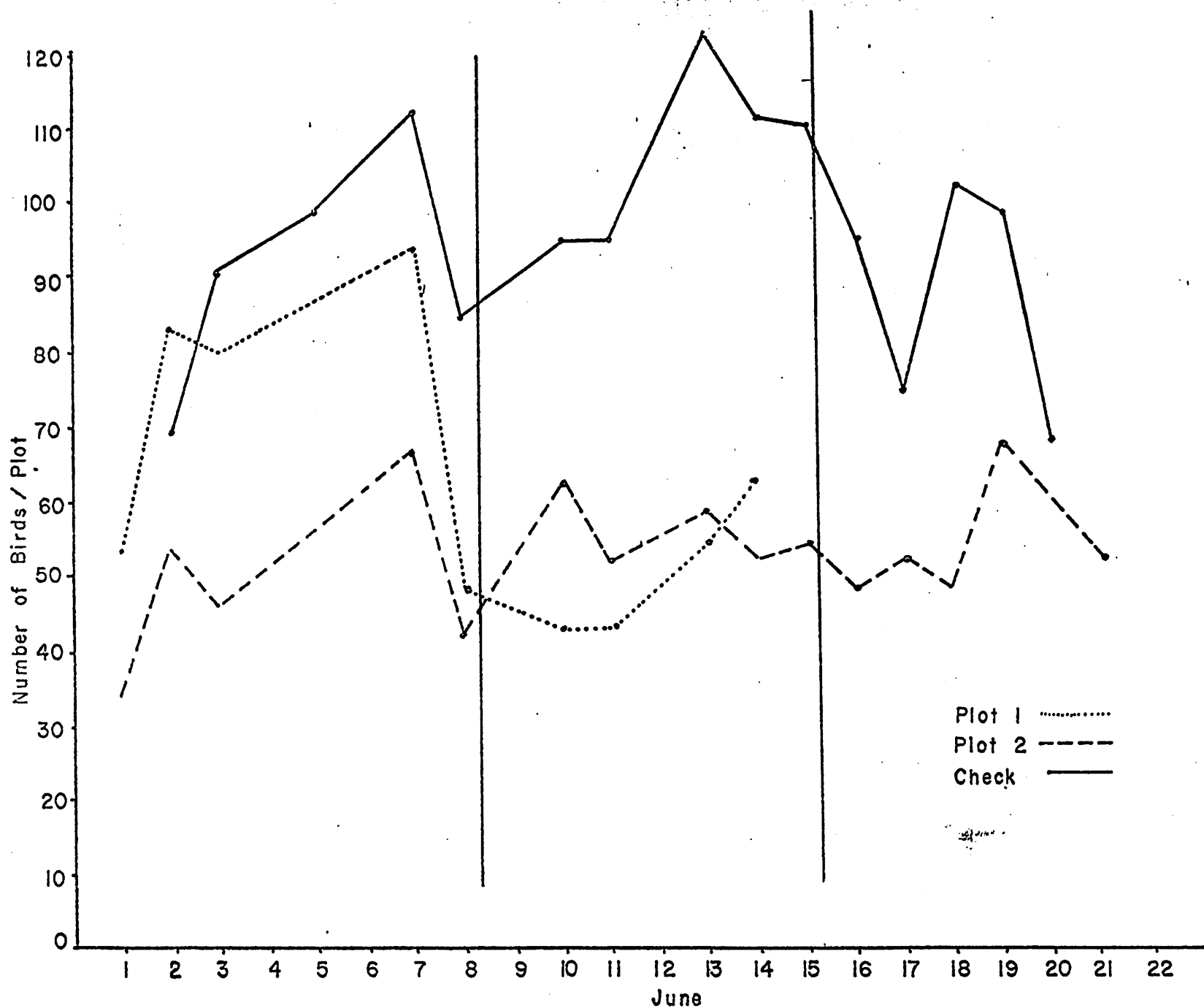


Fig. 1. Daily forest bird population trends on Orthene^R treated and untreated plots monitored during the New Brunswick experimental trials.

British Columbia, birds: A varied forest bird population density was recorded on the four treatment and one untreated check plot (Tables IV to VIII) censused. Irregular daily activity patterns were recorded on all plots except plot 3 which was the least densely populated (Fig. 2). No population decline or interruption of activity is indicated as a result of the application of Orthene on May 28th. Population trends after the treatment are very similar to those recorded prior to the application. Increases in population recorded on the untreated check after the operation resulted from small groups of species as the brown-headed cowbird, *Molothrus ater* (Boddaert); black-capped chickadees, *Parus atricapillus* Linnaeus; and pine siskins, *Spinus pinus* (Wilson) foraging through the plot. The data do not indicate that these groups of birds had vacated the treated areas. Species occupying breeding territories such as the Traill's flycatcher, *Empidonax traillii* (Audubon) and the chipping sparrow, *Spizella passerina* (Bechstein) were not affected by the treatment.

Red-winged blackbirds, *Agelaius phoeniceus* (Linnaeus) occupying territories in an open cattail marsh were observed throughout the Orthene trial monitoring period. Numerous territories were identified but only three nests were located close to the shore. Searches for nests in the other territories being hampered by deep water and muddy bottom conditions. Living young were observed in all three nests throughout the census period.

