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IMPACT OF REPEATED ANTIMYCIN TREATMENTS ON THE ZOOPLANKTON AND BENTHIC ORGANISMS IN CAMP, LAMEREAU AND NANCY LAKES BAYFIELD COUNTY, WISCONSIN

By
Thomas D. Beard
Bureau of Research, Spooner

INTRODUCTION

In the spring of 1971 a study was started on the population dynamics of young bluegills. As part of this study each fall three lakes are treated with antimycin to obtain an estimate of the number of fingerling bluegills produced from a known number of parent bluegills. This report will deal with the effects of the antimycin treatment in 1971, 1972 and 1973 on the zooplankton and the effects of the 1973 treatment on the benthic organisms.

The three winterkill lakes concerned in the study are in Bayfield County, Wisconsin: Camp Lake, 10 acres in size with an average depth of 3.4 ft.; Lamereau Lake, 10.4 acres with an average depth of 3.0 ft.; and Nancy Lake, 6.7 acres with an average depth of 2.8 ft. All three lakes have soft water with the specific conductance ranging from 22 to 40 micro-mhos/cm^2 during the summers of 1971 through 1973. The methyl purple alkalinity has varied from 4 to 14 ppm during the three summers of study while the pH has ranged from 6.2 to 6.7 during the same time period in the lakes.

METHODS

During the last week of September or the first part of October in 1971, 1972 and 1973, each lake was treated with Fintrol-5 (granular) at a concentration of 3 ppb. The toxicant was applied systematically throughout the lake with a grass seeder. The water temperatures during the treatments ranged from 47 to 64°F in the three lakes.

Zooplankton samples were collected twice each week starting in June and continuing through mid-September. Samples were taken with a Miller high speed plankton sampler with a No. 10 mesh net in 1971 and a No. 20 mesh net in 1972 and 1973. Two samples were taken in Camp and Lamereau Lakes. One sample was taken in the open water area of the lake at the 2-foot depth and the other sample at the surface in the weedy area of the lakes. In Nancy Lake only one 2-foot sample was taken throughout the lake. The zooplankton were preserved in a 10 percent solution of Formalin plus Lugols solution. Final counts were made by diluting the sample and taking three 1 ml sub-samples and placing the subsamples in a 3 ml circular counting cell (Priegel 1970) for analysis. Thus, zooplankton samples were taken one summer before treatment in 1971 and during the summer of 1972 after the first treatment and in the summer of 1973 after the second treatment.

Bottom samples were taken within three days before chemical treatment of each study lake and within 12 days after treatment in 1973 with a locally constructed dredge similar to the Petersen dredge but hand operated. The width of the dredge opening was 20 cm x 12.5 cm. Samples were taken in each lake at one location starting at the shore and every 2 ft. towards the middle of the lake until 10 samples were collected. The benthic samples were preserved in 10 percent Formalin and picked and identified at a later date.

RESULTS AND DISCUSSION

Zooplankton

Zooplankton in all three lakes during the three summers exhibited the summer decline in abundance typical of temperate region lakes. In Camp Lake, the zooplankton abundance peaked during June in all three summers with the numbers beginning to drop by July 1 (Fig. 1). In Nancy Lake, zooplankton abundance also peaked in June, 1971 and 1973 and began to drop by July 1. In 1972, the zooplankton numbers did not reach the level of abundance that they did in 1971 and 1973. In Lamereau Lake in 1971 and 1972 the number of zooplankton followed the same trend as in Camp Lake, peaking in abundance in June and decreasing the remainder of the summer. The zooplankton numbers fluctuated considerably from June 8 through July 20, 1973 in Lamereau Lake before they began to remain at a low level.

Camp Lake

The species diversity of zooplankton in Camp Lake changed very little after chemical treatment with Fintrol-5. In the summer of 1971 before the first treatment there were 10 different types of zooplankton in Camp Lake and in the summer of 1972 after the first treatment (in fall 1971) there were still 10 different types of zooplankton in the lake with *Polyphemus pediculus* being collected for the first time and *Leptodora Kindti* being absent from the samples (Table 1). During the summer of 1973 after the second fall treatment there were 9 different types of zooplankton with *Sida crystallina* being the species not collected. Both *Sida crystallina* and *Leptodora Kindti* occurred in small numbers before the treatment and the absence of these two species after treatment was probably due to sampling rather than the Fintrol-5.

