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Aquatic Impact Studies by FPMI in Quebec Spruce Budworm Spray Block 305, 1977

by

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ABSTRACT

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Extensive studies were carried out in a lake and a number of streams treated with two 0.280 kg/ha applications of fenitrothion followed by a 0.070 kg/ha aminocarb treatment applied for spruce budworm, Choristoneura fumiferana Clemens, control. No dramatic adverse effects on lake zooplankton, benthos or fish populations occurred but a significant effect on shallow dwelling baetid mayfly nymphs was indicated. Effects in streams were minimal and were far less than those caused by severe spate conditions. Short lived increases in drift and opportunistic feeding by brook trout, Salvalinus fontinalis Mitchell, were documented, but no significant depletion of bottom fauna was found.

Résumé

Des études poussées ont été effectuées dans un lac et un certain nombre de ruisseaux traités avec deux applications de fénitrothion á raison de 0.280 kg/ha, suivies de 0.070 kg/ha d'aminocarb pour lutter contre la Tordeuse des bourgeóns de l'Epinette (Choristoneura fumiferana Clemens). Il ne s'est produit aucun effet adverse sur le zooplancton du lac, ni sur le benthos ou les populations de poissons mais on a observé un effet significatif sur les larves de Baétidés éphémères habitant les eaux peu profondes. Dans les ruisseaux, les effets furent minimes et beaucoup moindres que ceux que causent de sévères crues. L'auteur observa de plus fortes mais éphémères dérives d'insectes, alors que la truite de ruisseau (Salvalinus fontinalis Mitchill) se gava, mais il ne nota aucune diminution ("épuisement") significative de la faune au fond de l'eau.

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I. INTRODUCTION

A severe spruce budworm, *Choristoneura fumiferana* Clem., outbreak in the Gaspe region of Quebec has presented a substantial hazard to the fir-spruce forests of the area in recent years. In the fall of 1976, budworm egg-mass surveys indicated an extremely high larval population would be present in the spring of 1977 within forests which had already been weakened by severe defoliation in the previous year. Entomologists at the Forest Pest Management Institute, Sault Ste. Marie, Ontario (formerly the Chemical Control Research Institute, Ottawa, Ontario) were consulted by the provincial agency responsible for forest protection and asked to recommend an insecticide application program which would reduce budworm populations sufficiently to protect the infested forests from severe defoliation. The recommendations given proposed that applications of insecticides at dosage rates above the levels currently registered for spruce budworm control would be required to protect the areas with the highest density of budworm egg-masses (greater than 2000 egg masses/10 m^2 of foliage). On the basis of this recommendation, the proposed Quebec 1977 spruce budworm spray program included treatment of a 120,960 hectare (298,900 acre) block of the most heavily infested forest with two successive applications

of 0.280 kg fenitrothion/ha (4.0 oz/acre) followed by 0.070 kg aminocarb/ha (1.0 oz/acre). This exceeds the registered maximum total dosage rate for fenitrothion of 2 x 0.210 kg/ha by 0.140 kg/ha.

The proposed application of above registered dosages of insecticides was approved by a working group of the Federal Interdepartmental Committee on Pesticides (FICP) under the procedures set out in Trade Memorandum T-104 established under the Pest Control Products Act. In agreeing to allow the use of the proposed applications, the FICP strongly recommended that complete monitoring studies be carried out within the spray areas to determine the effects on aquatic organisms. An extensive aquatic monitoring program was subsequently organized with direct input from three provincial and two federal agencies: Quebec Department of Tourism, Fish and Game, Quebec Department of Natural Resources, Quebec Environmental Protection Service, Inland Waters Division of Fisheries and Environment Canada and the Forest Pest Management Institute.

The monitoring program was carried out within a number of rivers and streams and a single lake, Lac Ste-Anne, located within spray block 305 treated with two 0.280 kg/ha applications of fenitrothion followed by 0.070 kg/ha aminocarb. The lake study incorporated monitoring of water chemistry, insecticide residues, primary production and fertility, zooplankton, benthic fauna and fish populations, with different participating agencies responsible for different aspects.

In light of the large input of resources into this study, Lac Ste-Anne was designated as an experimental spray area and spray application was not shut off over the lake (Fig. 1). This is contrary to

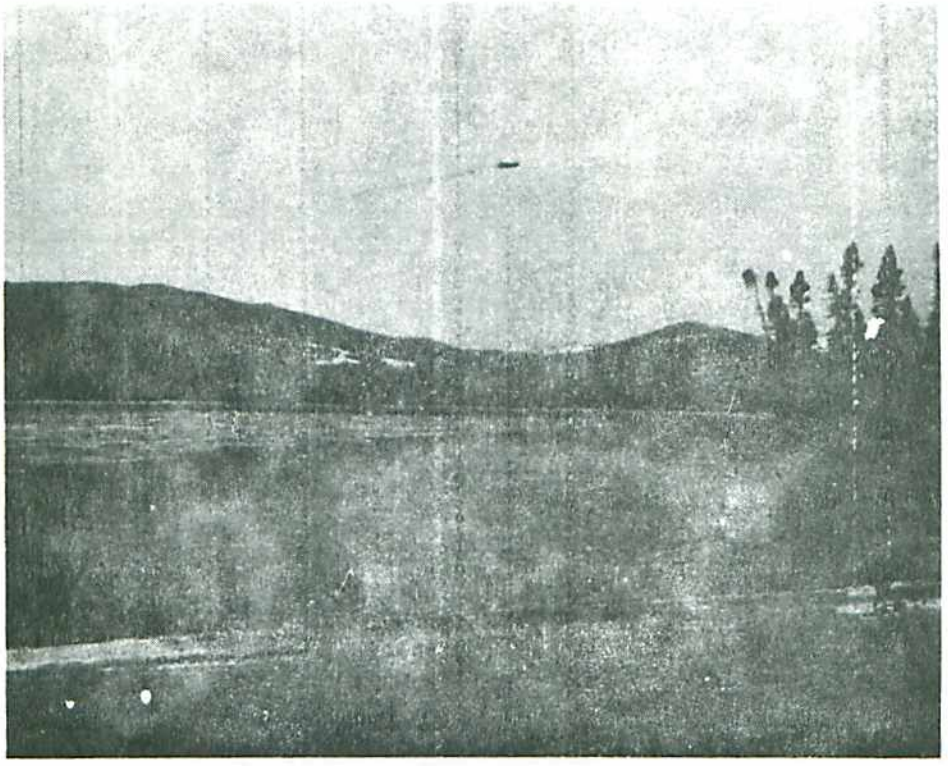

Fig. 1. DC-6B applying insecticide directly over Lac Ste-Anne, Quebec in May, 1977.

the normal procedure during operational spraying where insecticide application is cut off over lakes large enough to be avoided without also missing adjacent forest areas.

II. SITE DESCRIPTIONS

1. Lac Ste-Anne: Lac Ste-Anne is located within the Parc de la Gaspesie at the north-west corner of spray block 305 (Fig. 2). The lake is long (4.8 km) but narrow (maximum width about 0.5 km) and is divided into a large south basin and a smaller north basin by a narrow (40 m) neck over which the road to Murdochville passes (Fig. 3). Zooplankton, benthic fauna and fish sampling were confined to the north basin and within the shallow neck between basins, as these were the only portions of the lake clear of ice when sampling began.

2. Study Streams: Two streams within block 305 (Ruisseau Lesseps and Riviere Bonaventure Ouest) and an untreated station on a side-branch of Riviere Ste-Anne about 30 km downstream from the block were originally selected to study effects of the treatment on aquatic invertebrates and fish. Flood conditions shortly after the first fenitrothion application necessitated shifting the drift and bottom fauna studies to temporary streams over the period of the second and third treatments. These two streams were just west of Riviere Bonaventure Ouest and were given the names Ruisseau Grande Colline and Ruisseau Revognah for the purpose of this study. Two additional study sites were chosen to study fish populations. These were located in the Petite Riviere Cascapedia Ouest and in Riviere Ste-Anne just downstream from the edge of the spray block (referred to as the edge of block station

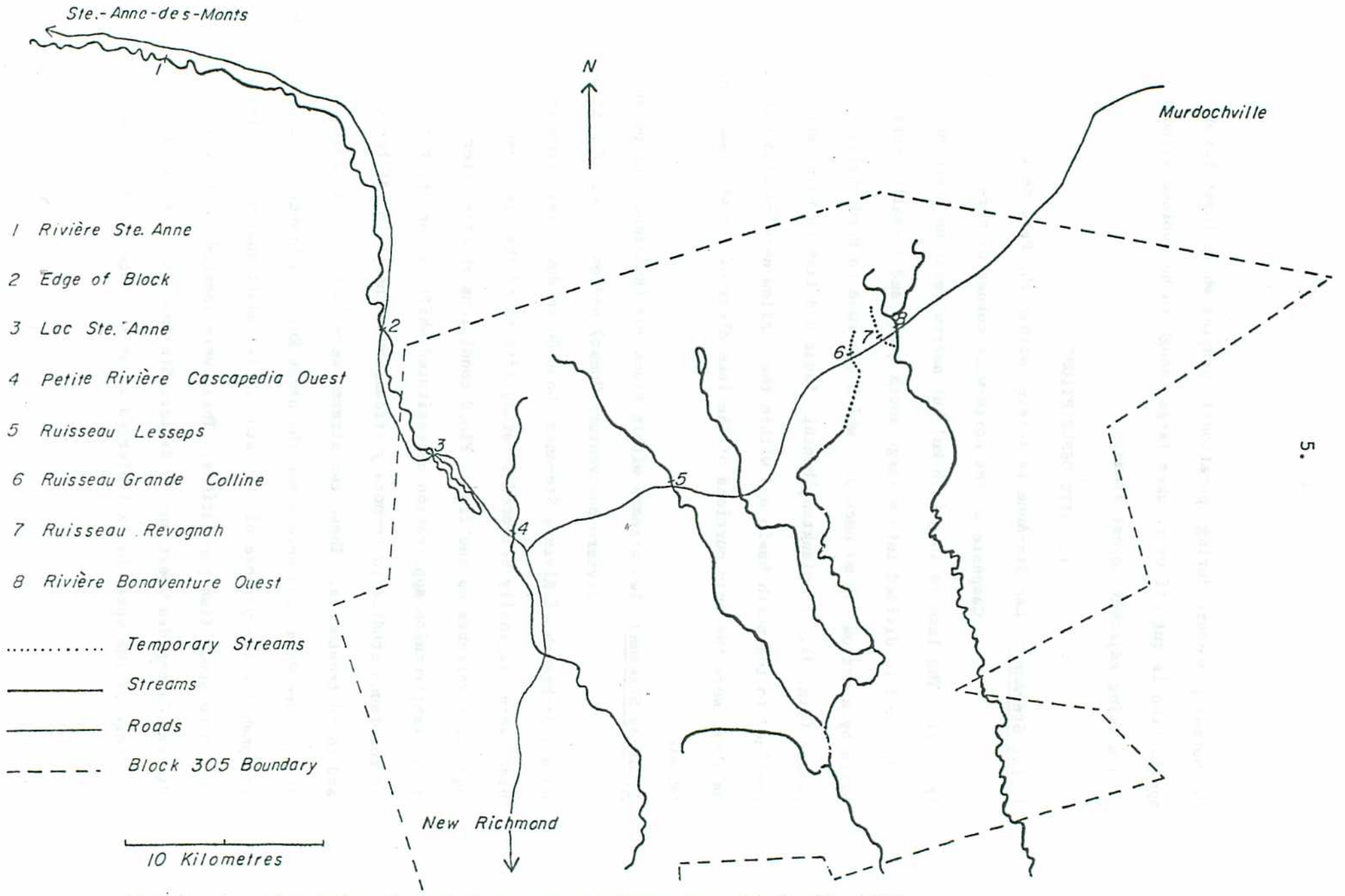

Fig. 2. Aquatic study sites, Quebec spruce budworm spray block 305, 1977.

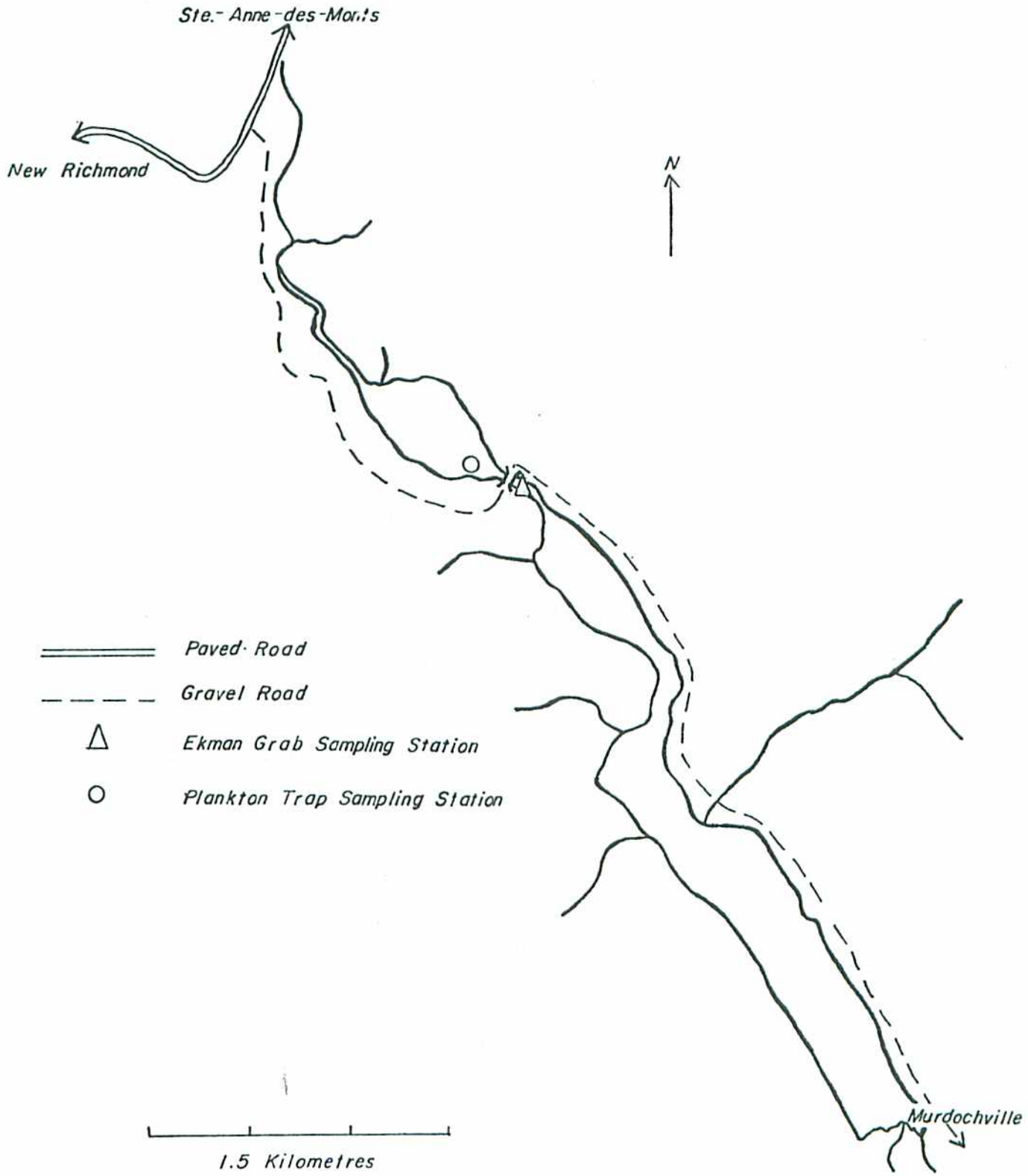

Fig. 3. Lac Ste-Anne, Quebec spruce budworm spray block 305, showing sampling stations, 1977.

in this report). All aquatic sampling stations were located close to points of access from the few available all-weather roads.

The streams sampled within block 305 all flow south towards the Baie des Chaleurs and all sampling stations were typical of headwater streams with fast-flowing waters over rock and gravel bottoms. The temporary streams were smaller and somewhat slower flowing than the permanent streams. Riviere Ste-Anne is much larger in size and volume of flow than the other streams studied. It flows north and empties into the St. Lawrence River.

III. METHODS

1. Treatment procedures and deposit measurement

Block 305 was treated with insecticides on three different occasions by DC-6B aircraft using Litton LTN-51 inertial navigation systems to fly parallel swath tracks 914 m (3000 ft) apart. The insecticide was emitted between 91 and 305 m (300 and 1000 ft) above the ground in a total volume of 0.842 l/ha (0.09 US gal/acre) formulation. Treatment dates and dosage rates of insecticide applied were:

1st application - 20 May AM - 280 g fenitrothion/ha

2nd application - 29 May PM - 280 g fenitrothion/ha

3rd application - 16 June PM - 70 g aminocarb/ha

The formulations applied were as follows:

1st and 2nd applications - fenitrothion - 26.3%

- Aerotex - 30.9%

- #2 fuel oil - 13.4%

- #4 fuel oil - 29.4%

3rd application - aminocarb - 49.6%

- #2 fuel oil - 26.3%

- #4 fuel oil - 24.2%

Deposit assessment for the study streams was conducted by setting out aluminum pans and Kromekote cards along the stream banks. The deposit of #4 fuel oil on the aluminum pans was determined colorimetrically and compared to the concentration in samples of emitted formulation to quantify the amount of formulation deposited. The Kromekote cards were sent to the National Aeronautical Establishment where insecticide deposit on them was determined by a computerized spot-counting system (Slack, 1973). Deposit on Lac Ste-Anne was assessed by other agencies working on the lake.

2. Lake studies

2.1 Zooplankton: Zooplankton populations in Lac Ste-Anne were sampled with a Schindler-Patalas plankton trap (Schindler 1969) with a 154 mesh to the centimeter straining net, which captured all the zooplankton present in 12 litre water samples. On each sampling occasion, samples were taken from the surface, 4 m and 8 m at a 9 m deep station in the north basin of Lac Ste-Anne. The samples were preserved immediately with formaldehyde and later counted and identified in the laboratory by viewing them in a gridded dish under a dissecting microscope.

2.2 Benthic Fauna: Bottom fauna populations were sampled from a shallow (1 to 3 m) area of Lac Ste-Anne in the narrow neck of the lake connecting the north and south basins. Samples were taken with an Ekman grab which sampled a 232 cm^2 (36 in^2) area of bottom. The bottom type sampled consisted of fine silt over a hard base of stones and rocks. Four grab samples were taken on each

sampling date and each was immediately preserved in its entirety with formaldehyde. Benthic organisms were later separated from the substrate in the laboratory with the aid of a "bubbler" (Kingsbury and Beveridge, 1977) and then counted and identified to order or family.

2.3 Fish: Fish populations in Lac Ste-Anne were sampled periodically by leaving gill nets set in the lake overnight. Gangs of gill nets with 30 m sections of various mesh size ranging from 1.3 to 5.1 cm^2 were run out from points of attachment along the shoreline towards the centre of the lake in the evening, and pulled the following morning. Fish caught in the net were removed and their total length, fork length, weight and sex recorded. A number of different organs and tissue types were then dissected out and frozen for later analysis for fenitrothion residues. The stomach with its contents was bottled separately and preserved with formaldehyde. Back in the laboratory the volume of the stomach contents was measured and their composition determined under a dissecting microscope.

3. Stream studies

3.1 Invertebrate Drift: The numbers and kinds of invertebrates drifting downstream with the current were measured over about a six-day period centred around the treatment dates at each sampling station. Drift nets were set for 15-minute periods each morning and evening with the nets sampling a 46 cm wide portion of the stream's flow from surface to bottom, including the surface film. Additional drift net sets were made on the day of spray application at each treatment station. Water level measurements were

made at the same time drift samples were being taken. All drift net samples were preserved in the field with formaldehyde.

3.2 Bottom fauna populations: Bottom fauna populations at each sampling station were measured periodically by two methods: Surber sampling and collecting invertebrates from rocks. Four 0.093 m^2 (foot square) Surber samples (Surber, 1936) were taken on each sampling occasion, and at the same time, four rocks, approximately 20 cm in diameter, were collected and the aquatic organisms on them removed and preserved. Surber samples were preserved in their entirety in the field with formaldehyde, and the organisms in them were later separated from the substrate in the lab with the aid of a "bubbler" (Kingsbury and Beveridge, 1977). Benthic organisms collected by both methods were counted and identified to order or family, using the classification of Usinger (1974).