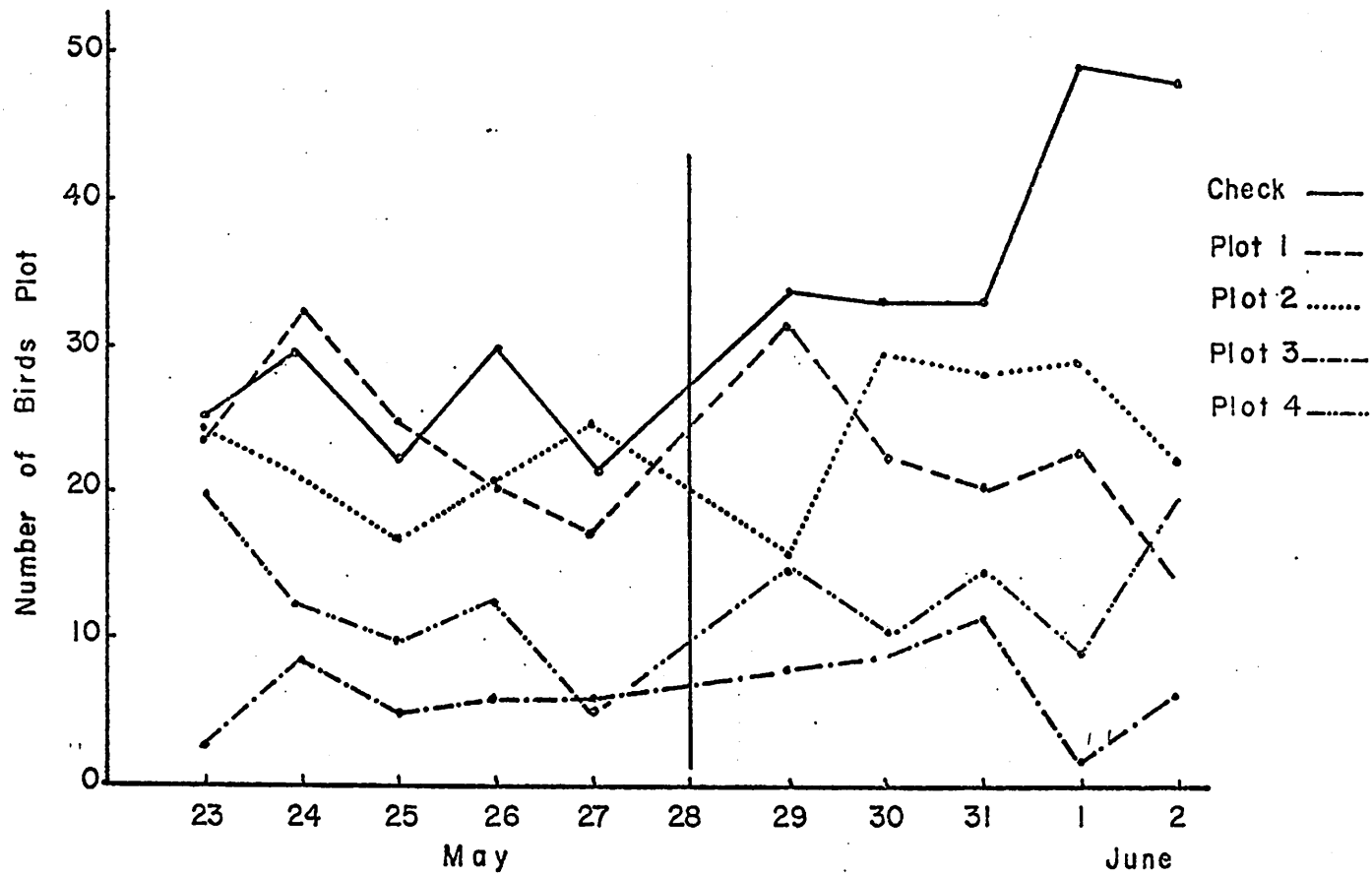


Fig. 2 Daily forest bird population trends on Orthene^R treated and untreated plots monitored during the British Columbia experimental trials.

Aquatic invertebrates: Aquatic insect and associated benthic organisms were not affected by the Orthene treatment as applied on May 28th (Table IX). Aquatic *Diptera*, the organisms most commonly recovered in the samples, showed population increased in both the treated and untreated pond between the last pre-spray sample and that taken two days after treatment. Populations of *Amphipoda* increased in number throughout the sample period while those in the treated pond declined. The decline of *Amphipoda* in the treated pond commenced prior to the application of Orthene and is attributed to other factors other than the effects of the insecticide.

SUMMARY

Orthene^R as applied in New Brunswick at the dosage rates of 0.280 kg AI/ha x 2 or 0.560 kg AI/ha (as two consecutive treatments of 0.280 kg AI/ha) did not affect the forest bird populations. Plot searches did not reveal any symptoms of insecticide poisoning to the varied species on the plots.

In British Columbia, Orthene was applied at the emitted dosage rate of 1.121 kg AI/ha. This treatment did not affect bird populations occupying forest habitat nor young blackbird nestlings in an exposed marsh. Populations of aquatic invertebrates were similarly unharmed by this application.