In Camp Lake, *Bosmina* spp., *Daphnia* spp. and Copepoda were the most abundant species of zooplankton in June and July comprising at least 80 percent of the zooplankton sampled in all three years. *Bosmina* spp. was the most abundant zooplankton in 1971 before the first treatment with Fintrol-5, averaging 19.6 organisms per liter of water sampled in June and July. During the same period in 1972 after the first treatment there were 7.4 *Bosmina* spp. per liter while in 1973 after the second treatment there were 9.0 organisms per liter (Table 2). *Daphnia* spp. decreased in numbers in the samples from a high of 15.9 per liter in 1971 to 4.7 per liter in 1973. Copepoda abundance remained fairly constant: 3.9 per liter in 1971, and 4.0 and 3.8 per liter in 1972 and 1973.

Table 2 presents the number of zooplankton per liter of water present in the lakes in June and July. The species diversity tables (Tables 1, 3, 4) record the different species of zooplankton found in the lakes from the first of June through mid-September. If some of the species listed in the diversity tables are not found in Table 2, it is because they were not collected in June or July but at a later date during the summer.

Lamereau Lake

Before the first chemical treatment there were 10 different types of zooplankton in Lamereau Lake and in the summer of 1972 after the first treatment there were 9 types of zooplankton (Table 3). Sida crystallina and Leptodora Kindti were absent from the samples in 1972. These two zooplanktons were not abundant in the population and could have been present in 1972 but not sampled. Streblocerus serricaudatus was the only species of zooplankton in 1972 that was not present in 1971. Species diversity increased in the summer of 1973 after the second treatment to 13 different types of zooplankton. The three new species of zooplankton collected in 1973 were: Ophryoxus gracilis, Ilyocryptus spinifer and Acantholeberis curvirostris. These three species of zooplankton were not abundant in the lake in 1973 and were probably there in 1971 and 1972 but not collected in the samples.

In Lamereau Lake Daphnia spp., Holopedium gibberum and Copepoda accounted for at least 80 percent of the zooplankton sampled in June and July. Daphnia spp. was the most abundant species of zooplankton but unlike Camp Lake Daphnia spp. increased in the number per liter sampled after each treatment from 8.0 in 1971 to 14.8 and 15.2 per liter in 1972 and 1973 (Table 2). Holopedium gibberum increased in numbers from 2.5 per liter before treatment to 3.7 per liter after the second treatment with Fintrol-5. Copepoda increased from 0.5 per liter in 1971 to 4.4 per liter in 1972 then dropped slightly to 3.7 per liter in June and July of 1973.

Nancy Lake

Species diversity stayed almost the same in Nancy Lake during the three summers. In 1971 there were 8 different types of zooplankton in the lake and in 1972 Streblocerus serricaudatus and a species of Chydorinae were added to the list (Table 4). In 1973 there were 9 different types of zooplankton in Nancy Lake.

Daphnia spp. was the most abundant species of zooplankton in Nancy Lake during June and July in 1971 and 1972. Before the first chemical treatment there were an average of 8.0 Daphnia spp. per liter of water while in 1972 after the first treatment the number per liter was 3.7. In 1973 after the second treatment the number of Daphnia spp. per liter had increased by 1.8 organisms per liter over the 1972 figure. The number of Holopedium gibberum dropped from 7.1 per liter in 1971 to 2.7 in 1972 but by 1973 the number per liter was higher than before treatment. The average number per liter of Copepoda stayed fairly constant during the three summers. Daphnia spp., Holopedium gibberum and Copepoda comprised at least 63 percent of the zooplankton sampled in June and July.

Comparison Among Lakes

Ceriodaphnia spp., Diaphanosoma spp. and Sida crystallina were not abundant in any of the lakes during June and July. Chydorinae were also not abundant in the collections in the lakes. One of the difficulties in collecting a quantitative sample of Chydorinae with the Miller Sampler is that Chydorinae are littoral planktors and it is very difficult to run this sampler through the vegetation. It is difficult to evaluate the effects of the Fintrol-5 treatments on these types of zooplankton that occur at low levels in the population. Only Leptodora kindti which was collected in one sample in both Camp and Lamereau Lakes before the treatment was not present after the chemical treatment. The other species listed above, although occurring at low levels of abundance, were present after the chemical treatments in approximately the same numbers as before.

