ECOLOGICAL IMPACT STUDIES OF EXPERIMENTAL AND OPERATIONAL SPRUCE BUDWORM (*Choristoneura fumiferana* Clemens) CONTROL PROGRAMS ON SELECTED NON-TARGET ORGANISMS IN QUEBEC, 1976

by

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RESUME

Les effets de l'application expérimental et en plein champ de fénitrothion et de phosphamidon, à des doses variables, sur des espèces non visées ont été contrôlés. Les premières applications de fénitrothion n'ont eu aucun effet sur les abeilles (Apis mellifera Linnaeus), les petits oiseaux chanteurs de la forêt et les organismes aquatiques. Les applications subséquentes ont diminué légèrement l'effectif des abeilles ouvrières, mais n'ont causé aucun tort aux petits oiseaux de la forêt ni aux organismes aquatiques. Le phosphamidon, appliqué à des doses de plus de 0,140 kg d'ingrédient actif à l'hectare, a entraîné la mort de certains petits oiseaux chanteurs de la forêt, et, en particulier, du roitelet à couronne rubis (Regulus calendula Linnaeus).

Des enquêtes, menées après que le fénitrothion, le phosphamidon et l'aminocarbe eurent été accusés de causer des dommages à l'environment, ont montré que ces affirmations n'étaient pas fondées.

ABSTRACT

Experimental and operational applications of fenitrothion and phosphamidon at varying dosage rates were monitored to assess the impact of these treatments upon selected non-target components of the environment. Early applications of fenitrothion did not affect honey bees, *Apis mellifera* Linnaeus , small forest songbirds or aquatic organisms. Subsequent treatments caused a noticeable but light impact upon the honey bee field force but did not harm the small forest bird or aquatic systems. Phosphamidon, where applied at dosage rates in excess of 0.140 kg AI/ha, caused mortality to the small forest songbird component, especially the ruby-crowned kinglet, *Regulus calendula* (Linnaeus).

Investigations into reports of pesticide damage to the environment by applications of fenitrothion, phosphamidon and aminocarb proved unfounded.

INTRODUCTION

Major infestations of the spruce budworm, *Choristoneura fumiferana* (Clem.) continue to damage the important spruce fir stands of central and eastern Quebec. Large scale budworm control operations employing aerially disseminated chemical insecticides constitute the only means of reducing the impact of these infestations to the high value stands in the province at the present time. In 1976, approximately 3,645,000 hectares (9 million acres) were treated with operational and experimental applications of insecticides employing a number of formulations and dosage rates. Several of these treatments were selected for monitoring their immediate and short-term effects upon various non-target organisms of the forest ecosystem. This report presents the findings of impact studies carried out in areas treated with the organophosphorus insecticides fenitrothion, (O, O-dimethyl O-(4 nitro m-tolyl) phosphorothioate and phosphamidon (2-chloro-N, N-diethyl-3-hydrocycrotonamide dimethyl phosphate) in the Mont Tremblant, LaTuque and Chandler areas of Quebec (Fig. I), and the results of investigations into reports of accidental damage to the environment resulting from budworm control programs.

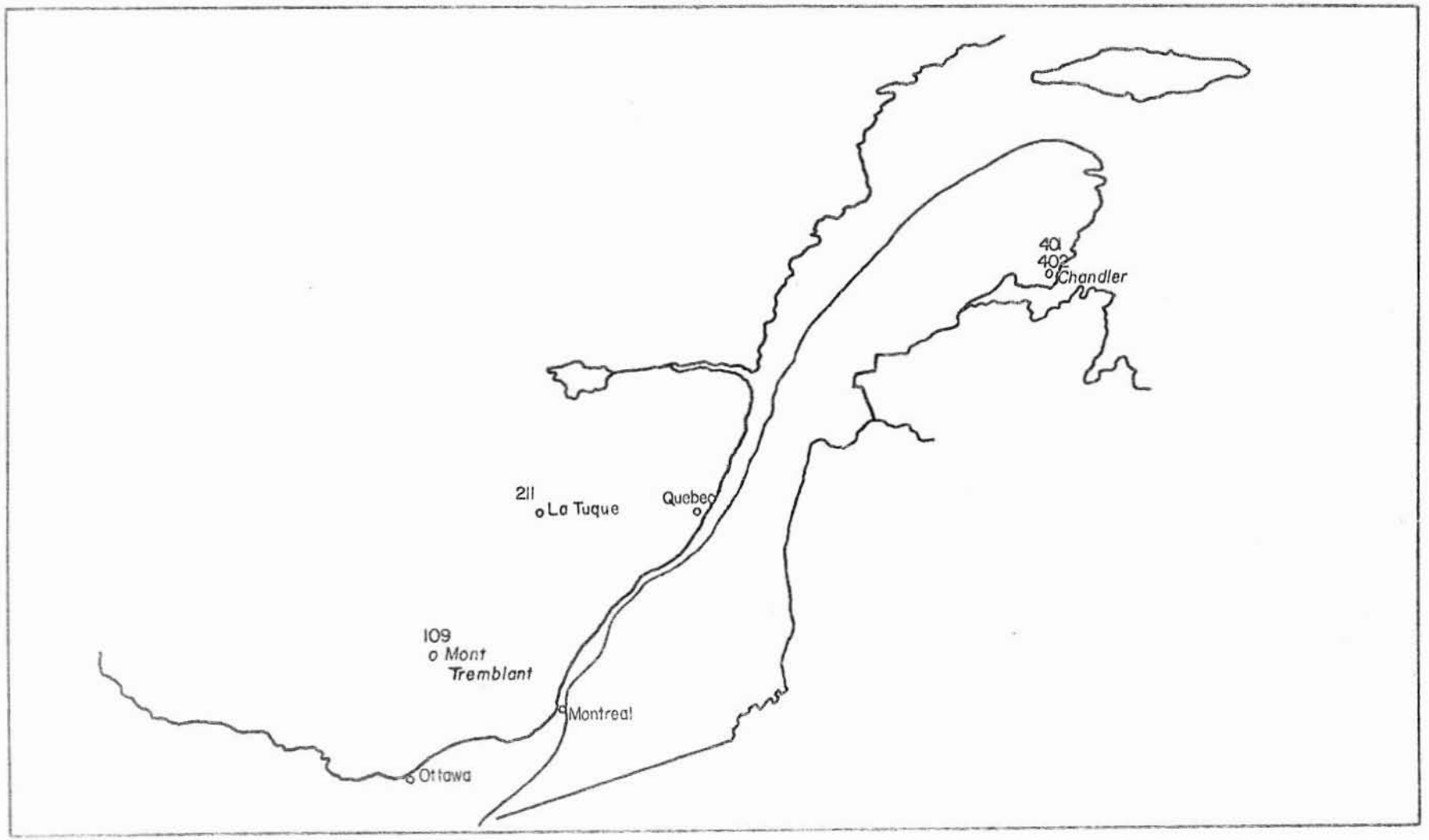

Fig. 1. Location of spruce budworm (*C. fumiferana* Clem.) treatment blocks where ecological impact studies were carried out in Quebec in 1976.

Spray Regimes

The spray regimes for the experimental and operational programs monitored for envrionmental impact upon non-target organisms is presented in Table I.

Table I

Location	Date	Insecticide	Dosage	Organisms Monitored
Mont Tremblant (#109)	April 30	fenitrothion	0.210 kg AI/ha	birds, bees, aquatics
Mont Tremblant (#109)	June 1	fenitrothion	0.210 kg AI/ha	birds, bees, aquatics
Chandler (#401)	May 25	fenitrothion	0.140 kg AI/ha	birds
Chandler (#401)	June 14	fenitrothion	0.140 kg AI/ha	birds
Chandler (#402)	May 20	fenitrothion	0.140 kg AI/ha	birds
Chandler (#402)	May 20	fenitrothion	0.140 kg AI/ha	birds, aquatics
Chandler (#402)	June 16	fenitrothion	0.140 kg AI/ha	birds, aquatics
LaTuque (#211-1)	May 3	phosphamidon	*0.280 kg AI/ha	birds, aquatics
LaTuque (#211-2)	May 3	phosphamidon	*0.280 kg AI/ha	birds
LaTuque (211-3)	April 28	phosphamidon	0.140 kg AI/ha	birds, aquatics
LaTuque (211-3)	May 15	phosphamidon	0.140 kg AI/ha	birds, aquatics
LaTuque (211-4)	pril 28	phosphamidon	0.140 kg AI/ha	birds

* sprayed twice in the same operation with emitted dosage rates of 0.140 kg AI/ha.

METHODS

Forest songbird populations were assessed on 4 hectare plots in treated and untreated areas using the singing male technique similar to that described by Kendeigh (1944) and Buckner and Turnock (1965). Populations were monitored daily and recorded on plot maps starting about 5 days prior to the application of the insecticide and continuing throughout the experimental period and ending approximately 5 days after treatment. On the day of the application of the insecticide, plot searches were carried out in an attempt to recover any sick or dead birds for insecticide residue analysis.

Streams in treated and untreated areas were sampled before and after insecticide applications to determine the impact of the treatments upon aquatic organisms. Aquatic invertebrate fauna were sampled using Surber (1936) samplers in riffle areas. Five samples were collected starting at the bottom of the riffle area and continuing upstream at approximately 3 meter intervals. Samples collected were preserved in a 10% formalin solution and returned to the laboratory for sorting, identification and analysis.

Honeybee colonies were placed in the experimental treatment block #109 in order to assess the impact of a double application of fenitrothion on bees early in the season. Newly purchased packages (3.4 kg) were set up in the headquarters apiary with mated queens and food reserves. When all colonies were established and brood production was in progress, the colonies were transferred to the experimental area. Five colonies were placed in an open area in the treatment block and 5 similarly located in an untreated check area. When the colonies had settled into the new areas, they were checked for queens and brood and all hives equipped with the following monitoring devices;

(i) dead bee traps attached to the front of the hives to collect dead adult bees and brood removed from the colony,

(ii) pollen traps attached to the bottom of the hives to collect a portion of the pollen being brought into the colony,

(iii) an electronic counter attached to the hive entrance to measure the adult activity.

In addition to monitoring with this equipment all hive were weighed periodically to determine weight loss or gain.

Where accidental insecticide contamination was investigated, samples of foliage or water were collected and bird populations were assessed in treated and untreated areas.

RESULTS

Fenitrothion Treatments

Birds:

In experimental block 109 (Mont Tremblant), forest songbird censuses commenced on April 25th before many birds had migrated into the area. The first of 2 experimental applications of fenitrothion (emitted dosage rate of 0.210 kg AI/ha) was applied at 1845 (E.D.T.) of April 30th. Plot searches carried out after the application failed to discover any dead or affected birds. Post treatment population census indicate that the first application did not affect the bird component. Cold weather accompanied by snow flurries on April 26th and May 6th are reflected in the reduced bird activity recorded on those dates (Appendix Tables I and II).

Pre-treatment population censuses for the second treatment commenced on May 24th and the block was sprayed on the evening of June 1st. Northward migration had passed through the experimental area and many species had set up breeding territories. Populations remained relatively constant throughout the census period on both the treated and untreated plots (Appendix Tables III and IV). Activity of the treated plot declined slightly on June 3rd but recovered by June 5th. Activity of small pesticide sensitive species such as the Cape May warbler, *Dendroica tigrina* (Gmelin), the myrtle warbler, *Dendroica coronata* (Linnaeus) and the mourning warbler, *Opororis philadelphia* (Wilson) were not affected and the decline recorded on the 3rd was due to circumstances other than the introduction of the insecticide. The data presented in Fig. 2 indicates that the experimental trials carried out in block 109 did not harm the bird component.

In the Chandler area, operational application of fenitrothion (emitted dosage rate 0.140 kg AI/ha) were applied twice to blocks 401 (May 25th and June 14th) and block 402 (May 20th and June 16th) (Appendix Tables V to VII). Parallel daily population trends on block 401 and the untreated plot indicate that neither treatment affected the breeding bird population (Fig. 3). A small reduction of activity was recorded on block 402 on May 23rd but is not considered pesticide oriented as it occurred 4 days after the treatment. A similar decline is also recordded on June 18th on the 3rd day after the 2nd treatment and does not appear to be pesticide related (Fig. 4).

Honey bees:

Colonies of honey bees (*Apis mellifera* L.) were placed in an open area on treatment block 109 (fenitrothion 0.210 kg AI/ha) and

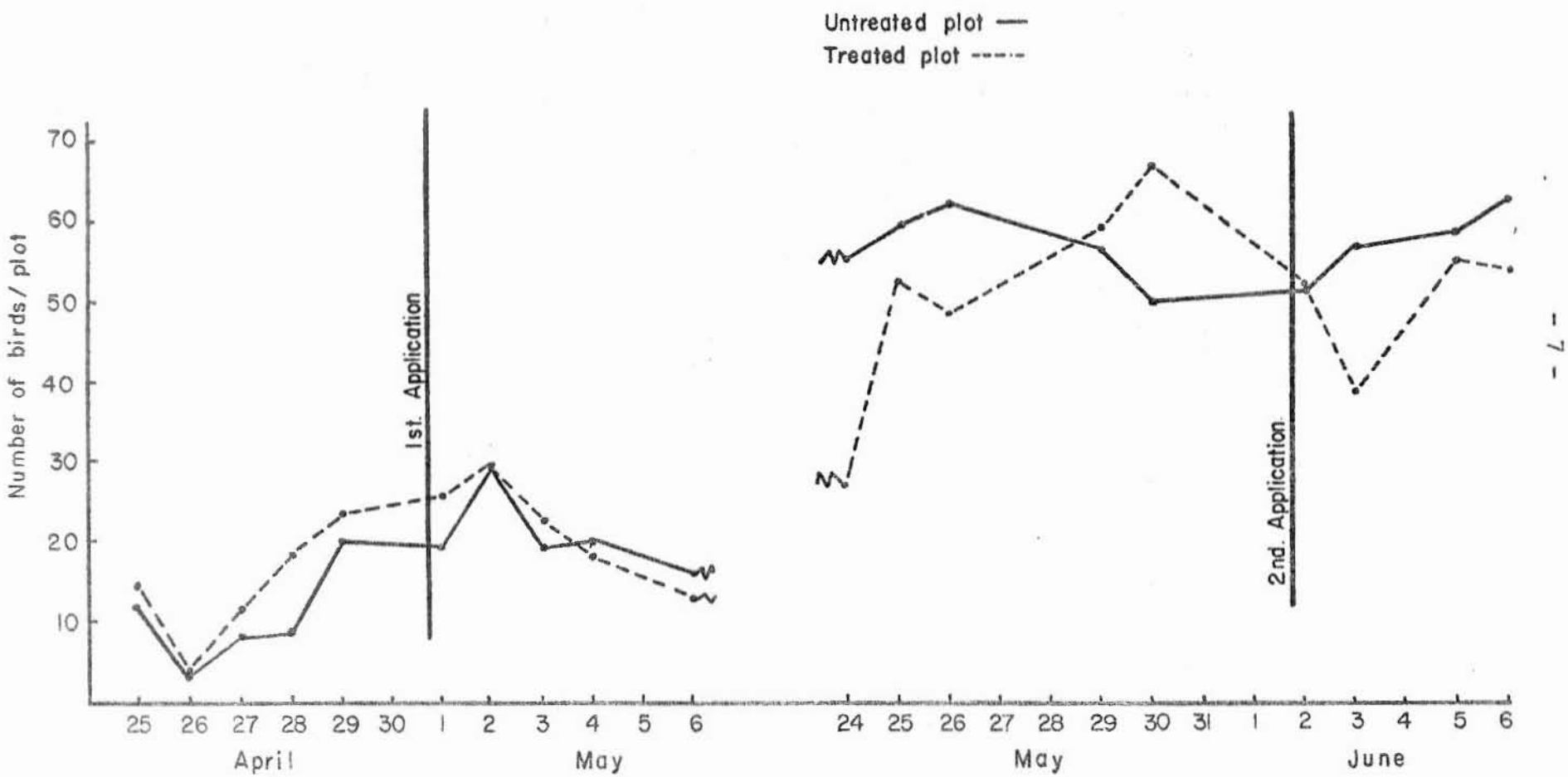

Fig. 2. Daily population trends of forest songbirds recorded on a fenitrothion treated (block 109) and untreated plot, Mont Tremblant, Quebec, 1976