3.3 Fish: Samples of native fish populations from the study streams were collected periodically by using an electroshocker to stun the fish and then capturing them with a dip net. Fish captured were measured and weighed in the field, and their stomachs were removed and preserved with formaldehyde for subsequent analysis of the stomach contents in the laboratory. The volume of the stomach contents of each fish was recorded and their composition determined under a dissecting microscope.

IV. RESULTS

1. Insecticide deposit

The measured deposit of spray formulations on the study streams over all three applications ranged from 17.2 to 55.8% of the emitted

dosage (Table 1.). Although the overall deposit of the aminocarb applications on block 305 was found to be considerably less than for the two early applications of fenitrothion (Aubin, 1977), the deposit of each spray was quite similar on individual streams. Ruisseau Lesseps appeared to get the heaviest deposit of the study streams and Ruisseau Grande Colline recorded the lowest levels of deposit. Good correlation was found between deposit of the first application measured colorimetrically and by spot counting, although more variability was detected in spot-counting results. Spot counting deposit assessment was not used for the second and third treatments.

2. Lake studies

2.1 Zooplankton: Zooplankton populations were present at very low densities in Lac Ste-Anne in the spring of 1977 (Table 2.). Calanoid and cyclopoid copepods were the only groups of zooplankters present in any kind of numbers throughout May and June. Very few cladocerans or rotifers were found in any of the samples taken except for the final samples taken in early July. The paupacity of zooplankton populations in Lac Ste-Anne early in the summer has been previously noted during inventories of the lake carried out by the Quebec Service de la Faune (Laperle, 1964).

Zooplankton populations in Lac Ste-Anne remained fairly constant over the period of insecticide applications (Fig. 4). Twelve hours after the first fenitrothion application (20 May, AM) numbers sampled were about twice as high as in pre-spray samples, but these dropped to low numbers two days after treatment and then levelled out at close to pre-spray numbers. Fluctuations of a similar magnitude were found

Table 1

Insecticide deposit measurements from study sites in Block 305, Quebec, 1977

Application	Stream	ℓ/ha	% deposit
1st (fenitrothion)	Lesseps-colorimetric	0.24 ± 0.03	23.0
	Lesseps-spot counting	0.30 ± 0.13	35.6
	Bonaventure-colorimetric	0.19 ± 0.08	22.8
	Bonaventure-spot counting	0.21 ± 0.12	25.3
	Overall Block 305*	0.39	46.0
2nd (fenitrothion)	Grande Colline-colorimetric	0.14 ± 0.05	17.2
	Revognah-colorimetric	0.28 ± 0.11	33.5
	Overall Block 305*	0.42	49.5
3rd (aminocarb)	Lesseps-colorimetric	0.47 ± 0.24	55.8
	Grande Colline-colorimetric	0.19 ± 0.04	22.6
	Revognah-colorimetric	0.28 ± 0.06	33.6
	Overall Block 305*	0.10	11.4

* from Aubin, 1977.

Table 2

Combined zooplankton catches from surface, 4 m and 8 m samples* taken from Lac Ste-Anne, Block 305, Gaspé, 6 May to 2 July, 1977

Date	May 6	May 11	May 17	May 20	May 22	May 24	May 30	June 1	June 2	June 6	June 11	June 15	June 17	June 19	June 26	July 2
Leptodora	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Daphnia	1	–	–	–	–	1	1	–	1	1	1	2	1	2	3	28
Bosmina	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Diaphanosoma	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	15
Holopedium	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14
Unknown	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Total Clodocera	1	–	–	–	–	1	1	–	1	1	2	2	1	2	3	61
Calanoid copepods	20	6	11	35	8	10	15	44	13	10	11	12	32	41	17	141
Cyclopoid copepods	13	27	16	38	2	10	20	41	25	11	16	11	14	38	34	50
Nauplii	20	5	19	31	11	33	15	16	42	18	26	61	65	93	93	186
Total Copepoda	53	38	46	104	21	53	50	101	80	39	53	84	111	172	144	377
Kellicotia	–	–	–	–	–	2	1	–	–	–	–	–	–	–	–	–
Asplanchna	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	21
Total Rotifera	–	–	–	–	–	2	1	–	–	–	–	–	–	1	–	21
Acari	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Total zooplankton	54	38	46	104	21	56	52	101	81	40	55	86	112	176	147	459

* 12ℓ samples taken with a Schindler-Patalas plankton trap.

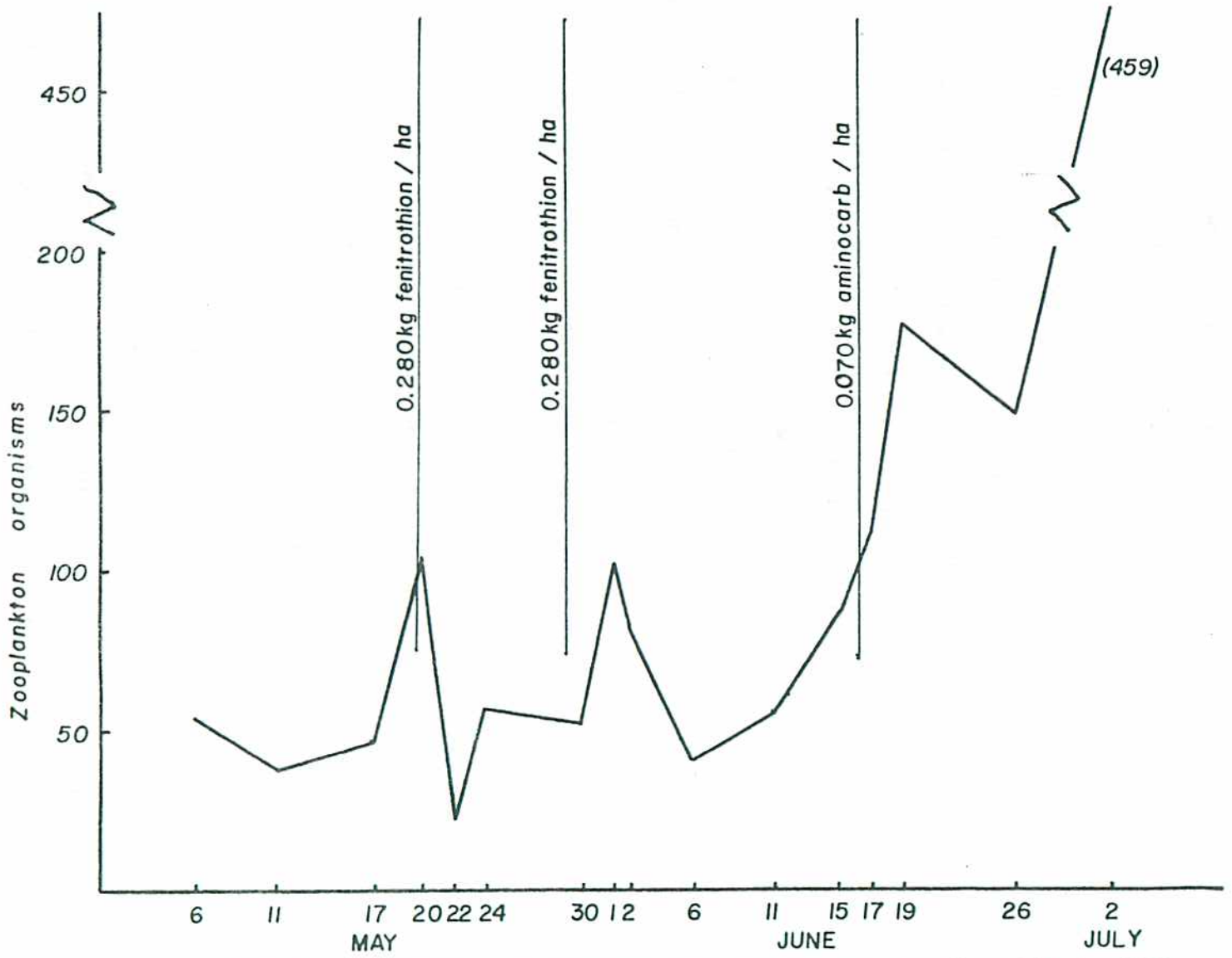

Fig. 4. Zooplankton populations in Lac Ste-Anne, May 6 to July 2, 1977.

following the second fenitrothion treatment (29 May, PM). These fluctuations are well within the normal variability found when sampling zooplankton numbers in lakes and can not be attributed to effects of the insecticide applications. Zooplankton numbers showed a substantial increase in numbers following the aminocarb application (16 June, PM). This was characterized not only by a build up of copepod populations, but by the appearance of a number of types of cladocerans and moderately large numbers of rotifers in early July. This buildup of zooplankton populations was probably a response to turnover of the lake waters and resulting increases in phytoplankton populations. It indicates that normal conditions prevailed among the zooplankton community in spite of exposure to the insecticide applications.

2.2 Benthic fauna: The shallow portion of Lac Ste-Anne from which Ekman grab samples were taken supported a very rich benthic fauna (Appendix B, Table 1) consisting primarily of midge larvae (Diptera: Chironomidae), amphipods (Amphipoda) and fingernail claims (Gastropoda: Sphaeridae). Other aquatic insect groups consistently present in small numbers were alderfly larvae, *Sialis* sp. (Megaloptera: Sialidae), and biting midge larvae, *Culicoides* sp. (Diptera: Heleidae). Baetid mayfly nymphs (Ephemeroptera: Baetidae) were consistently found in moderate numbers until early June when they disappeared completely from samples.

Bottom fauna populations in Lac Ste-Anne showed a general increase in numbers over the treatment period with large increases and declines superimposed over this general trend (Fig. 5). These short term fluctuations resulted from large differences in the numbers of midge larvae collected in different samples and can be primarily attributed

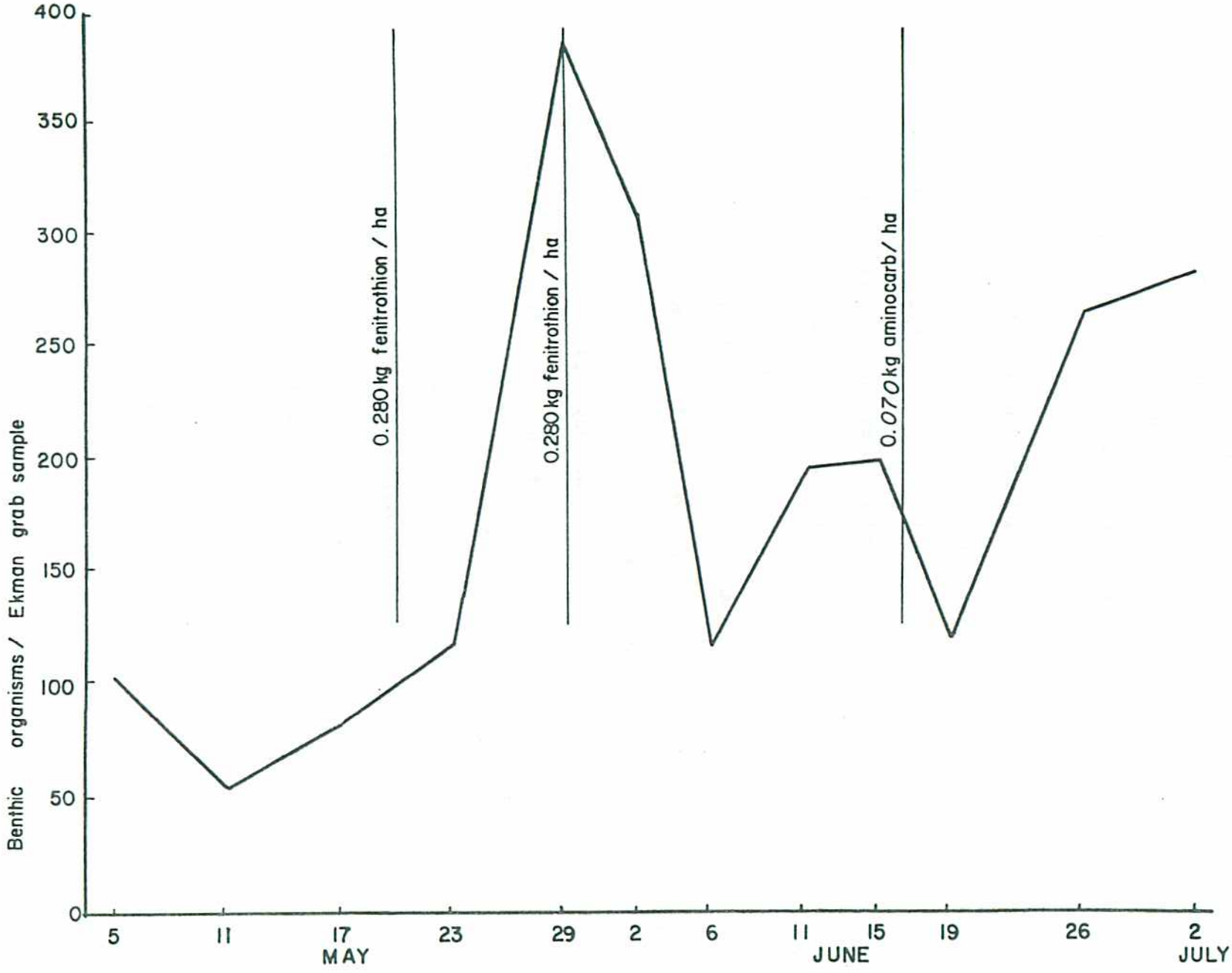

Fig. 5. Bottom fauna populations in Lac Ste-Anne, May 5 to July 2, 1977

to normal sampling variability associated with sampling very dense populations of tiny organisms. The only group of benthic organisms showing a consistent decline in numbers at the time of the insecticide applications was baetid mayfly nymphs. These were present at about pre-spray levels three days after the first fenitrothion application, but had declined noticeably by the time of the second fenitrothion application and disappeared completely one week later. Scuba searches following the first and second fenitrothion application did not reveal any dead aquatic invertebrates but considerable activity was noted among mayfly nymphs and caddisfly larvae.

2.3 Fish: Variable fishing success was achieved with gill nets set in Lac Ste-Anne over the period of insecticide treatment. Gill nets were first set on the evening of 5 May when only a very small portion of the north basin was free of ice. Over the prespray period, ten overnite gill net sets and two all day sets captured only ten brook trout, *Salvelinus fontinalis* Mitchell, and five lake trout, *Salvelinus namaycush* (Walbaum) (Appendix 3, Table 1). Between the first and second fenitrothion sprays eight brook trout and thirteen lake trout were caught in five overnite and five all day gill net sets. During this period the lake became free of ice and gill netting activities were moved into the south basin of the lake. This resulted in an increase in the catch of lake trout but less success in capturing brook trout. Twenty-seven lake trout and only five brook trout were caught in four overnite and three all day gill net sets following the second fenitrothion application.

Lake trout in Lac Ste-Anne were feeding almost exclusively on fish (brook trout) and amphipods prior to the first insecticide application (Table C-2). Their diet changed progressively to one primarily consisting of a variety of aquatic insects (chironomid larvae and pupae, caddisfly larvae, mayfly nymphs and alderfly larvae) over the period of the two fenitrothion applications. The mean volume of food present per lake trout stomach remained fairly constant over the sampling period indicating no abnormal increases or decreases in feeding. Brook trout fed primarily on amphipods over the sampling period except following the first fenitrothion application when feeding on baetid mayfly nymphs and caddisfly larvae increased sharply (Table C-3). This was reflected in a substantial increase in the mean volume of food present per brook trout stomach at this time. This indicates that mayfly nymphs and caddisfly larvae were affected to some extent by the fenitrothion treatment and rendered more susceptible to predation by fish as a result. This conclusion is supported by the observations of high levels of activity after fenitrothion spraying among these groups. The subsequent disappearance of baetid mayfly nymphs from bottom samples and decrease in their occurance in brook trout stomachs to low levels following the second fenitrothion application suggests that the effect on this group was significant. Despite this, they showed increased occurrance and importance in the diet of lake trout at this time. This may be because lake trout were beginning to feed deeper in the lake than brook trout and were feeding on deeper dwelling populations of baetid mayfly nymphs which hadn't been affected by the insecticide applications to the extent of the

shallow dwelling populations fed on by brook trout. The presence of such a deep dwelling mayfly nymph population is confirmed by scuba observations of large numbers of individuals on the bottom of the north basin of Lac Ste-Anne at depths of up to 10 m.

3. Stream studies

3.1 Invertebrate drift: Large increases in stream water levels over the period around the first fenitrothion application (Appendix A, Table 1) resulted in fluctuations in drift net catches and made drift sampling impossible shortly after the spray (Tables A-1 to 4). An initial increase in stream flow three days before treatment dislodged large numbers of stonefly nymphs (Plecoptera) and mayfly nymphs in Ruisseau Lesseps (Fig. 6) and smaller numbers of primarily stonefly nymphs in Ruisseau Bonaventure Ouest (Fig. 7). Effects of this spate in the control stream were much less noticeable, apparently because the increase in water levels was more gradual and it was a deeper stream to begin with. Shortly after the fenitrothion treatment very large numbers of blackfly larvae (Diptera: Simuliidae) were captured in drift net sets in Ruisseau Lesseps, apparently due to the insecticide treatment. These numbers tapered off over the next forty-eight hours following which rapidly rising water levels increased the numbers of drifting insects of all orders and further sampling became impossible. Only small increases in drifting insects were evident in Ruisseau Bonaventure Ouest immediately after the fenitrothion treatment until increasing water levels increased the drift of all aquatic insect groups and again brought an end to sampling.

For the second application of fenitrothion, drift sampling was carried out in small, temporary streams which gradually decreased in flow over the sampling period (Table A-5). These streams gave much smaller drift net catches (Tables A-6 and 7) than those studied during the first application. A very small increase in the drift of blackfly larvae after treatment was detected in Ruisseau Grande Colline (Fig. 8). A small but very short lived increase in the drift of stonefly nymphs was found in Ruisseau Revognah (Fig. 9).

Stream water levels were still decreasing at the time of the aminocarb application (Table A-8). Very small, short lived increases in the drift of aquatic organisms were recorded immediately after treatment in all three streams studied (Figs. 10 to 12, Tables A-10 to 12). These small increases were observed among mayfly nymphs (Ephemeroptera), blackfly larvae, midge larvae (Diptera: Chironomidae) and stonefly nymphs.

3.2 Bottom fauna: The severe spate conditions associated with spring runoff in the spring of 1977 resulted in low bottom fauna populations being present in surber samples and rock collections taken from the control stream, Riviere Ste-Anne, throughout the summer (Appendix B, Tables 2 and 3). Similar patterns in benthic fauna populations were found in Ruisseau Lesseps and Riviere Bonaventure Ouest (Figs 13 and 14, Tables B-4 to 7) except that large blackfly larvae and pupae populations built up on rocks in Ruisseau Lesseps towards the end of the summer. Benthic fauna populations in the two temporary streams studied were relatively stable over the

period of the last two insecticide applications and demonstrate no substantial changes related to the treatments (Figs. 15 and 16, Tables B8 to 11).

3.3 Fish: Brook trout at the untreated control station, Riviere Ste-Anne, fed on a fairly limited number of groups of aquatic insects with caddisfly larvae and various dipteran larvae important in the pre-spray period and mayfly nymphs and terestrial anthropods more important in late June (Appendix C, Tables 4 to 7). Brook trout in Riviere Ste-Anne at the edge of block station had a more stable and diverse diet of mayfly nymphs, stonefly nymphs, caddisfly larvae and dipteran larvae throughout May and June (Tables C8 to 11). A small increase in the utilization of blackfly larvae was noticeable the day after the first fenitrothion application on Block 305.

Increases in the number of food items consumed by brook trout in Ruisseau Lesseps were evident following the second fenitrothion treatment and were reflected in an increase in the mean volume of stomach contents (Tables C12 to 15). This was particularily noticeable for consumption of mayfly nymphs, stonefly nymphs, blackfly larvae and midge larvae. This effect declined rapidly over the first three days after treatment. In Riviere Bonaventure Ouest, some increased feeding on caddisfly larvae is suggested following the first fenitrothion treatment (Tables C16 to 19). An extensive series of brook trout stomachs sampled from Petite riviere Cascapedia Ouest following the first fenitrothion application show increased utilization of stonefly nymphs right after treatment but little overall effect on the quantity of food consumed (Tables C20 to 23).

