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NOTES ON THE ZOOPLANKTON AND BENTHOS OF RUSH LAKE, DOUGLAS COUNTY, SIX YEARS AFTER APPLICATION OF ANTIMYCIN

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INTRODUCTION

Antimycin was a relatively new fish toxicant in 1967 when it was used on an experimental basis to test its effects on the bluegill and largemouth bass population in Rush Lake, Wisconsin. An initial treatment of 0.5 ppb on August 21, 1967 killed a minimum of 5 percent of all bluegill yearlings and fingerlings while a second treatment of 0.75 ppb on September 11, 1967 killed almost all the bluegill fingerlings, a minimum of 30 percent of the remaining bluegill yearlings, a minimum of 20 percent of the bass fingerlings, and a few larger bluegills. There was no mortality of larger bass. At the time of treatment no study was made of the nontarget organisms; but in recent years the increasing need for information on the long-term effects of antimycin on nontarget species has become evident. Therefore, when the fish population was surveyed in 1973, the status of the zooplankton and benthos was also assessed.

It is well known that zooplankton and benthic populations can exhibit extreme fluctuation over short time intervals. The presence or absence of any species or group of organisms and their relationship to antimycin treatment is therefore difficult to determine. This is especially true of this study because no samples were collected immediately before or after treatment. Therefore, this paper constitutes only a status report on the benthos and zooplankton present in Rush Lake 6 years after treatment.

DESCRIPTION OF STUDY AREA

Rush Lake is a 22-acre, soft water seepage lake located on the east central edge of Douglas County. It is in the Brule River State Forest and is surrounded by aspen, jack pine and red pine. The soil is sandy as is the entire littoral area bottom of the lake. There is a public boat landing and picnic area at the north end of the lake. All the frontage is state-owned land and there is no private development.

The present fish population in Rush Lake consists of an abundant population of largemouth bass and bluegill and a remnant population of white suckers. An experimental stocking of 5- to 7.5-centimeter channel catfish in 1970 was unsuccessful.

Rush Lake has clear water and a Secchi disc can be seen to the bottom. Maximum depth varied from 2.7 to 3.8 m during the years of study. However, since there are jack pine stumps to a depth of approximately 1.2 m, the water level must have been considerably lower in the past.

Although Rush Lake is quite shallow there is no record of a winterkill. Dissolved oxygen levels were above 3 ppm during late winter in 1969 and 1973. The range of other parameters measured between 1966 and 1974 and the sample sizes were as follows: total alkalinity, 32-40 mg/l (4 samples); pH, 7.0-8.8 units (10 samples); and specific conductance, 61-88 mhos/cm^2 (4 samples).

METHODS

Zooplankton samples were collected with a Miller high-speed plankton net with No. 20 mesh and preserved in 10 percent formalin plus Lugols solution. A total of 7 samples were collected, 3 at a depth of 25 cm near shore, 2 at a depth of 25 cm in the center of the lake, and 2 at a depth of 2 meters in the center of the lake. All samples were collected from one minute tows on October 29, 1973. Final counts were made by diluting the sample (usually to 1000 cc) and placing three 1 ml subsamples in a 3 ml circular counting cell.

A total of 40 benthic samples were collected in 5 locations on October 30 and November 1, 1973. Ten samples were obtained at each of 3 sites in depths from about 15 to 120 cm. Each site was sampled from shore outward at intervals of ½ to 1 meter. In addition, 5 samples were collected at each of 2 locations in the deepest areas of the lake. The shallow areas were sampled with a locally made hand operated dredge similar to the Peterson dredge while the deep areas were sampled with a standard Eckman dredge (15 x 15 cm). Each dredge sampled approximately 1/40 of a square meter. After straining with a U. S. Standard No. 30 sieve, all samples were preserved in 10 percent formalin and hand picked and identified at a later date in the laboratory.

RESULTS

Zooplankton

Zooplankton of three taxa were counted. In order of decreasing total abundance, these were rotifers, cladocerans, and copepods. However, this order of abundance was not consistent within each zone sampled. Rotifers were most abundant in all zones, while copepods were second in abundance in the littoral zone and third in abundance in the limnetic zone. The abundance of all zooplankton collectively totalled 139.7/liter.

The most abundant species was the rotifer, Keratella cochlearis which occurred at a density of 113/liter in the littoral zone and 61/liter in the limnetic zone. The second most abundant species was the cladoceran, Bosmina longirostris (O. F. Müller) which occurred at a density of 4.9/liter in the littoral zone and 37.7 in the limnetic zone. This species was the only one that exhibited a difference in density at the two depths sampled in the limnetic zone -- 15.8/liter at the 25 cm depth compared to 59.6/liter at the 2-meter depth (Table 1). Abundance of other species found did not differ appreciably between zones or depth sampled.