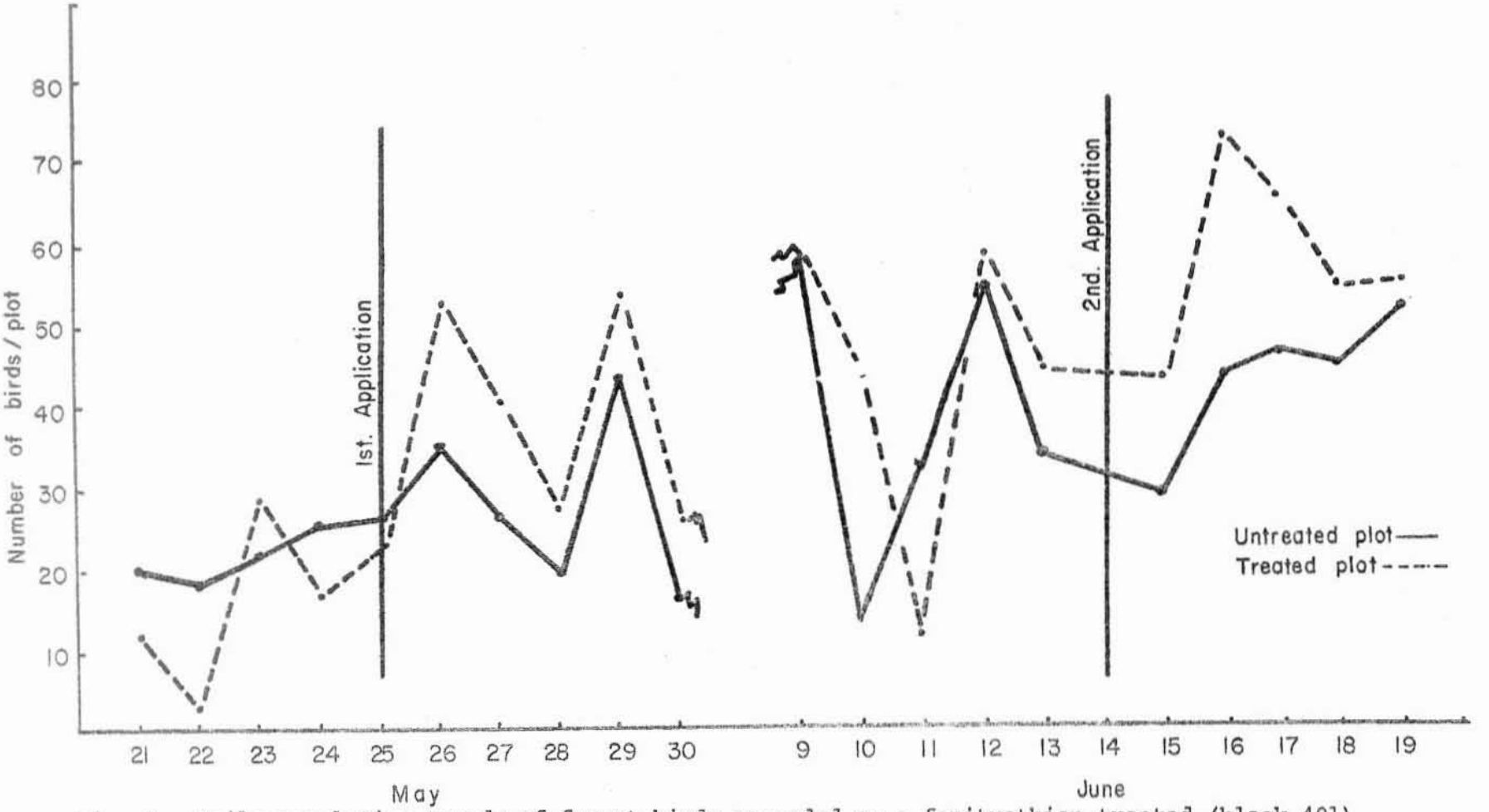

Fig. 3. Daily population trends of forest birds recorded on a fenitrothion treated (block 401) and untreated plot, Chandler, Quebec, 1976.

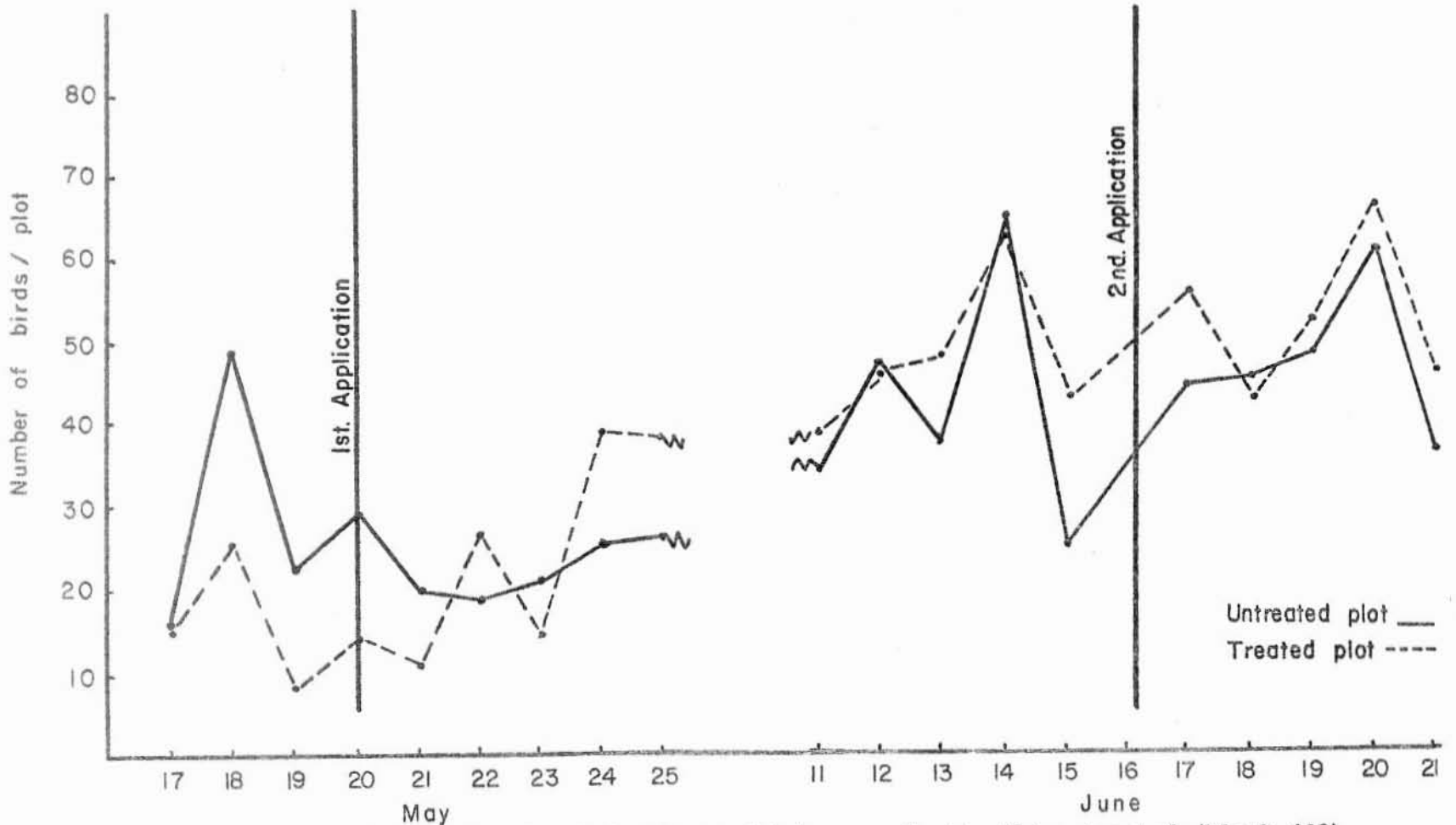

Fig. 4. Daily population trends of forest songbirds on a fenitrothion treated (block 402) and untreated plot Chandler, Quebec, 1976

in a similar location on a control block. Cool, cloudy weather coupled with rain and snow showers prevailed throughout the experimental period. This unsettled weather kept bees close to the hives which resulted in no pollen being collected at the treatment block and only small amounts collected on a few days at the control site (Table II).

The first fenitrothion application caused a slight increase in field force mortality on the treatment block but did not affect queens or brood.

The weather had improved considerably by the time of the second application (June 1st) and bees were observed foraging throughout the experimental areas. Five days prior to the second treatment the hives established in the treatment block had to be relocated due to predation by black bears, *Ursus americanus* Pallus. Relocation to another section of the treatment plot did not adversely affect the hives. The second treatment was applied at approximately 2000 hours when most of the foraging bees had retired to the hives so they were not exposed to the insecticide until the following day. Mortality of the adult foraging component reached it's peak over the next three days then slowly subsided until day +7 when mortality had returned to pre treatment levels (Table III). The collection of pollen on the treatment plot ceased for three days while the weight of pollen from the untreated plot declined noticeably over the same period. On June 1st a spray plane returning to the airstrip inadvertantly released a small volume of insecticide solution within 1.6 kilometer of the control hives. The following day a slight increase in adult mortality occurred accompanied by an absence of pollen collection.

Table II

Measurements of honey bees (*A. mellifera* L.) activity in fenitrothion treated and untreated areas
Mont Tremblant area of Quebec
April 26 - May 7
1976

FIRST APPLICATION

Date	Days from treatment	Untreated check plot				Fenitrothion treatment plot 109				Remarks
		Adult mortality	Adult activity trips/day	Pollen collected (gms.)	Hive weights (gms.)	Adult mortality	Adult activity trips/day	Pollen collected (gms.)	Hive weights (kg.)	
Apr. 26	-4	1	0	0	11.0	1	0	0	12.7	Snowflurries, cool
27	-3	6	1180	0	11.0	21	512	0	12.7	Showers, cool
28	-2	6	4384	0	10.4	11	48512	0	13.1	Cloudy, cool
29	-1	4	33344	0	10.4	10	86784	0	12.7	Clear, cool
30	0	6	13995	5.0	10.7	6	47774	0	12.7	Clear, cool
May 1	+1	4	8396	6.5	10.5	26	36224	0	12.7	Cloudy, cool
2	+2	3	15308	8.0	10.5	32	43520	0	11.9	Overcast, cool
3	+3	4	384	3.1	10.5	4	640	0	12.2	Cloudy, cool
*4	+4	4	896	0	-	2	31168	0	-	Snowshowers, cool
*5	+5	4	896	0	10.6	2	31168	0	12.3	Rain, cool
6	+6	2	1920	0	10.6	4	256	0	12.4	Snowflurries
7	+7	0	0	0	10.6	0	0	0	12.4	Snow

* Average of 2 days.

Table III

Measurements of honey bees (*A. mellifera* L.) activity in fenitrothion treated and untreated areas
Mont Tremblant area of Quebec
May 24 - June 8
1976

SECOND APPLICATION

Date	Days from treatment	Untreated check plot				Fenitrothion treatment plot 109				Remarks
		Adult mortality	Adult activity trips/day	Pollen collected (gms.)	Hive weight (gms.)	Adult mortality	Adult activity trips/day	Pollen collected (gms.)	Hive weights (kg.)	
May 24	-8	2	18688	23.9	10.8	1	640	0	10.9	Cloudy, warm
25	-7	7	44416	17.0	10.8	1	10240	5.9	10.9	P. cloudy, warm
26	-6	4	44416	23.5	10.8	2	8832	9.5	10.9	P. cloudy, warm
*27	-5	1	172672	24.9	-	†	-	-	-	Clear, warm
*28	-4	1	172676	24.9	10.8	†	-	-	-	Clear, warm
29	-3	2	58752	13.9	10.8	†	-	-	-	Clear, warm
*30	-2	4	50688	14.2		†		7.6	11.1	Clear, warm
*31	-1	4	50688	14.2	11.0	4	6672	7.6	11.1	Overcast, warm
June 1	0	0	100608	4.1	11.0	2	4992	2.0	10.9	Clear, cool
2	+1	18	92032	0	11.2	122	3712	0	10.9	Clear, warm
*3	+2	9	66560	5.8	-	118	5504	0	-	Clear, warm
*4	+3	9	66560	5.8	11.2	118	5504	0	11.0	Clear, warm
5	+4	4	63616	3.1	11.4	93	5632	2.5	11.0	Clear, warm
6	+5	2	146560	3.1	11.4	43	7296	2.5	11.0	Clear, warm
7	+6	1	308224	17.6	11.5	23	15488	7.6	11.0	Clear, warm
8	+7	0	36992	15.9	11.5	3	7296	5.0	11.0	Clear, warm

* Average of 2 days
† Colonies moved to new site in treatment Block # 109.

Hive weights were recorded daily at both sites and show a greater increase in weight for the untreated colonies as compared to the treated hives. Queens and brood were not affected and inspection of the hives at the end of the season revealed that honey production in the hives on the treated plot compared favorably with those from the untreated control.

Aquatic fauna, 0.210 kg AI/ha:

Bottom fauna populations were monitored in a fairly large (10 m wide) relatively shallow (mean depth 45 cm) fast flowing stream in treatment block 109. The stream was open to the sky and had a gravel bottom interspersed with a few large flat rocks. A smaller (3m wide, 15 cm deep) alder lined stream with a similar bottom type was sampled outside the spray area to serve as the untreated control stream.

Aquatic insect populations in both the untreated (Table V) and treated (Table IV) stream were very sparse over the sampling period, reflecting the early spring condition of the streams. The small numbers of aquatic insects which were present showed no particular signs of decrease in numbers related to the fenitrothion treatment.

Aquatic fauna, 0.140 kg AI/ha:

Stream bottom fauna populations were monitored in a small stream (mean width 1.2 m, mean depth 30 cm) located in treatment block 402 and exposed to an application of 0.140 kg fenitrothion/ha on 20 May, 1976. The stream bed consisted of coarse gravel and large, algae-covered stones. The stream bank was covered with grass with no overhead forest canopy. The untreated control stream was also quite small (mean width 1.0 m, mean

Table IV

Bottom fauna populations expressed as mean numbers and standard deviations per $0.093m^2$ from a fenitrothion treated (0.210 kg AI/ha) stream

Mont Tremblant, Quebec, 29 April to 10 May, 1976

Number of days before or after treatment	-1	+3	+10
Water temperature	8°C	7°C	-
Number of samples	3	3	4
Plecoptera	0.0	0.0	0.3 ± 0.5
Trichoptera	0.3 ± 0.6	1.0 ± 0.0	0.5 ± 0.6
Diptera: Tipulidae	0.7 ± 1.2	0.3 ± 0.6	0.3 ± 0.5
Chironomidae	8.0 ± 3.0	4.0 ± 1.7	5.3 ± 2.5
Heleidae	0.0	0.7 ± 0.6	0.3 ± 0.5
Oligochaeta	12.7 ± 10.7	4.7 ± 2.5	4.0 ± 3.4
Pelecypoda: Sphaeridae	16.3 ± 18.2	18.7 ± 9.5	9.3 ± 10.6
Totals	38.0 ± 30.5	29.3 ± 13.6	19.8 ± 13.5

Table V

Bottom fauna populations expressed as mean numbers and standard deviations per $0.093m^2$ from an untreated stream

Mont Tremblant, Quebec, 29 April to 10 May, 1976

Number of days before or after treatment	-1	+3	+10
Water temperature	7°C	7°C	-
Number of samples	3	3	4
Ephemeroptera: Baetidae	0.0	0.3 ± 0.6	0.0
Odonata: Libellulidae	0.0	0.3 ± 0.6	0.3 ± 0.5
Plecoptera	3.7 ± 2.5	6.8 ± 6.4	4.3 ± 7.2
Trichoptera	0.0	0.3 ± 0.6	0.5 ± 0.6
Coleoptera: Elmidae	0.3 ± 0.6	0.0	0.0
Diptera: Simuliidae	0.7 ± 0.6	2.0 ± 1.0	2.3 ± 2.9
Chironomidae	2.3 ± 0.6	0.7 ± 1.2	1.3 ± 1.9
Heleidae	1.3 ± 0.6	0.0	0.0
Tabanidae	0.3 ± 0.6	0.0	0.0
Oligochaeta	1.0 ± 1.0	0.0	0.3 ± 0.5
Totals	9.7 ± 3.5	10.3 ± 5.1	8.8 ± 8.6

depth 30 cm) with a coarse gravel bottom but differed in that it was lined with alders (*Alnus sp.*) which completely closed the stream off from the sky.

The treated stream supported a large and diverse aquatic insect fauna which remained relatively stable throughout the treatment period (Table VI). Caddisfly larvae decreased then disappeared from the post-spray samples but numbers of this group also fluctuated considerably in the untreated control stram (Table VII). The decrease of caddisfly larvae in the treatment stream is believed to be due to their spotty distribution rather than a result of an effect of the fenitrothion treatment. The general stability of numbers of benthic organisms in both the treatment and control streams incicate that the insecticide had no significant effect on stream fauna.