Daphnia spp. decreased in abundance after each chemical treatment in Camp Lake while in Lamereau Lake the number per liter increased each year after treatment. In Nancy Lake the number per liter of *Daphnia* spp. stayed at about the same level before and after treatment. If the antimycin had an effect on the *Daphnia* spp. population the number per liter in each lake should have shown the same trend in all three lakes. Houf and Hughey (1973) found that when concentrations of antimycin between 1.5 and 40 ppb were used in field tests there were no short or long-term effects on *Daphnia pulex* numbers. Walker et al.(1964) found that when concentrations of antimycin over 10 ppb were used in laboratory tests that *Daphnia* spp. died.

In Camp Lake the number per liter of *Bosmina* spp. declined after the first treatment with Fintrol-5 but Gilderhus et al.(1969) found no short or long-term effects in the field of an antimycin treatment of 3.12 ppb on the *Bosmina* spp. population. There was also no effect of a field treatment of 3.12 ppb antimycin on the *Ceriodaphnia* spp. population in experiments conducted by Gilderhus et al.(1969).

There were a number of factors which could have affected the zooplankton abundance other than the antimycin. These factors were effects of temperature on the zooplankton abundance, intraspecific and interspecific competition and effects of introducing a fish population in lakes which had no population. Nevertheless, from the information presented, it is apparent that none of the abundant types of zooplankton in the lakes were eliminated from the lakes after two treatments with Fintrol-5 at 3 ppb.

The trends in zooplankton abundance displayed in Figure 1 show the difficulty a biologist may encounter in trying to evaluate the effects of a toxicant treatment on the zooplankton population. If an assessment was to be made before and after chemical treatment in Camp Lake in 1971, the time the assessment was made would have been very important. If samples were taken on June 23, when zooplankton numbers were 165 per liter and an assessment of the zooplankton population was made after chemical treatment on July 6, when numbers were 11 per liter, it would seem evident that the toxicant may have caused the reduction. Also, when the zooplankton numbers fluctuate as they did in Lamereau Lake in 1973, it would be difficult to determine what effects the toxicant treatment had on the population.

If time is limited to make an assessment of the effect of a toxicant treatment on the zooplankton population in a lake, the samples should be taken the day before or preferably the day of the treatment and the day following the treatment. If more time is available a better assessment of the treatment can be made if samples are taken once a week one month before treatment and once a week for a month following treatment as well as the day of the treatment and the day after treatment.

Benthic Organisms

Because of the limited amount of information collected before and after chemical treatment in 1973, the abundance of the benthic organisms will not be discussed by individual lakes but by species found in the lakes. Chironomidae were the most abundant benthic organisms in each lake. The midge larvae increased from $276/m^2$ to $888/m^2$ in Camp Lake after treatment but in Lamereau Lake the opposite occurred -- the abundance of midge larvae decreased from $696/m^2$ before to $244/m^2$ after treatment (Table 5). Chironomidae numbers remained the same from both the pre- and post-treatment samples in Nancy Lake. Two other families of the order Diptera were found in the lakes. Tabanidae and Heleidae increased after treatment in Camp Lake but decreased in abundance after treatment in both Lamereau and Nancy Lakes.

Oligochaeta were the second most abundant benthic organism in the lakes. In each lake the number of oligochaetes decreased after chemical treatment. The greatest reduction occurred in Lamereau Lake going from $212/m^2$ before to $68/m^2$ after treatment.

Baetidae was the only family of mayflies in each lake and it decreased in abundance after treatment in each lake. The dragonfly Libellulidae decreased in abundance after treatment in Lamereau Lake from $56/m^2$ to $16/m^2$ but remained about the same in numbers in Nancy Lake, $32/m^2$ to $28/m^2$. Gomphidae increased in numbers in Camp Lake following treatment from $4/m^2$ to $8/m^2$ while the dragonfly Aeshnidae increased slightly in Nancy Lake following treatment from $8/m^2$ to $12/m^2$. The number of Trichoptera increased slightly after treatment in each lake.

Hirudinea increased in numbers after treatment in each lake while Pelecypoda increased in Nancy Lake following treatment but decreased in abundance in Lamereau Lake after treatment. Lamereau Lake was the only lake with significant numbers of Amphipoda and they remained at the same level before and after treatment. Only one nematode was collected in Nancy Lake before treatment and none after treatment.

With the information collected in the fall it is very difficult to relate a change in abundance of a benthic organism to the chemical treatment. For example, the estimated number of Chironomidae in Camp Lake showed a considerable increase in abundance following treatment while in Lamereau Lake the data showed the opposite to be true and in Nancy Lake the number of midge larvae stayed at the same level. If abundance was related to chemical treatment, all three lakes should have shown the same trend.