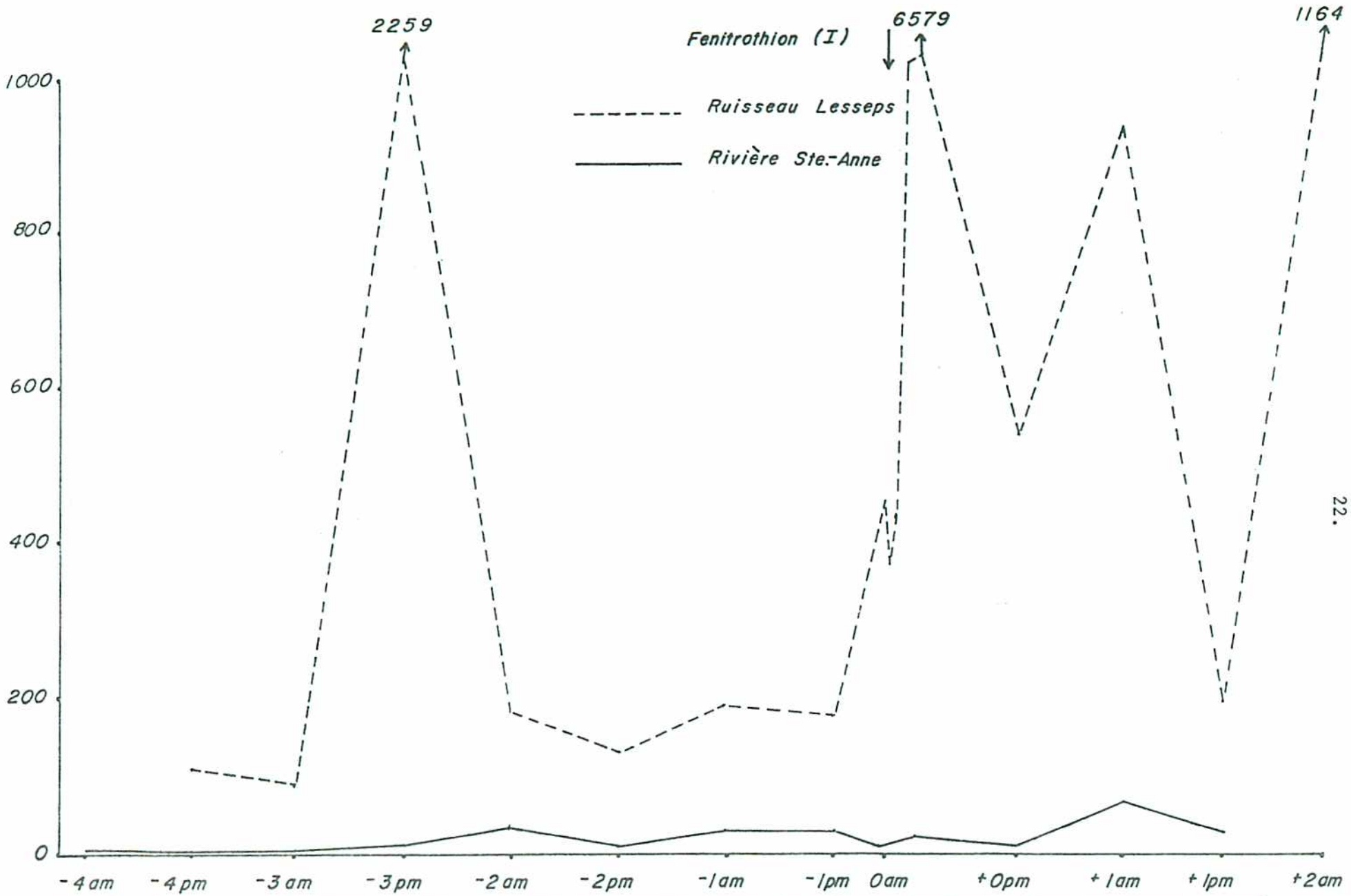

Fig. 6. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Lesseps and the untreated control station, Rivière Ste-Anne, around the date of the first fenitrothion application.

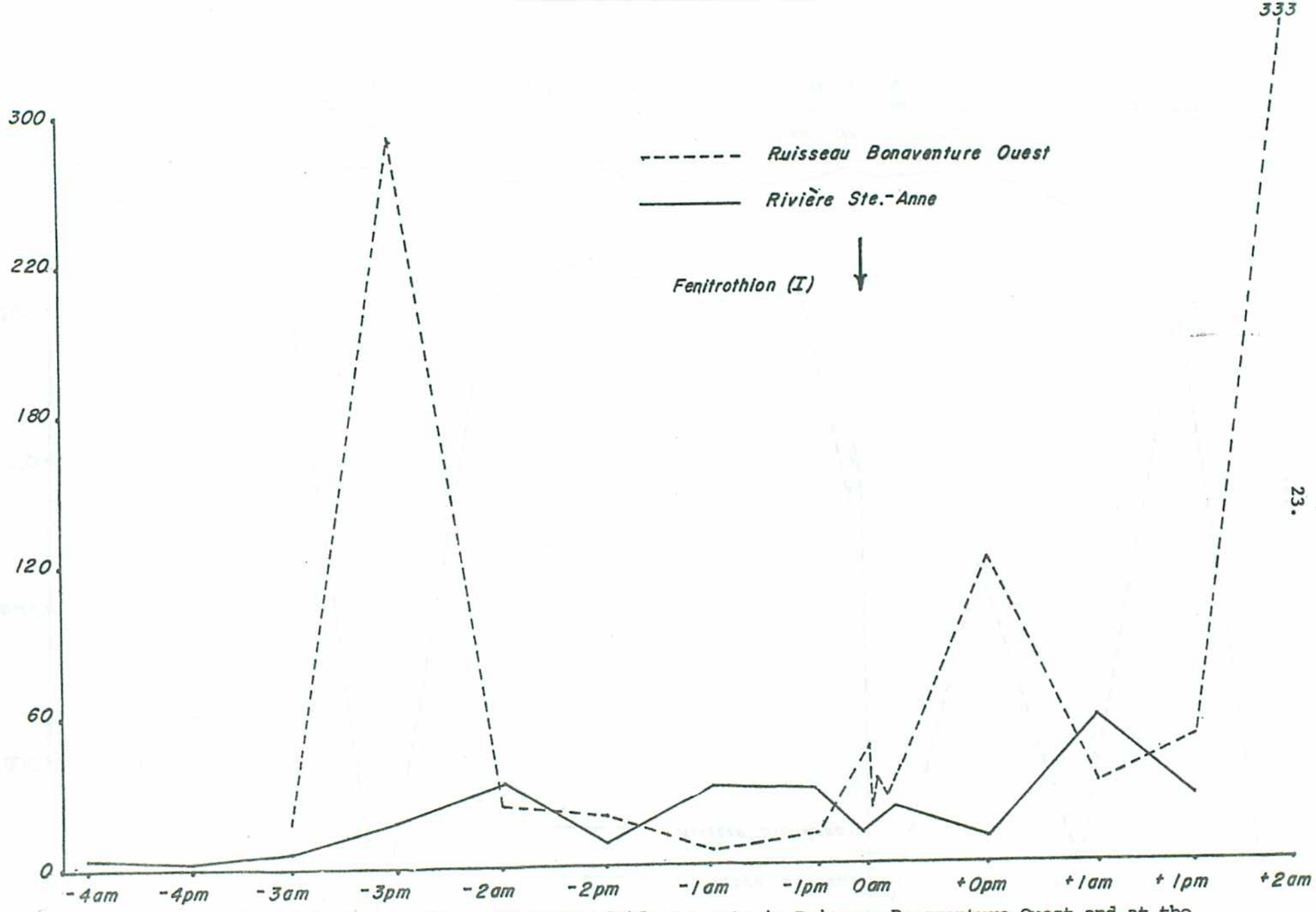

Fig. 7. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Bonaventure Ouest and at the untreated control station, Rivière Ste-Anne, around the date of the first fenitrothion application.

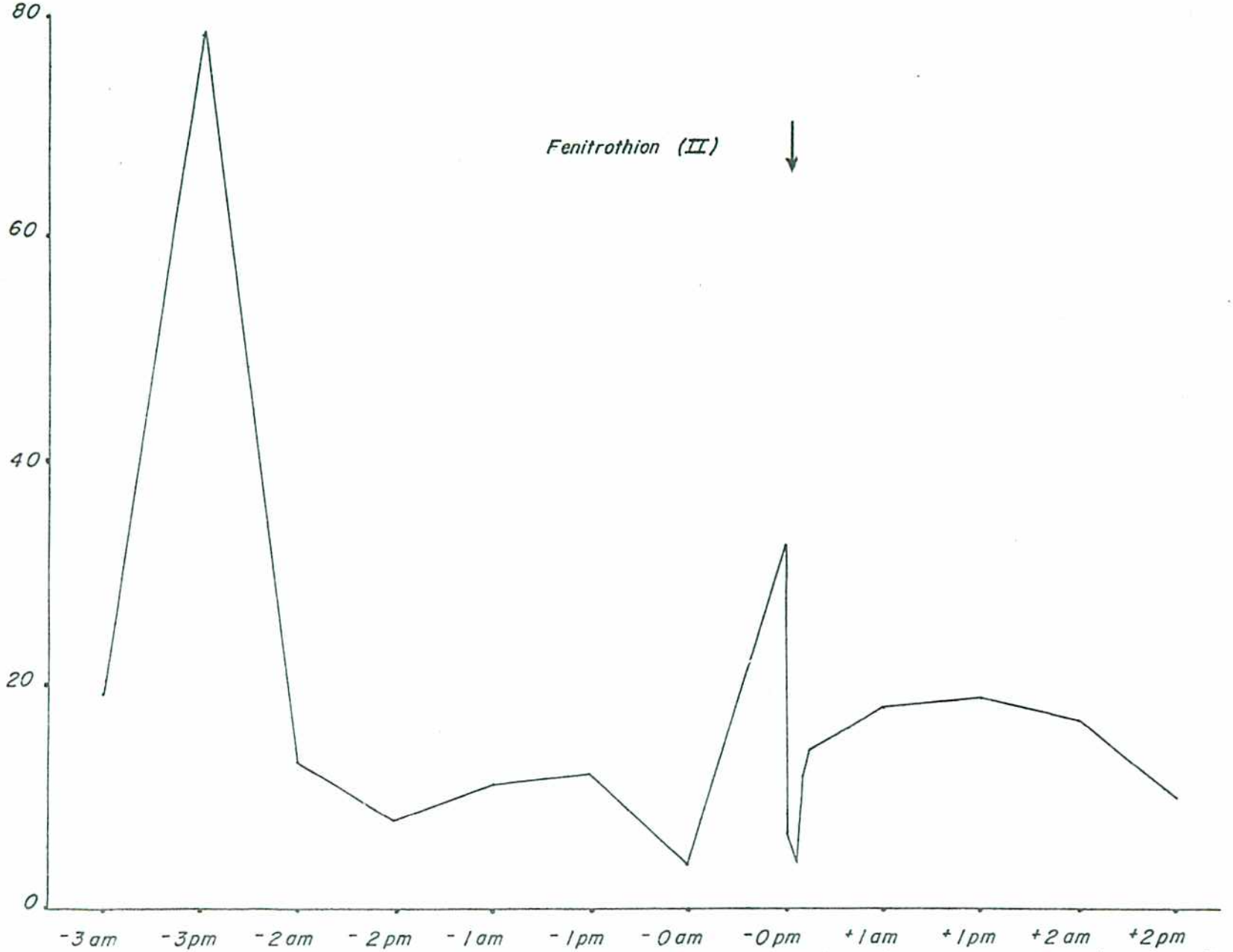

Fig. 8. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Grande Colline around the date of the second fenitrothion application.

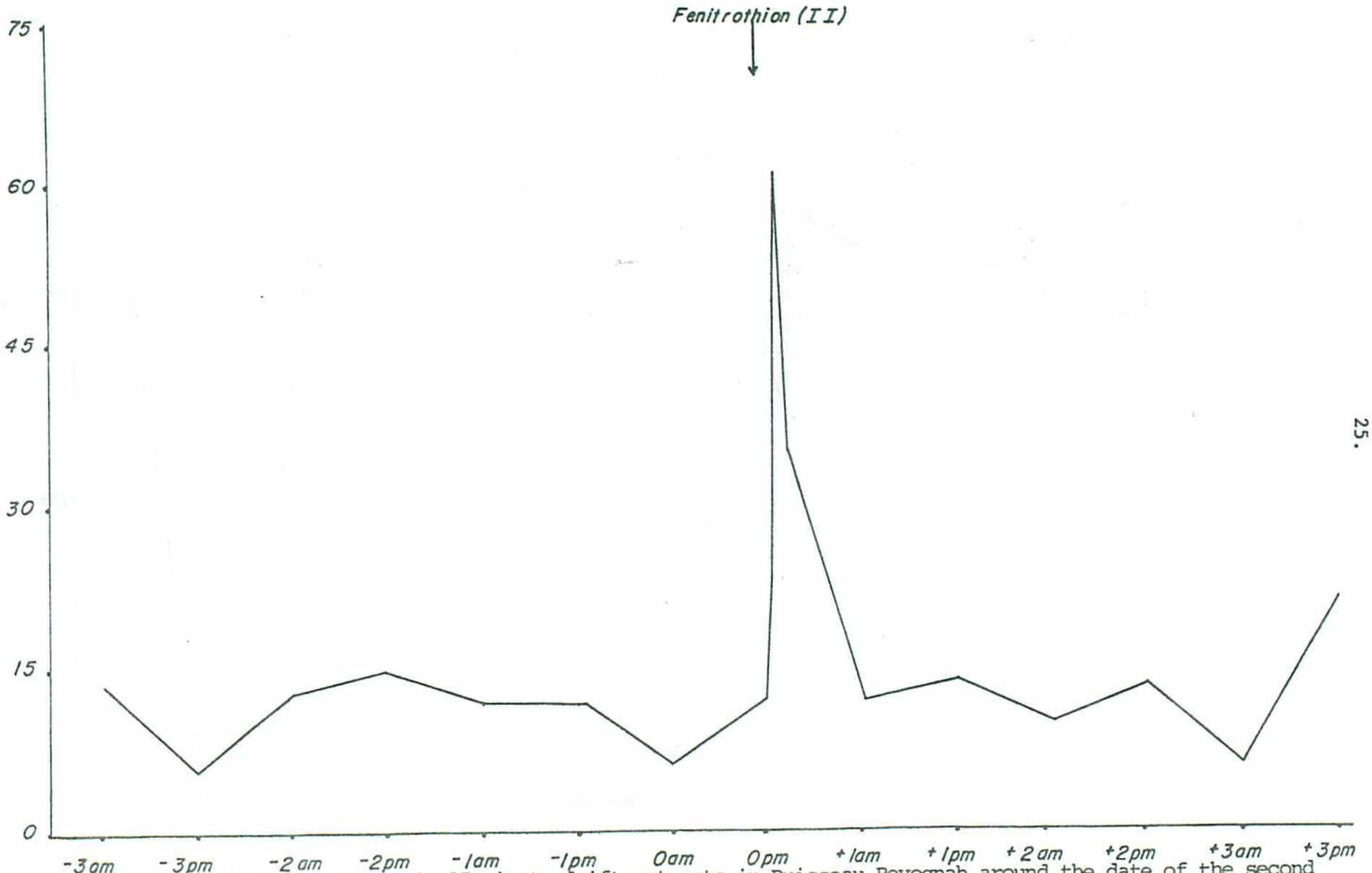

Fig. 9. Aquatic insects caught in 15 minute drift net sets in Ruisseau Revognah around the date of the second fenitrothion application.

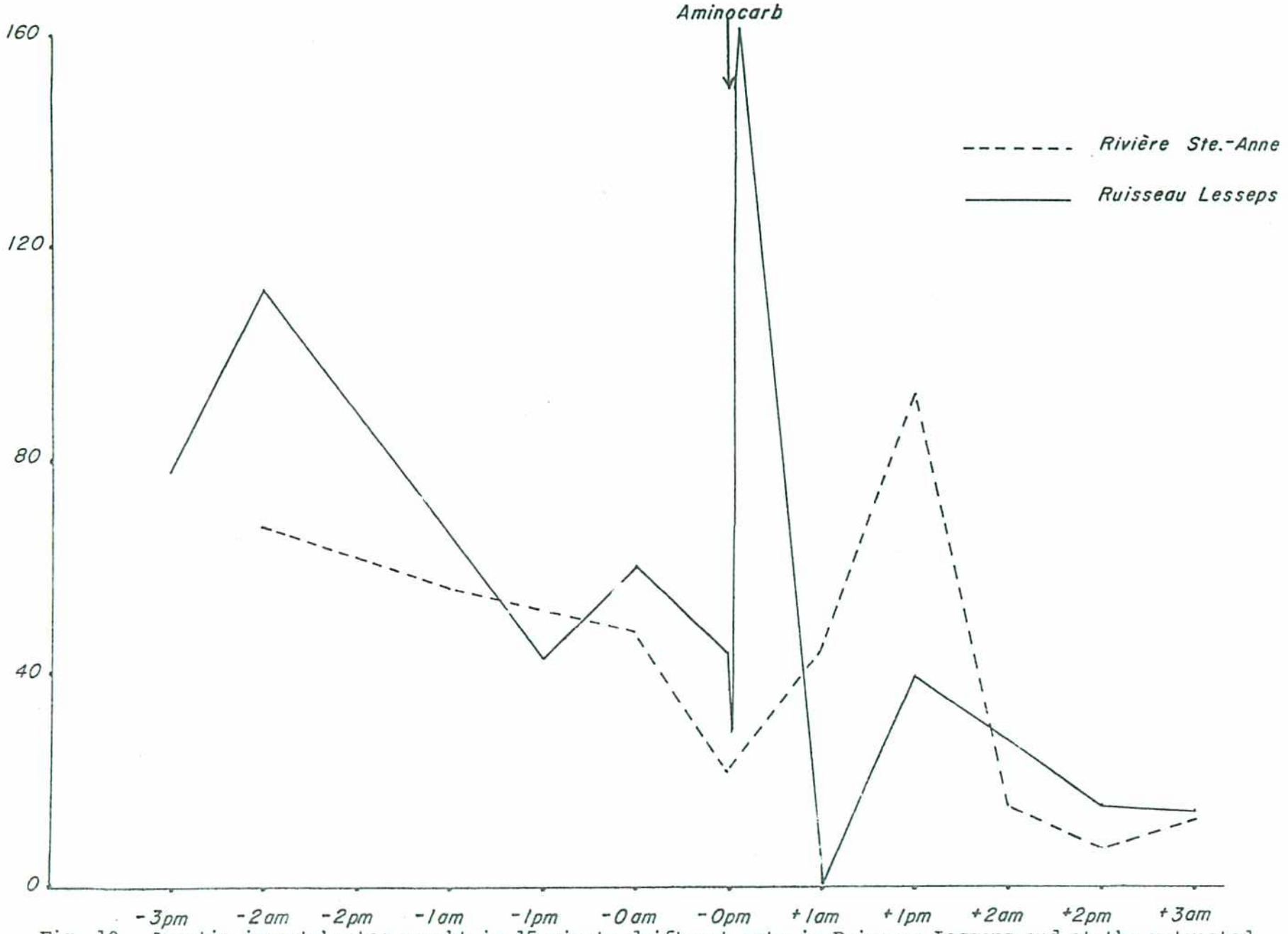

Fig. 10. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Lesseps and at the untreated control station, Rivière Ste-Anne, around the date of the aminocarb application.