Table VI

Bottom fauna populations expressed as mean numbers and standard deviations per 0.093m^2 sample from a fenitrothion treated (0.140 kg AI/ha) stream

Chandler, Quebec, 19 May to 26 May, 1976

Number of days before or after treatment	-1	+2	+6
Water temperature	-	7°C	11°C
Number of samples	4	4	4
Collembola	0.3 ± 0.5	0.0	0.8 ± 0.9
Ephemeroptera:Heptageniidae	36.5 ± 18.7	43.0 ± 6.5	54.5 ± 25.6
Baetidae	17.0 ± 8.4	17.0 ± 2.9	10.3 ± 5.1
Odonata:Gomphidae	0.0	0.0	1.0 ± 0.0
Plecoptera	3.0 ± 2.4	1.3 ± 0.9	2.5 ± 1.7
Trichoptera	3.0 ± 2.2	0.5 ± 0.6	0.0
Coleoptera:Elmidae	19.5 ± 17.9	14.3 ± 9.3	12.8 ± 8.4
Diptera:Tipulidae	1.0 ± 0.8	0.3 ± 0.5	0.3 ± 0.5
Culicidae	0.0	0.0	0.3 ± 0.5
Simuliidae	0.3 ± 0.5	0.0	0.0
Chironomidae	0.8 ± 0.5	1.0 ± 1.2	2.0 ± 1.2
Heleidae	0.3 ± 0.5	0.5 ± 0.6	0.0
Rhagionidae	1.3 ± 1.3	0.8 ± 0.9	0.5 ± 1.0
Tabanidae	0.3 ± 0.5	0.0	2.0 ± 2.2
Empididae	0.3 ± 0.5	0.0	0.0
Turbellaria	0.3 ± 0.5	0.0	0.0
Oligochaeta	20.8 ± 12.4	28.3 ± 5.7	29.0 ± 14.9
Gastropoda	0.0	0.0	0.5 ± 1.0
Totals	104.3 ± 55.3	106.8 ± 15.4	113.8 ± 42.5

Table VII

Bottom fauna populations expressed as mean numbers and standard deviations per 0.093m^2 sample from an untreated stream

Chandler, Quebec, 19 May to 26 May, 1976

Number of days before or after treatment	-1	+2	+6
Water temperature	5°C	5°C	7°C
Number of samples	4	4	4
Collembola	0.0	0.0	0.3 ± 0.5
Ephemeroptera:Heptageniidae	8.3 ± 3.4	6.3 ± 4.1	5.8 ± 3.3
Baetidae	6.0 ± 2.2	5.3 ± 4.9	8.3 ± 3.1
Plecoptera	5.0 ± 2.9	7.0 ± 11.5	10.3 ± 6.3
Megaloptera: Corydalidae	0.0	0.0	1.8 ± 2.4
Trichoptera	2.3 ± 1.3	4.5 ± 4.7	0.8 ± 0.9
Lepidoptera:Pyralidae	0.0	0.3 ± 0.5	0.0
Diptera:Tipulidae	0.5 ± 0.6	2.3 ± 3.3	0.0
Simuliidae	0.3 ± 0.5	1.5 ± 2.4	2.0 ± 1.6
Chironomidae	4.5 ± 3.7	3.3 ± 1.3	2.8 ± 1.7
Heleidae	0.0	0.3 ± 0.5	0.0
Rhagionidae	0.0	0.3 ± 0.5	0.0
Empididae	0.3 ± 0.5	0.5 ± 0.6	0.3 ± 0.5
Acari	0.5 ± 0.6	0.0	0.0
Nematoda	0.0	0.3 ± 0.5	0.0
Oligochaeta	0.5 ± 1.0	3.0 ± 3.4	1.0 ± 0.8
Totals	28.0 ± 6.2	32.0 ± 19.1	33.0 ± 17.8

Phosphamidon Treatments

Birds:

Few migratory species of small forest songbirds had returned to the experimental area at the time the first experimental application of phosphamidon was applied.

The ruby-crowned kinglet, *Regulus calendula* (L.), a small, mainly insectivorous species, was one of the first migrants to have returned and had set up breeding territories in the experimental area prior to the first application.

On 28 April, phosphamidon was applied to treatment plots 211-3 and 211-4 at the emitted dosage rate of 0.140 kg AI/ha. Plot 211-3 was to receive an additional application of the same dosage rate on 15 May. The daily population census data indicate that this early application did not affect bird populations on the plots (Fig. 5, Appendix Tables XIII to XV). Kinglet territories identified on the untreated check plot (Fig. 6) and the treatment plot 211-3 (Fig. 7) remained occupied throughout the census period. Several kinglets were recorded on treatment plot 211-4 prior to the application but breeding territories were not established until after the treatment on this plot (Fig. 8). Plot 211-3 received it's second treatment on 15 May. A decline in kinglet activity is recorded on both the treatment and untreated control plots (Appendix Tables XVI and XVII) but the territories defined on both plots remained occupied (Figs. 9 and 10).

On 3 May, treatment plots 211-1 and 211-2 received an application of phosphamidon at the emitted dosage rate of 0.280 kg AI/ha (2 consecutive applications of 0.140 kg AI/ha). Overall bird populations did not appear

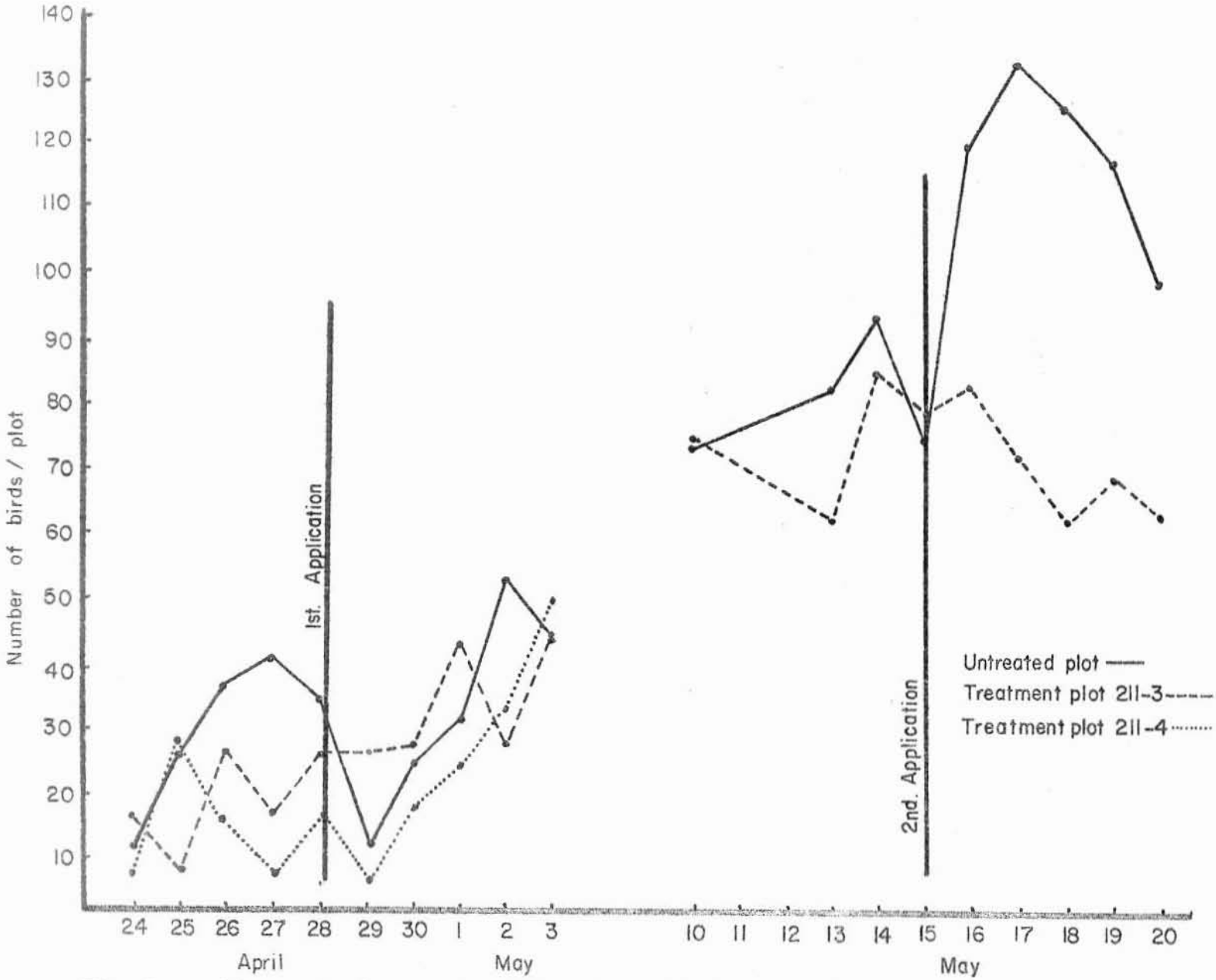

Fig. 5. Daily population trends of forest songbirds recorded on phosphamidon treated and untreated plots, La Tuque, Quebec, 1976.

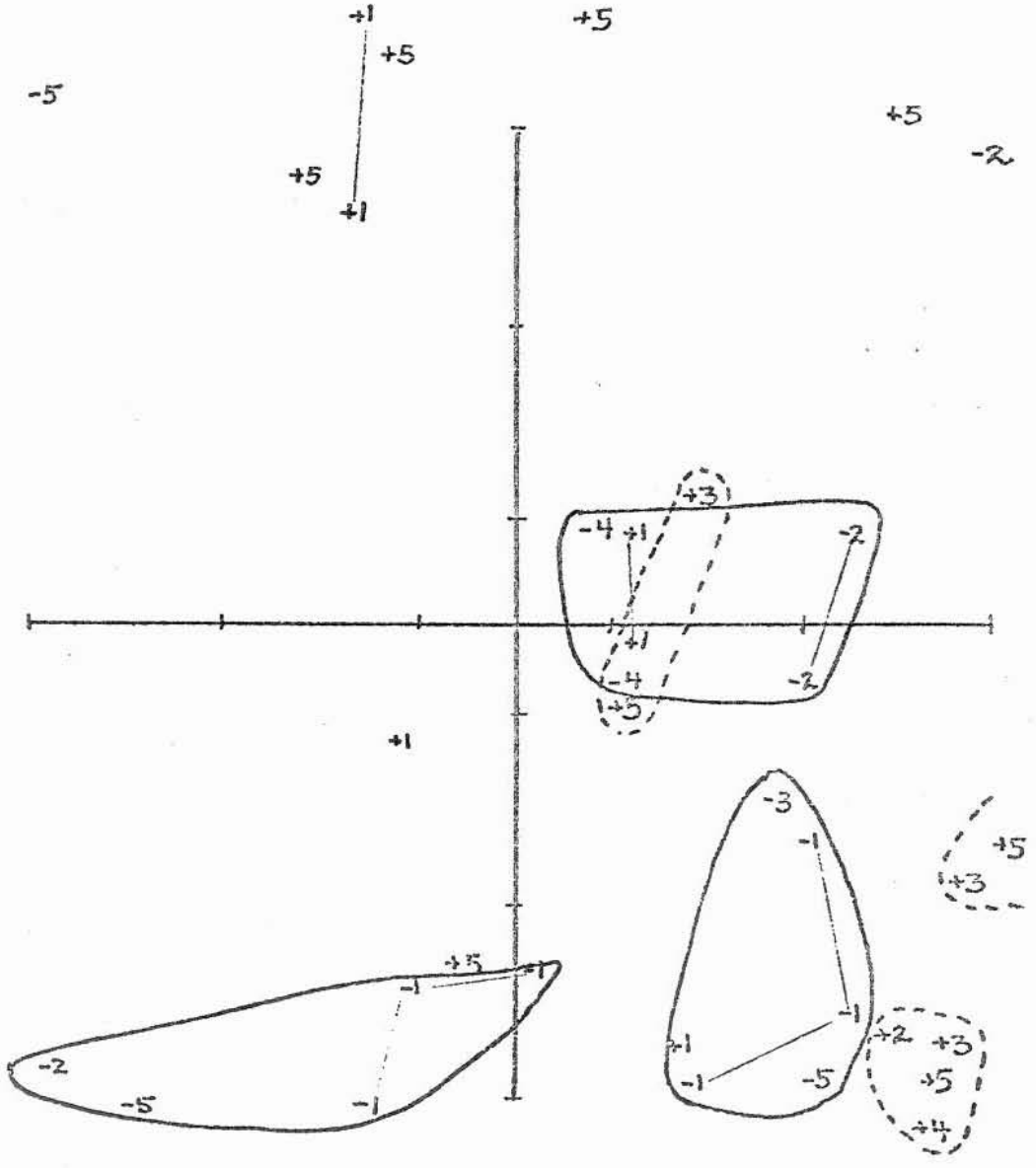

Fig. 6. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (Linnaeus) untreated control plot, LaTuque, Quebec, 1976.

——— Pre-spray territory

- - - - - - Post-spray territory

⟵——⟶ Scale = 2 chains (40 meters)

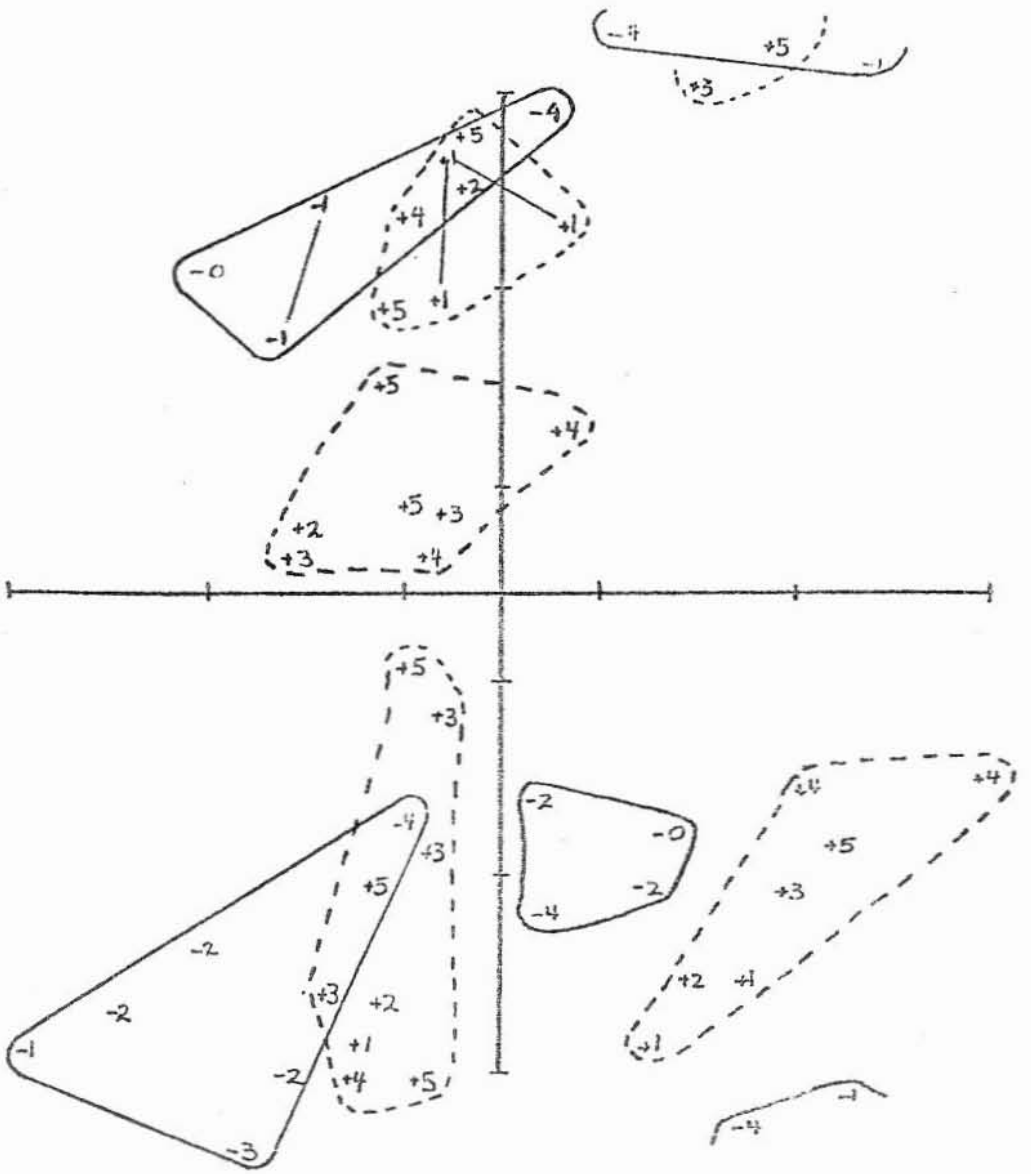

Fig. 7. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (Linnaeus) on plot 211-3, LaTuque, Quebec, 1976.