Benthos

Based on the 40 samples collected, Rush Lake supported a standing stock of 933 benthic organisms/m^2. Of this total 82 percent were chironomids, 10 percent gastropods, and 6 percent oligochaetes. No other group of the 10 groups of organisms identified comprised more than 1 percent of the total.

The number of organisms decreased with increasing depth. This trend was due primarily to chironomids which averaged 2009/m^2, 175/m^2, and 92/m^2, respectively, in the three zones of increasing depth (Table 2). Gastropods averaged about 120/m^2 in each of the first two zones and only 37/m^2 in the deepest area. Oligochaetes also decreased with increasing depth from 115/m^2 to 52/m^2 to zero in the deepest area. The density of the other organisms captured did not vary much with depth, although this may be the result of the low numbers sampled.

The number of groups of organisms captured also decreased with increasing depth varying from 10 in the 15-60 cm zone to 8 in the 61-120 cm zone and to only 3 in the 240-300 cm zone.

DISCUSSION AND CONCLUSIONS

Although there was no evaluation of the immediate effects of antimycin on benthic organisms, photographs taken on August 22, 1967 the day after treatment with 0.5 ppb antimycin showed windrows of insect remains. Based on cursory field examination in 1967 and examination of the 1973 benthic samples, it was concluded that the windrows of insects were most likely chironomids, either cases of hatched pupae, the entire pupae, or larvae. There is a remote possibility that a natural hatch occurred the same day of treatment, and that the insect remains present the day after treatment were just a chance occurrence. It is also possible that the antimycin treatment either triggered a hatch or was the cause of mortality of larvae or pupae. However, if the 1967 treatment did result in an initial mortality, its effects were nullified through reproduction of survivors or through natural reintroduction from other areas by 1973.

All the zooplankton and benthic organisms found in Rush Lake in 1973 are those groups which are commonly found in ponds and small lakes. Most organisms found can exhibit extreme fluctuations in population density over short time intervals and many, especially zooplankton, usually reach maximum abundance in spring and/or fall. Because of the extreme variation in abundance that occurs naturally, it would be difficult to evaluate any long-term changes in density as related to antimycin treatment. Nevertheless, the very presence of the organisms noted in 1973 is prima facie evidence that no gross long-term detrimental effects to these organisms occurred as a result of the use of antimycin.

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TABLE 1. The Average Number of Zooplankton Per Liter of Water Sampled in Rush Lake, October 29, 1973.*

	LITTORAL ZONE				LIMNETIC ZONE							
	25 cm. depth				25 cm. depth			2 meter depth				
	Sample No. 1	2	3	Sample Avg.	Sample No. 1	2	Sample Avg.	Sample No. 1	2	Sample Avg.	Limnetic Avg.	GRAND AVG.
Rotifera												
Keratella cochlearis	53.0	134.1	152.0	113.0	61.2	72.6	66.9	69.9	38.3	54.1	60.5	83.0
Polyarthra sp.	14.7	24.2	13.6	17.5	17.5	22.6	20.1	24.0	7.9	16.0	18.0	17.8
Unknown		1.2	0.6	0.6	--	0.6	0.3	2.3	0.7	1.5	0.9	0.8
Cladocera												
Daphnia laevis Birge	--	0.4	--	0.1	--	0.3	0.2	--	0.5	0.3	0.2	0.2
Bosmina longirostris (O. F. Müller)	1.1	2.3	11.4	4.9	18.4	13.2	15.8	28.3	90.8	59.6	37.7	23.6
Copepoda												
Cyclops thomasi (S. A. Forbes)												
Nauplius stage	10.7	19.9	17.1	15.9	11.4	15.4	13.4	13.0	9.3	11.2	12.3	13.8
Copepodid stage	0.4	--	1.3	0.6	0.3	0.3	0.3	0.3	0.7	0.5	0.4	0.5
Total	79.9	182.1	196.0	152.6	108.8	125.0	117.0	137.8	148.2	143.2	130.0	139.7

*All samples were examined by Byron G. Torke of the Center for Great Lakes Studies, the University of Wisconsin-Milwaukee. The author identified all organisms to genus while Mr. Torke identified to Species (Rotifers excepted). Species and genera found by Mr. Torke in addition to those listed above and their relative abundance were: the cladoceran, Polyphemus pediculus (L.) - rare - 1 specimen, and the rotifer, Asplanchna sp. - common.

TABLE 2. The Average Number of Benthic Organisms Per Square Meter in Rush Lake, October 30 - November 1, 1973.

	Depth in Centimeters		
	0-60	61-120	240-300
Annelida			
Oligochaeta	115	52	--
Hirudinea	2	--	--
Crustacea			
Amphipoda	7	6	--
Insecta			
Ephemeroptera			
Baetidae	5	3	4
Odonata			
Anisoptera			
Gomphidae	2	6	--
Trichoptera	26		
Diptera			
Chironomidae	2,009	175	92
Tabanidae	2	3	
Heleidae	2	3	
Gastropoda	113	129	37
Total	2,257	377	133
No. of Samples	17	13	10

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