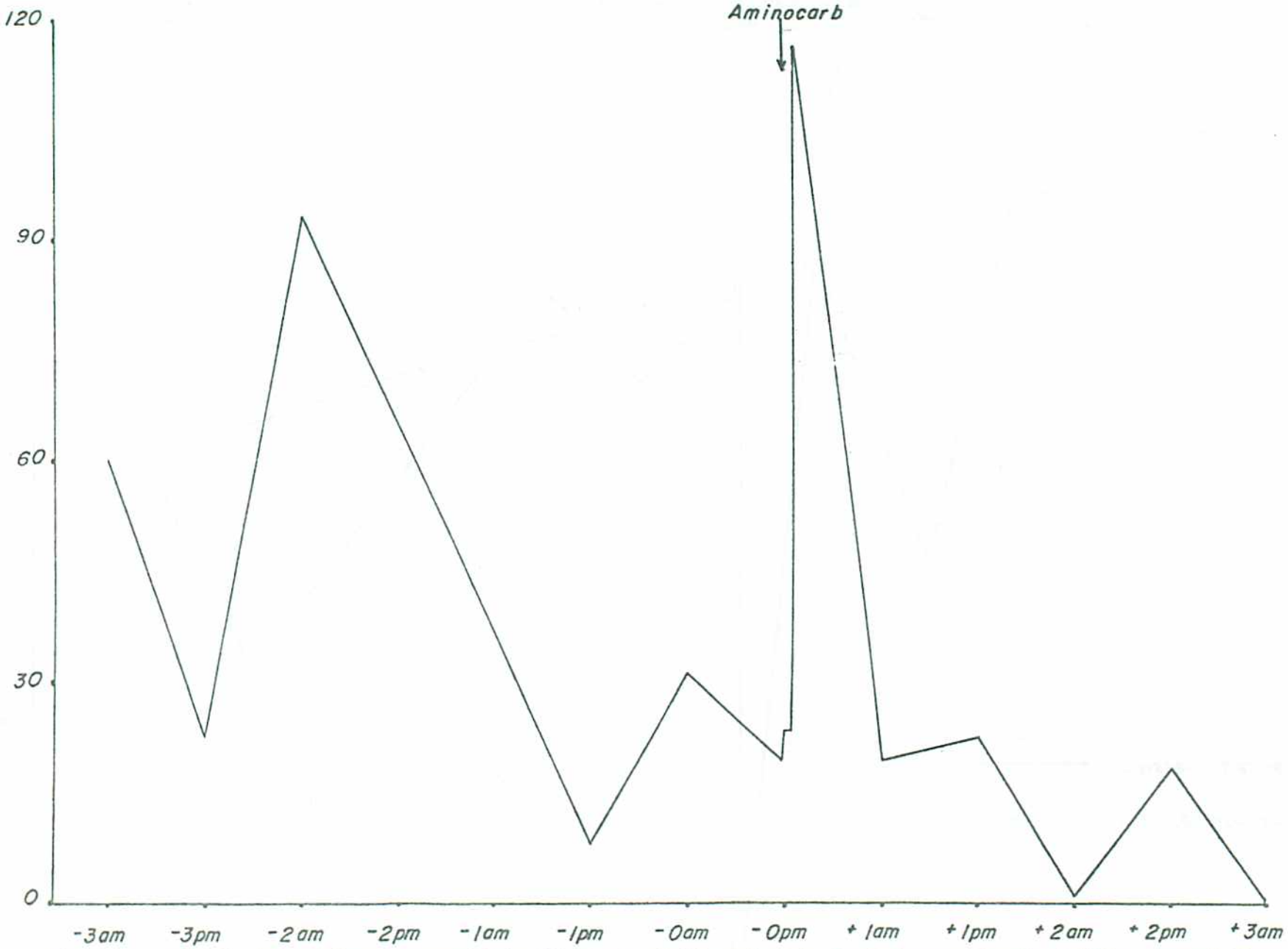

Fig. 11. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Grande Colline around the date of the aminocarb application.

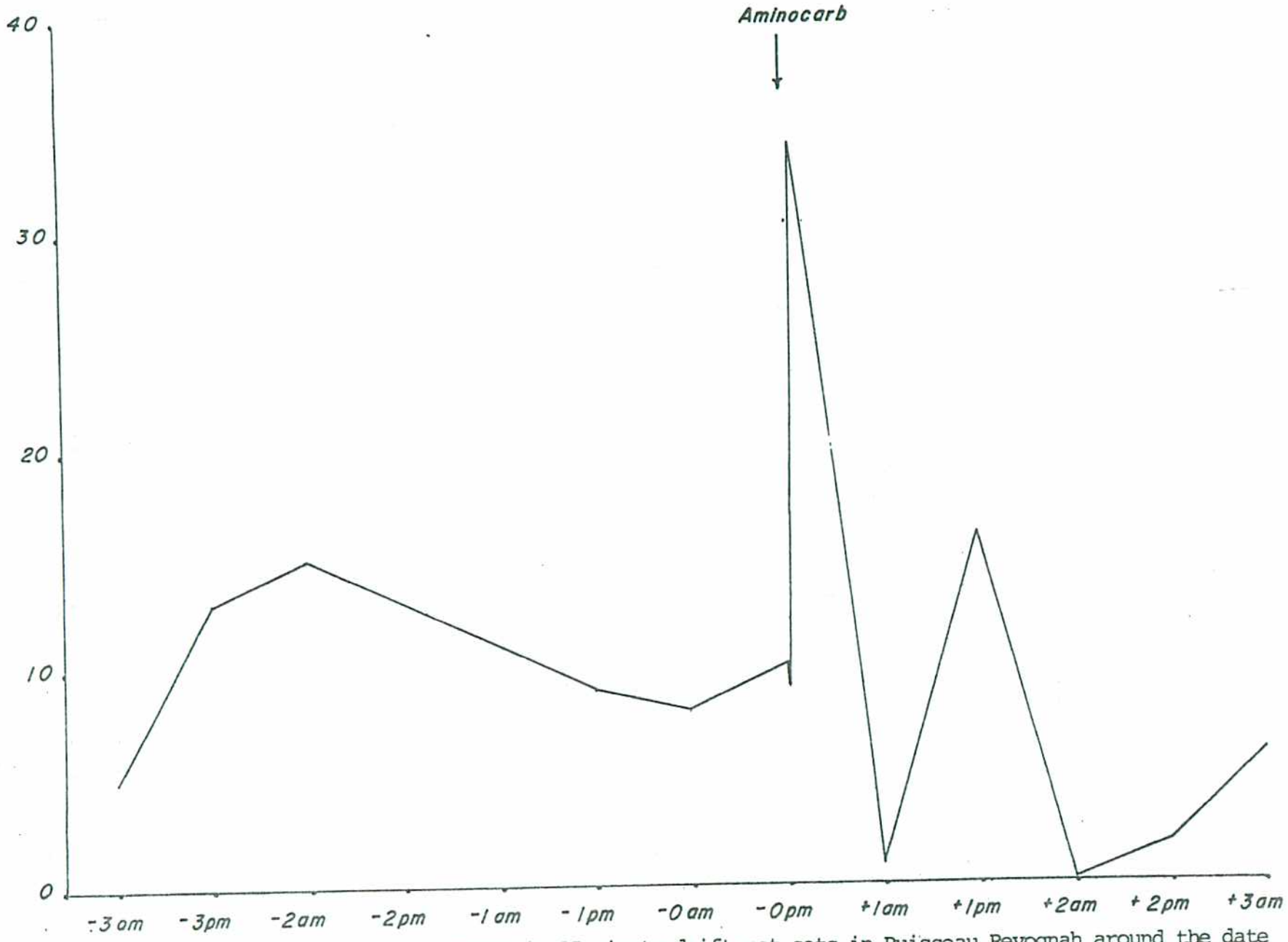

Fig. 12. Aquatic invertebrates caught in 15 minute drift net sets in Ruisseau Revognah around the date of the aminocarb application.

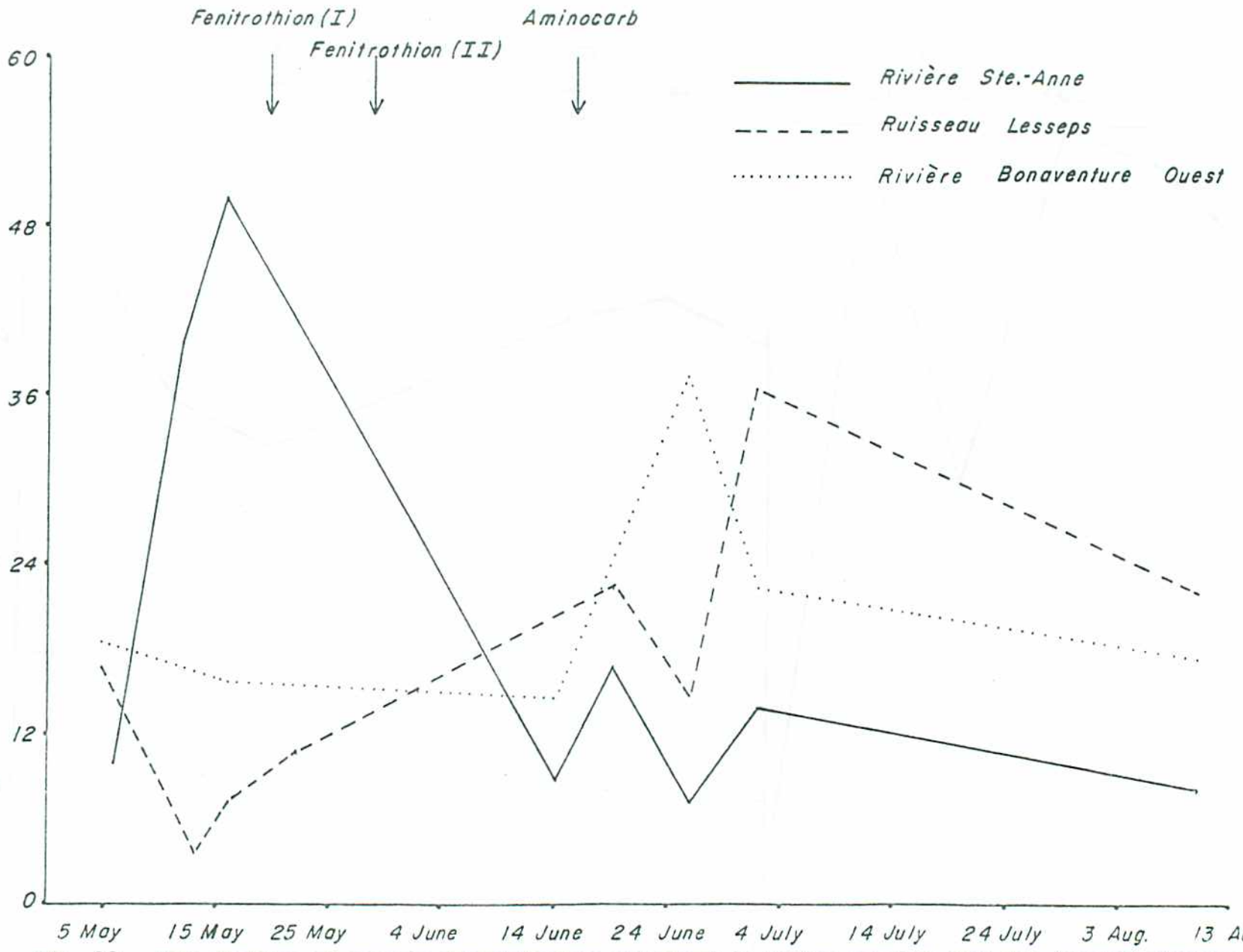

Fig. 13. Mean numbers of aquatic invertebrates collected in Surber samples from two treated streams, Ruisseau Lesseps and Rivière Bonaventure Ouest, and the untreated control stream, Rivière Ste-Anne, in 1977.

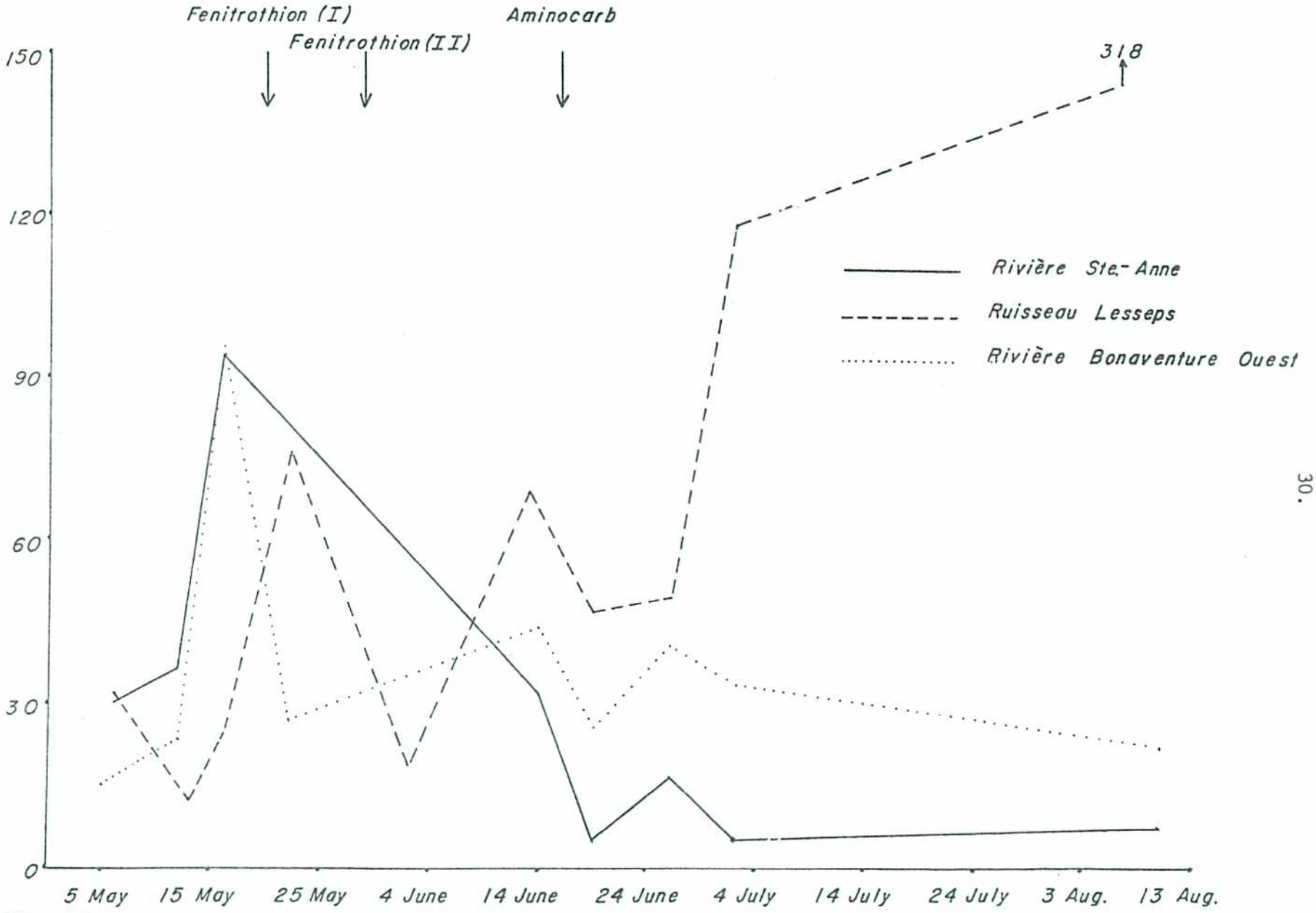

Fig. 14. Mean numbers of aquatic invertebrates collected from rocks from two treated streams, Ruisseau Lesseps and Rivière Bonaventure Ouest, and the untreated control stream, Rivière Ste-Anne, in 1977.

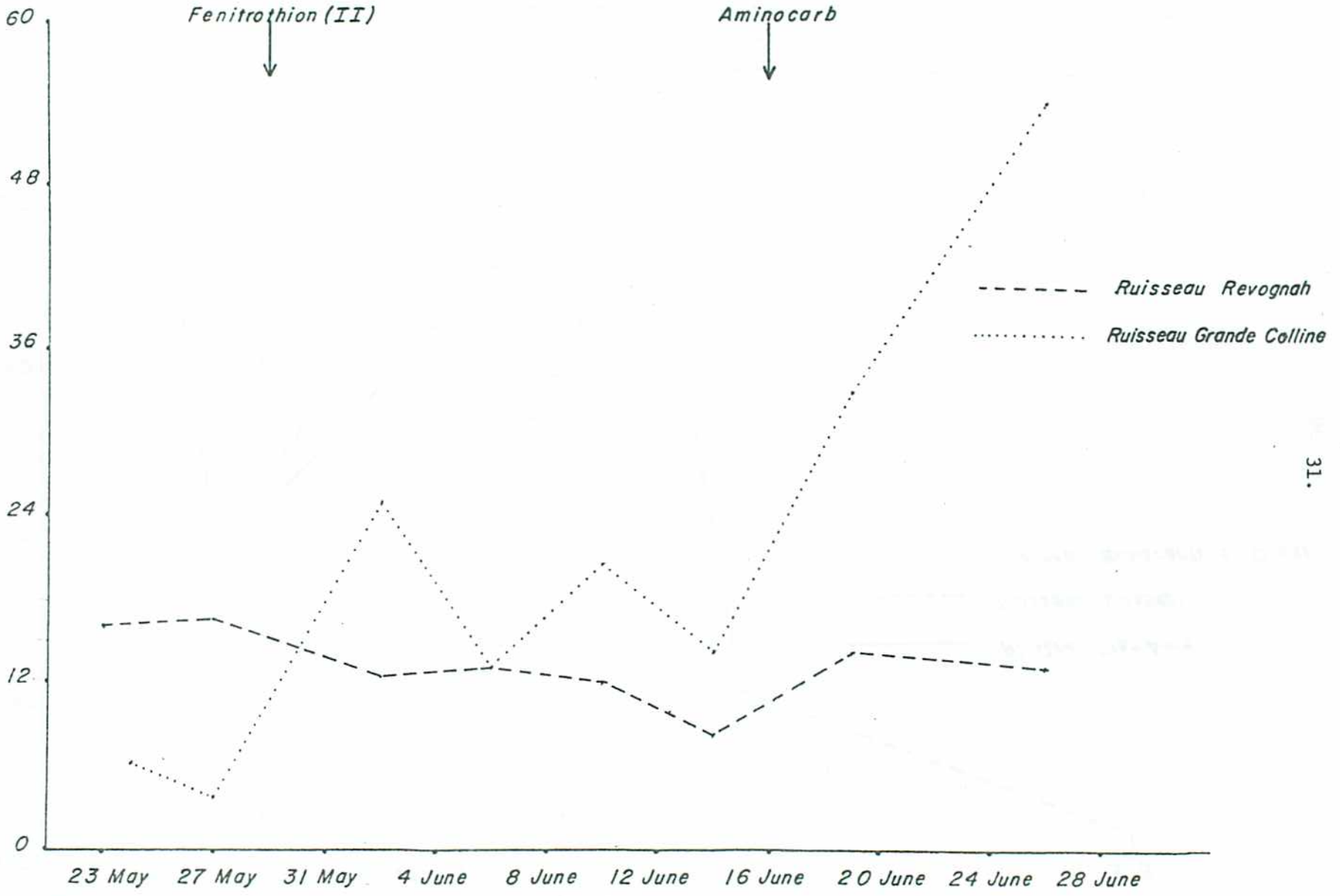

Fig. 15. Mean numbers of aquatic invertebrates collected in Surber samples from Ruisseau Revognah and Ruisseau Grande Colline in 1977.