——— Pre-spray territory boundary

- - - - - Post-spray territory

⊢————⊣ Scale = 2 chains (40 meters)

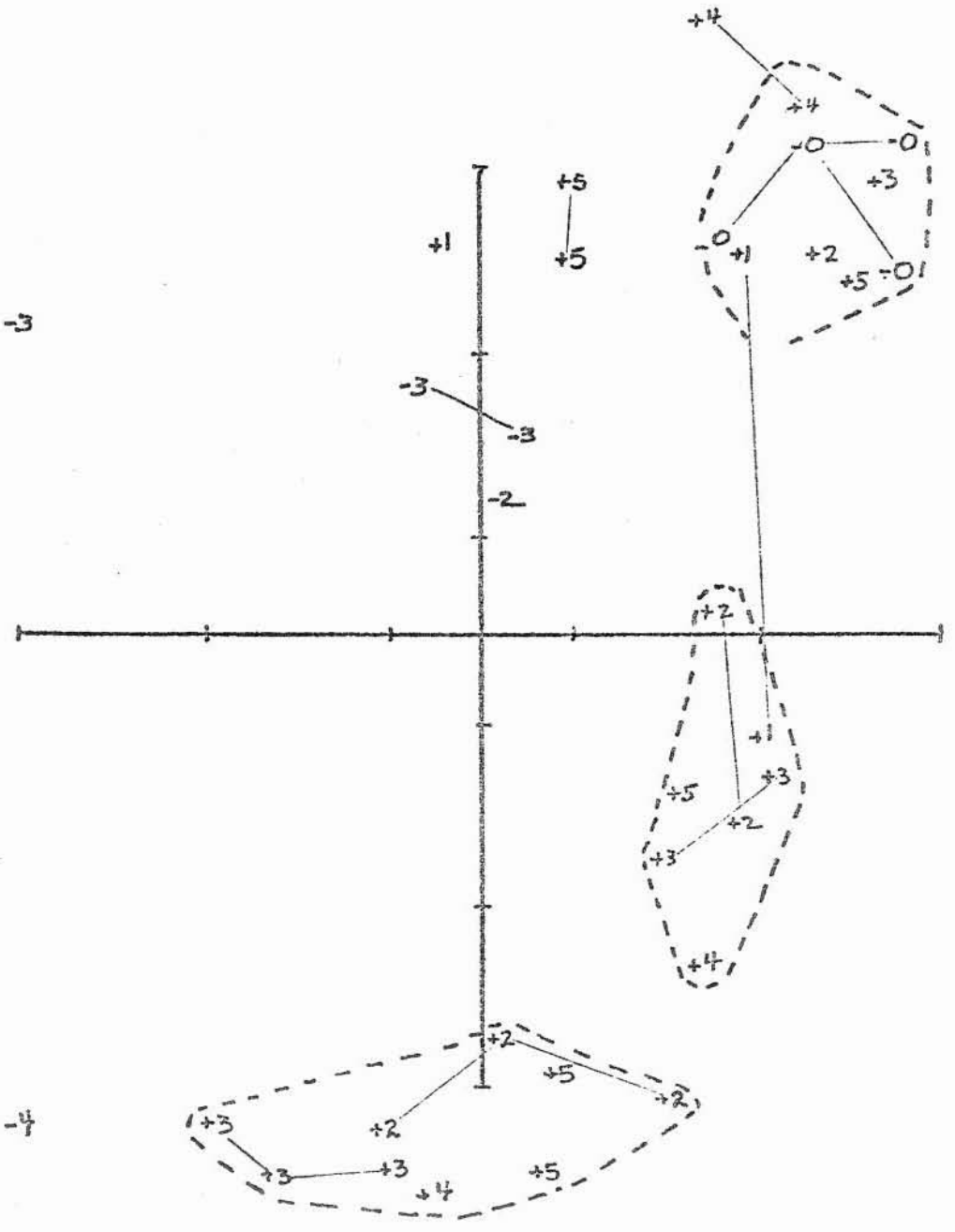

Fig. 8. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (Linnaeus) on plot 211-4, LaTuque, Quebec, 1976.

——— Pre-spray territory

– – – – Post-spray territory

|——————| Scale = 2 chains (40 meters)

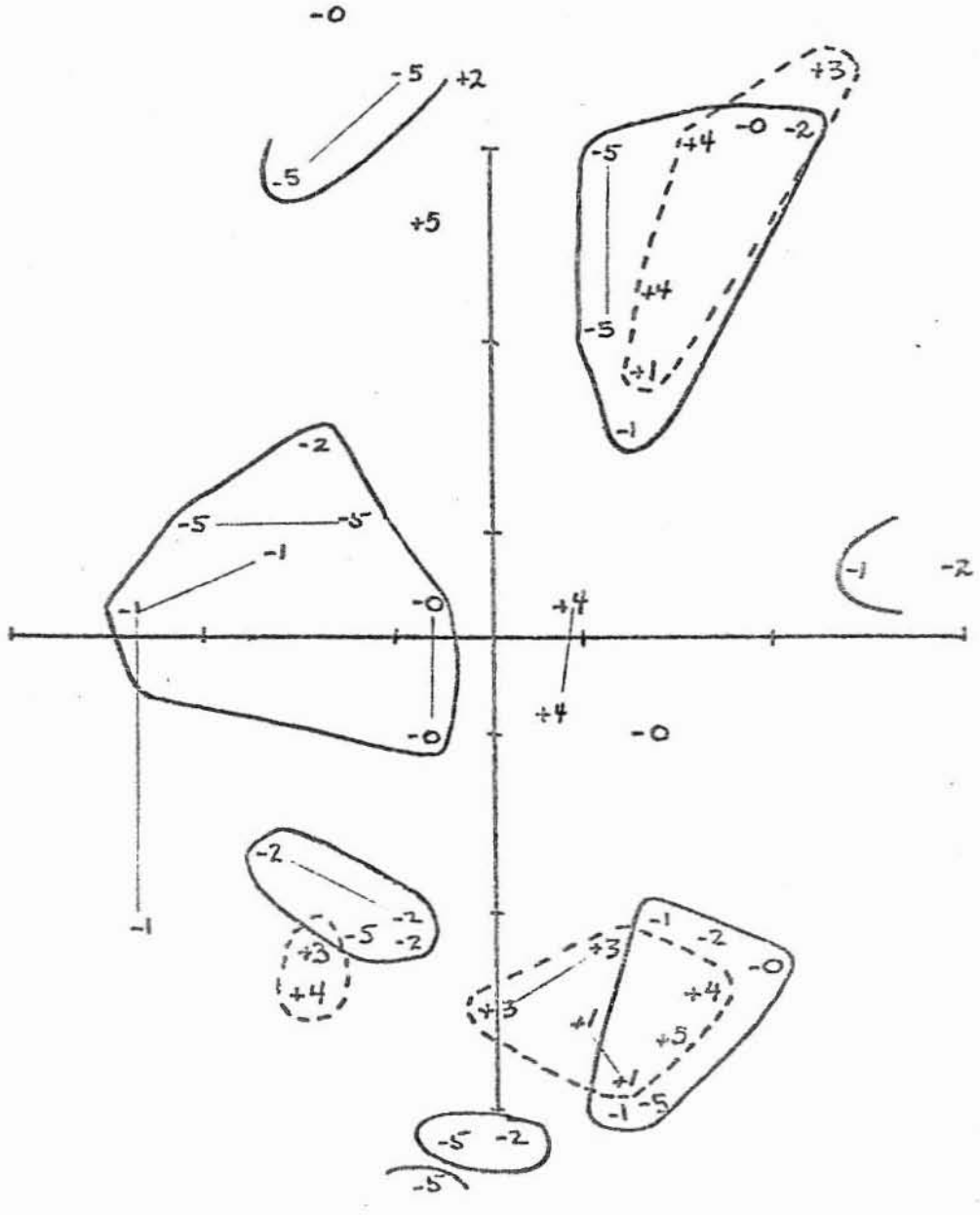

Fig. 9. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (Lennaeus) on untreated check plot (2nd application) LaTuque, Quebec, 1976

_____ Pre-spray territory

\- - - - - Post-spray territory

|——————| Scale = 2 chains (40 meters)

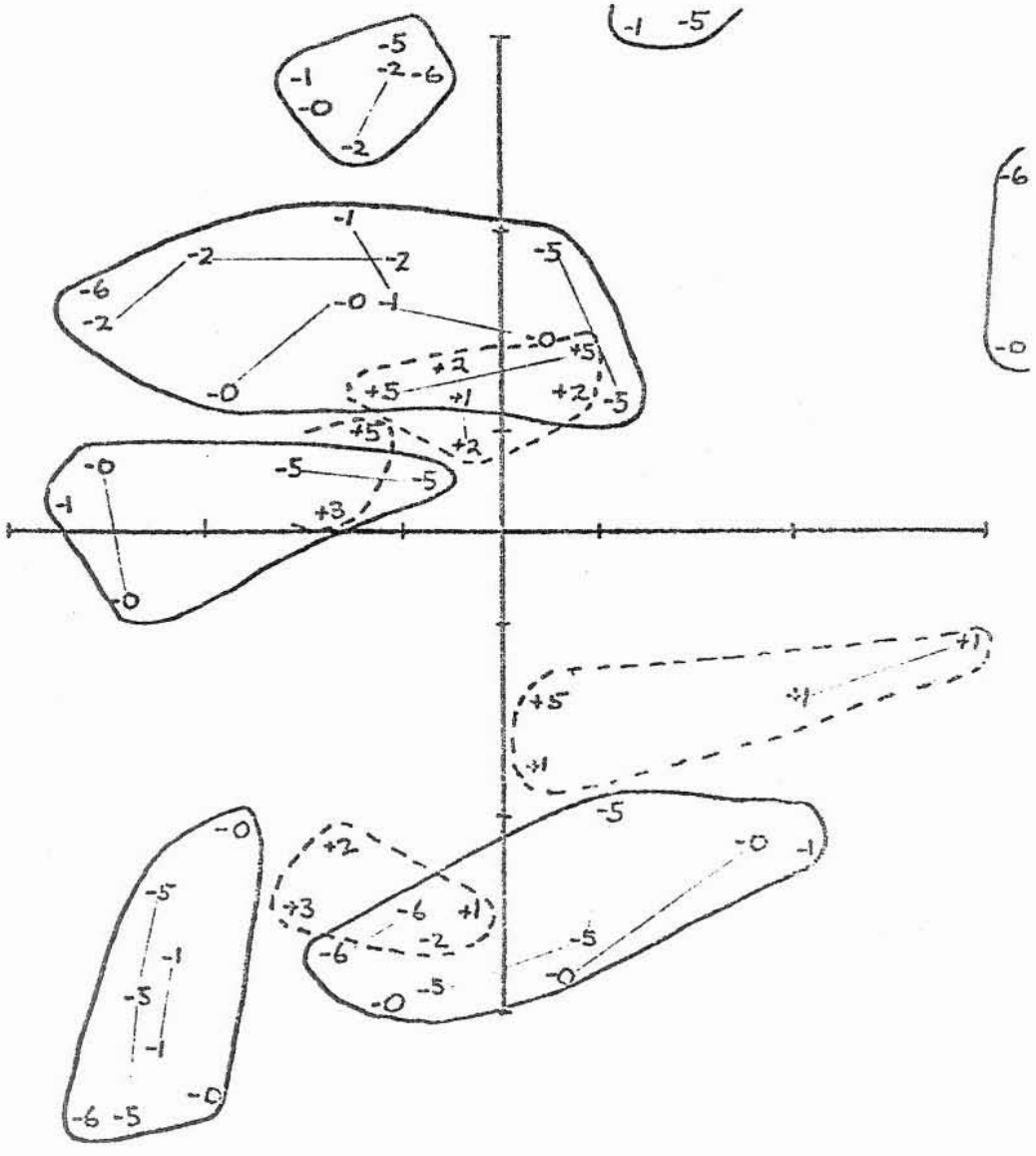

Fig. 10. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (L) plot 211-3 (2nd treatment), La Tuque, Quebec, 1976.

——— Pre-spray territory boundary

- - - - - Post-spray territory boundary

⟷ Scale=2 chains (40 meters)

to have been harmed (Fig. 11, Appendix Tables XVIII to XX). Examination of the breeding territories of *R. calendula* L. revealed that the kinglets inhabitating plot 211-1 were not affected by the treatment as territories remained occupied (Fig. 12), while those on plot 211-2 were vacant immediately after the treatment and remained so throughout the post treatment census period (Fig. 13).

On 16 and 17 June, approximately one month after the last application, avian populations were resurveyed on phosphamidon plots 211-2, 211-3, 211-4 and on the untreated check plot (Tables VII to XI). Populations of *R. calendula* (L.) had decreased on all 4 plots. Population decreases of approximately 50% were recorded on plots 211-3 and 211-4 while those on the untreated control plot decreased from 6.6 pairs per 4 hectares to 1.1 pairs (83%). Populations on treatment plot 211-2, which had suffered a severe reduction following the application of phosphamidon at 0.280 kg AI/ha, had recovered to approximately the same kinglet density as the other plots.

Aquatic fauna, 0.280 kg AI/ha:

Bottom fauna samples were collected from a small alder lined stream (2 m wide, 30 cm deep) flowing through an open meadow within the block treated with 0.280 kg phosphamidon/ha on 30 May 1976. The stream flowed over a varied bottom of sand, gravel and rocks. The untreated control stream also flowed through a meadow and was similar in most respects but slightly wider (3 m) and slower flowing.

Total numbers of benthic organisms in both the untreated and treated streams increased substantially over the sampling period (Tables XIII and IX). Benthic populations in the treated stream increased to

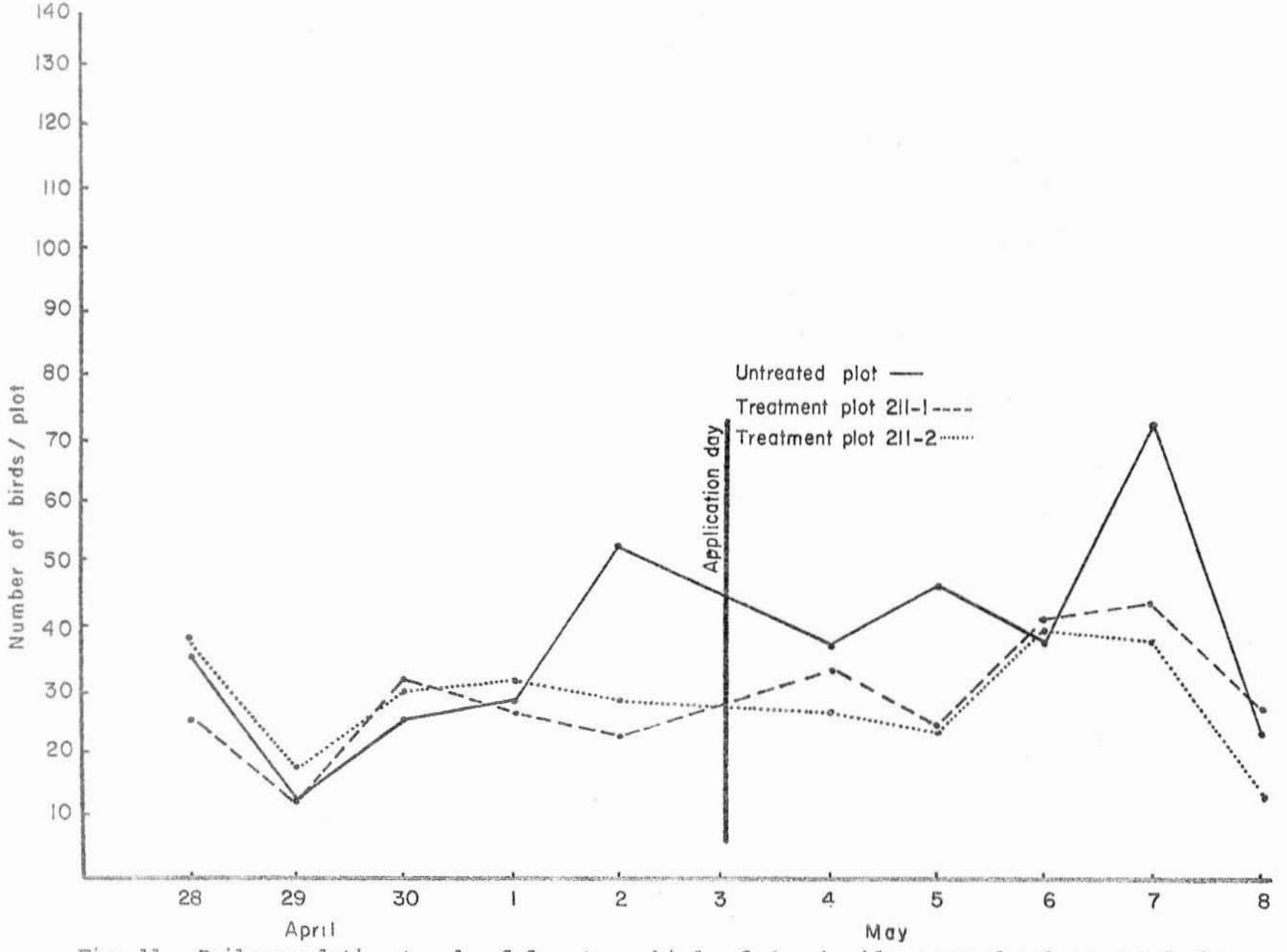

Fig. 11. Daily population trends of forest songbirds of phosphamidon treated and untreated plots, La Tuque, Quebec, 1976.