Table I
 Forest bird population census
 Untreated check block
 Stanley, N.B.
 June 1976

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 2	June 3	June 5	June 7	June 8	June 10	June 11	June 13	June 14	June 15	June 16	June 17	June 18	June 19	June 20			
		-6	-5	-3	-1	-0	+2	+3	+5	+6	+7	+0	+1	+2	+3	+4			
Tetraonidae	Ruffed Grouse	0	1	0	0	0	0.2	0	0	1	0	0	0.2	0	0	0	0	0	0.0
Picidae	Common Flicker	0	0	0	0	1	0.2	0	0	0	0	2	0.4	0	0	0	2	0	0.4
	Yellow-bellied Sapsucker	0	0	0	0	0	0.0	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Tyrannidae	Least Flycatcher	4	5	8	4	6	5.4	4	2	6	4	2	3.6	4	0	0	0	0	0.8
	Eastern Wood Peewee	1	0	0	0	0	0.2	4	2	0	2	0	1.6	0	0	0	0	0	0.0
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	1	0	2	0.6	2	0	0	0	0	0.4
Hirundinidae	Barn Swallow	0	0	0	0	0	0.0	0	4	0	0	0	0.8	0	0	0	0	0	0.0
Corvidae	Blue Jay	0	1	2	0	0	0.6	2	1	4	3	0	2.0	1	0	0	0	0	0.2
Paridae	Black-capped Chickadee	0	0	0	0	0	0.0	0	7	0	0	0	1.4	4	0	0	0	0	0.8
	Boreal Chickadee	0	0	0	0	0	0.0	0	0	2	0	0	0.4	0	0	0	0	0	0.0
Sittidae	Red-breasted Nuthatch	0	2	0	0	0	0.4	0	0	1	0	0	0.2	0	0	2	0	0	0.4
Certhiidae	Brown Creeper	0	2	2	0	0	0.8	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	2	4	2	4	2	2.8	6	2	2	0	4	2.8	4	4	6	8	6	5.6
Turdidae	American Robin	2	1	2	3	2	2.0	1	2	5	1	2	2.2	6	2	2	3	2	3.0
	Wood Thrush	2	0	4	2	0	1.6	4	0	0	0	0	0.8	0	0	2	0	0	0.4
	Hermit Thrush	0	0	0	0	0	0.0	0	1	0	0	0	0.2	0	0	0	0	0	0.4
	Swainson's Thrush	3	2	3	3	1	2.4	1	0	9	13	8	6.2	0	4	5	2	1	2.4

Table I Cont'd

Family	Species	Pre-spray treatment 1						Post-spray treatment 1						Post-spray treatment 2					
		June 2	June 3	June 5	June 7	June 8	Daily ave.	June 10	June 11	June 13	June 14	June 15	Daily ave.	June 16	June 17	June 18	June 19	June 20	Daily ave.
		-6	-5	-3	-1	-0		+2	+3	+5	+6	+7		+0	+1	+2	+3	+4	
Turdidae	Veery	1	2	3	4	2	2.4	4	6	4	3	6	4.6	7	3	3	3	2	3.6
Sylviidae	Golden-crowned Kinglet	0	0	0	2	0	0.4	0	1	2	2	2	1.4	2	4	4	2	2	2.8
	Ruby-crowned Kinglet	0	2	2	4	2	2.0	2	2	0	8	4	3.2	2	2	2	4	2	2.4
Bombycillidae	Cedar Waxwing	0	0	0	0	2	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Vireonidae	Solitary Vireo	2	4	0	0	0	1.2	0	0	0	0	4	0.8	4	2	0	0	0	1.2
	Red-eyed Vireo	0	0	0	0	0	0.0	2	0	0	0	0	0.4	0	0	0	0	0	0.0
Parulidae	Black and White Warbler	0	0	2	6	6	2.8	1	2	6	0	0	1.8	0	0	0	2	2	0.8
	Tennessee Warbler	2	2	4	4	2	2.8	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Nashville Warbler	4	0	0	2	0	1.2	4	2	0	2	6	2.8	0	2	0	4	4	2.0
	Parula Warbler	4	4	6	6	0	4.0	2	6	4	4	4	4.0	0	2	4	0	2	1.6
	Magnolia Warbler	6	9	14	10	6	9.0	5	4	8	2	2	4.2	0	2	2	2	0	1.2
	Black-throated Blue Warbler	2	0	2	4	2	2.0	0	0	4	2	0	1.2	0	0	2	2	2	1.2
	Myrtle Warbler	0	0	4	2	0	1.2	0	2	2	0	4	1.6	0	2	2	0	0	0.8
	Black-throated Green Warbler	0	0	0	0	0	0.0	2	0	2	2	2	1.6	4	0	0	2	0	1.2
	Blackburnian Warbler	2	5	2	4	2	3.0	2	4	0	0	2	1.6	2	2	1	0	2	1.4
	Bay-breasted Warbler	2	0	0	2	2	1.2	0	0	0	0	0	0.0	4	0	4	4	0	2.4