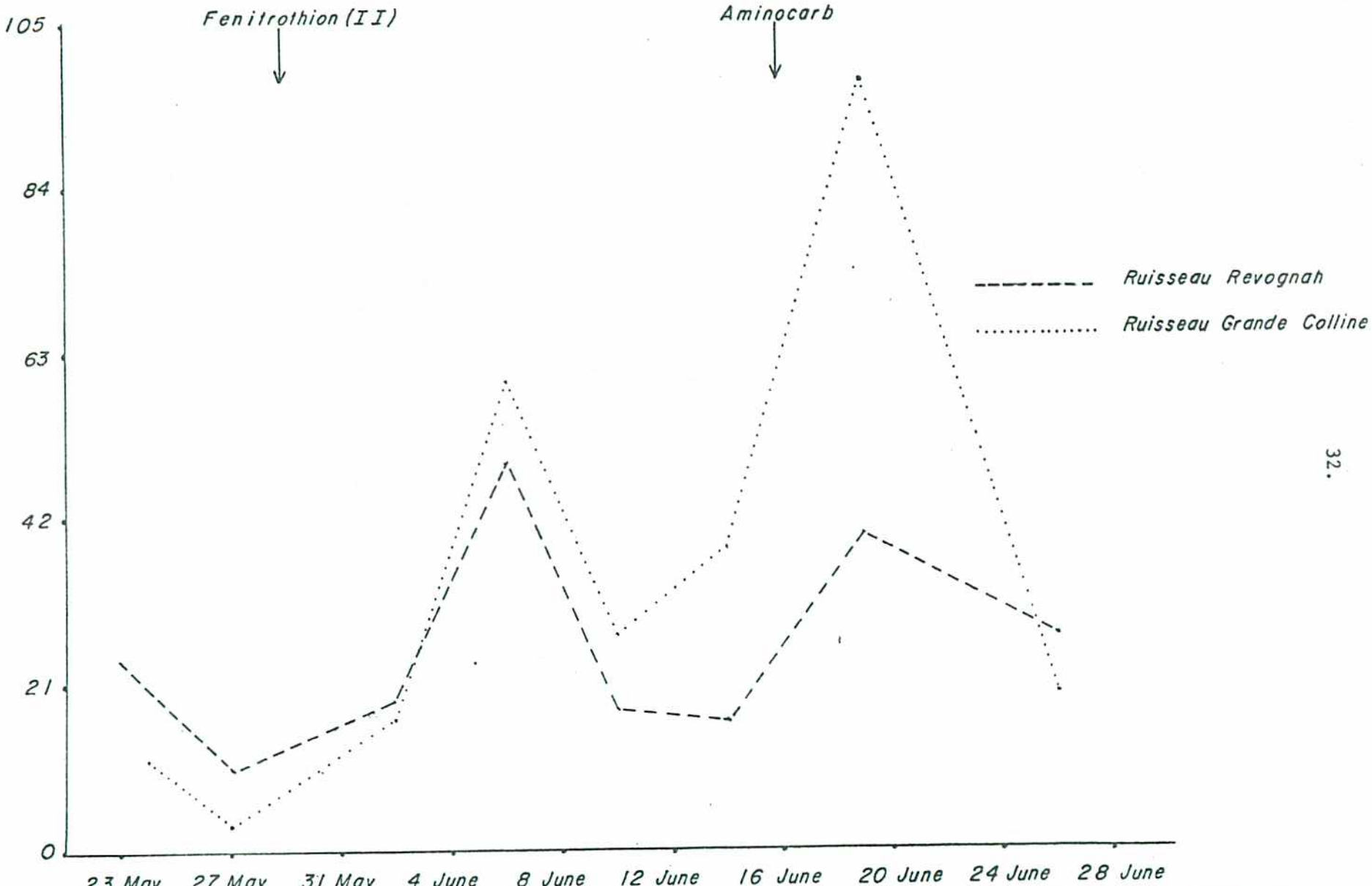

Fig. 16. Mean numbers of aquatic invertebrates collected from rocks from Ruisseau Revognah and Ruisseau Grande Colline in 1977.

V. SUMMARY AND CONCLUSIONS

The three insecticide applications to Lac Ste-Anne did not have dramatic adverse effects on resident zooplankton, benthos or fish populations. A significant effect of the fenitrothion treatments on shallow dwelling baetid mayfly nymphs is indicated, as is opportunistic feeding on affected mayfly nymphs and caddisfly larvae by resident trout populations. Deep dwelling mayfly nymph populations did not appear to be affected.

Severe spate conditions in streams in block 305 had far greater effects on aquatic fauna than the insecticide applications. Short lived disruption of aquatic insect populations was apparent from increases in the numbers of some groups collected in drift nets after each of the three treatments. Fenitrothion had the greatest effect on blackfly larvae and also affected stonefly nymphs. Effects of aminocarb were not as great but this may be partly due to decreased stream flow and seasonal differences in bottom fauna populations at the time of the aminocarb application. There were no indications that any of the increases in invertebrate drift resulted in significant depletion of bottom fauna populations. Some short-lived increases in the utilization of aquatic insects by brook trout were apparent following the fenitrothion treatments.

In summary, it can be concluded that the insecticide treatments applied to block 305 had no substantial short term impact on aquatic fauna.

VI. ACKNOWLEDGEMENTS

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VIII. APPENDICES

APPENDIX 'A'

Stream water levels and

drift net catches

Table A-1

Stream water levels*, first fenitrothion application**

Block 305, Gaspé, Quebec

Days before or after insecticide application	-4 am	-4 pm	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	-0 am	+0 pm	+1 am	+1 pm	+2 am
Rivière Ste-Anne (untreated control)	71	73	77	86	94	93	88	89.5	91	97	101	110	-
Ruisseau Lesseps	67	67	68	77	83	81	85	88	88	93	91	102	103
Rivière Bonaventure Ouest	52.5	53	54.5	63	67	71	71	72	72.5	77.5	80	83	86

* in centimetres

** 4:30 to 6:00 am, 20 May 1977.

Table A-2

Drift net catches*, Rivière Ste-Anne, untreated control stream, first fenitrothion application**

Gaspé, Quebec

Days Before or After Insecticide Application	-4 am	-4 pm	-3 am	-3 pm	-2 am	-2 am	-1 am	-1 pm	-0 am	+0 am	+0 pm	+1 am	+1 pm
Aquatic Organisms													
Ephemeroptera:Heptagenidae	-	-	-	-	1	-	-	2	1	3	-	1	2
:Baetidae	-	-	1	1	2	-	3	1	2	2	1	2	3
Plecoptera	-	-	-	1	3	1	2	3	2	-	-	3	-
Trichoptera	-	-	-	1	-	-	2	2	1	-	-	-	-
Coleoptera:Hydrophilidae	-	-	-	-	2	-	-	-	-	1	-	-	1
:Elmidae	-	-	-	-	1	-	-	-	-	-	-	-	-
Diptera:Tipulidae	-	-	-	1	2	1	1	-	-	1	-	3	-
:Blephariceridae	-	-	-	-	-	-	-	-	-	-	-	1	1
:Simuliidae	-	-	-	-	1	-	1	-	-	-	-	-	-
:Chironomidae	4	1	3	8	17	6	19	15	4	9	5	47	12
:Rhagionidae	-	-	-	-	-	-	-	-	-	1	-	-	-
:Empididae	-	-	1	-	-	-	-	1	-	-	-	-	-
Nematoda	-	-	-	1	-	-	-	-	-	-	-	-	-
Oligochaeta	-	1	-	5	5	1	3	4	2	4	4	-	6
Gastropoda	-	-	1	-	-	-	-	-	-	-	-	-	1
Total Aquatic Organisms	4	2	6	18	33	10	30	29	12	21	10	57	26
Terrestrial Organisms													
Diplopoda	-	-	-	-	-	-	-	-	-	1	-	-	-
Lepidoptera	-	1	-	-	-	-	1	4	-	-	-	2	3
Diptera	-	-	-	-	-	-	1	-	-	1	-	-	-
Hymenoptera	-	-	-	-	-	-	-	1	-	-	-	-	-
Total Terrestrial Organisms	0	1	0	0	0	0	2	5	0	2	0	2	3

* 15 minute net sets

** 4:30 to 6:00 am, 20 May 1977

Table A-3

Drift net catches*, Ruisseau Lesseps, first fenitrothion application**

Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-4 pm	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	+5 min	+½ h	+1½ h	+2½ h	+4h***	+0 pm	+1 am	+1 pm	+2 am
Aquatic Organisms																
Ephemeroptera:Heptagenidae	8	6	163	12	7	3	5	23	34	20	10	-	3	32	11	39
:Baetidae	56	35	892	46	24	28	33	49	50	38	30	43	13	51	21	84
Plecoptera	17	14	899	6	15	12	23	86	51	21	15	6	18	57	19	63
Trichoptera	1	-	13	8	14	5	2	18	8	9	30	12	3	14	4	12
Diptera:Tipulidae	-	-	26	2	3	1	6	6	4	-	-	-	-	2	1	-
:Simuliidae	8	26	107	75	35	112	61	157	116	300	891	6500	451	556	58	285
:Chironomidae	18	6	116	27	30	27	39	95	100	40	42	12	46	213	75	648
:Heleidae	-	-	2	-	-	1	1	8	-	-	2	6	-	1	-	12
:Rhagionidae	-	-	34	3	1	-	2	4	-	-	-	-	-	3	2	3
:Empididae	-	-	1	-	-	-	1	-	2	-	-	-	-	-	-	-
:Unknown	-	-	3	-	-	1	-	6	-	3	2	-	-	4	1	12
Nematoda	-	-	1	-	-	-	-	-	2	2	-	-	-	-	-	-
Oligochaeta	1	-	1	2	-	-	-	-	2	-	-	-	3	-	1	6
Hydracarina	1	-	1	-	-	-	1	-	2	-	-	-	-	-	-	-
Gastropoda	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-
Total Aquatic Organisms	110	87	2259	181	130	190	175	452	371	433	1022	6579	539	933	193	1164
Terrestrial Organisms																
Arachnida	1	-	-	1	1	-	-	2	-	-	-	6	-	-	-	-
Collembola	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plecoptera	1	1	1	-	-	1	-	-	-	-	2	-	-	-	-	-
Coleoptera	3	-	1	-	-	-	-	-	-	-	-	-	-	2	1	-
Lepidoptera	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	9
Diptera	1	-	-	1	1	1	-	-	3	-	-	6	-	-	-	3
Total Terrestrial Organisms	9	1	2	2	2	2	1	2	3	0	2	12	0	2	1	12

* 15 minute net sets

** 4:30 to 6:00 am, 20 May 1977

***numbers extrapolated from subsamples.

Table A-4

Drift net catches*, Rivière Bonaventure Ouest, first fenitrothion application**

Block 305, Gaspè, Quebec

Days Before or After Insecticide Application	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	+5 min	+½h	+1h	+2h	+3h	+0 pm	+1 am	+1 pm	+2 am
Aquatic Organisms															
Ephemeroptera:Heptagenidae	2	9	-	-	-	1	9	-	1	3	15	16	7	6	21
:Baetidae	2	32	1	3	1	3	9	1	8	3	3	13	8	3	39
Plecoptera	6	194	1	3	2	3	9	2	5	15	5	34	4	15	72
Trichoptera	-	2	-	-	-	1	-	-	1	-	1	4	1	2	18
Coleoptera:Dytiscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
:Hydrophilidae	-	-	-	-	-	-	-	-	-	-	-	1	1	-	3
Diptera:Tipulidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
:Simuliidae	1	6	3	1	1	-	3	3	1	-	-	14	-	1	9
:Chironomidae	7	26	19	13	2	2	15	15	17	5	12	36	10	21	153
:Stratiomyidae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
:Heleidae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
:Rhagionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
:Empididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Oligochaeta	-	2	-	-	-	1	-	-	-	-	-	-	-	-	3
Hydracarina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Total Aquatic Organisms	18	271	24	20	6	11	45	21	33	26	36	120	31	48	333
Terrestrial Organisms															
Arachnida	1	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Collembolla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Plecoptera	-	-	-	-	-	-	-	-	-	-	-	-	2	1	3
Thysanoptera	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Coleoptera	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
Lepidoptera	-	-	1	-	-	-	-	-	-	-	-	1	-	-	6
Diptera	1	-	-	-	-	-	-	-	-	-	-	3	-	-	6
Hymenoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Total Terrestrial Orgamisms	2	0	1	0	0	0	0	0	0	0	1	6	2	1	27

* 15 minute net sets

** 4:30 to 6:00 am, 20 May 1977

Table A-5

Stream water levels*, second fenitrothion application**

Block 305, Gaspé, Quebec

Days before or after insecticide application	-4 pm	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	-0 am	-0 pm	+1 am	+1 pm	+2 am	+2 pm	+3 am	+3 pm
Ruisseau Grande Colline	44	37	28	17	17	17	20	18	17	16	16	16	16	13	13
Ruisseau Revognah	55.5	49.5	42	33	27	27	25	23	27	27	28	23.5	29	25	37

* in centimetres

** 1930 to 2015 pm, 29 May 1977

Table A-6

Drift net catches*, Ruisseau Grande Colline, second fenitrothion application**

Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	-0 am	-0 pm	+5 min	+½h	+1h	+1½h	+2h	+1 am	+1 pm	+2 am	+2 pm
Aquatic Organisms																	
Ephemeroptera:Baetidae	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Diptera:Tipulidae	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
:Simuliidae	1	15	1	1	3	1	1	22	4	1	2	6	10	17	16	10	3
:Chironomidae	11	47	10	7	8	11	3	9	3	4	2	6	4	1	3	7	7
:Empididae	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
:Unknown	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligochaeta	6	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydracarina	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastropoda	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Aquatic Organisms	19	78	13	8	11	12	4	32	7	5	4	12	14	18	19	17	10
Terrestrial Organisms																	
Arachnida	1	-	-	-	1	-	-	2	-	-	1	-	3	-	2	2	1
Diplopoda	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Collembolla	4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Lepidoptera	5	2	-	2	3	-	-	1	-	-	-	-	-	6	13	17	4
Diptera	1	1	-	-	-	-	-	-	-	-	-	-	4	-	1	1	-
Total Terrestrial Organisms	11	3	1	2	4	0	0	3	0	0	2	0	7	6	16	20	8

* 15 minute net sets

** 1930 to 2015 pm, 29 May 1977

Table A-7

Drift net catches*, Ruisseau Revognah, second fenitrothion application**

Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-3am	-3pm	-2am	-2pm	-1am	-1pm	-0am	-0pm	+5 min	+½h	+1h	+1½h	+2h	+1am	+1pm	+2am	+2pm	+3am	+3pm
Aquatic Organisms																			
Ephemeroptera:Heptagenidae	-	-	-	1	-	-	-	-	1	1	4	-	-	-	-	-	-	-	-
:Baetidae	1	-	-	1	-	1	-	-	-	4	1	3	1	1	-	-	-	-	-
Plecoptera	5	1	2	5	7	4	3	2	9	13	47	31	25	1	3	2	4	3	11
Trichoptera	-	-	1	-	-	1	-	-	-	-	-	1	2	1	-	-	-	-	1
Diptera:Tipulidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
:Culicidae	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
:Simuliidae	-	-	-	1	-	1	-	-	1	-	1	-	-	-	2	-	-	-	-
:Chironomidae	5	2	7	5	5	1	3	6	2	4	6	10	4	6	6	7	4	1	5
:Heleidae	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
:Rhagionidae	1	2	3	1	-	3	-	4	2	-	1	1	3	1	3	1	3	2	3
:Empididae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
:Unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Nematoda	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligochaeta	1	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Hydracarina	-	-	-	-	-	1	-	-	-	1	1	-	-	1	-	-	2	-	-
Total Aquatic Organisms	14	6	13	15	12	12	6	12	17	24	61	47	35	12	14	10	13	6	21
Terrestrial Organisms																			
Arachnida	-	-	-	2	-	3	-	2	1	1	1	-	-	1	-	-	1	-	-
Collembolla	-	1	-	-	-	-	-	-	1	2	-	-	-	1	1	-	-	-	-
Plecoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Coleoptera	1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	-	1
Lepidoptera	2	1	1	-	1	1	1	1	-	4	-	-	-	3	1	1	3	3	-
Diptera	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	1	-
Hymenoptera	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Total Terrestrial Organisms	3	2	1	2	1	4	1	3	3	7	3	1	2	5	2	1	5	4	3

* 15 minute net sets

1930 to 2015 pm, 29 May 1977

Table A-8

Stream water levels*, aminocarb application**

Block 305, Gaspé, Quebec

Days before or after insecticide application	-4 pm	-3 am	-3 pm	-2 am	-2 pm	-1 am	-1 pm	-0 am	-0 pm	+1 am	+1 pm	+2 am	+2 pm	+3 am
Rivière Ste-Anne (untreated control)	-	-	-	-	53	-	50.5	45	42	38	36	34	33	32
Ruisseau Grande Colline	12	11	12	11	-	-	10	10	9	8	9	8	8	8
Ruisseau Revognah	22	22	21	20	-	-	19	18	18	16	16	16	16	15

* in centimetres

** 1950 to 2030 pm, 16 June, 1977.

Table A-9

Drift net catches*, Rivière Ste-Anne, untreated control stream, aminocarb application**

Gaspé, Quebec

Days Before or After Insecticide Application	-2 pm	-1 pm	-0 am	-0 pm	+1 am	+1 pm	+2 am	+2 pm	+3 am
Aquatic Organisms									
Ephemeroptera:Heptagenidae	6	20	6	1	6	17	3	-	3
:Baetidae	29	13	14	5	19	54	4	1	6
Plecoptera	2	-	1	-	1	3	-	-	-
Tricoptera	1	3	1	3	3	2	3	-	1
Coleoptera:Elmidae	-	-	-	1	-	-	-	-	-
Diptera:Tipulidae	1	2	3	-	-	1	-	-	-
:Blephariceridae	3	-	1	-	1	2	-	-	-
:Simuliidae	5	3	6	-	2	2	1	-	-
:Chironomidae	16	13	13	8	11	11	4	6	2
:Empididae	1	-	-	-	1	-	-	-	-
:Unknown	2	-	-	-	-	-	-	-	-
Oligochaeta	1	1	2	3	-	-	-	-	-
Hydracarina	-	1	-	-	-	-	-	-	-
Total Aquatic Organisms	67	56	47	21	44	92	15	7	12
Terrestrial Organisms									
Arachnida	-	-	-	-	-	-	-	-	1
Ephemeroptera	1	-	-	-	-	-	-	-	-
Lepidoptera	25	21	6	6	7	12	1	-	-
Diptera	7	12	2	1	6	12	-	4	1
Hymenoptera	1	-	-	-	-	-	-	-	-
Total Terrestrial Organisms	34	33	8	7	13	24	1	4	2

* 15 minute net sets

** 1950 to 2030 pm, 16 June 1977

Table A-10

Drift net catches*, Ruisseau Lesseps, aminocarb application**, Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-3 pm	-2 am	-2 pm	-1 pm	-0 am	-0 pm	+5 min	+½ h	+1 h	+1½ h	+1 am	+1 pm	+2 am	+2 pm	+3 am
Aquatic Organisms															
Ephemeroptera:Heptagenidae	2	6	2	3	1	1	2	5	14	17	-	5	1	1	2
:Baetidae	57	74	57	22	33	22	14	18	51	70	-	16	7	10	3
Plecoptera	2	14	18	1	4	2	1	1	12	16	-	1	-	1	-
Trichoptera	-	3	2	1	6	4	3	2	5	2	-	-	4	-	1
Coleoptera:Hydrophilidae	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Diptera:Tipulidae	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
:Simuliidae	1	3	-	1	5	2	1	54	29	25	-	3	1	-	1
:Chironomidae	13	10	10	13	10	13	8	31	37	31	-	13	22	3	7
:Rhagionidae	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
:Empididae	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-
:Unknown	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nematoda	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Oligochaeta	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydracarina	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-
Total Aquatic Organisms	78	112	89	43	60	44	29	113	150	161	1	39	35	15	14
Terrestrial Organims															
Arachnida	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-
Collembolla	-	-	-	-	-	-	1	1	-	2	-	-	-	-	-
Plecoptera	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Homoptera	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coleoptera	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-
Lepidoptera	-	-	1	3	1	3	2	3	3	1	-	3	-	-	-
Diptera	3	2	2	1	2	3	6	8	7	7	-	8	2	3	7
Total Terrestrial Organisms	4	2	3	5	3	6	9	15	12	13	0	11	2	3	7