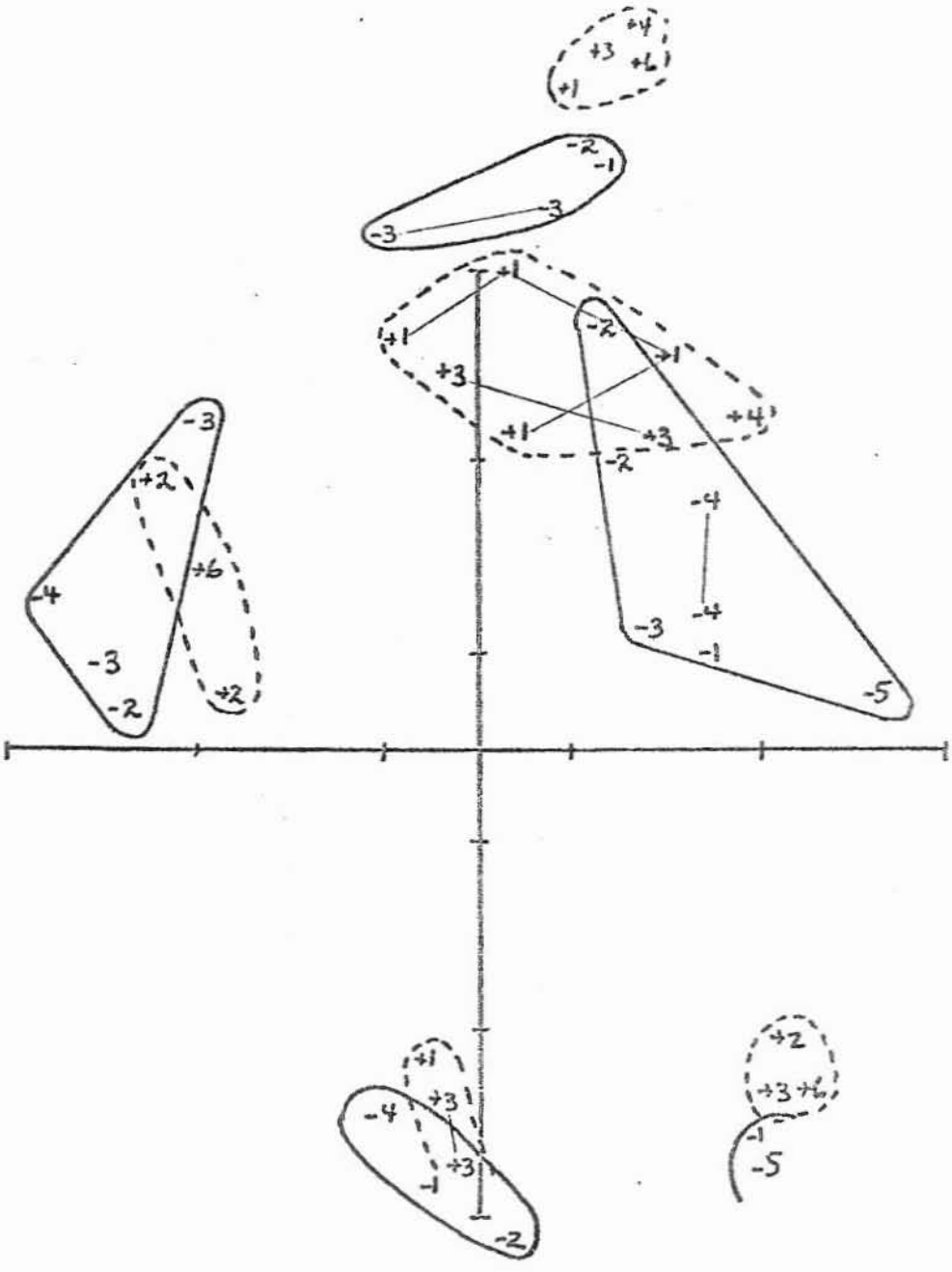

Fig. 12. Pre and post spray territories of the ruby-crowned kinglet, *R. calendula* (Linnaeus) on plot 211-1, LaTuque, Quebec, 1976

——— Pre-spray territory

------ Post-spray territory

Scale = 2 chains (40 meters)

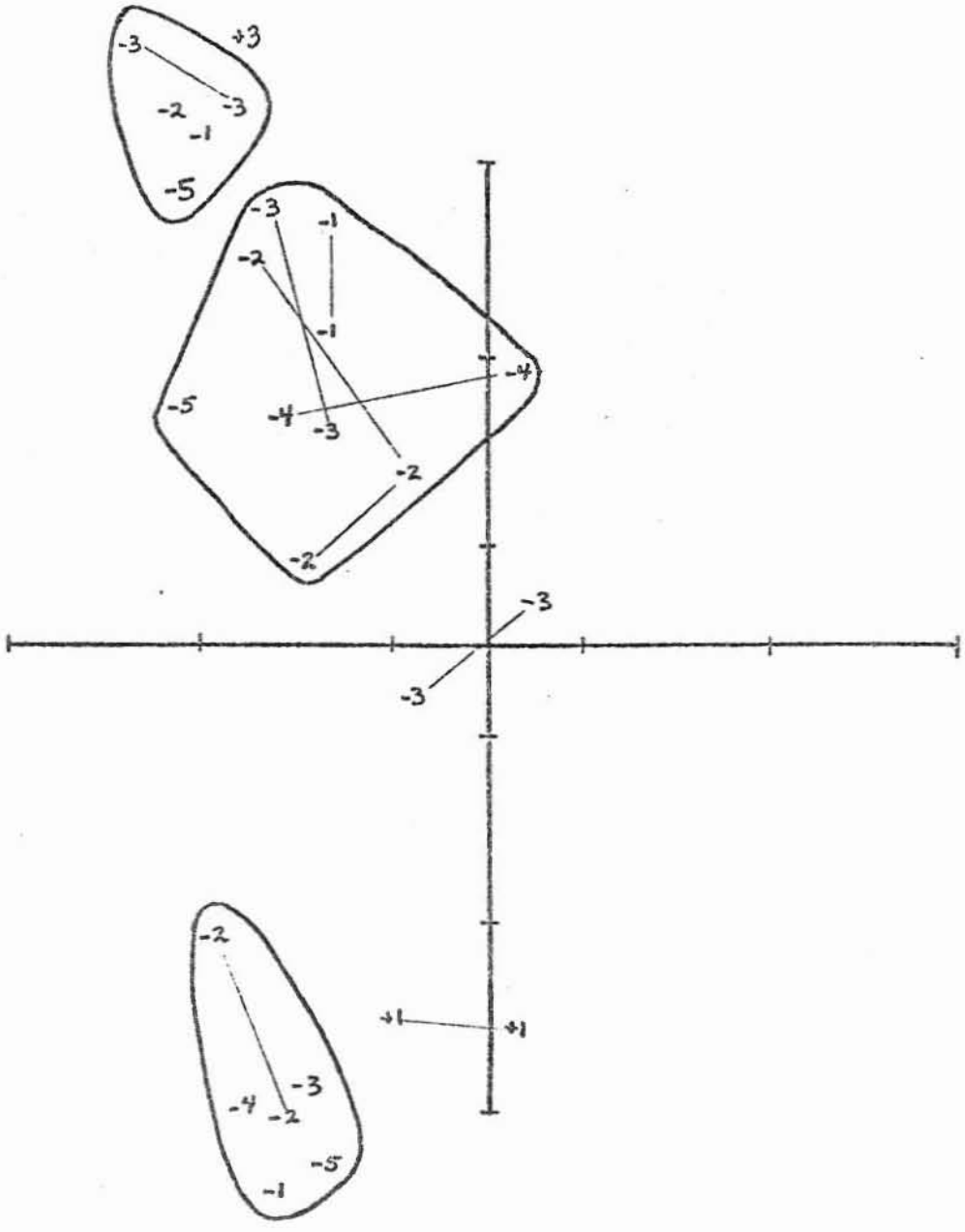

Fig. 13. Pre and post spray territory of the ruby-crowned kinglet, *R. calendula* (Lennaeus) on plot 211-2, LaTuque, Quebec, 1976

——— Pre-spray territory

- - - - - Post-spray territory

Scale = 2 chains (40 meters)

Table VIII

Bottom fauna populations expressed as mean numbers and standard deviations per $0.093m^2$ from a phosphamidon treated stream (0.280 kg AI/ha)

La Tuque, Quebec, 26 April to 6 May, 1976

Number of days before or after treatment	-7	+3
Water temperature	2.5°C	4°C
Number of samples	4	4
Collembola	0.0	0.3 ± 0.5
Ephemeroptera: Heptageniidae	5.0 ± 4.7	24.3 ± 29.9
Baetidae	8.8 ± 8.6	20.5 ± 14.9
Plecoptera	7.3 ± 4.6	13.0 ± 7.7
Trichoptera	9.5 ± 6.2	12.0 ± 13.1
Coleoptera:Hydrophilidae	0.3 ± 0.5	0.3 ± 0.5
Elmidae	0.3 ± 0.5	3.3 ± 6.5
Diptera:Tipulidae	1.0 ± 0.0	3.0 ± 2.6
Simuliidae	2.5 ± 1.3	5.8 ± 3.3
Chironomidae	2.3 ± 3.2	15.3 ± 13.4
Heleidae	0.0	0.8 ± 0.9
Oligochaeta	0.3 ± 0.5	1.3 ± 1.3
Totals	37.0 ± 23.6	99.5 ± 70.5

Table IX

Bottom fauna populations expressed as mean numbers and standard deviations per 0.093m^2 from an untreated stream

La Tuque, Quebec, 26 April to 6 May, 1976

Number of days before or after treatment	-7	+3
Water temperature	3°C	5.5°C
Number of samples	4	4
Ephemeroptera:Heptageniidae	2.3 ± 1.3	9.5 ± 2.5
Baetidae	6.5 ± 6.4	6.8 ± 5.6
Plecoptera	3.8 ± 5.7	6.0 ± 3.5
Trichoptera	2.8 ± 2.5	5.5 ± 5.7
Diptera:Tipulidae	0.8 ± 1.5	0.3 ± 0.5
Simuliidae	1.0 ± 2.0	5.3 ± 6.2
Chironomidae	3.5 ± 2.9	8.0 ± 7.2
Heleidae	0.0	0.5 ± 1.0
Oligochaeta	0.0	0.8 ± 0.9
Totals	21.5 ± 19.1	42.5 ± 19.8

a greater extent than those in the untreated control stream, demonstrating that no impact had occurred on aquatic invertebrates. The probable reason for this increase in populations occurring in both streams was warming of the stream water with subsequent increased aqatic insect activity.

Aquatic fauna, 0.140 kg AI/ha x 2:

A fast flowing, fairly large (3-5 m wide, 60 cm mean depth) alder lined stream was sampled over the period it was exposed to two applications of 0.140 kg phosphamidon/ha. Samples were taken from a gravel and rock bottom containing moderate amounts of organic debris. The untreated control stream sampled for the 0.280 kg phosphamidon/ha trial also served as a control for this stream by extending the period over which it was sampled.

Large increases in the total numbers of aquatic invertebrates were found in both the treated and untreated control streams over the study period (Tables X and XI). The treated stream showed greater increases than the untreated control stream and there are no indications of pesticide impact.

Table X

Bottom fauna populations expressed as mean numbers and standard deviations per $0.093m^2$ from a phosphamidon treated stream (2 X 0.140kg AI ha)
La Tuque, Quebec, 25 April to 18 May, 1976

Number of days before or after treatment	-3	+3	+16 (-1 second application)	+20 (+3 second application)
Water temperature	3°C	3°C	4°C	5°C
Number of samples	4	4	4	4
Ephemeroptera: Heptageniidae	0.8 ± 0.9	0.5 ± 0.6	3.3 ± 3.6	1.8 ± 1.3
Baetidae	0.5 ± 0.6	7.5 ± 3.8	17.8 ± 4.9	45.3 ±21.6
Odonata: Gomphidae	0.0	0.0	0.0	1.5 ± 3.0
Libellulidae	0.0	0.0	0.3 ± 0.5	0.0
Plecoptera	1.5 ± 1.3	2.8 ± 1.7	4.8 ± 6.9	3.0 ± 1.4
Trichoptera	4.8 ± 3.7	4.0 ± 6.1	7.8 ± 6.1	59.5 ±17.7
Lepidoptera: Pyralidae	0.3 ± 0.5	0.3 ± 0.5	0.0	0.0
Coleoptera: Dytiscidae	0.0	0.3 ± 0.5	0.0	0.0
Hydrophilidae	0.0	0.5 ± 0.6	0.0	0.0
Elmidae	0.3 ± 0.5	0.3 ± 0.5	0.0	9.8 ±18.2
Diptera: Tipulidae	0.0	0.8 ± 0.9	0.3 ± 0.5	3.5 ± 3.7
Simuliidae	5.0 ± 1.4	13.3 ±14.9	2.3 ± 1.7	18.8 ± 9.3
Chironomidae	0.5 ± 1.0	3.3 ± 1.7	2.5 ± 1.7	8.0 ±10.9
Heleidae	0.0	0.0	0.0	0.3 ± 0.5
Rhagionidae	0.0	0.5 ± 0.6	0.0	1.8 ± 2.9
Tabanidae	0.3 ± 0.5	0.3 ± 0.5	0.0	0.8 ± 0.9
Empididae	0.0	0.0	0.0	0.5 ± 0.6
Acari	0.0	0.3 ± 0.5	0.0	0.0
Turbellaria	0.0	0.0	0.0	5.0 ± 9.3
Nematoda	0.3 ± 0.5	0.8 ± 1.5	0.0	0.0
Oligochaeta	0.5 ± 0.6	1.0 ± 1.2	0.0	0.0
Totals	14.5 ± 5.7	36.0 ±24.5	36.3 ±10.2	159.3 ±74.8

Table XI

Bottom fauna populations expressed as mean numbers and standard deviations per $0.093m^2$ from an untreated stream

La Tuque, Quebec, 26 April to 18 May, 1976

Number of days before or after treatment	-2	+8	+16 (-1 second application)	+20 (+3 second application)
Water temperature	3°C	5.5°C	5°C	7°C
Number of samples	4	4	4	4
Ephemeroptera: Heptageniidae	2.3 ± 1.2	9.5 ± 2.5	6.8 ± 4.7	12.0 ± 10.8
Baetidae	6.5 ± 6.4	6.8 ± 5.6	25.3 ±17.1	23.3 ± 7.4
Plecoptera	3.8 ± 5.7	6.0 ± 3.5	13.0 ± 9.8	15.5 ± 9.1
Trichoptera	2.8 ± 2.5	5.5 ± 5.7	6.3 ± 4.2	6.3 ± 1.9
Coleoptera: Elmidae	0.0	0.0	0.5 ± 1.0	0.8 ± 0.9
Diptera: Tipulidae	0.8 ± 1.5	0.3 ± 0.5	0.3 ± 0.5	0.5 ± 1.0
Simuliidae	1.0 ± 2.0	5.3 ± 6.2	4.3 ± 2.7	4.3 ± 4.2
Chironomidae	4.5 ± 2.9	8.0 ± 7.2	13.3 ±12.5	13.5 ± 6.5
Heleidae	0.0	0.5 ± 1.0	0.0	0.0
Dolichopodidae	0.0	0.0	0.8 ± 0.9	0.8 ± 1.5
Oligochaeta	0.0	0.8 ± 0.9	1.8 ± 2.2	0.5 ± 0.6
Totals	21.5 ±19.1	42.5 ±19.8	72.0 ±29.3	77.3 ± 28.9