Table I

Cont'd

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 2	June 3	June 5	June 7	June 8	June 10	June 11	June 13	June 14	June 15	June 16	June 17	June 18	June 19	June 20			
		-6	-5	-3	-1	-0	+2	+3	+5	+6	+7	+0	+1	+2	+3	+4			
Parulidae cont'd	Ovenbird	6	12	6	8	8	8.0	8	12	8	8	6	8.4	6	10	12	8	8	8.8
	Northern Waterthrush	0	2	0	0	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Mourning Warbler	0	0	0	0	0	0.0	2	0	4	0	0	1.2	2	2	0	2	4	2.0
	Yellowthroat	2	0	0	0	0	0.4	0	0	0	0	2	0.4	2	0	0	0	0	0.4
	Canada Warbler	2	4	2	2	4	2.8	4	4	4	8	4	4.0	2	4	4	4	4	3.6
Icteridae	American Redstart	4	7	8	11	10	8.0	8	5	13	10	6	8.4	14	7	10	12	10	10.6
	Common Grackle	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	4	0	0	0.8
	Brown-headed Cowbird	0	0	0	0	0	0.0	2	2	4	4	6	3.6	1	4	2	2	4	2.6
	Rose-breasted Grosbeak	5	2	6	7	7	5.4	5	7	3	8	6	5.8	2	3	6	4	2	3.4
	Evening Grosbeak	0	0	0	0	0	0.0	0	1	0	1	0	0.4	0	0	0	0	0	0.0
Fringillidae	Purple Finch	4	5	2	2	4	3.4	5	6	7	6	2	5.2	0	2	4	4	2	2.4
	Pine Siskin	0	0	0	0	2	0.4	0	0	1	0	0	0.2	0	0	0	0	0	0.0
	American Goldfinch	2	2	0	1	0	1.0	0	0	0	0	0	0.0	0	0	4	0	0	0.8
	Dark-eyed Junco	0	4	3	3	4	2.8	3	1	6	4	4	3.6	2	3	7	9	0	4.2
	Chipping Sparrow	1	0	0	0	0	0.2	0	0	0	0	0	0.0	8	2	0	2	0	2.4
Totals:	White-throated Sparrow	6	8	10	13	9	9.2	10	6	10	12	16	10.4	10	6	8	11	4	7.8
		69	92	99	113	86	91.8	94	94	123	111	110	106.4	95	74	102	98	67	87.2

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Table II
Forest bird population census
Orthene^R treatment block 1
Stanley, New Brunswick
1976

Family	Species	Pre-spray days					Post-spray days					
		June	June	June	June	June	June	June	June	June	Daily	
		1	2	3	7	8	10	11	13	14	ave	
		-7	-6	-5	-1	-0	ave	+2	+3	+5	+6	ave
Trochilidae	Ruby-throated Hummingbird	2	4	0	1	0	1.4	2	0	0	0	0.5
Picidae	Yellow-bellied Sapsucker	0	5	0	3	0	1.6	0	0	0	0	0.0
Tyrannidae	Least Flycatcher	2	0	0	0	0	0.4	0	0	0	0	0.0
Corvidae	Raven	1	0	2	2	0	1.0	1	0	2	2	1.3
Paridae	Black-capped Chickadee	1	0	0	0	0	0.2	0	0	0	0	0.0
Sittidae	Red-breasted Nuthatch	0	0	0	2	0	0.4	0	0	0	0	0.0
Troglodytidae	Winter Wren	2	0	4	6	2	2.8	0	2	2	2	1.5
Turdidae	American Robin	0	4	2	0	5	2.2	0	0	2	1	0.8
	Wood Thrush	0	4	4	2	4	2.8	4	2	2	0	2.0
	Swainson's Thrush	0	0	0	3	1	0.8	0	1	0	0	0.3
	Veery	1	2	3	4	2	2.4	4	2	1	2	2.3
Sylviidae	Ruby-crowned Kinglet	0	0	0	0	0	0.0	0	0	0	4	1.0
Vireonidae	Solitary Vireo	2	0	0	2	0	0.8	0	0	0	2	0.5
Parulidae	Black and White Warbler	2	2	2	4	2	2.4	0	4	2	4	2.0
	Tennessee Warbler	8	18	12	12	2	10.4	2	0	4	1	1.2
	Nashville Warbler	0	2	4	0	0	1.2	0	0	0	2	0.5

Table II Cont'd

Family	Species	Pre-spray days					Daily ave	Post-spray days				Daily ave
		June	June	June	June	June		June	June	June	June	
		1	2	3	7	8		10	11	13	14	
		-7	-6	-5	-1	-0		+2	+3	+5	+6	
Parulidae cont'd	Parula Warbler	4	2	2	4	2	2.8	2	2	2	4	2.5
	Magnolia Warbler	5	12	8	8	8	8.2	6	2	4	8	5.0
	Black-throated Blue Warbler	2	0	0	0	0	0.4	0	0	0	0	0.0
	Myrtle Warbler	2	0	0	0	0	0.4	0	0	0	0	0.0
	Black-throated Green Warbler	0	0	0	0	0	0.0	0	2	0	0	0.5
	Blackburnian Warbler	2	0	2	0	0	0.8	0	0	0	4	1.0
	Chestnut-sided Warbler	4	0	0	0	0	0.8	0	0	0	0	0.0
	Bay-breasted Warbler	2	2	0	2	0	1.2	0	0	0	0	0.0
	Ovenbird	2	4	6	12	4	5.6	8	2	8	4	5.5
	Northern Waterthrush	4	2	0	4	2	2.4	0	2	0	0	0.5
	Yellowthroat	0	2	0	0	2	0.8	0	0	0	0	0.0
	Canada Warbler	1	0	2	2	2	1.4	2	2	8	4	4.0
American Redstart	1	2	4	6	1	2.8	6	2	8	6	5.5	
Icteridae	Red-winged Blackbird	0	0	0	0	2	0.4	0	0	0	0	0.0
	Brown-headed Cowbird	0	0	0	0	0	0.0	0	0	0	2	0.5