Houf and Hughey (1973) found that there were no short or long-term effects on Chironomus spp. when subjected to field concentrations of 1.5 - 40 ppb antimycin, and Callaham and Huish (1969) also found Chironomus spp. did not disappear with concentrations of 5 ppb antimycin.

Smith (1972) subjected mayfly larvae to a concentration of 12 ppb antimycin without mortality occurring and Houf and Hughey (1973) found that concentrations of 1.5 to 40 ppb had no short or long-term effect on the dragonfly larvae Libellulidae. Schoettger et al.(1967) determined that caddisfly larvae could withstand concentrations of antimycin of 3.5 to 5 ppb with no effect on the organisms. Blood suckers were not affected by a concentration of 5 ppb antimycin (Chamberland 1966). Berger (1965) subjected nematodes in the field to a concentration of 15 ppb antimycin without mortality occurring.

There were a number of other factors which were difficult to eliminate during sampling which were probably more responsible than the chemical treatment for the changes in abundance that occurred in the lakes. These factors were emergence, immigration, emigration and variation in abundance of organisms among sample sites. However, from the information presented, none of the abundant benthic organisms were eliminated from the lakes after chemical treatment.

SUMMARY

1. Because of natural fluctuations in zooplankton numbers during the summer the timing in collecting samples for an assessment of the effect of a certain chemical on the zooplankton is critical. Adequate assessments of a treatment can be made if samples are taken once a week one month prior and once a week for a month following treatment as well as the day of the treatment and the day after treatment.

2. Factors such as the effects of temperature on zooplankton abundance, intraspecific and interspecific competition and effects of introducing a fish population in lakes which had no population probably had a greater effect on zooplankton

abundance than the antimycin treatment. All the zooplankton found in the lakes before the chemical treatments were found after the treatment except for Leptodora kindti. This particular zooplankton was collected in one sample in both Camp and Lamereau Lakes and could have been present after the treatments but not collected.

3. None of the abundant benthic organisms were eliminated from the lakes after treatment with 3 ppb antimycin. The changes in abundance that occurred in the lakes after treatment were probably due to emergence, immigration, emigration and variation in abundance of organisms among sample sites, rather than from the treatment.

LITERATURE CITED

All literature cited information except for Priegel (1970) was cited from a literature review paper entitled "Responses of Non-Target Organisms to Antimycin", by Rosalie A. Schnick, U. S. Bureau of Sport Fisheries and Wildlife, Control Laboratory, La Crosse, Wisconsin.

Berger, Bernard L. 1965. Rough fish removal with Antimycin in Coe and Sidie Hollow Creeks, Vernon County, Wisconsin, on August 13, 1965. U. S. Bureau of Sport Fisheries and Wildlife, Fish Control Laboratory, La Crosse, Wisconsin. 4 p.

Callaham, M. A., and M. T. Huish. 1969. Effects of Antimycin on plankton and benthic organisms. Proceedings of the Southeastern Association of Game and Fish Commissioners, 22 (1968):255-263.

Chamberland, Ernest. 1966. Experimental poisoning of Beauty Lake (Cty Gatineau, P. Que.) with "FINTROL" by Ayerst Laboratories of Canada LTD. Quebec Biological office, Drummondville-Sub., Quebec. 8 p.

Gilderhus, Philip A., Bernard L. Berger, and Robert E. Lennon. 1969. Field trials of Antimycin as a fish toxicant. U. S. Bureau of Sport Fisheries and Wildlife, Investigations in Fish Control 27:1-21.

Houf, Larry J., and Ronald E. Hughey. 1973. Benthic and zooplankton fauna for which no demonstrable short-term or long-term effects of treatment with Antimycin were observed. I. Benthos. II. Zooplankton. Cooperative Fishery Unit, University of Missouri, Columbia, Missouri. 2 p.

Priegel, Gordon R. 1970. Food of the White Bass, Roccus chrysops, in Lake Winnebago, Wisconsin. Trans. Am. Fish. Society 99(2):440-443.

Schoettger, Richard A., Bernard L. Berger, and Philip A. Gilderhus. 1967. Reclamation of Turquoise Lake, Leadville, Colorado. U. S. Bureau of Sport Fisheries and Wildlife, Fish Control Laboratory, La Crosse, Wisconsin. 20 p.

Smith, David W. 1972. Chemical reclamation of Fish Creek, Montcalm County, using Fintrol bars (Antimycin). Michigan Department of Natural Resources, Fisheries Division. 5 p.