Table VII

Forest bird population census
Fenitrothion treatment plot 402 (1st application)
Chandler, Quebec
May 17-25, 1976

Family	Species	Pre-spray days					Post-spray days					
		May 17	May 18	May 19	May 20	Daily	May 21	May 22	May 23	May 24	May 25	Daily
		-3	-2	-1	-0	ave	+1	+2	+3	+4	+5	ave
Tetraonidae	Ruffed Grouse	1	0	0	0	0.3	0	1	0	0	0	0.2
Corvidae	Blue Jay	1	0	0	0	0.3	0	0	0	1	1	0.4
Paridae	Black-capped Chickadee	0	1	0	0	0.3	0	0	0	0	0	0.0
	Boreal Chickadee	0	2	1	2	1.3	2	1	0	0	0	0.6
Sittidae	White-breasted Nuthatch	0	1	0	0	0.3	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	0	0	0	0.0	0	3	0	0	0	0.6
Turdidae	American Robin	5	9	2	5	5.3	3	4	1	4	5	3.4
	Hermit Thrush	0	1	0	0	0.3	0	0	0	0	2	0.4
Sylviidae	Ruby-crowned Kinglet	0	3	0	1	1.0	0	1	0	2	0	0.6
Parulidae	Nashville Warbler	0	0	0	0	0.0	0	0	1	1	0	0.4
	Myrtle Warbler	0	0	1	0	0.3	0	0	0	0	0	0.0
	Ovenbird	0	3	2	1	1.5	0	6	3	9	7	5.0
	Northern Waterthrush	0	0	0	0	0.0	0	0	0	1	1	0.4
Icteridae	Red-winged Blackbird	0	1	0	0	0.3	0	0	0	2	0	0.4
	Common Grackle	0	0	0	0	0.0	0	0	3	0	2	1.0
	Brown-headed Cowbird	0	0	0	0	0.0	0	0	1	3	11	3.0

Table VII Cont'd

Family	Species	Pre-spray days					Post-spray days					
		May 17 -3	May 18 -2	May 19 -1	May 20 -0	Daily ave	May 21 +1	May 22 +2	May 23 +3	May 24 +4	May 25 +5	Daily ave
Fringillidae	Evening Grosbeak	0	0	0	0	0.0	0	1	0	0	0	0.2
	Purple Finch	2	1	0	0	0.8	0	0	0	1	1	0.4
	Pine Grosbeak	4	0	0	0	1.0	0	0	0	0	0	0.0
	Dark-eyed Junco	2	0	0	0	0.5	0	0	0	0	1	0.2
	White-throated Sparrow	1	2	1	3	1.8	5	10	4	13	5	7.4
	Fox Sparrow	0	1	1	2	1.0	1	0	1	2	2	1.2
Totals:		16	25	8	14	15.8	11	27	14	39	38	25.8

Table VIII

Forest bird population census
Fenitrothion untreated check plot (1st application, 402)
Chandler, Quebec
May 17-25, 1976

Family	Species	Pre-spray days					Post-spray days					
		May 17	May 18	May 19	May 20	Daily ave	May 21	May 22	May 23	May 24	May 25	Daily ave
		-3	-2	-1	-0		+1	+2	+3	+4	+5	
Trochilidae	Ruby-throated Hummingbird	0	1	0	0	0.3	0	0	1	0	0	0.2
Picidae	Common Flicker	0	0	0	1	0.3	0	0	0	0	0	0.0
	Yellow-bellied Sapsucker	0	0	2	0	0.5	0	1	0	0	0	0.2
Corvidae	Blue Jay	0	0	0	0	0.0	0	0	0	0	2	0.4
Paridae	Black-capped Chickadee	1	0	0	0	0.3	0	0	0	0	2	0.4
	Boreal Chickadee	0	6	0	0	1.5	0	0	0	0	0	0.0
Turdidae	American Robin	5	10	6	8	7.3	6	5	4	4	3	4.4
	Veery	0	0	0	0	0.0	0	0	0	0	1	0.2
Sylviidae	Ruby-crowned Kinglet	4	7	3	2	4.0	3	2	3	1	2	2.2
Vireonidae	Solitary Vireo	1	0	0	0	0.3	0	0	0	0	0	0.0
Parulidae	Nashville Warbler	0	0	0	0	0.0	0	1	0	1	1	0.6
	Black-throated Blue Warbler	0	0	0	0	0.0	0	0	1	0	0	0.2
	Myrtle Warbler	0	2	1	3	1.5	1	1	1	0	0	0.6
	Ovenbird	0	0	1	0	0.3	0	0	0	0	0	0.0
	Northern Waterthrush	0	0	0	0	0.0	1	0	0	1	0	0.4
Icteridae	Common Grackle	0	1	0	0	0.3	1	0	0	0	0	0.2
	Brown-headed Cowbird	0	1	1	0	0.5	0	1	0	1	3	1.0

Table VIII Cont'd

Family	Species	Pre-spray days					Post-spray days					
		May 17 -3	May 18 -2	May 19 -1	May 20 -0	Daily ave	May 21 +1	May 22 +2	May 23 +3	May 24 +4	May 25 +5	Daily ave
Fringillidae	Evening Grosbeak	0	0	0	1	0.3	0	0	0	0	0	0.0
	Purple Finch	0	7	0	0	1.8	0	2	0	8	5	3.0
	Dark-eyed Junco	0	0	2	0	0.5	0	0	0	0	1	0.2
	White-throated Sparrow	6	13	6	13	9.5	7	4	9	9	5	6.8
	Fox Sparrow	0	1	1	1	0.8	1	2	2	0	1	1.2
Totals:		17	49	23	29	29.5	20	19	21	25	26	22.2

Table IX

Forest bird population census
Fenitrothion treatment plot 401 (2nd application)
Chandler, Quebec
June 9-19, 1976

Family	Species	Pre-spray days						Post-spray days					
		June 9 -5	June 10 -4	June 11 -3	June 12 -2	June 13 -1	Daily ave	June 15 +1	June 16 +2	June 17 +3	June 18 +4	June 19 +5	Daily ave
Trochilidae	Ruby-throated Hummingbird	0	0	0	0	0	0.0	0	0	0	1	0	0.2
Alcedinidae	Belted Kingfisher	0	0	0	0	0	0.0	0	1	0	0	0	0.2
Tyrannidae	Least Flycatcher	0	1	0	0	0	0.2	1	0	4	2	0	1.4
	Olive-sided Flycatcher	0	0	0	1	1	0.4	1	0	0	1	0	0.4
Hirundinidae	Tree Swallow	3	7	0	0	0	2.0	0	0	0	0	0	0.0
Corvidae	Blue Jay	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Paridae	Black-capped Chickadee	0	1	0	0	0	0.2	0	1	2	0	0	0.6
	Boreal Chickadee	0	1	0	0	0	0.2	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	1	0	0	1	1	0.6	0	1	3	1	0	1.0
Turdidae	American Robin	4	4	3	4	3	3.6	4	7	3	4	6	4.8
	Swainson's Thrush	2	0	0	1	0	0.6	4	5	8	5	4	5.2
	Veery	0	0	0	0	0	0.0	0	1	0	1	1	0.6
Sylviidae	Ruby-crowned Kinglet	5	0	1	2	3	2.2	2	7	4	8	3	4.8
Vireonidae	Red-eyed Vireo	3	3	0	4	1	2.2	2	1	0	1	0	0.8
	Philadelphia Vireo	1	0	0	0	0	0.2	0	4	0	0	0	0.8

Table IX Cont'd

Family	Species	Pre-spray days						Post-spray days					
		June 9 -5	June 10 -4	June 11 -3	June 12 -2	June 13 -1	Daily ave	June 15 +1	June 16 +2	June 17 +3	June 18 +4	June 19 +5	Daily ave
Parulidae	Black and White Warbler	0	1	0	0	0	0.2	0	0	0	0	0	0.0
	Tennessee Warbler	2	1	0	1	2	1.2	0	0	0	1	0	0.2
	Nashville Warbler	0	1	0	1	0	0.4	0	1	1	0	1	0.6
	Magnolia Warbler	2	1	0	3	3	1.8	2	3	4	4	4	3.4
	Black-throated Green Warbler	3	2	2	5	3	3.0	3	1	2	2	0	1.6
	Blackpoll Warbler	4	2	0	5	3	2.8	4	9	7	5	3	5.6
	Ovenbird	1	0	0	0	0	0.2	0	1	0	0	0	0.2
	Northern Waterthrush	1	0	0	0	0	0.2	0	1	0	0	0	0.2
	Yellowthroat	1	0	0	0	1	0.4	0	1	3	0	0	0.8
	Wilson's Warbler	0	0	0	3	1	0.8	0	0	0	0	0	0.0
	Canada Warbler	2	0	0	0	0	0.4	0	5	0	0	0	1.0
	American Redstart	5	3	2	9	10	5.8	7	6	13	12	11	9.8
Icteridae	Common Grackle	0	0	0	0	0	0.0	0	0	0	1	0	0.2
	Brown-headed Cowbird	0	0	0	3	1	0.8	0	1	0	0	0	0.2
Fringillidae	Rose-breasted Grosbeak	0	0	0	0	0	0.0	0	1	2	0	0	0.6
	Evening Grosbeak	0	0	0	0	0	0.0	1	0	0	0	0	0.2

Table IX Cont'd

Family	Species	Pre-spray days						Post-spray days					
		June 9 -5	June 10 -4	June 11 -3	June 12 -2	June 13 -1	Daily ave	June 15 +1	June 16 +2	June 17 +3	June 18 +4	June 19 +5	Daily ave
Fringillidae	Purple Finch	0	0	0	3	0	0.6	1	1	2	0	0	0.8
	Pine Grosbeak	0	2	0	0	0	0.4	0	0	0	1	0	0.2
	Pine Siskin	4	4	0	3	0	2.2	0	1	0	0	0	0.2
	American Goldfinch	7	4	0	4	3	3.6	10	4	2	0	4	4.0
	Dark-eyed Junco	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	White-throated Sparrow	4	4	3	5	7	4.6	1	7	4	2	5	3.6
Totals:		57	42	11	58	44	42.4	43	71	64	52	42	54.4

Table X

Forest bird population census
Fenitrothion untreated check plot (2nd application, 401)
Chandler, Quebec
June 9-19, 1976

Family	Species	Pre-spray days						Post-spray days					
		June 9	June 10	June 11	June 12	June 13	Daily	June 15	June 16	June 17	June 18	June 19	Daily
		-5	-4	-3	-2	-1	ave	+1	+2	+3	+4	+5	ave
Scolopacidae	American Woodcock	0	0	0	0	0	0.0	3	0	0	0	0	0.6
Picidae	Common Flicker	1	0	0	0	0	0.2	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	0	0	0	1	0	0.2	0	0	0	0	1	0.2
	Least Flycatcher	1	0	2	4	1	1.6	1	3	5	4	5	3.6
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	0	0	1	0.2
Paridae	Black-capped Chickadee	2	0	0	0	0	0.4	0	0	0	0	0	0.0
	Boreal Chickadee	0	0	0	0	0	0.0	0	2	0	0	0	0.4
Turdidae	American Robin	2	4	4	3	3	3.2	3	2	5	7	6	4.6
	Hermit Thrush	2	0	0	0	0	0.4	0	0	0	0	0	0.0
	Swainson's Thrush	0	0	1	2	1	0.8	2	1	3	4	6	2.8
	Veery	2	0	0	0	0	0.4	2	0	0	0	2	0.8
Sylviidae	Ruby-crowned Kinglet	4	3	5	5	4	4.2	1	4	2	2	4	2.6
Vireonidae	Red-eyed Vireo	0	0	0	0	2	0.4	0	2	2	1	0	1.0
Parulidae	Black-and-White Warbler	0	0	1	0	0	0.2	0	0	0	0	0	0.0
	Magnolia Warbler	3	1	1	2	1	1.6	0	2	2	4	3	2.2
	Black-throated Green Warbler	4	1	1	3	4	2.6	3	3	3	6	5	4.0

Table X Cont'd

Family	Species	Pre-spray days						Post-spray days					
		June 9 -5	June 10 -4	June 11 -3	June 12 -2	June 13 -1	Daily ave	June 15 +1	June 16 +2	June 17 +3	June 18 +4	June 19 +5	Daily ave
Parulidae cont'd	Blackpoll Warbler	5	3	4	3	2	3.4	4	6	5	1	1	3.4
	Ovenbird	3	1	1	3	3	2.2	0	2	2	2	3	1.8
	Canada Warbler	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	American Redstart	3	1	4	5	2	3.0	3	5	4	5	5	4.4
Icteridae	Brown-headed Cowbird	9	0	0	5	0	2.8	4	0	1	2	3	2.0
Fringillidae	Rose-breasted Grosbeak	0	0	1	1	0	0.4	0	0	0	0	0	0.0
	Evening Grosbeak	0	0	0	0	0	0.0	0	0	0	0	1	0.2
	Purple Finch	3	0	0	4	0	1.4	0	0	0	0	0	0.0
	Pine Grosbeak	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Pine Siskin	3	0	0	5	4	2.4	0	0	2	1	0	0.6
	American Goldfinch	5	0	5	5	0	3.0	1	5	5	0	0	2.2
	White-throated Sparrow	2	0	1	2	5	2.0	0	1	2	4	2	1.8
	Fox Sparrow	2	0	0	0	1	0.6	2	4	2	2	2	2.4
	Song Sparrow	0	0	0	0	0	0.0	0	0	1	0	0	0.2
Totals:		57	14	31	53	33	37.6	29	42	45	43	50	41.8

Table XI

Forest bird population census
Fenitrothion treatment plot 402 (2nd application)
Chandler, Quebec
June 11-21, 1976

Family	Species	Pre-spray days						Post-spray days					
		June 11	June 12	June 13	June 14	June 15	Daily ave	June 17	June 18	June 19	June 20	June 21	Daily ave
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Tetraonidae	Ruffed Grouse	0	0	1	0	0	0.2	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	1	1	0	0	0	0.4	1	0	3	2	1	1.4
	Least Flycatcher	0	3	0	0	1	0.8	1	1	0	0	0	0.4
Hirundinidae	Tree Swallow	0	0	0	6	0	1.2	1	0	0	0	0	0.2
Corvidae	Blue Jay	0	0	0	0	1	0.2	1	0	0	1	1	0.6
Paridae	Black-capped Chickadee	2	1	3	1	3	2.0	1	1	0	0	0	0.4
	Boreal Chickadee	0	1	1	0	0	0.4	0	0	0	1	0	0.2
Sittidae	White-breasted Nuthatch	0	1	0	0	0	0.2	0	0	0	0	0	0.0
Troglodytidae	Winter Wren	0	2	1	0	1	0.8	1	0	1	0	0	0.4
Turdidae	American Robin	3	3	4	4	5	3.8	7	6	10	14	9	9.2
	Hermit Thrush	0	1	0	0	0	0.2	0	0	1	3	0	0.8
	Swainson's Thrush	0	2	1	5	5	2.6	5	5	4	6	5	5.0
	Veery	1	2	0	3	2	1.6	3	3	0	3	0	1.8
Sylviidae	Ruby-crowned Kinglet	4	1	2	5	0	2.4	0	3	1	4	2	2.0
Vireonidae	Red-eyed Vireo	0	0	1	0	0	0.2	1	0	2	1	1	1.0
Parulidae	Black and White Warbler	0	0	0	0	2	0.4	0	0	0	0	0	0.0
	Tennessee Warbler	0	0	0	1	0	0.2	0	0	1	0	0	0.2