Table II Cont'd

Family	Species	Pre-spray days					Daily ave	Post-spray days				
		June	June	June	June	June		June	June	June	June	June
		1	2	3	7	8		10	11	13	14	Daily
		-7	-6	-5	-1	-0		+2	+3	+5	+6	ave
Fringillidae	Rose-breasted Grosbeak	0	0	2	4	1	1.4	0	3	2	1	1.5
	Purple Finch	2	4	6	6	3	4.2	6	6	2	4	4.5
	Pine Siskin	0	2	0	0	0	0.4	0	0	0	2	0.5
	Dark-eyed Junco	1	0	0	0	0	0.2	0	2	0	0	0.5
	Chipping Sparrow	0	0	2	0	0	0.4	0	0	0	2	0.5
	White-throated Sparrow	0	8	3	6	3	4.0	0	7	4	1	3.0
	Unidentified Species	0	3	0	1	0	0.8	1	1	1	0	0.8
	Totals:	53	84	80	96	48	72.2	44	44	54	62	51.0

Table III

Forest bird population census
 Orthene^R treatment block 2
 Stanley, N.B.
 June 1976

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 1	June 2	June 3	June 7	June 8	June 10	June 11	June 13	June 14	June 15	June 16	June 17	June 18	June 19	June 21			
		-7	-6	-5	-1	-0	ave	+2	+3	+5	+6	+7	ave	+1	+2	+3	+4	+6	ave
Trochilidae	Ruby-throated Hummingbird	1	0	3	0	0	0.8	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Picidae	Hairy Woodpecker	0	0	0	0	0	0.0	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Tyrannidae	Least Flycatcher	0	0	0	4	2	1.2	2	2	2	2	2	2.0	2	0	2	2	0	1.2
	Eastern Wood Peewee	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	2	0	0	0	0.4
Paridae	Black-capped Chickadee	0	2	1	0	0	0.6	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Turdidae	American Robin	1	2	1	1	1	1.2	0	0	0	0	0	0.0	0	3	2	2	2	1.8
	Hermit Thrush	4	3	0	0	0	1.4	1	2	0	0	2	1.0	0	0	0	0	0	0.0
	Swainson's Thrush	3	2	0	1	0	1.2	2	2	6	5	4	3.8	2	2	5	5	6	4.0
	Veery	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	1	0	0.2
Sylviidae	Golden-crowned Kinglet	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	0	1	0.2
	Ruby-crowned Kinglet	2	2	0	2	2	1.6	2	2	0	2	4	2.0	0	0	0	4	0	0.8
Vireonidae	Solitary Vireo	0	2	0	2	0	0.8	0	0	2	2	0	0.8	2	2	0	0	0	0.8
Parulidae	Black and White Warbler	0	0	0	0	0	0.0	0	2	4	2	0	1.6	4	2	2	2	2	2.4
	Tennessee Warbler	2	2	1	0	0	1.0	0	0	0	0	0	0.0	0	0	2	0	0	0.4
	Nashville Warbler	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	2	2	0.8
	Parula Warbler	0	0	0	4	4	1.6	4	0	4	4	2	2.8	0	4	4	2	6	3.2
	Magnolia Warbler	0	2	1	8	4	3.0	12	6	4	2	2	5.2	4	2	4	4	2	3.2

Table III Cont'd

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 1	June 2	June 3	June 7	June 8	June 10	June 11	June 13	June 14	June 15	June 16	June 17	June 18	June 19	June 21	Daily ave		
		-7	-6	-5	-1	-0	+2	+3	+5	+6	+7	+1	+2	+3	+4	+6	ave		
	Black-throated Blue Warbler	0	2	2	0	2	1.2	0	0	0	0	2	0.4	0	2	2	2	0	1.2
	Myrtle Warbler	2	0	0	0	0	0.4	0	2	0	2	0	0.8	0	0	0	0	0	0.0
	Black-throated Green Warbler	4	4	4	8	0	4.0	6	4	4	2	4	4.0	2	4	0	2	4	2.4
	Blackburnian Warbler	0	4	2	2	0	1.6	2	2	2	0	0	1.2	0	0	0	2	0	0.4
	Bay-breasted Warbler	0	4	2	6	2	2.8	2	4	2	2	0	2.0	2	4	2	1	0	1.8
	Ovenbird	6	11	11	12	12	10.4	12	12	8	10	12	10.8	8	10	8	14	8	9.6
	Mourning Warbler	0	0	0	0	2	0.4	2	2	2	0	2	1.6	2	0	2	0	2	1.2
	Yellowthroat	0	0	0	0	0	0.0	0	0	2	0	0	0.4	0	0	2	0	0	0.4
	Canada Warbler	0	0	2	0	0	0.4	0	0	0	0	2	0.4	2	0	0	4	0	1.2
	American Redstart	0	0	8	6	7	4.2	2	4	8	6	2	5.4	6	4	6	8	5	5.8
Thraupidae	Scarlet Tanager	0	4	0	0	0	0.8	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Fringillidae	Rose-breasted Grosbeak	0	1	2	2	2	1.4	2	2	0	0	0	0.8	4	4	0	0	3	2.2
	Purple Finch	4	4	2	4	2	3.2	2	2	0	2	1	1.4	0	0	0	2	3	1.0
	Pine Grosbeak	0	0	0	2	0	0.4	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	American Goldfinch	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	2	0	0	0	0.4
	Dark-eyed Junco	0	0	0	0	0	0.0	3	2	2	1	8	3.0	0	0	0	3	2	1.0