* 15 minute net sets

** 1950 to 2030 pm, 16 June 1977

Table A-11

Drift net catches*, Ruisseau Grande Colline, aminocarb application**

Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-3 am	-3 pm	-2 am	-1 pm	-0 am	-0 pm	+5 min	+½ h	+1 h	+1 am	+1 pm	+2 am	+2 pm	+3 am
Aquatic Organisms														
Ephemeroptera: Heptagenidae	-	-	-	-	-	-	-	-	-	-	1	-	-	-
: Baetidae	-	-	-	1	-	-	-	-	-	3	1	1	-	-
Trichoptera	-	-	-	-	1	-	-	-	-	-	-	-	1	-
Coleoptera: Hydrophilidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Diptera: Tipulidae	-	-	-	-	1	-	-	-	-	-	-	-	-	-
: Simuliidae	20	17	19	5	5	11	19	18	28	2	15	-	13	-
: Chironomidae	36	6	74	2	24	7	3	3	86	13	4	-	4	-
Oligochaeta	3	-	-	-	-	1	-	-	2	-	-	-	-	-
Hydracarina	-	-	-	-	-	-	1	2	-	1	-	-	-	-
Total Aquatic Organisms	60	23	93	8	31	19	23	23	116	19	21	1	18	0
Terrestrial Organisms														
Arachinida	-	1	1	-	-	-	1	1	3	-	-	-	1	-
Diplopoda	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Collembola	-	-	-	-	-	-	-	-	1	-	2	-	2	-
Coleoptera	-	-	1	-	-	-	-	-	-	2	1	-	2	-
Lepidoptera	-	-	2	-	-	-	-	-	-	3	1	-	-	-
Diptera	1	1	16	-	3	-	-	1	-	10	1	-	5	-
Total Terrestrial Organisms	1	2	21	0	3	0	1	2	4	15	5	0	10	0

* 15 minute net sets

** 1950 to 2030 pm, 16 June 1977

Table A-12

Drift net catches*, Ruisseau Revognah, aminocarb application**

Block 305, Gaspé, Quebec

Days Before or After Insecticide Application	-3 am	-3 pm	-2 am	-1 pm	-0 am	-0 pm	+5 min	+½ h	+1 h	+1 am	+1 pm	+2 am	+2 pm	+3 am
Aquatic Organisms														
Ephemeroptera: Baetidae	2	6	1	4	1	3	-	2	10	-	2	-	-	-
Plecoptera	1	3	2	2	-	-	3	4	10	-	2	-	1	-
Trichoptera	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Diptera: Tipulidae	-	-	-	-	-	-	1	-	-	-	-	-	-	-
: Simuliidae	-	1	1	2	1	-	1	3	6	-	1	-	-	1
: Chironomidae	1	2	11	1	4	6	4	7	5	-	8	-	1	4
: Rhagionidae	-	1	-	-	1	1	-	1	2	1	-	-	-	1
: Unknown	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydracarina	-	-	-	-	-	-	-	-	1	-	3	-	-	-
Total Aquatic Organisms	5	13	15	9	8	10	9	17	34	1	16	0	2	6
Terrestrial Organisms														
Arachnida	-	1	1	-	1	-	-	-	1	-	1	-	-	-
Collembola	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Lepidoptera	-	1	-	-	-	-	-	1	-	-	-	-	-	1
Diptera	-	-	-	-	2	-	-	-	1	-	-	-	1	-
Total Terrestrial Organisms	0	2	1	0	3	0	0	2	2	0	1	0	1	1

* 15 minute net sets

** 1950 to 2030 pm, 16 June 1977

APPENDIX 'B'

Bottom Fauna populations

Table B-1

Bottom fauna populations* in Lac Ste-Anne, Block 305
Gaspé, May 5 to July 2, 1977

Date	May 5	May 11	May 17	May 23	May 29	June 2	June 6	June 11	June 15	June 19	June 26	July 2
Mean depth (m)	1.46	1.00	1.31	2.75	1.85	1.80	2.00	1.80	1.75	1.15	1.20	1.20
Ephemeroptera: Baetidae	2.8	6.2	1.2	3.0	0.5	0.8	-	-	-	-	-	-
Odonata: Libellulidae	0.2	-	-	-	-	-	-	-	-	-	-	-
: Aeshnidae	-	0.2	-	-	-	-	-	-	-	-	-	-
Plecoptera	-	1.0	-	-	-	-	-	-	-	-	-	-
Megaloptera: Sialidae	1.0	1.0	1.0	1.0	5.5	4.8	1.2	4.8	3.2	4.0	5.8	4.2
Trichoptera	-	0.2	0.2	0.2	0.2	-	-	1.0	-	0.2	1.0	0.2
Diptera: Chironomidae larvae	72.2	17.0	30.5	70.0	278.0	203.8	69.0	139.5	121.8	77.2	124.2	145.2
: Chironomidae pupae	-	-	0.2	-	-	-	-	1.0	0.5	0.5	43.0	11.8
: Heleiidae	-	0.2	-	-	1.0	1.0	0.8	1.5	1.0	1.5	4.2	12.0
Nematoda	-	-	-	-	-	-	-	-	-	-	-	0.2
Oligochaeta	-	-	-	-	-	0.2	-	-	-	0.2	2.2	1.8
Amphipoda	13.8	19.0	19.0	18.5	50.0	38.5	23.2	25.8	45.8	24.2	37.5	24.2
Hydracarina	-	-	-	-	-	0.2	-	-	-	-	-	-
Gastropoda: Sphaeridae	13.5	10.2	30.2	24.8	49.8	54.8	20.0	21.2	26.8	11.8	46.2	83.0
Total	103.5	55.2	82.5	117.0	385.0	304.0	114.2	194.8	199.0	119.8	264.2	282.8

* mean numbers collected in four 232 cm^2 Ekman grab samples.

Table B-2

Bottom fauna populations* in Rivière Ste-Anne, untreated control stream,

6 May to 10 August, 1977, Gaspé, Quebec

	6 May	12 May	16 May	14 June	19 June	26 June	2 July	10 Aug.
Ephemeroptera:Heptagenidae	3.0 ± 1.8	1.0 ± 0.8	0.2 ± 0.5	0.5 ± 1.0	0.5 ± 0.6	0.8 ± 1.0	6.8 ± 5.0	-
:Baetidae	0.5 ± 0.6	0.5 ± 0.6	1.0 ± 0.8	2.2 ± 1.5	5.2 ± 4.3	1.5 ± 1.1	1.8 ± 1.2	0.5 ± 0.6
Plecoptera	0.2 ± 0.5	0.8 ± 0.5	2.2 ± 1.9	-	-	0.5 ± 0.6	-	1.2 ± 1.2
Megaloptera:Sialidae	-	-	0.5 ± 0.6	-	-	-	-	-
Trichoptera	1.0 ± 1.4	0.2 ± 0.5	0.2 ± 0.5	0.5 ± 1.0	2.2 ± 2.1	1.0 ± 1.4	0.5 ± 0.6	0.2 ± 0.5
Coleoptera:Dytiscidae	-	-	-	-	-	-	-	1.0 ± 0.8
:Elmidae	0.8 ± 1.5	0.2 ± 0.5	-	-	-	-	0.2 ± 0.5	-
Diptera:Tipulidae	-	0.2 ± 0.5	0.2 ± 0.5	2.8 ± 1.0	3.0 ± 1.4	1.8 ± 1.0	2.2 ± 2.6	0.8 ± 1.5
:Simuliidae	0.2 ± 0.5	-	-	-	-	0.2 ± 0.5	-	-
:Chironomidae	2.0 ± 1.8	21.5 ± 16.8	21.8 ± 19.1	1.0 ± 0.6	4.5 ± 4.8	1.2 ± 1.0	1.5 ± 2.4	1.2 ± 1.0
:Heleidae	0.2 ± 0.5	4.0 ± 2.9	4.8 ± 3.9	-	0.2 ± 0.5	-	-	0.5 ± 0.6
:Empididae	-	1.8 ± 1.2	0.8 ± 1.0	0.2 ± 0.5	0.5 ± 0.6	-	-	2.0 ± 3.4
Turbellaria	-	0.8 ± 1.0	0.2 ± 0.5	0.2 ± 0.5	-	-	-	0.2 ± 0.5
Oligochaeta	2.0 ± 2.2	9.0 ± 7.4	17.8 ± 18.9	1.0 ± 1.4	1.0 ± 2.0	0.5 ± 0.6	1.0 ± 1.4	-
Gastropoda	-	-	0.2 ± 0.5	-	-	-	-	0.2 ± 0.5
Total	10.0 ± 6.2	39.8 ± 18.2	50.0 ± 27.4	8.5 ± 1.4	17.2 ± 11.1	7.5 ± 2.6	14.0 ± 5.9	8.0 ± 4.1

* Mean numbers and standard deviations of organisms collected in four 0.093 m^2 Surber samples.

Table B-3

Aquatic invertebrates* collected from rocks taken from Rivière Ste-Anne, untreated control stream, 7 May to 10 August, 1977, Gaspé, Quebec.

	6 May	12 May	16 May	14 June	19 June	26 June	2 July	10 Aug.
Ephemeroptera:Heptagenidae	3.0 ± 1.6	-	2.8 ± 4.9	6.8 ± 15.9	2.8 ± 4.2	4.2 ± 1.7	0.5 ± 0.6	0.2 ± 0.5
:Baetidae	1.0 ± 1.2	-	0.5 ± 0.6	22.2 ± 15.6	1.0 ± 2.0	7.0 ± 9.4	1.0 ± 1.2	0.5 ± 0.6
Plecoptera	-	0.2 ± 0.5	-	-	-	-	-	-
Trichoptera:larvae	0.5 ± 0.6	-	-	0.2 ± 0.5	-	0.5 ± 0.6	-	-
:pupae	2.5 ± 2.5	-	-	0.2 ± 0.5	-	0.2 ± 0.5	-	1.2 ± 1.2
Diptera:Tipulidae	-	-	-	0.2 ± 0.5	-	-	-	-
:Blephariceridae	0.8 ± 1.5	-	-	-	-	-	-	-
:Simuliidae	-	-	-	0.2 ± 0.5	-	0.8 ± 1.0	-	-
:Chironomidae	22.2 ± 13.7	35.8 ± 32.4	90.0 ± 44.8	2.0 ± 2.4	1.2 ± 1.4	3.5 ± 3.7	3.8 ± 3.5	2.0 ± 1.2
:Heleidae	-	-	-	-	-	-	-	2.2 ± 1.5
:Empididae	-	-	-	-	-	-	-	0.2 ± 0.5
Turbellaria	-	-	0.5 ± 0.6	-	0.2 ± 0.5	-	-	-
Hydracarina	-	-	-	-	-	0.2 ± 0.5	0.2 ± 0.5	0.8 ± 1.5
Gastropoda	-	-	-	-	-	-	-	0.2 ± 0.5
Total	30.0 ± 15.9	36.0 ± 32.1	93.8 ± 47.9	32.0 ± 24.4	5.2 ± 7.9	16.5 ± 12.4	5.5 ± 2.6	7.5 ± 3.1

* Mean numbers and standard deviations of organisms collected from four rocks approximately 20 cm in diameter.

Table B-4

Bottom fauna populations* in Ruisseau Lesseps, 5 May to 10 August, 1977

Block 305, Gaspé, Quebec

	5 May	13 May	16 May	22 May	13 June	19 June	26 June	2 July	Aug. 10
Ephemeroptera									
:Heptagenidae	0.8 ± 1.5	-	0.5 ± 0.6	0.8 ± 1.0	3.0 ± 1.4	4.0 ± 2.2	6.5 ± 9.0	12.2 ± 4.6	1.8 ± 1.7
:Baetidae	2.0 ± 2.2	0.2 ± 0.5	2.0 ± 2.8	1.0 ± 1.4	7.0 ± 2.8	12.5 ± 11.7	5.0 ± 6.8	6.5 ± 1.7	2.8 ± 1.3
Plecoptera	0.8 ± 1.5	-	-	-	0.8 ± 1.5	0.8 ± 1.5	0.2 ± 0.5	0.2 ± 0.5	1.2 ± 1.0
Trichoptera	9.5 ± 7.1	1.5 ± 1.7	0.5 ± 0.6	-	3.8 ± 1.7	1.0 ± 1.2	0.8 ± 0.6	1.0 ± 0.8	1.2 ± 1.9
Diptera									
:Tipulidae	-	0.2 ± 0.5	-	-	1.2 ± 1.0	0.2 ± 0.5	-	0.5 ± 1.0	-
:Simuliidae	0.2 ± 0.5	0.2 ± 0.5	0.2 ± 0.5	3.2 ± 1.3	-	0.5 ± 1.0	0.2 ± 0.5	8.0 ± 8.8	-
:Chironomidae	2.5 ± 2.1	1.2 ± 1.9	3.2 ± 2.2	4.8 ± 3.5	3.2 ± 1.2	3.5 ± 3.1	1.5 ± 1.0	7.2 ± 3.5	13.5 ± 7.0
:Heleidae	-	-	0.5 ± 0.6	-	0.2 ± 0.5	-	0.2 ± 0.5	-	-
:Rhagionidae	-	0.2 ± 0.5	-	-	-	-	-	-	0.2 ± 0.5
Turbellaria	0.8 ± 1.5	-	0.2 ± 0.5	-	-	-	-	0.2 ± 0.5	0.2 ± 0.5
Nematoda	-	-	-	-	-	-	-	0.2 ± 0.5	0.2 ± 0.5
Oligochaeta	-	-	-	-	0.2 ± 0.5	-	0.2 ± 0.5	-	-
Amphipoda	0.2 ± 0.5	-	-	0.8 ± 1.0	-	-	-	-	-
Hydracarina	-	-	0.2 ± 0.5	-	-	-	-	0.2 ± 0.5	1.2 ± 1.0
Gastropoda	-	-	-	-	0.2 ± 0.5	-	-	-	-
Pelecypoda									
:Sphaeridae	-	-	-	0.2 ± 0.5	-	-	-	-	-
Total	16.8 ± 9.5	3.8 ± 1.7	7.5 ± 4.2	10.8 ± 6.4	19.8 ± 4.2	22.5 ± 11.3	14.5 ± 16.3	36.5 ± 7.8	22.2 ± 10.1

* Mean numbers and standard deviations of organisms collected in four 0.093 m^2 Surber samples.

Table B-5

Aquatic invertebrates* collected from rocks taken from Ruisseau Lesseps, 6 May to 10 August, 1977

Block 305, Gaspé, Quebec.

	6 May	13 May	16 May	22 May	2 June	13 June	19 June	26 June	2 July	10 Aug.
Ephemeroptera:										
Heptagenidae	5.8 ± 5.0	1.5 ± 1.7	3.5 ± 1.7	3.5 ± 6.4	-	7.5 ± 4.4	2.5 ± 4.4	2.5 ± 4.4	3.0 ± 2.2	6.0 ± 2.9
Baetidae	9.8 ± 6.2	7.5 ± 4.6	7.0 ± 8.1	20.5 ± 29.3	1.2 ± 1.5	16.0 ± 14.0	5.5 ± 4.6	6.2 ± 7.8	5.2 ± 2.2	5.5 ± 7.8
Plecoptera	0.8 ± 1.0	-	-	-	-	-	-	0.2 ± 0.5	0.2 ± 0.5	-
Trichoptera:										
larvae	3.0 ± 3.2	0.2 ± 0.5	0.2 ± 0.5	0.8 ± 0.5	-	0.2 ± 0.5	-	-	0.2 ± 0.5	0.2 ± 0.5
pupae	2.5 ± 4.4	-	0.8 ± 1.5	2.5 ± 2.1	10.2 ± 12.6	0.5 ± 1.0	4.0 ± 8.0	0.2 ± 0.5	-	±
Lepidoptera:										
Pyralidae	-	-	-	-	0.2 ± 0.5	-	-	-	-	-
Diptera:										
Simuliidae:										
larvae			0.8 ± 1.5	2.2 ± 2.2	0.8 ± 1.0	12.8 ± 16.4	11.0 ± 12.8	1.2 ± 1.9	77.0 ± 90.6	86.5 ± 153.5
pupae	-	-	-	-	-	-	-	-	-	179.8 ± 349.5
Chironomidae:										
larvae	10.0 ± 5.4	3.2 ± 2.5	12.0 ± 5.5	46.2 ± 38.1	6.0 ± 6.0	32.0 ± 31.3	24.0 ± 26.5	35.2 ± 26.5	21.8 ± 10.8	40.0 ± 26.2
pupae	-	-	-	-	-	-	-	3.5 ± 5.7	10.8 ± 10.0	-
Oligochaeta	-	-	-	-	-	-	-	-	-	0.2 ± 0.5
Hydracarina	-	-	-	-	-	-	-	0.2 ± 0.5	-	-
Total	31.8 ± 19.1	12.5 ± 5.2	24.2 ± 15.8	75.8 ± 46.3	18.5 ± 8.9	69.0 ± 41.9	47.0 ± 46.1	49.5 ± 39.5	118.2 ± 78.1	318.2 ± 530.7

* Mean numbers and standard deviations of organisms collected from four rocks approximately 20 cm in diameter.

Table B-6

Bottom fauna populations* in Rivière Bonaventure Ouest, 5 May to 10 August, 1977

Block 305, Gaspé, Quebec

	5 May	12 May	16 May	14 June	19 June	26 June	2 July	10 Aug.
Ephemeroptera:Heptagenidae	2.5 ± 3.8	1.0 ± 0.8	1.8 ± 1.0	10.5 ± 4.7	6.2 ± 1.0	18.2 ± 4.0	11.0 ± 1.8	7.2 ± 4.5
:Baetidae	2.0 ± 3.4	4.8 ± 2.9	5.8 ± 1.2	0.8 ± 1.5	0.5 ± 0.6	4.8 ± 3.2	2.5 ± 2.4	2.0 ± 1.2
Plecoptera	3.0 ± 2.2	2.8 ± 3.1	1.2 ± 0.5	0.2 ± 0.5	0.5 ± 0.6	3.5 ± 2.6	2.0 ± 1.4	2.5 ± 1.9
Megaloptera:Sialidae	-	-	-	-	-	-	-	0.2 ± 0.5
Trichoptera	4.0 ± 3.2	2.2 ± 2.2	1.5 ± 1.9	2.0 ± 0.8	4.0 ± 2.2	5.5 ± 3.1	4.0 ± 2.4	5.0 ± 4.5
Coleoptera:Elmidae	-	-	0.5 ± 1.0	-	0.2 ± 0.5	-	-	-
Diptera:Tipulidae	0.2 ± 0.5	-	0.2 ± 0.5	1.0 ± 0.8	0.2 ± 0.5	0.2 ± 0.5	0.5 ± 0.6	-
:Simuliidae	0.2 ± 0.5	-	0.2 ± 0.5	-	-	-	0.2 ± 0.5	-
:Chironomidae	4.8 ± 8.8	5.5 ± 5.8	4.2 ± 7.8	0.8 ± 1.5	0.5 ± 0.6	3.8 ± 4.5	2.0 ± 1.8	0.5 ± 0.6
:Rhagionidae	-	-	-	0.2 ± 0.5	0.5 ± 0.6	0.5 ± 0.6	0.2 ± 0.5	0.2 ± 0.5
:Empididae	0.5 ± 0.6	-	-	-	0.2 ± 0.5	-	-	-
Turbellaria	-	-	0.2 ± 0.5	-	-	0.8 ± 1.0	-	-
Nematoda	-	-	0.2 ± 0.5	-	-	0.8 ± 1.0	-	-
Oligochaeta	0.2 ± 0.5	0.2 ± 0.5	-	-	-	-	-	-
Gastropoda	-		-	-	-	0.2 ± 0.5	-	-
Total	17.5 ± 16.7	16.5 ± 9.1	15.8 ± 11.0	15.5 ± 6.8	13.0 ± 4.1	37.5 ± 10.9	22.5 ± 1.7	17.8 ± 8.5

* Mean numbers and standard deviations of organisms collected in four 0.093 m^2 Surber samples.

Table B-7

Aquatic invertebrates* collected from rocks taken from Rivière Bonaventure Ouest, 5 May to 10 August, 1977

Block 305, Gaspé, Quebec.