Table XI Cont'd

Family	Species	Pre-spray days						Post-spray days					
		June 11	June 12	June 13	June 14	June 15	Daily ave	June 17	June 18	June 19	June 20	June 21	Daily ave
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Parulidae	Nashville Warbler	0	0	0	0	1	0.2	4	5	5	5	0	3.8
	Magnolia Warbler	0	2	3	3	2	2.0	2	3	0	4	0	1.8
	Black-throated Green Warbler	4	5	7	1	3	4.0	2	0	3	1	1	1.4
	Blackpoll Warbler	0	0	0	1	1	0.4	1	0	0	0	0	0.2
	Ovenbird	2	5	3	6	5	4.2	3	4	5	8	4	4.8
	Canada Warbler	0	2	3	2	2	1.8	2	0	1	4	2	1.8
	American Redstart	4	5	6	7	7	5.8	5	4	4	4	7	4.8
Icteridae	Common Grackle	0	0	0	0	0	0.0	0	0	0	0	1	0.2
	Brown-headed Cowbird	4	2	4	2	0	2.4	6	3	3	2	1	3.0
Fringillidae	Rose-breasted Grosbeak	1	1	1	1	0	0.8	1	0	2	0	0	0.6
	Evening Grosbeak	1	1	2	0	0	0.8	3	1	1	0	3	1.6
	Purple Finch	2	1	0	9	1	2.6	0	0	0	1	0	0.2
	Pine Siskin	5	0	0	0	0	1.0	1	0	0	0	1	0.4
	American Goldfinch	0	0	0	0	0	0.0	0	1	0	1	0	0.4
	White-throated Sparrow	3	2	2	1	0	1.6	1	1	3	0	3	1.6
	Fox Sparrow	1	3	3	5	2	2.8	3	2	2	1	3	2.2
Totals:		38	47	48	63	43	47.8	56	43	51	65	45	52.0

Table XII

Forest bird population census
Fenitrothion untreated check plot (2nd application 402)
Chandler, Quebec
June 11-21, 1976

Family	Species	Pre-spray days						Post-spray days					
		June 11	June 12	June 13	June 14	June 15	Daily ave	June 17	June 18	June 19	June 20	June 21	Daily ave
		-5	-4	-3	-2	-1		+1	+2	+3	+4	+5	
Scolopacidae	American Woodcock	0	0	0	0	3	0.6	0	0	0	0	0	0.0
Picidae	Yellow-bellied Sapsucker	0	0	2	0	0	0.4	0	0	0	0	0	0.0
Tyrannidae	Yellow-bellied Flycatcher	0	1	0	0	0	0.2	0	0	1	0	0	0.2
	Least Flycatcher	2	3	1	0	1	1.4	4	4	4	6	2	4.0
	Olive-sided Flycatcher	0	0	0	0	0	0.0	0	0	1	1	0	0.4
Hirundinidae	Barn Swallow	0	0	0	2	0	0.4	0	0	0	0	0	0.0
Turdidae	American Robin	4	3	3	3	3	3.2	5	7	6	4	7	5.8
	Swainson's Thrush	1	2	1	1	2	1.4	3	4	4	6	2	3.8
	Veery	0	0	0	2	2	0.8	0	0	2	5	0	1.4
Sylviidae	Ruby-crowned Kinglet	5	5	3	8	1	4.4	2	2	4	7	4	3.8
Vireonidae	Red-eyed Vireo	0	0	2	1	0	0.6	2	1	0	0	0	0.6
Parulidae	Black and White Warbler	0	1	0	1	0	0.4	0	1	1	0	0	0.4
	Tennessee Warbler	1	0	0	0	0	0.2	0	0	0	0	0	0.0
	Magnolia Warbler	1	2	1	3	0	1.4	2	4	3	4	2	3.0
	Black-throated Green Warbler	1	3	4	7	2	3.4	3	5	4	5	6	4.6

Table XII Cont'd

Family	Species	Pre-spray days						Post-spray days					
		June 11 -5	June 12 -4	June 13 -3	June 14 -2	June 15 -1	Daily ave	June 17 +1	June 18 +2	June 19 +3	June 20 +4	June 21 +5	Daily ave
Parulidae cont'd	Blackpoll Warbler	3	3	3	9	4	4.4	5	1	1	8	0	3.0
	Ovenbird	1	2	3	2	0	1.6	2	2	3	0	2	1.8
	American Redstart	4	5	3	4	3	3.8	4	5	5	7	4	5.4
Icteridae	Brown-headed Cowbird	5	0	1	4	1	2.2	1	2	3	2	2	2.0
Fringillidae	Rose-breasted Grosbeak	1	1	0	0	0	0.4	0	0	0	0	0	0.0
	Evening Grosbeak	0	0	0	0	0	0.0	0	0	1	0	0	0.2
	Purple Finch	0	4	0	1	0	1.0	0	0	0	0	0	0.0
	Pine Siskin	0	5	4	6	0	3.0	2	1	0	0	1	0.8
	American Goldfinch	5	5	0	5	1	3.2	5	0	0	1	2	1.4
	Dark-eyed Junco	0	0	0	1	0	0.2	0	0	0	0	0	0.0
	White-throated Sparrow	0	2	5	3	0	2.0	1	4	2	2	2	2.2
	Fox Sparrow	0	0	1	1	2	0.8	2	2	2	2	0	1.6
	Song Sparrow	0	0	0	0	0	0.0	1	0	0	0	0	0.2
Totals:		34	47	37	64	25	41.4	44	45	48	60	36	46.6

Table XIII

Forest bird population census
Phosphamidon treatment plot 211-3 (First application)
La Tuque, Quebec
April 24-May 3, 1976

Family	Species	Pre-spray days						Post-spray days					
		-4 Apr. 24	-3 Apr. 25	-2 Apr. 26	-1 Apr. 27	-0 Apr. 28	Daily ave	+1 Apr. 29	+2 Apr. 30	+3 May 1	+4 May 2	+5 May 3	Daily ave
Alcedinidae	Belted Kingfisher	0	0	1	2	2	1.0	0	1	1	0	2	0.8
Picidae	Common flicker	0	0	0	0	0	0.0	0	0	2	0	2	0.8
	Yellow-bellied Sapsucker	2	0	0	0	0	0.4	2	2	0	0	1	1.0
	Hairy Woodpecker	0	0	2	0	0	0.4	0	0	2	2	0	0.8
Paridae	Black-capped Chickadee	0	1	0	0	0	0.2	0	0	0	0	1	0.2
	Boreal Chickadee	0	0	0	0	1	0.2	0	0	0	0	0	0.0
Certhiidae	Brown Creeper	0	0	0	0	0	0.0	0	0	0	1	0	0.2
Troglodytidae	Winter Wren	2	0	0	0	2	0.8	4	4	2	0	2	2.4
Turdidae	American Robin	0	1	1	1	3	1.4	2	0	12	2	4	4.0
Sylviidae	Golden-crowned Kinglet	0	0	3	0	0	0.6	5	1	5	6	6	4.6
	Ruby-crowned Kinglet	12	6	6	8	8	8.0	6	8	9	8	10	8.2
Parulidae	Myrtle Warbler	0	0	0	0	0	0.0	0	0	0	0	2	0.4
Icteridae	Red-winged Blackbird	0	0	0	0	0	0.0	1	0	0	2	0	0.6
	Rusty Blackbird	0	0	0	0	3	0.6	2	0	0	0	1	0.6
	Common Grackle	0	0	0	0	0	0.0	0	0	1	1	0	0.4
	Brown-headed Cowbird	0	0	0	0	1	0.2	2	2	0	0	2	1.2

Table XIII Cont'd

Family	Species	Pre-spray days						Post-spray days					
		-4 Apr. 24	-3 Apr. 25	-2 Apr. 26	-1 Apr. 27	-0 Apr. 28	Daily ave	+1 Apr. 29	+2 Apr. 30	+3 May 1	+4 May 2	+5 May 3	Daily ave
Fringillidae	Purple Finch	0	0	0	0	2	0.4	0	0	2	0	6	1.6
	American Goldfinch	0	0	0	0	0	0.0	0	2	0	0	0	0.4
	Dark-eyed Junco	0	0	0	6	4	2.0	2	7	5	3	0	3.4
	White-throated Sparrow	0	0	0	0	0	0.0	0	0	3	2	7	2.4
Totals:		16	8	13	17	26	16.0	26	27	44	27	46	34.0

Table XIV

Forest bird population census
Phosphamidon treatment plot 211-4
La Tuque, Quebec
April 24-May 3, 1976

Family	Species	Pre-spray days						Post-spray days					
		-4 Apr. 24	-3 Apr. 25	-2 Apr. 26	-1 Apr. 27	-0 Apr. 28	Daily ave	+1 Apr. 29	+2 Apr. 30	+3 May 1	+4 May 2	+5 May 3	Daily ave
Alcedinidae	Belted Kingfisher	0	0	0	0	0	0.0	1	0	0	0	0	0.2
Picidae	Common Flicker	0	0	0	0	0	0.0	0	0	0	0	2	0.4
	Yellow-bellied Woodpecker	0	0	0	0	1	0.2	0	1	2	0	1	0.8
	Hairy Woodpecker	0	2	0	2	0	0.8	1	1	0	0	1	0.6
Paridae	Black-capped Chickadee	0	0	0	0	0	0.0	0	1	3	0	0	0.8
Troglodytidae	Winter Wren	2	0	0	0	0	0.4	0	2	0	0	2	0.8
Turdidae	American Robin	0	2	12	1	4	3.8	0	1	5	11	4	4.2
	Hermit Thrush	0	0	0	1	2	0.6	0	0	0	0	2	0.4
Sylviidae	Golden-crowned Kinglet	0	0	0	0	0	0.0	0	0	0	2	1	0.6
	Ruby-crowned Kinglet	2	4	1	0	2	1.8	3	6	6	6	8	5.8
Parulidae	Myrtle Warbler	0	0	0	0	0	0.0	2	0	0	4	4	2.0
Icteridae	Red-winged Blackbird	0	0	0	0	2	0.4	0	0	0	2	1	0.6
	Rusty Blackbird	0	0	0	2	4	1.2	0	3	0	0	0	0.6
	Common Grackle	0	2	0	0	0	0.4	0	0	2	0	0	0.4
	Brown-headed Cowbird	0	0	2	0	0	0.4	0	2	2	0	2	1.2

Table XIV Cont'd

Family	Species	Pre-spray days						Post-spray days					
		-4 Apr. 24	-3 Apr. 25	-2 Apr. 26	-1 Apr. 27	-0 Apr. 28	Daily ave	+1 Apr. 29	+2 Apr. 30	+3 May 1	+4 May 2	+5 May 3	Daily ave
Fringillidae	Purple Finch	0	0	0	0	0	0.0	0	0	0	0	4	0.8
	Junco	0	6	2	2	0	2.0	0	0	0	2	1	0.6
	White-throated Sparrow	0	10	0	0	2	2.4	0	0	5	6	16	5.4
	Song Sparrow	2	2	0	0	0	0.8	0	2	0	0	1	0.6
Totals:		6	28	17	8	17	15.2	7	19	25	33	50	26.8

Table XV

Forest bird population census
Phosphamidon untreated check plot (for 211-3 and 211-4)
La Tuque, Quebec
April 24-May 3, 1976

Family	Species	Pre-spray days						Post-spray days					
		-4 Apr 24	-3 Apr 25	-2 Apr 26	-1 Apr. 27	-0 Apr. 28	Daily ave	+1 Apr 29	+2 Apr 30	+3 May 1	+4 May 2	+5 May 3	Daily ave
Corvidae	Blue Jay	0	0	2	0	0	0.4	0	0	0	0	0	0.0
Paridae	Black-capped Chickadee	5	1	0	7	2	3.0	1	1	0	1	2	1.1
Troglodytidae	Winter Wren	0	0	0	2	0	0.4	0	0	2	0	2	0.8
Turdidae	American Robin	0	2	3	2	4	2.2	1	5	4	3	3	3.2
	Hermit Thrush	0	0	2	1	2	1.0	0	2	2	4	0	1.6
Sylviidae	Golden-crowned Kinglet	0	5	2	0	0	1.4	0	0	0	4	2	1.2
	Ruby-crowned Kinglet	7	10	8	11	13	9.8	5	4	8	12	10	7.6
Icteridae	Brown-headed Cowbird	0	0	4	2	2	1.6	0	1	2	4	0	1.4
Fringillidae	Purple Finch	0	0	0	0	0	0.0	2	0	0	0	0	0.4
	Dark-eyed Junco	0	8	13	16	12	9.8	3	6	3	16	12	8.0
	White-throated Sparrow	0	0	0	0	0	0.0	0	6	8	6	12	6.4
	Song Sparrow	0	0	4	0	0	0.8	0	0	0	2	2	0.8
Totals:		12	26	37	41	35	30.2	12	25	31	52	45	33.0

Table XVI

Forest bird population census
Phosphamidon treatment plot 211-3 (2nd application)
La Tuque, Quebec,
May 9-20, 1976.

Family	Species	Pre-spray days						Post-spray days					
		May 9	May 10	May 13	May 14	May 15	Daily avg.	May 16	May 17	May 18	May 19	May 20	Daily avg.
		-6	-5	-2	-1	-0		+1	+2	+3	+4	+5	
Alcedinidae	Belted Kingfisher	1	1	1	1	1	1.0	0	1	1	1	2	1.2
Picidae	Common Flicker	0	4	2	1	0	1.4	0	0	0	2	2	0.8
	Yellow-bellied Sapsucker	0	1	4	0	2	1.4	0	0	0	1	0	0.2
	Hairy Woodpecker	1	0	1	1	1	0.8	1	1	1	1	1	1.0
Tyrannidae	Least Flycatcher	0	0	0	0	0	0.0	0	1	0	0	0	0.2
Corvidae	Gray Jay	0	0	1	0	0	0.2	0	0	0	1	0	0.2
Paridae	Black-capped Chickadee	0	0	0	0	0	0.0	0	0		1	0	0.4
	Boreal Chickadee	1	0	1	6	2	2.0	0	2	1	2	2	1.4
Sittidae	Red-breasted Nuthatch	0	0	0	0	0	0.0	2	2	2	2	0	1.6
Certhiidae	Brown Creeper	1	1	0	1	1	0.8	3	1	0	1	2	1.4
Troglodytidae	Winter Wren	0	2	2	4	4	2.4	2	2	4	6	4	3.6
Turdidae	American Robin	5	7	5	6	13	7.2	9	5	6	10	8	7.6
	Hermit Thrush	2	1	0	0	0	0.6	0	0	0	0	0	0.0
	Swainson's Thrush	0	0	0	0	0	0.0	0	0	0	6	0	1.2
Sylviidae	Golden-crowned Kinglet	8	7	4	8	8	7.0	6	4	6	4	6	5.2
	Ruby-crowned Kinglet	10	12	7	13	13	11.0	7	3	4	0	6	4.0
Vireonidae	Solitary Vireo	0	0	0	0	0	0.0	0	2	0	0	0	0.4

Table XVI Cont'd.

Family	Species	Pre-spray days						Post-spray days					
		May 9	May 10	May 13	May 14	May 15	Daily avg.	May 16	May 17	May 18	May 19	May 20	Daily avg.
		-6	-5	-2	-1	-0		+1	+2	+3	+4	+5	
Parulidae	Black-and-White Warbler	0	0	0	0	0	0.0	0	0	0	2	0	0.4
	Nashville Warbler	0	0	0	0	4	0.8	2	2	0	0	0	0.8
	Magnolia Warbler	0	0	0	0	0	0.0	0	0	0	2	0	0.4
	Myrtle Warbler	0	0	0	2	0	0.4	6	6	2	2	0	3.2
	Black-throated Green Warbler	0	0	0	0	0	0.0	0	0	0	0	2	0.4
	Ovenbird	0	0	0	0	0	0.0	0	2	0	0	0	0.4
	Northern Waterthrush	0	0	0	0	0	0.0	0	2	0	0	2	0.8
Icteridae	Red-winged Balckbird	0	0	0	0	0	0.0	0	2	2	0	2	1.2
	Rusty Blackbird	0	2	0	0	0	0.4	0	0	1	0	0	0.2
	Common Grackle	0	0	0	1	0	0.2	0	0	1	1	0	0.4
	Brown-headed Cowbird	0	2	2	4	0	1.6	2	3	4	2	4	3.0
Fringillidae	Rose-breasted Grosbeak	0	0	0	0	0	0.0	0	1	0	0	0	0.2
	Evening Grosbeak	0	0	0	0	0	0.0	0	3	0	0	3	1.2
	Purple Finch	6	6	10	8	4	6.8	6	8	6	6	2	5.6
	Dark-eyed Junco	3	7	4	6	5	4.0	5	4	3	2	4	3.6
	White-throated Sparrow	13	20	18	24	21	19.2	22	14	16	14	11	15.4
Totals:		51	73	62	86	79	70.2	83	71	61	69	63	67.4

Table XVII

Forest bird population census
Phosphamidon untreated check plot (2nd application)
La Tuque, Quebec
May 10-20, 1976

Family	Species	Pre-spray days					Post-spray days					
		May 10	May 13	May 14	May 15	Daily avg.	May 16	May 17	May 18	May 19	May 20	Daily avg.
		-5	-2	-1	-0		+1	+2	+3	+4	+5	
Scolopacidae	American Woodcock	0	0	0	0	0.0	0	0	0	0	1	0.2
Picidae	Common Flicker	0	2	0	0	0.5	4	0	4	2	1	2.2
Tyrannidae	Least Flycatcher	0	0	0	0	0.0	0	4	2	0	0	1.2
Corvidae	Blue Jay	1	4	0	0	1.3	3	4	5	2	0	2.8
Paridae	Black-capped Chickadee	1	0	0	2	0.8	4	4	0	1	5	2.8
	Boreal Chickadee	0	0	0	0	0.0	1	0	0	0	0	0.2
Sittidae	Red-breasted Nuthatch	0	0	0		0.5	0	0	2	0	0	0.4
Troglodytidae	Winter Wren	2	2	0	0	1.0	2	2	0	0	0	0.8
Turdidae	American Robin	1	4	14	7	6.5	13	8	2	6	4	6.6
	Hermit Thrush	4	5	8	5	5.5	3	4	1	0	4	2.4
	Swainson's Thrush	0	0	0	0	0.0	0	0	0	0	2	0.4
	Veery	0	1	0	1	0.5	1	1	2	3	2	1.8
Sylviidae	Golden-crowned Kinglet	0	6	2	2	2.0	0	0	0	0	2	0.4
	Ruby-crowned Kinglet	17	19	15	14	16.3	5	1	11	10	6	6.6
Vireonidae	Solitary Vireo	0	0	0	2	0.5	0	2	2	2	0	1.2

Table XVII Cont'd.