Table III Cont'd

Family	Species	Pre-spray treatment 1					Post-spray treatment 1					Post-spray treatment 2							
		June 1	June 2	June 3	June 7	June 8	June 10	June 11	June 13	June 14	June 15	June 16	June 17	June 18	June 19	June 21	Daily ave		
		-7	-6	-5	-1	-0	+2	+3	+5	+6	+7	+1	+2	+3	+4	+6			
	Chipping Sparrow	0	1	2	0	0	0.6	0	0	0	0	0	0.0	2	0	0	0	2	0.8
	White-throated Sparrow	2	3	2	3	0	2.0	6	0	6	5	4	4.2	6	4	4	6	2	4.4
	Unidentified Species	3	0	0	0	0	0.6	0	0	0	0	0	0.0	0	0	0	0	0	0.0
	Totals:	34	54	46	67	42	48.6	62	52	58	51	53	55.2	48	51	47	68	52	53.2

Table IV

Forest bird population census
 Orthene^R untreated check plot
 Kamloops, British Columbia
 May 23 - June 2
 1976

Family	Species	Pre-spray days					Daily Average	Post-spray days					Daily Average
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Scolopacidae	Common Snipe	0	0	1	1	1	0.6	1	1	1	1	1	1.0
Columbidae	Mourning Dove	1	1	1	1	0	0.8	1	0	0	0	0	0.2
Trochilidae	Calliope Hummingbird	0	0	0	0	0	0.0	1	1	1	0	0	0.6
Picidae	Common Flicker	0	1	0	0	0	0.2	0	0	0	0	0	0.0
	Yellow-bellied Sapsucker	0	0	0	0	0	0.0	1	1	2	2	2	1.6
Tyrannidae	Say's Phoebe	1	1	0	0	0	0.4	1	0	0	0	0	0.2
	Traill's Flycatcher	4	2	2	4	5	3.4	4	5	6	6	6	5.6
Corvidae	Raven	0	1	0	2	0	0.6	0	0	1	0	0	0.2
Paridae	Black-capped Chickadee	1	2	1	4	3	2.2	5	5	4	0	6	4.0
	Mountain Chickadee	0	2	0	0	0	0.4	0	0	0	4	0	0.8
Sittidae	White-breasted Nuthatch	0	0	0	0	0	0.0	0	1	1	0	0	0.4
	Red-breasted Nuthatch	0	0	0	0	0	0.0	1	1	0	1	1	0.8

Table IV cont'd

Family	Species	Pre-spray days					Daily Average	Post-spray days					Daily Average
		May	May	May	May	May		May	May	May	June	June	
		23	24	25	26	27		29	30	31	1	2	
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Turdidae	American Robin	1	4	1	0	1	1.4	1	1	3	4	4	2.6
	Swainson's Thrush	1	1	1	1	0	0.8	1	2	0	0	1	0.8
	Townsend's Solitaire	0	0	0	0	0	0.0	0	0	0	1	1	0.4
Vireonidae	Solitary Vireo	2	0	2	2	1	1.4	2	2	0	3	3	2.0
Parulidae	Magnolia Warbler	0	1	0	0	0	0.2	0	0	0	0	0	0.0
	Black-throated Gray Warbler	0	0	1	0	2	0.6	1	0	0	0	0	0.0
	Audubons Warbler	3	2	3	0	1	1.8	1	3	2	3	2	2.2
	Chestnut-sided Warbler	0	0	0	2	0	0.4	0	0	0	0	0	0.0
	Wilson's Warbler	1	0	0	2	0	0.6	0	2	1	1	0	0.8
Icteridae	Brewer's Blackbird	1	3	1	0	0	1.0	0	0	0	0	0	0.0
	Brown-headed Cowbird	0	0	0	3	1	0.8	5	2	3	7	3	4.0
Thraupidae	Western Tanager	3	5	3	4	1	3.2	2	2	4	6	2	3.2
Fringillidae	Pine Siskin	0	0	0	1	0	0.2	2	0	0	5	8	3.0
	Chipping sparrow	6	3	5	2	6	4.4	2	5	5	5	5	4.4
	Unidentified species	0	0	1	0	0	0.2	1	0	0	0	3	0.8
Totals		25	29	23	29	22	26.6	33	34	34	49	47	39.4

Table V
 Forest bird population census
 Orthene[®] treatment plot 1
 Kamloops, British Columbia
 May 23 - June 2, 1976