	5 May	12 May	16 May	22 May	14 June	19 June	26 June	2 July	Aug. 10
Ephemeroptera:									
Heptagenidae	4.5 ± 4.0	4.2 ± 3.4	1.5 ± 0.6	0.2 ± 0.5	6.5 ± 1.9	6.5 ± 3.7	5.2 ± 4.6	9.8 ± 5.5	0.2 ± 0.5
Baetidae	1.0 ± 1.4	2.8 ± 3.6	5.0 ± 4.5	0.8 ± 1.0	4.0 ± 3.6	7.0 ± 10.1	5.0 ± 8.1	6.8 ± 4.0	-
Plecoptera	0.2 ± 0.5	-	2.0 ± 2.7	0.5 ± 0.6	-	0.2 ± 0.5	-	0.2 ± 0.5	2.0 ± 2.8
Trichoptera									
larvae	1.0 ± 1.4	2.5 ± 2.6	7.5 ± 9.9	2.8 ± 4.9	0.8 ± 0.5	0.5 ± 0.6	3.5 ± 3.3	3.5 ± 2.1	1.5 ± 1.9
pupae	3.0 ± 4.0	1.2 ± 1.5	-	3.8 ± 5.2	1.2 ± 1.5	1.5 ± 3.0	9.0 ± 3.7	7.0 ± 4.8	0.2 ± 0.5
Diptera:									
Tipulidae	-	-	-	-	-	-	-	-	0.5 ± 0.6
Simuliidae	2.0 ± 1.8	4.2 ± 4.3	1.2 ± 1.9	2.8 ± 2.8	3.2 ± 5.2	2.2 ± 2.1	0.2 ± 0.5	-	
Chironomidae	3.8 ± 4.3	8.5 ± 14.4	74.5 ± 87.7	6.0 ± 3.6	28.0 ± 19.7	11.5 ± 10.7	17.0 ±11.0	6.2 ± 5.1	17.5 ± 10.2
Hydracarina	-	-	4.2 ± 8.5	-	-	-	0.2 ± 0.5	-	-
Total	15.5 ± 11.4	23.5 ± 24.5	96.0 ± 99.4	16.8 ± 7.3	43.8 ± 27.9	29.5 ± 22.5	40.2 ± 7.3	33.5 ± 11.3	22.0 ± 12.4

* Mean numbers and standard deviations of organisms collected from four rocks approximately 20 cm in diameter.

Table B-8

Bottom fauna populations* in Ruisseau Grande Colline, 24 May to 26 June, 1977

Block 305, Gaspé, Quebec

	24 May	27 May	2 June	6 June	10 June	14 June	19 June	26 June
Ephemeroptera:Heptagenidae	-	-	1.0 ± 2.0	-	-	-	-	0.2 ± 0.5
:Baetidae	-	-	-	-	-	-	-	0.2 ± 0.5
Plecoptera	-	-	-	0.2 ± 0.5	-	-	0.2 ± 0.5	-
Megaloptera:Corydalidae	-	-	0.8 ± 1.5	-	-	-	-	-
Trichoptera	-	-	0.2 ± 0.5	0.2 ± 0.5	-	-	-	0.2 ± 0.5
Coleoptera:Elmidae	0.2 ± 0.5	-	-	-	-	-	-	-
:Dytiscidae	-	-	0.5 ± 1.0	-	-	-	-	-
Diptera:Tipulidae	0.2 ± 0.5	0.2 ± 0.5	-	-	0.8 ± 1.0	-	0.2 ± 0.5	0.2 ± 0.5
:Simuliidae	-	-	1.0 ± 2.0	1.2 ± 1.5	4.8 ± 2.2	8.8 ± 5.4	24.0 ± 14.7	29.5 ± 18.1
:Chironomidae	5.5 ± 3.1	3.5 ± 1.2	21.5 ± 37.1	11.2 ± 10.0	14.8 ± 10.0	5.2 ± 4.6	8.0 ± 4.2	29.2 ± 32.9
:Empididae	-	-	-	-	-	0.2 ± 0.5	-	-
Turbellaria	-	-	-	0.2 ± 0.5	-	-	0.2 ± 0.5	-
Oligochaeta	0.2 ± 0.5	-	-	-	0.2 ± 0.5	-	-	-
Gastropoda	-	-	-	-	-	-	-	0.2 ± 0.5
Total	6.2 ± 3.3	3.8 ± 2.9	25.0 ± 37.5	13.2 ± 10.4	20.5 ± 12.3	14.2 ± 8.0	32.8 ± 16.1	60.2 ± 40.3

* Mean numbers and standard deviations of organisms collected in four 0.093 m^2 Surber samples.

Table B-9

Aquatic invertebrates* collected from rocks taken from Ruisseau Grande Colline,

24 May to 26 June, 1977, Block 305, Gaspé, Quebec

	24 May	27 May	2 June	6 June	10 June	14 June	19 June	26 June
Ephemeroptera:Baetidae	-	-	-	-	-	-	0.5 ± 1.0	-
Trichoptera	-	-	0.2 ± 0.5	-	-	-	-	-
Diptera:Tipulidae	-	-	0.2 ± 0.5	-	0.2 ± 0.5	-	0.5 ± 0.6	
:Simuliidae	3.2 ± 6.5	1.2 ± 1.2	7.0 ± 5.4	14.0 ± 17.9	2.5 ± 2.1	13.2 ± 13.7	15.0 ± 16.3	11.2 ± 8.2
:Chironomidae	8.5 ± 17.0	1.5 ± 2.4	8.5 ± 7.3	45.0 ± 39.7	24.2 ± 40.0	24.8 ± 29.6	81.0 ± 141.8	8.5 ± 2.1
:Empididae	-	-	-	-	-	-	0.2 ± 0.5	-
Turbellaria	-	0.2 ± 0.5	-	-	-	-	-	-
Hydracarina	-	-	0.2 ± 0.5	0.2 ± 0.5	0.2 ± 0.5	-	0.5 ± 0.6	-
Total	11.8 ± 23.5	3.0 ± 3.5	16.2 ± 11.6	59.2 ± 57.1	27.2 ± 41.5	38.0 ± 34.1	97.8 ± 147.5	19.8 ± 7.0

* Mean numbers and standard deviations of organisms collected from four rocks approximately 20 cm in diameter.

Table B-10

Bottom fauna populations* in Ruisseau Revognah, 23 May to 26 June, 1977

Block 305, Gaspé, Quebec.

	23 May	27 May	2 June	6 June	10 June	14 June	19 June	26 June
Ephemeroptera:Heptagenidae	0.5 ± 1.0	0.5 ± 0.6	1.5 ± 1.9	-	0.2 ± 0.5	1.5 ± 2.4	3.0 ± 2.2	3.0 ± 1.2
:Baetidae	2.8 ± 1.7	2.0 ± 2.2	2.5 ± 2.1	1.5 ± 1.0	2.0 ± 0.8	2.0 ± 2.7	2.2 ± 1.0	1.8 ± 1.5
Plecoptera	1.0 ± 1.4	0.2 ± 0.5	-	0.5 ± 0.6	0.2 ± 0.5	-	0.2 ± 0.5	-
Trichoptera	0.5 ± 0.6	1.2 ± 0.5	-	0.8 ± 1.0	-	0.8 ± 1.0	0.2 ± 0.5	0.2 ± 0.5
Diptera:Tipulidae	0.2 ± 0.5	-	-	-	-	-	-	-
:Simuliidae	0.2 ± 0.5	-	-	-	-	-	0.2 ± 0.5	1.2 ± 1.0
:Chironomidae	0.8 ± 1.0	1.2 ± 1.5	0.8 ± 1.0	0.5 ± 0.6	1.2 ± 1.2	2.2 ± 1.5	0.8 ± 1.0	
:Heleidae	0.2 ± 0.5	0.2 ± 0.5	-	0.5 ± 1.0	0.8 ± 1.0	-	0.5 ± 0.6	0.5 ± 0.6
:Rhagionidae	7.0 ± 6.0	8.8 ± 2.9	4.2 ± 2.2	7.0 ± 4.9	6.5 ± 2.4	1.2 ± 1.2	6.2 ± 3.6	4.2 ± 2.9
:Empididae	0.5 ± 1.0	0.2 ± 0.5	0.2 ± 0.5	-	0.2 ± 0.5	-	-	-
Turbellaria	2.0 ± 2.2	1.2 ± 1.5	2.5 ± 1.0	1.5 ± 1.3	-	0.2 ± 0.5	0.2 ± 0.5	1.0 ± 0.8
Nematoda	-	0.8 ± 1.0	0.5 ± 1.0	0.2 ± 0.5	0.2 ± 0.5	-	0.2 ± 0.5	-
Oligochaeta	0.2 ± 0.5	-	-	0.2 ± 0.5	0.2 ± 0.5	-	-	0.2 ± 0.5
Amphipoda	-	-	-	-	-	0.2 ± 0.5	-	0.2 ± 0.5
Hydracarina	-	-	0.2 ± 0.5	-	0.2 ± 0.5	-	-	0.2 ± 0.5
Pelecypoda	-	-	-	-	-	-	0.2 ± 0.5	-
Total	16.0 ± 7.0	16.5 ± 3.8	12.5 ± 4.8	12.8 ± 6.9	12.0 ± 4.1	8.2 ± 5.0	14.2 ± 6.9	12.8 ± 6.8

* Mean numbers and standard deviations of organisms collected in four 0.093 m^2 Surber samples.

Table B-11

Aquatic invertebrates* collected from rocks taken from Ruisseau Revognah, 23 May to 26 June, 1977

Block 305, Gaspé, Quebec

	23 May	27 May	2 June	6 June	10 June	14 June	19 June	26 June
Ephemeroptera:Heptagenidae	-	0.2 ± 0.5	0.5 ± 0.6	0.5 ± 1.0	0.2 ± 0.5	0.5 ± 1.0	0.2 ± 0.5	0.2 ± 0.5
:Baetidae	-	1.2 ± 1.2	3.0 ± 1.8	3.5 ± 0.6	1.5 ± 1.3	2.0 ± 1.6	3.5 ± 4.4	1.5 ± 1.3
Plecoptera	0.2 ± 0.5	-	0.5 ± 1.0	1.5 ± 3.0	1.5 ± 1.3	0.2 ± 0.5	-	-
Trichoptera:larvae	0.2 ± 0.5	-	0.2 ± 0.5	-	0.8 ± 1.0	-	1.0 ± 0.8	-
:pupae	-	-	-	-	-	-	-	0.2 ± 0.5
Diptera:Simuliidae	0.8 ± 0.5	-	-	0.2 ± 0.5	0.2 ± 0.5	-	2.0 ± 1.6	0.8 ± 1.0
:Chironomidae	22.2 ± 2.8	9.0 ± 9.2	14.5 ± 8.6	41.8 ± 26.6	9.2 ± 5.1	13.5 ± 7.0	31.0 ± 32.6	23.8 ± 8.8
:Heleidae	-	-	-	-	0.2 ± 0.5	-	-	-
:Rhagionidae	-	-	-	-	0.2 ± 0.5	-	0.2 ± 0.5	0.2 ± 0.5
Turbellaria:	-	-	-	-	0.8 ± 1.0	-	1.5 ± 1.9	0.2 ± 0.5
Amphipoda:	-	-	-	-	0.8 ± 1.0	-	-	-
Hydracarina:	0.5 ± 1.0	0.2 ± 0.5	-	1.5 ± 0.6	2.2 ± 3.2	-	0.2 ± 0.5	-
Total:	24.0 ± 3.7	10.8 ± 10.3	18.8 ± 7.0	49.0 ± 26.8	17.8 ± 7.4	16.2 ± 8.2	39.8 ± 37.6	27.0 ± 8.0

* Mean numbers and standard deviations of organisms collected from four rocks approximately 20 cm in daimeter.

APPENDIX 'C'

Fish stomach contents

Table C-1

Fish sampled from Lac Ste-Anne, Block 305, Gaspé
May 7 to June 9, 1977

Lake Trout

Period	Prespray (May 9-12)	Post first spray (May 20-29)	Post second spray (May 30 - June 9)
Number of fish sampled	5	13	27
Mean total length (mm)	606.2	533.2	530.6
Range	548-665	294-680	268-635
Mean fork length (mm)	558.0	487.6	485.1
Range	504-614	268-625	245-580
Mean weight (gm)	1968.0	1351.0	1347.6
Range	1437-2718	202-2872	122-2280
Sex ratio (male: female: immature)	0:5:0	3:6:4	8:14:5
Mean volume of food present/stomach (ml)	9.42	5.66	10.89
Range	0.0-25.0	0.2-28.0	0.0-120.0

Brook Trout

Period	Prespray (May 7-18)	Post first spray (May 21-26)	Post second spray (May 31)
Number of fish sampled	10	8	5
Mean total length (mm)	299.4	294.1	321.6
Range	225-524	221-440	260-375
Mean fork length (mm)	287.9	281.9	312.0
Range	215-509	209-421	250-370
Mean weight (gm)	407.3	304.2	340.4
Range	100-1846	106-841	120-582
Sex ratio (male: female)	3:7	4:4	1:4
Mean volume of food present/stomach (ml)	2.92	5.49	1.56
Range	0.3-10.6	0.1-16.0	0.1-6.0

Table C-2

Fish food items found in the stomachs of lake trout from Lac Ste-Anne
Block 305, Gaspé, May 9 to June 9, 1977

	Percent occurence			Mean percent contribution to total Volume of stomach contents			Average Number/Stomach		
	Prespray	Post 1	Post 2	Prespray	Post 1	Post 2	Prespray	Post 1	Post 2
Alderfly larvae (SIALIS sp.)	20	15	33	0.2	7.3	4.7	12	33	11
Amphipods	80	54	48	40.8	37.3	9.1	10	40	90
Blackfly larvae	0	0	4	0.0	0.0	0.1	0	0	1
Caddisfly larvae	20	69	26	0.5	20.2	21.0	2	5	50
Chironomid larvae	20	23	37	3.8	1.2	27.2	1	4	150
Chironomid pupae	0	31	48	0.0	2.3	17.1	0	8	115
Dragonfly nymphs	0	0	4	0.0	0.0	1.0	0	0	1
Fingernail clams	0	31	11	0.0	0.8	0.1	0	2	2
Fish	40	23	18	48.2	22.3	12.3	1	3	2
Leeches	0	15	0	0.0	3.8	0.0	0	1	0
Mayfly nymphs (Baetidae)	20	38	67	6.2	3.2	7.7	3	5	9
Stonefly nymphs	20	8	4	0.2	1.5	0.1	1	3	1
Empty stomachs	20	0	4	-	-	-	-	-	-

Table C-3

Fish food items found in the stomachs of brook trout from Lac Ste-Anne, Block 305, Gaspé, May 7-31, 1977

	Percent Occurence			Mean percent contribution to total Volume of stomach contents			Average Number/Stomach		
	Prespray	Post 1	Post 2	Prespray	Post 1	Post 2	Prespray	Post 1	Post 2
Alderfly larvae (SIALIS sp.)	40	12	20	22.5	1.2	0.8	24	1	1
Amphipods	90	62	80	56.0	26.2	57.0	25	10	10
Caddisfly larvae	40	88	20	11.5	35.9	7.0	3	21	25
Chironomid larvae	10	0	0	0.2	0.0	0.0	1	0	0
Chironomid pupae	10	0	0	0.3	0.0	0.0	2	0	0
Dragonfly nymphs	0	0	20	0.0	0.0	5.0	0	0	2
Fingernail clams	10	12	20	0.2	0.1	0.2	1	1	1
Fish	0	12	0	0.0	11.9	0.0	0	1	0
Mayfly nymphs (Baetidae)	60	75	20	9.3	19.8	2.0	1½	46	1
Oligochaetes	0	12	40	0.0	5.0	28.0	0	3	1

Table C-4

Brook trout sampled for stomach content analysis from Rivière Ste-Anne untreated control station 7 May to 28 June, 1977. Gaspé, Quebec.

	7 May	19 May	18-20 June	28 June
No. of Fish Sampled	14	17	24	10
Mean Total Length (mm)	81.6	86.8	97.1	80.7
Range	61-130	56-208	64-155	62-125
Mean Fork Length (mm)	78.2	83.4	92.8	77.5
Range	58-126	54-202	60-148	59-120
Mean Weight (g)	5.40	7.91	12.0	7.05
Range	2.0-16.9	1.4-56.7	2.4-31.5	3.3-22.7
Mean Volume Stomach Contents (ml)	0.05	0.7	0.52	0.23
Range	0.0-0.1	0.0-0.3	0.0-2.2	0.1-0.5

Table C-5

Percent occurrence of various food items in brook trout stomachs, Rivière Ste-Anne untreated control station, 7 May to 28 June, 1977. Gaspé, Quebec.

	7 May	19 May	18-20 June	28 June
Aquatic Insects				
Ephemeroptera:Heptagenidae	0	12	71	20
:Baetidae	0	0	83	60
Plecoptera	0	0	50	0
Trichoptera:larvae	43	29	75	30
:pupae	7	0	0	0
Coleoptera	7	0	0	0
Diptera:Tipulidae	14	29	25	10
:Blephariceridae	0	0	8	0
:Simuliidae	7	0	21	20
:Chironomidae	21	0	17	10
:Empididae	14	6	0	20
Other Aquatic Invertebrates				
Oligochaeta	7	0	0	10
Terrestrial Arthropods				
Collembola	7	0	0	0
Hemiptera	0	0	0	20
Lepidoptera	0	0	0	80
Hymenoptera	0	0	0	10
Coleoptera	0	12	4	20
Diptera	29	0	8	60
Arachnida	7	0	4	20
Empty Stomachs	7	9	4	0

Table C-6

Mean percentage of the volume of brook trout stomach contents contributed by various food items, Rivière Ste-Anne, untreated control station, 7 May to 28 June, 1977. Gaspé, Quebec.

	7 May	19 May	18-20 June	28 June
Aquatic Insects				
Ephemeroptera:Heptagenidae	0.0	9.6	13.3	3.0
:Baetidae	0.0	0.0	29.1	22.0
Plecoptera	0.0	0.0	14.8	0.0
Trichoptera:larvae	25.4	35.0	32.4	13.0
:pupae	7.7	0.0	0.0	0.0
Coleoptera	1.5	0.0	0.0	0.0
Diptera:Tipulidae	10.0	37.5	3.7	5.0
:Blepariceridae	0.0	0.0	1.1	0.0
:Simuliidae	2.3	0.0	3.0	2.0
:Chironomidae	11.2	0.0	1.5	1.0
:Empididae	11.5	1.2	0.0	2.0
Other Aquatic Invertebrates				
Oligochaeta	7.7	0.0	0.0	2.0
Terrestrial Arthropods				
Collembola	1.2	0.0	0.0	0.0
Lepidoptera	0.0	0.0	0.0	26.0
Hymenoptera	0.0	0.0	0.0	2.0
Coleoptera	0.0	16.7	0.2	2.0
Diptera	16.9	0.0	0.6	12.0
Arachnida	4.6	0.0	0.2	4.0

Table C-7

Mean numbers of various food items in brook trout stomachs in which they occurred, Rivière Ste-Anne, untreated control station, 7 May to 28 June, 1977. Gaspé, Quebec.

	7 May	19 May	18-20 June	28 June
Aquatic Insects				
Ephemeroptera:Heptagenidae	-	1	5	1
:Baetidae	-	-	12	6
Plecoptera	-	-	2	-
Trichoptera:larvae	1	2	6	2
:pupae	1	-	-	-
Coleoptera	1	-	-	-
Diptera:Tipulidae	4	1	2	1
:Blephariceridae	-	-	1	-
:Simuliidae	2	-	2	1
:Chironomidae	1	-	5	1
:Empididae	1	2	-	2
Other Aquatic Invertebrates				
Oligochaeta	1	-	-	1
Terrestrial Arthropods				
Collembola	1	-	-	-
Hemiptera	-	-	-	2
Lepidoptera	-	-	-	11
Hymenoptera	-	-	-	2
Coleoptera	-	1	1	1
Diptera	1	-	1	2
Arachnida	1	-	1	1

Table C-8

Brook trout sampled for stomach content analysis from Rivière Ste-Anne, edge of block station, 15 May to 20 June, 1977. Block 305, Gaspé, Quebec

	15-19 May	21 May	31 May-1 June	5-9 June	20 June
No. of Fish Sampled	10	10	6	5	8
Mean Total Length (mm)	103.8	101.3	120.3	117.4	116.4
Range	44-162	69-165	112-133	97-150	74-145
Mean fork length (mm)	99.4	97.0	111.7	111.6	111.6
Range	43-155	67-163	104-123	91-143	70-140
Mean Weight (g)	11.59	10.09	16.65	16.62	17.26
Range	0.6-29.7	2.6-32.5	13.7-20.6	9.1-31.1	3.5-29.5
Mean Volume Stomach Contents (mℓ)	0.10	0.04	0.31	0.09	0.11
Range	0.0-0.4	0.0-0.05	0.05-0.7	0.05-0.2	0.05-0.3

Table C-9

Percent occurrence of various food items in brook trout stomachs, Rivière Ste-Anne, edge of block station, 15 May to 20 June, 1977. Block 305, Gaspé, Quebec

	15-19 May	21 May	31 May-1 June	5-9 June	20 June
Aquatic Insects					
Ephemeroptera:Heptagenidae	30	60	50	60	12
:Baetidae	60	10	67	40	50
Plecoptera	30	30	67	40	62
Trichoptera:larvae	20	30	50	40	75
:pupae	0	0	17	0	0
Coleoptera	0	0	17	20	0
Diptera:Tipulidae	10	0	17	20	12
:Simuliidae:larvae	30	70	17	0	0
:Chironomidae:larvae	20	60	17	22	12
:Heleidae	0	0	17	0	0
:Empididae	0	0	17	20	0
Other Aquatic Invertebrates					
Oligochaeta	0	0	17	0	0
Terrestrial Arthropods					
Homoptera	10	0	0	0	0
Lepidoptera	0	0	33	0	12
Coleoptera	10	0	0	20	25
Arachnida	0	0	0	20	0
Empty Stomachs	20	10	0	0	0

Table C-10

Mean percentage of the volume of brook trout stomach contents contributed by various food items, Rivière Ste-Anne, edge of block station, 15 May to 20 June. Block 305, Gaspé, Quebec.