Walker, Charles R., Robert E. Lennon, and Bernard L. Berger. 1964. Preliminary oberservations on the toxicity of Antimycin A to fish and other aquatic animals. U. S. Bureau of Sport Fisheries and Wildlife, Investigations in Fish Control 2 and Circular, No. 186:1-18.

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The author is Fishery Biologist, Bureau of Research, Spooner, Wisconsin.

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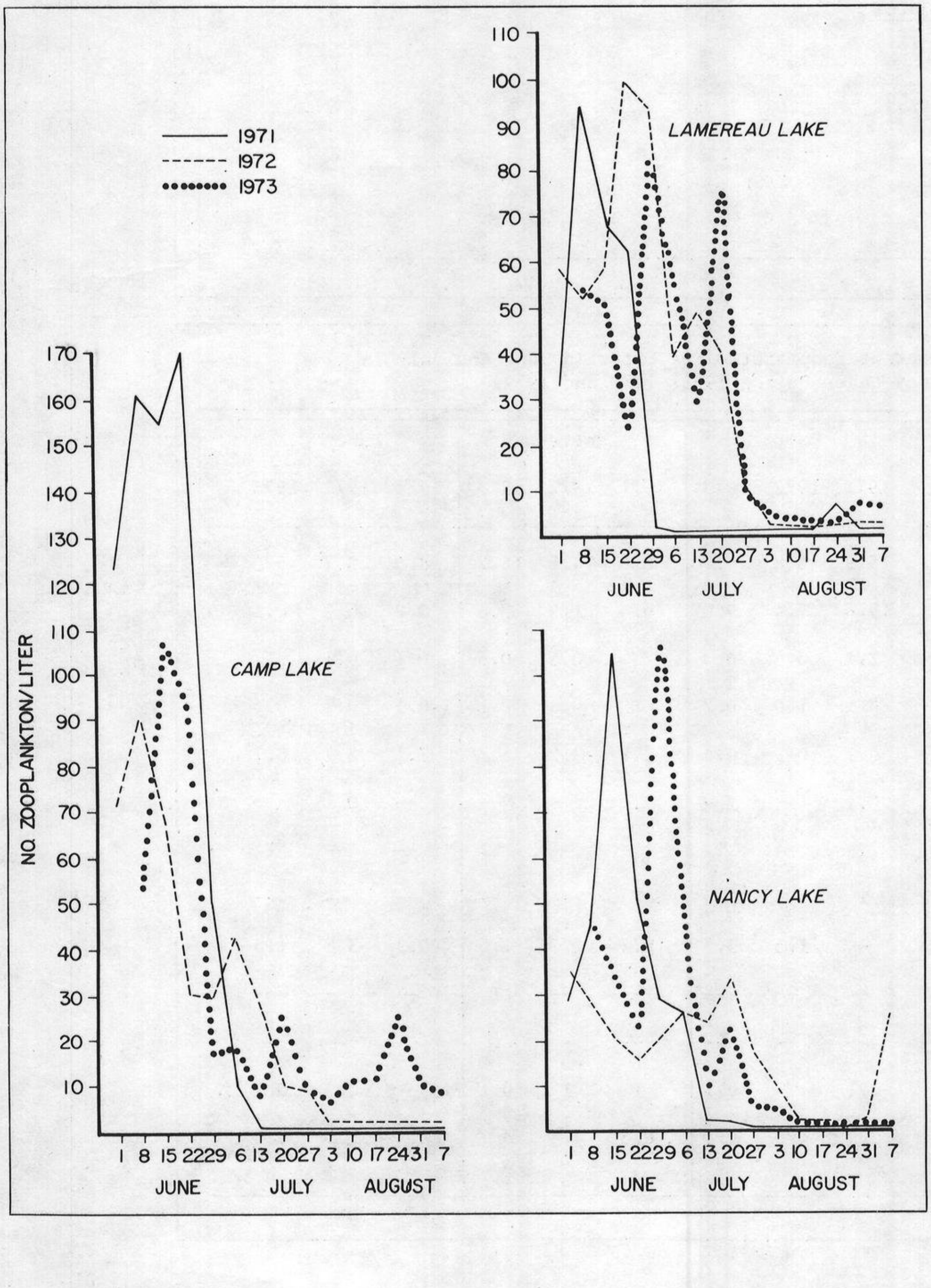

FIGURE 1. The average number of zooplankton per liter of water during summers of 1971, 1972 and 1973 in Camp, Lamereau and Nancy Lakes.

TABLE 1. Species Diversity of Zooplankton Before (1971) and After (1972, 1973) Treatment With Fintrol-5 in Camp Lake From June Through Mid-September.