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
Tetraonidae	Ruffed Grouse	1	1	2	0	0	0.8	0	1	0	0	0	0.2
Trochilidae	Calliope Hummingbird	2	2	4	1	2	2.2	0	2	2	0	1	1.0
Falconidae	Common Flicker	0	0	1	0	0	0.2	1	1	0	0	0	0.4
	Yellow-bellied Sapsucker	0	0	0	1	0	0.2	0	0	0	0	1	0.2
Tyrannidae	Traill's Flycatcher	1	1	3	2	2	1.8	5	5	3	4	2	3.8
Corvidae	Black-billed Magpie	0	0	0	0	1	0.2	0	0	0	0	0	0.0
Paridae	Black-capped Chickadee	0	2	0	1	0	0.6	5	0	2	0	0	1.4
	Mountain Chickadee	0	0	2	0	0	0.4	0	0	0	2	0	0.4
Sittidae	Red-breasted Nuthatch	0	0	0	1	0	0.2	0	0	0	1	0	0.2
Turdidae	American Robin	2	3	1	4	1	2.2	0	0	1	3	1	1.0
	Swainson's Thrush	0	0	0	1	1	0.4	0	0	1	1	1	0.6
	Townsend's Solitaire	0	1	0	0	1	0.4	2	0	1	0	2	1.0
Vireonidae	Solitary Vireo	3	1	0	1	1	1.2	0	0	0	1	1	0.4
	Warbling Vireo	0	0	0	0	0	0.0	0	1	0	0	0	0.2

Table V Cont'd

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Parulidae	Nashville Warbler	0	1	1	0	0	0.4	1	0	0	0	0	0.2
	Audubon's Warbler	1	0	0	0	0	0.2	1	0	0	1	0	0.4
	MacGillivray's Warbler	1	0	0	1	0	0.4	0	1	0	0	0	0.2
	Wilson's Warbler	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Icteridae	Rusty Blackbird	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Brewer's Blackbird	0	0	0	0	0	0.0	1	0	0	0	0	0.2
	Brown-headed Cowbird	0	0	0	1	0	0.2	0	1	0	0	1	0.4
Thraupidae	Western Tanager	2	2	1	2	1	1.6	4	4	1	1	2	2.4
Fringillidae	Evening Grosbeak	0	4	0	0	0	0.8	0	0	0	0	0	0.0
	Pine Siskin	3	7	2	1	0	2.6	3	2	2	5	0	2.4
	Dark-eyed Junco	0	0	0	0	0	0.0	1	0	3	1	1	1.2
	Chipping Sparrow	5	7	8	3	7	6.0	7	4	4	2	0	3.4
Totals:		23	32	25	20	17	23.4	31	22	20	22	13	21.6

Table VI
 Forest bird population census
 Orthene® treatment plot 2
 Kamloops, British Columbia
 May 23 - June 2, 1976

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
Tetraonidae	Ruffed Grouse	1	1	0	0	0	0.4	0	1	0	0	1	0.4
Columbidae	Mourning Dove	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Trochilidae	Calliope Hummingbird	0	2	0	2	1	1.0	1	0	1	1	0	0.6
Picidae	Common Flicker	0	0	0	0	1	0.2	1	1	0	0	0	0.4
	Yellow-bellied Sapsucker	0	0	1	0	0	0.2	0	1	2	0	0	0.6
Tyrannidae	Traill's Flycatcher	1	1	1	1	0	0.8	1	3	4	3	2	2.6
Paridae	Black-capped Chickadee	0	1	1	4	2	1.6	1	4	5	1	0	2.2
	Mountain Chickadee	0	0	1	0	0	0.2	0	0	0	0	1	0.2
Sittidae	Red-breasted Nuthatch	1	0	0	0	0	0.2	1	0	0	0	0	0.2
Turdidae	American Robin	3	0	2	2	3	2.0	0	2	1	4	1	1.6
	Swainson's Thrush	0	0	0	0	0	0.0	2	1	1	1	2	1.4
Vireonidae	Hutton's Vireo	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Solitary Vireo	2	1	2	3	0	1.6	0	0	2	1	1	0.8
Parulidae	Nashville Warbler	0	0	0	0	1	0.2	0	0	0	0	0	0.0
	Audubon's Warbler	2	5	2	2	2	2.6	1	2	2	1	3	1.8
	Townsend's Warbler	0	2	0	0	0	0.4	0	0	0	0	0	0.0
	Wilson's Warbler	0	0	0	0	1	0.2	0	0	0	1	1	0.4

Table VI Cont'd

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May	May	May	May	May		May	May	May	June	June	
		23	24	25	26	27		29	30	31	1	2	
Icteridae	Brewer's Blackbird	1	0	0	0	0	0.2	0	1	0	0	0	0.2
	Brown-headed Cowbird	0	0	1	0	4	1.0	2	2	1	3	2	2.0
Thraupidae	Western Tanager	0	1	0	1	4	1.2	0	1	0	0	4	1.0
Fringillidae	Eyening Grosbeak	0	0	0	0	2	0.4	0	0	0	0	1	0.2
	Purple Finch	0	1	0	0	0	0.2	0	0	0	0	0	0.0
	Pine Siskin	2	0	0	0	0	0.4	2	3	4	2	1	2.4
	Chipping Sparrow	8	8	6	5	5	6.4	4	8	5	9	2	5.6
Unidentified Species		0	0	0	0	0	0.0	0	0	0	1	0	0.2
Totals:		23	21	17	20	26	21.4	16	29	27	28	22	24.4

Table VII
 Forest bird population census
 Orthene^R treatment plot 3
 Kamloops, British Columbia
 May 23 - June 2
 1976.