Family	Species	Pre-spray days					Post-spray days					
		May 10	May 13	May 14	May 15	Daily avg.	May 16	May 17	May 18	May 19	May 20	Daily avg.
		-5	-2	-1	-0		+1	+2	+3	+4	+5	
Parulidae	Black-and-White-Warbler	0	0	1	2	0.8	4	4	4	8	2	5.4
	Tennessee Warbler	0	0	0	0	0.0	0	7	4	4	4	3.8
	Nashville Warbler	0	3	8	6	4.3	18	14	14	16	13	15.0
	Magnolia Warbler	0	0	0	0	0.0	4	6	7	6	4	5.4
	Cape May Warbler	0	0	0	0	0.0	0	0	0	2	0	0.4
	Myrtle Warbler	0	0	0	0	0.0	0	2	2	2	2	1.6
	Black-throated Green Warbler	0	0	0	0	0.0	2	4	4	2	2	2.8
	Chestnut-sided Warbler	0	0	0	0	0.0	5	8	6	4	4	5.4
	Bay-breasted Warbler	0	0	0	0	0.0	2	2	2	0	0	1.2
	Ovenbird	0	2	4	6	2.5	12	14	12	12	14	12.8
	Yellowthroat	0	0	0	0	0.0	0	0	1	0	0	0.2
	American Redstart	0	0	0	0	0.0	0	6	2	2	0	2.0
Icteridae	Red-winged Blackbird	0	0	0	0	0.0	2	0	2	2	0	1.2
	Common Grackle	0	0	0	0	0.0	1	0	0	0	0	0.2
	Brown-headed Cowbird	0	2	4	2	2.0	2	4	0	4	1	1.8
Fringillidae	Rose-breasted Grosbeak	0	0	0	0	0.0	0	2	2	5	7	3.2
	Evening Grosbeak	0	0	0	0	0.0	0	2	0	0	0	0.4
	Purple Finch	4	8	8	6	6.5	3	4	6	8	3	4.8
	Dark-eyed Junco	9	5	2	4	5.0	0	1	0	1	0	0.4
	Chipping Sparrow	0	0	0	0	0.0	0	0	1	0	0	0.2
	White-throated Sparrow	28	19	28	12	21.8	19	20	19	19	16	18.6
	Song Sparrow	6	0	0	2	2.0	4	3	0	0	0	1.4
	White-crowned Sparrow	0	0	0	0	0.0	5	0	6	4	2	3.4
Totals:		73	82	94	75	81.0	119	133	125	117	98	118.4

Table XVIII

Forest bird population census

Phosphamidon treatment plot 211-1

La Tuque, Quebec, 1976

April 28 - May 8, 1976

Family	Species	Pre-spray days						Post-spray days					
		-5 Apr. 28	-4 Apr. 29	-3 Apr. 30	-2 May 1	-1 May 2	Daily ave 3	+1 May 4	+2 May 5	+3 May 6	+4 May 7	±5 May 8	Daily ave
Picidae	Common Flicker	2	0	0	0	0	0.4	4	0	0	0	0	0.8
Paridae	Black-capped Chickadee	3	0	0	0	0	0.6	0	0	1	0	0	0.2
	Boreal Chickadee	0	0	1	0	0	0.2	0	0	2	0	0	0.4
Certhiidae	Brown Creeper	0	0	0	1	0	0.2	0	0	0	0	0	0.0
Turdidae	American Robin	10	0	0	0	0	2.0	1	0	5	4	11	4.0
	Hermit Thrush	1	0	3	2	2	1.4	2	1	4	2	1	2.0
Sylviidae	Golden-crowned Kinglet	2	2	4	6	4	3.6	0	4	4	3	0	2.2
	Ruby-crowned Kinglet	4	6	10	8	8	7.2	5	4	8	4	0	4.2
Parulidae	Myrtle Warbler	0	0	0	2	2	0.8	2	0	0	0	0	0.4
Icteridae	Red-winged Blackbird	1	0	0	0	0	0.2	0	0	2	0	0	0.4
	Brown-headed Cowbird	0	0	2	0	0	0.4	2	2	0	3	0	1.4
Fringillidae	Purple Finch	0	0	2	0	1	0.6	0	2	2	2	0	1.2
	Junco	2	3	6	6	0	3.4	1	4	4	9	10	5.6
	White-throated Sparrow	0	0	3	2	5	2.0	17	7	8	15	4	10.2
Totals:		25	11	31	27	22	23.2	34	24	40	42	26	33.2

Table XIX

Forest bird population census

Phosphamidon treatment plot 211-2

La Tuque, Quebec

April 28 - May 8, 1976

Family	Species	Pre-spray days						Post-spray days					
		-5 Apr. 28	-4 Apr. 29	-3 Apr. 30	-2 May 1	-1 May 2	Daily ave	+1 May 4	+2 May 5	+3 May 6	+4 May 7	+5 May 8	Daily ave
Alcedinidae	Belted Kingfisher	1	1	1	1	1	1.0	0	0	0	0	0	0.0
Picidae	Common Flicker	2	0	0	0	0	0.4	0	2	0	0	0	0.4
	Downy Woodpecker	0	0	2	2	0	0.8	0	0	1	0	0	0.2
Paridae	Black-capped Chickadee	0	0	2	1	0	0.6	0	0	0	1	0	0.2
Turdidae	American Robin	5	0	2	1	1	1.8	1	2	3	3	1	2.0
	Hermit Thrush	2	0	0	0	0	0.4	1	0	0	0	0	1.0
Sylviidae	Golden-crowned Kinglet	0	4	0	0	0	0.8	0	0	0	0	0	0.0
	Ruby-crowned Kinglet	6	4	8	8	8	6.8	1	1	2	0	0	0.8
Parulidae	Black-throated Blue Warbler	0	0	0	4	0	0.8	1	0	0	0	0	0.2
Icteridae	Red-winged Blackbird	8	2	6	4	8	5.6	6	9	8	11	2	7.2
	Rusty Blackbird	0	1	0	0	0	0.2	0	1	0	5	0	1.2
	Common Grackle	0	0	1	0	0	0.2	0	0	0	0	0	0.0
	Brown-headed Cowbird	1	0	0	0	0	0.2	2	0	0	1	0	0.6
Fringillidae	Purple Finch	2	0	0	0	0	0.4	0	0	2	2	0	0.8
	Vesper Sparrow	0	0	0	0	0	0.0	0	0	1	0	0	0.2
	Dark-eyed Junco	4	0	3	5	8	4.0	2	1	10	0	5	3.6

Table XIX Cont.

Family	Species	Pre-spray days						Post-spray days					
		-5 Apr. 28	-4 Apr. 29	-3 Apr. 30	-2 May 1	-1 May 2	Daily ave	+1 May 4	+2 May 5	+3 May 6	+4 May 7	+5 May 8	Daily ave
	White-throated Sparrow	3	1	1	1	1	1.4	10	6	10	12	5	8.6
	Swamp Sparrow	0	2	2	2	2	1.6	2	0	2	2	0	1.2
	Song Sparrow	4	3	2	2	0	2.2	0	0	0	0	0	0.0
Totals		38	18	30	31	29	29.2	26	22	39	37	13	27.4

Table XX

Forest bird population census
Phosphamidon untreated check plot (for 211-1 and 211-2)
La Tuque, Quebec
April 28 - May 8, 1976

Family	Species	Pre-spray treatment						Post-spray treatment					
		Apr. 28 -5	Apr. 29 -4	Apr. 30 -3	May 1 -2	May 2 -1	Daily avg.	May 4 +1	May 5 +2	May 6 +3	May 7 +4	May 8 +5	Daily avg.
Picidae	Common Flicker	0	0	0	0	0	0.0	0	0	0	2	2	0.8
Corvidae	Blue Jay	0	0	0	0	0	0.0	0	0	0	1	3	0.8
Paridae	Black-capped Chickadee	2	1	1	0	1	1.0	2	4	1	7	0	2.8
	Boreal Chickadee	0	0	0	0	0	0.0	0	1	0	0	0	0.2
Troglodytidae	Winter Wren	0	0	0	2	0	0.4	0	0	0	2	0	0.4
Turdidae	American Robin	4	1	5	4	3	3.4	2	0	2	6	1	2.2
	Hermit Thrush	2	0	2	2	4	2.0	2	2	3	2	0	1.8
Sylviidae	Golden-crowned Kinglet	0	0	0	0	4	0.8	0	0	0	0	0	0.0
	Ruby-crowned Kinglet	13	5	4	8	12	8.4	8	8	6	20	3	9.0
Icteridae	Brown-headed Cowbird	2	0	1	2	4	1.8	0	2	0	0	0	0.4
Fringillidae	Purple Finch	0	2	0	0	0	0.4	0	2	0	0	0	0.4
	Dark-eyed Junco	12	3	6	3	16	8.0	5	6	6	10	6	6.6
	White-throated Sparrow	0	0	6	8	6	4.0	18	18	19	22	7	16.8
	Song Sparrow	0	0	0	0	2	0.4	0	3	0	0	0	0.6
Totals		35	12	25	29	52	30.6	37	46	37	72	22	42.8

Table XXI

Forest bird population census
Phosphamidon treatment block 211-2
La Tuque, Quebec
June 16 and 17, 1976

Family	Species	June 16	June 17
Alcedinidae	Belted Kingfisher	0	1
Picidae	Yellow-shafted Flicker	0	1
Tyrannidae	Great-crested Flycatcher	2	0
	Traill's Flycatcher	2	0
	Least Flycatcher	6	6
Corvidae	Gray Jay	2	0
	Blue Jay	1	0
Sittidae	Red-breasted Nuthatch	2	2
Turdidae	American Robin	1	0
	Swainson's Thrush	0	6
Sylviidae	Golden-crowned Kinglet	2	0
	Ruby-crowned Kinglet	2	2
Vireonidae	Solitary Vireo	0	4
	Red-eyed Vireo	2	0
Parulidae	Black-and-white Warbler	0	2
	Nashville Warbler	4	8
Parulidae cont'd	Parula Warbler	2	0
	Magnolia Warbler	6	2
	Blackburnian Warbler	0	4
	Chestnut-sided Warbler	2	4
	Ovenbird	8	2
	Mourning Warbler	6	2
	Yellowthroat	6	6
	American Redstart	2	2
Icteridae	Redwinged Blackbird	15	13
	Brown-headed Cowbird	5	2
Fringillidae	Evening Grosbeak	2	6
	American Goldfinch	0	4
	Dark-eyed Junco	0	2
	White-throated Sparrow	4	7
	Swamp Sparrow	2	2
Totals		86	91

Table XXII
Forest bird population census
Phosphamidon treatment plot 211-3
Latuque, Quebec
June 16-17, 1976

Family	Species	June 16	June 17	Family	Species	June 16	June 17
Trochilidae	Ruby-throated Hummingbird	1	0	Vireonidae	Solitary Vireo	2	6
					Red-eyed Vireo	2	0
Picidae	Common Flicker	0	1	Parulidae	Tennessee Warbler	10	8
	Hairy Woodpecker	3	2		Nashville Warbler	10	10
Tyrannidae	Great Crested Flycatcher	0	2		Magnolia Warbler	8	8
					Blackburnian Warbler	4	4
	Least Flycatcher	8	6		Bay-breasted Warbler	14	10
Corvidae	Blue Jay	1	0		American Redstart	2	6
Paridae	Black-capped Chickadee	2	0	Icteridae	Redwinged Blackbird	3	0
	Boreal Chickadee	1	1		Brown-headed Cowbird	4	0
Sittidae	Red-breasted Nuthatch	0	2		Common Grackle	1	0
				Fringillidae	Evening Grosbeak	5	1
Troglodytidae	Winter Wren	0	2		Purple Finch	7	5
Turdidae	American Robin	9	5		American Goldfinch	2	0
	Hermit Thrush	2	4		Vesper Sparrow	2	2
	Swainson's Thrush	6	1		Dark-eyed Junco	2	3
	Gray-cheeked Thrush	2	0		Chipping Sparrow	0	2
Sylviidae	Golden-crowned Kinglet	2	4		White-throated Sparrow	16	8
	Ruby-crowned Kinglet	0	4		Swamp Sparrow	0	2
Bombycillidae	Cedar Waxwing	2	8	Totals:		133	117

Table XXIII

Forest bird population census
Phosphamidon treatment block 211-4
La Tuque, Quebec
June 16 and 17, 1976

amily	Species	June 16	June 17
rochilidae	Ruby-throated Hummingbird	3	0
icidae	Yellow-bellied Sapsucker	0	1
	Hairy Woodpecker	0	1
yrannidae	Least Flycatcher	4	4
orvidae	Blue Jay	0	1
imidae	Catbird	0	2
rdidae	Hermit Thrush	0	10
	Swainson's Thrush	6	0
	Veery	4	3
lviidae	Golden-crowned Kinglet	2	0
	Ruby-crowned Kinglet	2	4
reonidae	Solitary Vireo	2	4
	Red-eyed Vireo	2	2
rulidae	Yellow Warbler	0	2
	Magnolia Warbler	4	6
	Black-throated Blue Warbler	0	1

Family	Species	June 16	June 17
Parulidae cont'd	Chestnut-sided Warbler	4	2
	Bay-breasted Warbler	8	4
	Northern Waterthrush	2	0
	Mourning Warbler	6	4
	Yellowthroat	4	2
	Canada Warbler	0	2
	American Redstart	10	6
Icteridae	Eastern Meadowlark	1	0
	Red-winged Blackbird	7	2
	Brown-headed Cowbird	2	4
Fringillidae	Rose-breasted Grosbeak	2	2
	Evening Grosbeak	0	3
	Vesper Sparrow	0	2
	Dark-eyed Junco	1	0
	White-crowned Sparrow	1	0
	White-throated Sparrow	5	2
Totals		82	76

Table XXIV

Forest bird population census

Phosphamidon untreated check plot

La Tuque, Quebec

June 16 and 17, 1976

Family	Species	June 16	June 17
Picidae	Yellow-shafted Flicker	1	1
Tyrannidae	Least Flycatcher	4	0
Corvidae	Common Crow	1	0
Turdidae	American Robin	2	0
	Hermit Thrush	0	2
	Swainson's Thrush	2	2
	Veery	6	2
Sylviidae	Ruby-crowned Kinglet	2	0
Vireonidae	Solitary Vireo	2	0
	Red-eyed Vireo	0	4
Parulidae	Black and White Warbler	2	0
	Nashville Warbler	0	6
	Magnolia Warbler	2	0
Parulidae cont'd	Blackburnian Warbler	4	2
	Chestnut-sided Warbler	2	4
	Ovenbird	4	0
	Mourning Warbler	6	6
	Yellowthroat	2	0
	Canada Warbler	0	2
	American Redstart	4	4
Icteridae	Brown-headed Cowbird	0	2
Fringillidae	Rose-breasted Grosbeak	2	2
	Dark-eyed Junco	2	0
	White-throated Sparrow	3	2
Totals:		53	41