Zooplankton	Present in 1971	Present in 1972	Present in 1973
Daphnia spp.	X	X	X
Bosmina spp.	X	X	X
Ceriodaphnia spp.	X	X	X
Diaphanosoma spp.	X	X	X
Holopedium gibberum	X	X	X
Sida crystallina	X	X	-
Streblocerus serricaudatus	X	X	X
Leptodora Kindti	X	-	-
Polyphemus pediculus	-	X	X
Chydorinae	X	X	X
Copepoda	X	X	X

TABLE 2. The Average Number of Zooplankton Per Liter in June and July in Camp, Lamereau and Nancy Lakes During 1971, 1972 and 1973.

	Camp			Lamereau			Nancy		
Zooplankton	1971	1972	1973	1971	1972	1973	1971	1972	1973
Daphnia spp.	15.9	6.8	4.7	8.0	14.8	15.2	8.0	3.7	5.5
Bosmina spp.	19.6	7.4	9.0	0.4	1.9	0.6	0.2	0.2	0.1
Ceriodaphnia spp.	2.1	0.4	0.2	T	0.5	0.6	0.1	0.1	T
Diaphanosoma spp.	0.1	1.0	0.2	T	0.8	0.1	0.1	0.2	0.5
Holopedium gibberum	0.1	0.1	0.4	2.5	3.2	3.7	7.1	2.7	8.7
Sida crystallina	0.1	--	--	T	--	--	--	0.1	--
Streblocerus serricaudatus	T*	--	T	--	--	T	--	--	T
Leptodora Kindti	T	--	--	T	--	--	--	--	--
Polyphemus pediculus	--	1.5	3.3	0.3	2.2	1.5	0.3	3.8	1.3
Ophryoxus gracilis	--	--	--	--	--	T	--	--	--
Acantholeberis curvirostris	--	--	--	--	--	T	--	--	--
Chydorinae	0.1	T	0.1	T	T	0.1	--	0.3	0.1
Copepoda	3.9	4.0	3.8	0.5	4.4	3.7	2.4	1.5	2.4

* Less than .05 per liter

TABLE 3. Species Diversity of Zooplankton Before (1971) and After (1972, 1973) Treatment with Fintrol-5 in Lamereau Lake From June Through Mid-September.

Zooplankton	Present in 1971	Present in 1972	Present in 1973
Daphnia spp.	X	X	X
Bosmina spp.	X	X	X
Ceriodaphnia spp.	X	X	X
Diaphanosoma spp.	X	X	X
Holopedium gibberum	X	X	X
Sida crystallina	X	-	X
Streblocerus serricaudatus	-	X	X
Leptodora Kindti	X	-	-
Polyphemus pediculus	X	X	X
Ophryoxus gracilis	-	-	X
Ilyocryptus spinifer	-	-	X
Acantholeberis curvirostris	-	-	X
Chydorinae	X	X	X
Copepoda	X	X	X

TABLE 4. Species Diversity of Zooplankton Before (1971) and After (1972, 1973) Treatment With Fintrol-5 in Nancy Lake From June Through Mid-September.

Zooplankton	Present in 1971	Present in 1972	Present in 1973
Daphnia spp.	X	X	X
Bosmina spp.	X	X	X
Ceriodaphnia spp.	X	X	X
Diaphanosoma spp.	X	X	X
Holopedium gibberum	X	X	X
Sida crystallina	X	X	-
Streblocerus serricaudatus	-	X	X
Polyphemus pediculus	X	X	X
Chydorinae	-	X	X
Copepoda	X	X	X

TABLE 5. The Average Number of Benthic organisms Per Square Meter Before and After Chemical Treatment with Fintrol-5 in Camp, Lamereau and Nancy Lakes in 1973.

Organisms	Camp Lake		Lamereau Lake		Nancy Lake	
	Before	After	Before	After	Before	After
Insecta						
Ephemeroptera						
Baetidae	20	12	32	4	12	4
Odonata						
Anisoptera						
Libellulidae			56	16	32	28
Gomphidae	4	8				
Aeshnidae					8	12
Diptera						
Chironomidae	276	888	696	244	240	240
Tabanidae	4	12	4		4	
Heleidae		4	8		32	
Trichoptera		4	8	12	12	24
Amphipoda		4	60	60	4	
Hirudinea		8	32	40	8	12
Pelecypoda			24	4	4	60
Nematoda						
Oligochaeta	348	296	212	68	68	12

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