Family	Species	Pre-spray days					Daily Average	Post-spray days					Daily Average
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Tetraonidae	Ruffed Grouse	0	0	0	0	0	0.0	0	0	1	0	0	0.2
Columbidae	Mourning Dove	0	0	1	0	0	0.2	1	0	0	0	0	0.2
Trochilidae	Calliope Hummingbird	0	0	0	0	0	0.0	0	1	1	0	1	0.6
Picidae	Yellow-bellied Sapsucker	0	0	1	0	0	0.2	0	0	1	0	0	0.4
Tyrannidae	Traill's Flycatcher	0	1	0	1	0	0.4	1	0	1	0	2	0.8
Paridae	Black-capped Chickadee	0	0	0	0	1	0.2	0	3	0	0	2	1.0
Turdidae	American Robin	0	1	0	1	0	0.4	1	0	0	0	0	0.2
Sylviidae	Ruby-crowned Kinglet	1	1	0	1	0	0.6	0	1	0	0	0	0.2
Vireonidae	Solitary Vireo	0	0	0	0	0	0.0	0	0	1	0	0	0.2
Parulidae	Audubon's Warbler	0	0	1	1	1	0.6	0	1	0	0	0	0.2
	Wilson's Warbler	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Icteridae	Brewer's Blackbird	1	0	1	0	0	0.4	0	0	0	0	0	0.0
Fringillidae	Pine Siskin	0	3	0	0	2	1.0	0	0	3	0	0	0.6
	Chipping Sparrow	0	1	1	1	2	1.0	2	1	2	1	1	1.4
	Song Sparrow	0	0	0	1	0	0.2	1	1	1	1	1	1.0
Totals		3	7	5	6	6	5.4	7	8	11	2	7	7.0

Table VIII

Forest bird population census
Orthene[®] treatment plot 4
Kamloops, British Columbia
May 23 - June 2, 1976

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
Tetraonidae	Ruffed Grouse	1	1	1	1	1	1.0	1	0	0	0	1	0.4
Columbidae	Mourning Dove	1	1	0	0	0	0.4	0	0	0	0	0	0.0
Trochilidae	Calliope Hummingbird	0	0	0	0	0	0.0	0	0	1	0	1	0.2
Picidae	Yellow-bellied Sapsucker	0	1	1	1	1	0.8	1	0	0	0	1	0.2
Tyrannidae	Traill's Flycatcher	1	1	0	1	0	0.6	1	2	1	0	0	0.8
Paridae	Black-capped Chickadee	1	0	0	0	0	0.2	3	0	1	0	1	1.0
	Mountain Chickadee	0	0	0	1	0	0.2	0	0	0	0	1	0.2
Sittidae	Red-breasted Nuthatch	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Turdidae	American Robin	1	0	1	1	0	0.6	0	0	0	0	1	0.2
	Swainson's Thrush	0	0	0	0	0	0.0	1	1	0	2	2	1.2
Sylviidae	Golden-crowned Kinglet	0	0	0	0	0	0.0	0	0	0	0	2	0.4
	Ruby-crowned Kinglet	2	2	3	2	2	1.2	1	2	2	2	2	1.8
Vireonidae	Solitary Vireo	0	0	0	0	0	0.0	0	1	1	0	1	0.6
	Warbling Vireo	1	1	1	1	1	1.0	2	0	1	0	1	0.8

Table VIII

Cont'd

Family	Species	Pre-spray days					Daily ave	Post-spray days					Daily ave
		May 23	May 24	May 25	May 26	May 27		May 29	May 30	May 31	June 1	June 2	
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Parulidae	Audubon's Warbler	0	0	1	0	0	0.2	0	1	0	1	0	0.4
	Wilson's Warbler	1	1	0	1	1	0.8	1	1	1	1	0	0.8
Icteridae	Brewer's Blackbird	0	0	1	0	0	0.2	0	0	0	0	0	0.0
	Brown-headed Cowbird	0	0	0	0	0	0.0	2	0	0	1	0	0.6
Thraupidae	Western Tanager	0	0	0	1	0	0.2	1	0	1	1	2	1.0
Fringillidae	Pine Siskin	10	5	0	1	0	3.2	0	2	3	0	0	1.0
	Dark-eyed Junco	0	0	1	2	0	0.6	0	0	0	0	0	0.0
	Chipping Sparrow	0	0	0	0	0	0.0	0	0	2	0	0	0.4
	Song Sparrow	0	0	0	0	0	0.0	0	0	0	1	0	0.2
Totals:		20	13	10	13	6	12.4	14	10	14	9	16	12.6

Table IX

Pre and post-spray benthic populations sampled from Orthene[®] treated and untreated ponds
 Kamloops area, British Columbia
 May, 1976

	Treated pond			Untreated pond		
	May 21 - 7 days	May 25 - 3 days	May 30 + 2 days	May 21 - 7 days	May 25 - 3 days	May 30 + 2 days
Ephemeroptera	0	0	0	1	4	0
Hemiptera						
Corixidae	0	0	1	0	0	0
Notonectidae	1	0	0	1	0	0
Coleoptera						
Dytiscidae	0	0	1	2	0	0
Hydrophilidae	1	1	1	0	0	0
Elmidae	0	0	1	0	0	0
Trichoptera	0	1	1	0	68	6
Diptera						
Culicidae	0	0	0	0	1	0
Chironomidae	0	25	132	2	0	19
Simuliidae	0	0	0	0	0	88
Heleidae	0	1	1	1	0	0
Total Insects	2	28	138	7	73	113
Acari	0	0	0	0	1	0
Amphipoda	70	17	1	14	578	625
Oligochaeta	0	0	9	2	0	1
Hirudinea	0	0	0	0	0	1
Gastropoda	0	10	9	11	2	14

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