	15-19 May	21 May	31 May-1 June	5-9 June	20 June
Aquatic Insects					
Ephemeroptera:Heptagenidae	10.0	23.3	11.7	32.0	3.8
:Baetidae	33.8	2.2	26.7	6.0	15.0
Plecoptera	16.2	12.8	19.2	17.0	28.8
Trichoptera:larvae	10.0	13.9	16.7	18.0	41.2
:pupae	0.0	0.0	1.7	0.0	0.0
Coleoptera	0.0	0.0	0.8	6.0	0.0
Dipetera:Tipulidae	1.2	0.0	1.7	5.0	3.1
:Simuliidae:larvae	5.0	38.9	0.8	0.0	0.0
:Chironomidae:larvae	15.0	8.9	0.8	1.0	0.6
:Heleidae	0.0	0.0	1.7	0.0	0.0
:Empididae	0.0	0.0	1.7	5.0	0.0
Other Aquatic Invertebrates					
Oligochaeta	0.0	0.0	5.8	0.0	0.0
Terrestrial Arthopods					
Homoptera	1.2	0.0	0.0	0.0	0.0
Lepidoptera	0.0	0.0	10.8	0.0	0.6
Coleoptera	7.5	0.0	0.0	6.0	6.9
Arachnida	0.0	0.0	0.0	4.0	0.0

Table C-11

Mean numbers of various food items in brook trout stomachs in which they occurred

Rivière Ste-Anne, edge of block station, 15 May to 20 June, 1977. Block 305, Gaspé, Quebec.

	15-19 May	21 May	31 May-1 June	5-9 June	20 June
Aquatic Insects					
Ephemeroptera:Heptagenidae	3	2	5	1	1
:Baetidae	3	3	5	2	2
Plecoptera	4	1	6	2	3
Trichoptera:larvae	2	2	5	2	1
:pupae	-	-	1	-	-
Coleoptera	-	-	2	1	-
Diptera:Tipulidae	1	-	4	1	2
:Simuliidae:larvae	2	7	2	-	-
:Chironomidae:larvae	2	2	1	4	2
:Heleidae	-	-	1	-	-
:Empididae	-	-	1	3	-
Other Aquatic Invertebrates					
Oligochaeta	-	-	2	-	-
Terrestrial Arthropods					
Homoptera	1	-	-	-	-
Lepidoptera	-	-	2	-	1
Coleoptera	1	-	-	1	2
Arachnida	-	-	-	1	-

Table C-12

Brook trout sampled for stomach content analysis from Ruisseau Lesseps, 10 May to 28 June, 1977

Block 305, Gaspé, Quebec

	10 May	20 May	30 May	31 May	1 June	20 June	28 June
No. of Fish Sampled	16	5	16	5	7	12	12
Mean Total Length (mm)	62.4	64.4	68.2	76.2	64.0	84.3	58.9
Range	48.0-114.0	52.0-88.0	43.0-129.0	69.0-84.0	58.0-69.0	55.0-170.0	48.0-81.0
Mean Fork Length (mm)	59.9	60.6	65.4	72.6	60.0	80.6	56.8
Range	46.0-108.0	50.0-80.0	42.0-123.0	65.0-80.0	54.0-65.0	53.0-162.0	47.0-77.0
Mean Weight (g)	2.12	2.26	4.39	4.20	2.68	8.22	3.26
Range	0.5-10.0	1.0-5.0	1.3-19.1	3.1-5.4	1.9-4.4	1.3-41.1	1.6-7.1
Mean Volume Stomach Contents (mℓ)	0.06	0.07	0.26	0.15	0.07	0.03	0.08
Range	0.0-0.1	0.05-0.15	0.05-2.6	0.05-0.3	0.05-0.1	0.05-1.3	0.05-0.2

Table C-13

Percent occurrence of various food items in brook trout stomachs from Ruisseau Lesseps, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec

	10 May	20 May	30 May	31 May	1 June	20 June	28 June
Aquatic Insects							
Ephemeroptera:Heptagenidae	12	0	62	100	71	16	0
:Baetidae	56	20	75	80	86	100	58
Plecoptera	44	60	75	0	86	58	50
Trichoptera	7	20	25	40	57	33	8
Lepidoptera	0	0	0	0	28	8	0
Diptera:Tipulidae	6	0	0	20	0	16	8
:Simuliidae	19	60	81	40	86	33	8
:Chironomidae:larvae	19	40	88	80	100	100	42
:pupae	0	0	0	0	0	8	0
:Empidae	0	20	0	0	0	0	0
Other Aquatic Invertebrates							
Oligochaeta	0	20	6	0	0	0	0
Fish							
Unknown fish remains	0	0	6	0	0	0	0
Terrestrial Arthropods							
Collembola	0	0	0	0	0	0	8
Plecoptera	0	0	19	0	0	0	8
Homoptera	0	0	0	2	0	0	0
Hymenoptera	0	0	0	0	0	16	8
Coleoptera	0	0	0	0	0	25	0
Diptera	0	0	0	0	0	50	25
Arachnida	0	0	6	0	0	8	17

Table C-14

Mean percent of the volume of brook trout stomach contents contributed by various food items, Ruisseau Lesseps, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec

	10 May	20 May	30 May	31 May	1 June	20 June	28 June
Aquatic Insects							
Ephemeroptera:Heptagenidae	5.3	0.0	11.2	15.0	26.4	3.3	0.0
:Baetidae	47.3	7.0	26.8	20.0	11.4	36.7	30.8
Plecoptera	24.0	30.0	26.8	32.0	22.1	12.8	27.9
Trichoptera	6.7	20.0	1.8	10.0	5.7	5.2	0.8
Lepidoptera	0.0	0.0	0.0	0.0	2.8	0.4	0.0
Diptera:Tipulidae	1.3	0.0	0.0	5.0	0.0	1.7	1.7
:Simuliidae	11.3	26.0	10.4	8.0	13.6	2.6	1.7
:Chironomidae:larvae	4.0	3.0	18.1	9.0	17.8	24.7	12.9
:pupae	0.0	0.0	0.0	0.0	0.0	0.4	0.0
:Empididae	0.0	6.0	0.0	0.0	0.0	0.0	0.0
Other Aquatic Invertebrates							
Oligochaeta	0.0	8.0	0.3	0.0	0.0	0.0	0.0
Fish							
Unknown fish remains	0.0	0.0	4.1	0.0	0.0	0.0	0.0
Terrestrial Arthropods							
Collembola	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Plecoptera	0.0	0.0	0.6	0.0	0.0	0.0	1.2
Homoptera	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Hymenoptera	0.0	0.0	0.0	0.0	0.0	0.9	0.8
Coleoptera	0.0	0.0	0.0	0.0	0.0	3.2	0.0
Diptera	0.0	0.0	0.0	0.0	0.0	7.8	16.7
Arachnida	0.0	0.0	0.1	0.0	0.0	0.4	5.0

Table C-15

Mean numbers of various food items in brook trout stomachs in which they occurred, Ruisseau Lesseps, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec.

	10 May	20 May	30 May	31 May	1 June	20 June	28 June
Aquatic Insects							
Ephemeroptera:Heptagenidae	2	-	7	5	3	1	-
:Baetidae	2	4	19	4	2	5	2
Plecoptera	2	1	8	12	8	3	3
Trichoptera	1	1	4	2	1	2	1
Lepidoptera	-	-	-	-	4	1	-
Diptera:Tipulidae	1	-	-	1	-	2	1
:Simuliidae	3	1	3	10	3	1	1
:Chironomidae:larvae	2	1	12	6	11	22	7
:pupae	-	-	-	-	-	1	-
:Empididae	-	1	-	-	-	-	-
Other Aquatic Invertebrates							
Oligochaeta	-	6	1	-	-	-	-
Fish							
Unknown fish remains	-	-	1	-	-	-	-
Terrestrial Arthropods							
Collembola	-	-	-	-	-	-	1
Plecoptera	-	-	1	-	-	-	1
Homoptera	-	-	-	1	-	-	-
Hymenoptera	-	-	-	-	-	1	1
Coleoptera	-	-	-	-	-	2	-
Diptera	-	-	-	-	-	2	4
Arachnida	-	-	1	-	-	1	-

Table C-16

Brook trout sampled for stomach content analysis from Rivière Bonaventure Ouest, 10 May to 25 June, 1977. Block 305, Gaspé, Quebec

	10-11 May	20-21 May	28 June
No. of Fish Sampled	12	7	10
Mean Total Length (mm)	50.3	123.4	98.0
Range	36-85	48-165	52-141
Mean Fork Length (mm)	48.3	118.8	94.9
Range	35-81	46-158	50-135
Mean Weight (g)	1.2	17.03	13.42
Range	0.3 - 4.5	1.0 - 33.3	3.0 - 29.1
Mean Volume Stomach Contents (mℓ)	0.5	0.16	0.90
Range	0.05 - 0.1	0.0 - 0.4	0.05 - 2.8

Table C-17

Percent occurrence of various food items in brook trout stomachs from Rivière Bonaventure Ouest, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec.

	10-11 May	20-21 May	28 June
Aquatic Insects			
Ephemeroptera:Heptagenidae	17	0	30
:Baetidae	50	14	90
Plecoptera	50	43	80
Trichoptera:larvae	17	57	50
:pupae	0	0	10
Diptera:Tipulidae	0	0	10
:Simuliidae	8	0	30
:Chironomidae:larvae	58	0	90
:pupae	0	0	20
:Heleidae	0	0	10
Other Aquatic Invertebrates			
Hydracarina	0	0	10
Terrestrial Arthropods			
Collembola	17	0	0
Plecoptera	0	14	0
Lepidoptera	0	0	30
Hymenoptera	0	0	70
Coleoptera	0	0	40
Diptera	0	28	60
Arachnida	0	0	10
Empty Stomachs	0	14	0

Table C-18

Mean percentage of the volume of brook trout stomach contents contributed by various food items, Rivière Bonaventure Ouest, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec

	10-11 May	20-21 May	28 June
Aquatic Insects			
Ephemeroptera:Heptagenidae	3.3	0.0	4.0
:Baetidae	30.0	6.7	18.4
Plecoptera	33.3	21.7	15.4
Trichoptera:larvae	5.8	41.7	5.1
:pupae	0.0	0.0	0.5
Diptera:Tipulidae	0.0	0.0	1.0
:Simuliidae	8.3	0.0	2.0
:Chironomidae:larvae	17.5	0.0	10.5
:pupae	0.0	0.0	1.0
:Heleidae	0.0	0.0	0.5
Other Aquatic Invertebrates			
Hydracarina	0.0	0.0	1.0
Terrestrial Arthropods			
Collembola	1.7	0.0	0.0
Plecoptera	0.0	1.7	0.0
Lepidoptera	0.0	0.0	2.4
Hymenoptera	0.0	0.0	28.0
Coleoptera	0.0	0.0	4.0
Diptera	0.0	28.3	5.2
Arachnida	0.0	0.0	1.0

Table C-19

Mean numbers of various food items in brook trout stomachs in which they occurred

Rivière Bonaventure Ouest, 10 May to 28 June, 1977. Block 305, Gaspé, Quebec

	10-11 May	20-21 May	28 June
Aquatic Insects			
Ephemeroptera:Heptagenidae	1	-	9
:Baetidae	2	3	4
Plecoptera	2	2	4
Trichoptera:larvae	2	4	2
:pupae	-	-	1
Diptera:Tipulidae	-	-	1
:Simuliidae	1	-	2
:Chironomidae:larvae	3	-	6
:pupae	-	-	3
:Heleidae	-	-	1
Other Aquatic Invertebrates			
Hydracarina	-	-	3
Terrestrial Arthropods			
Collembola	2	-	-
Plecoptera	-	1	-
Lepidoptera	-	-	5
Hymenoptera	-	-	6
Coleoptera	-	-	3
Diptera	-	7	3
Arachnida	-	-	1

Table C-20

Brook trout sampled for stomach content analysis from Petite rivière Cascapedia Ouest, 15 May to 20 June, 1977
Block 305, Gaspé, Quebec

	15 May	17 May	20 May	21 May	22 May	23 May	25-26 May	30-31 May	5-9 June	20 June
No. of fish sampled	5	12	9	13	10	4	4	11	3	4
Mean Total Length (mm)	122.4	59.4	98.7	96.7	94.7	81.2	102.8	94.0	93.3	64.2
Range	97-145	41-110	64-160	50-160	62-150	45-112	73-139	68-132	50-120	51-83
Mean fork length (mm)	117.4	56.8	94.7	93.2	91.2	77.2	98.5	90.2	89.3	60.5
Range	93-140	38-107	61-156	49-153	60-146	43-105	70-133	65-127	49-114	49-76
Mean Weight (g)	12.75	2.46	9.92	10.03	8.75	5.52	10.42	7.84	7.40	2.32
Range	7.6-18.1	0.4-12.0	1.9-30.0	1.1-30.0	1.7-26.1	1.1-10.1	2.4-21.0	3.1-17.2	1.1-11.0	0.8-4.6
Mean Volume Stomach Contents (mℓ)	0.13	0.04	0.07	0.04	0.04	0.05	0.08	0.14	0.08	0.06
Range	0.05-0.2	0.0-0.1	0.0-0.3	0.0-0.1	0.0-0.05		0.0-0.2	0.0-0.7	0.0-0.2	0.05-0.1

Table C-21

Percent occurrence of various food items in brook trout stomachs, Petite rivière Cascapedia Ouest, 15 May to 20 June, 1977

Block 305, Gaspé, Quebec

	15 May	17 May	20 May	21 May	22 May	23 May	25-26 May	30-31 May	5-9 June	20 June
Aquatic Insects										
Ephemeroptera:Heptagenidae	100	17	11	0	10	0	0	0	0	0
:Baetidae	100	33	22	23	10	25	25	64	0	75
Plecoptera	60	17	44	23	0	75	50	27	0	0
Trichoptera:larvae	20	0	0	0	10	0	25	18	0	0
Coleoptera	0	0	0	0	30	0	25	9	0	0
Diptera:Tipulidae	0	0	0	0	0	0	25	9	33	25
:Simuliidae:larvae	60	25	11	8	20	50	25	36	0	0
:Chironomidae:larvae	20	33	22	8	20	50	25	54	0	75
:Heleidae	0	0	0	15	0	0	25	0	0	0
:Empididae	0	0	0	8	0	0	0	9	0	0
Other Aquatic Invertebrates										
Oligochaeta	0	0	0	0	0	0	0	9	0	0
Hydracarina	0	0	0	0	0	0	0	9	0	0
Terrestrial Arthropods										
Ephemeroptera	0	0	0	8	0	0	0	0	0	0
Plecoptera	0	8	0	0	0	0	0	0	0	0
Homoptera	0	0	0	0	0	0	0	0	33	0
Trichoptera	0	0	0	0	0	0	0	0	0	25
Lepidoptera	0	0	0	0	0	0	0	18	0	0
Coleoptera	0	0	11	15	10	0	25	18	0	25
Diptera	0	0	0	23	0	0	0	0	0	50
Diplopoda	0	0	0	0	0	0	0	9	0	0
Arachnida	0	8	0	15	10	0	0	9	0	0
Empty Stomachs	0	25	22	31	20	0	25	9	33	0

Table C-22

Mean percentage of the volume of brook trout stomach contents contributed by various food items, Petite rivière Cascapedia Ouest, 15 May to 20 June, 1977. Block 305, Gaspé, Quebec.

	15 May	17 May	20 May	21 May	22 May	23 May	25-26 May	30-31 May	5-9 June	20 June
Aquatic Insects										
Ephemeroptera:Heptagenidae	21.0	22.2	0.1	0.0	12.5	0.0	0.0	0.0	0.0	0.0
:Baetidae	54.0	24.4	28.6	12.2	6.2	10.0	33.3	23.5	0.0	55.0
Plecoptera	6.0	15.6	50.7	19.4	0	55.0	30.0	10.0	0.0	0.0
Trichoptera:larvae	8.0	0.0	0.0	0.0	4.2	0.0	5.0	6.0	0.0	0.0
Coleoptera	0.0	0.0	0.0	0.0	25.0	0.0	5.0	3.0	0.0	0.0
Diptera:Tipulidae	0.0	0.0	0.0	0.0	0.0	0.0	6.7	3.0	50.0	7.5
:Simuliidae:larvae	8.0	7.2	0.3	5.6	16.6	22.5	3.3	9.5	0.0	0.0
:Chironomidae:larvae	3.0	22.8	14.6	1.1	16.6	12.5	10.0	15.5	0.0	10.0
:Heleidae	0.0	0.0	0.0	10.0	0.0	0.0	3.3	0.0	0.0	0.0
:Empididae	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.0		
Other Aquatic Invertebrates										
Oligochaeta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0
Hydracarina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Terrestrial Arthopods										
Ephemeroptera	0.0	0.0	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0
Plecoptera	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Homoptera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	6.2
Lepidoptera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0
Coleoptera	0.0	0.0	5.7	12.8	6.2	0.0	3.3	4.5	0.0	6.2
Diptera	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	15.0
Diplopoda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
Arachnida	0.0	5.6	0.0	13.9	12.5	0.0	0.0	0.5	0.0	0.0

Table C-23

Mean numbers of various food items in brook trout stomachs in which they occurred, Petit rivière Cascapédia Ouest, 15 May to 20 June, 1977. Block 305, Gaspé, Quebec.

	15 May	17 May	20 May	21 May	22 May	23 May	25-26 May	30-31 May	5-9 June	20 June
Aquatic Insects										
Ephemeroptera:Heptagenidae	3	1	1	-	1	-	-	-	-	-
:Baetidae	7	4	2	2	2	1	1	2	-	5
Plecoptera	1	2	15	2	-	4	2	3	-	-
Trichoptera:larvae	2	-	-	-	2	-	2	4	-	-
Coleoptera	-	-	-	-	1	-	1	1	-	-
Diptera:Tipulidae	-	-	-	-	-	-	1	1	1	1
:Simuliidae:larvae	2	1	1	1	3	1	1	2	-	-
:Chironomidae:larvae	1	2	2	1	3	2	7	2	-	1
:Heleidae	-	-	-	1	-	-	1	-	-	-
:Empididae	-	-	-	1	-	-	-	1	-	-
Other Aquatic Invertebrates										
Oligochaeta	-	-	-	-	-	-	-	4	-	-
Hydracarina	-	-	-	-	-	-	-	1	-	-
Terrestrial Arthropods										
Ephemeroptera	-	-	-	1	-	-	-	-	-	-
Plecoptera	-	1	-	-	-	-	-	-	-	-
Homoptera	-	-	-	-	-	-	-	-	1	-
Trichoptera	-	-	-	-	-	-	-	-	-	1
Lepidoptera	-	-	-	-	-	-	-	2	-	-
Coleoptera	-	-	1	2	1	-	1	1	-	1
Diptera	-	-	-	1	-	-	-	-	-	2
Diplopoda	-	-	-	-	-	-	-	1	-	-
Arachnida	-	1	-	2	1	-	-	1	-	-