PRELIMINARY ATTEMPTS TO INCREASE MIDGES (TENDIPEDIDAE-DIPTERA) IN HATCHERY PONDS

W. A. ROGERS, *Fishery Management Biologist* [1]
Bureau of Sport Fisheries and Wildlife
Marion, Alabama

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ABSTRACT

In a food-habits study of young largemouth bass at the National Fish Hatchery, Marion, Alabama, midges were found to comprise 80 to 90 percent of the total food volume in fish from 25 to 55 millimeters in length. Since midges were found to be such an abundant food item in the diet of these fish, attempts were made to increase the midge crop by providing additional surface area in the pond for attachment.

It was found that ponds having a dominant blue-green algae bloom (*Anacystis spp.* and *Anabaena spp.)* produced more midges than ponds having a dominant green algae bloom *(Oocystis spp., Chlorella spp.,* and *Coelastrum spp.).* Black polyethylene sheets, ⅛-inch masonite board, and ¼-inch cement-asbestos board, plus concrete and clay-tile building blocks were oriented in different positions in a pond to determine which material and position were most productive. The masonite board proved to produce the most midges. Polyethylene sheet was next most productive. Of the three positions in which the sheet materials were tested; vertical (0°); horizontal (90°); and a 45° slant — the 45° position produced the most midges. Building blocks produced fewer midges than sheet materials and were more difficult to work with.

INTRODUCTION

A food habits study of largemouth bass fry and fingerlings at the Marion, Alabama, National Fish Hatchery, showed that midges made up the greatest percentage of food volume in bass ranging from 20 to 55 millimeters in length. Since they played such an important role in the diet of the young bass, several preliminary tests were conducted to determine the feasibility of increasing midges and to study factors influencing their production.

Sadler (1935) showed that midges could be reared profitably in small propagating ponds treated with artificial fertilizer. In the present study, several different materials were placed in a fish-free pond to provide increased attachment area for the midges and inorganic fertilizer was added to promote an algal bloom. An attempt was made to correlate midge production with different phytoplankton assemblages in order to find which types of algae were most productive of midges.

RESULTS OF THE FOOD STUDY

Five hundred twenty-five bass fry and fingerlings were collected from four rearing ponds during April of 1962. Collections were started three days after the bass fry were placed in the rearing ponds and terminated when the fish were harvested for distribution. Stomachs of the fish were dissected and the contents placed on a microscope slide for identification and measurement. Relative volumes of the food organisms were determined by measuring the length and width of the organism to determine the area, and then using the area as an index to volume (Welch, 1948, pp. 290-292). This method has its limitations, but proved to be very satisfactory on small fish although quite time-consuming.

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[1] Present address: Fisheries Building, Auburn University, Auburn, Alabama.

The fish were placed in size groups to the nearest 5 millimeters and the groups ranged from 5 to 55 millimeters in length. In the 5 and 10 millimeter size groups, the greatest percentage of food volume was copepods and cladocerans with very small midge larvae and pupae comprising about 11 percent in each group (Figure 1). The percentage volume of copepods and cladocerans steadily decreased in the larger size groups of fish. Cladocerans were not found in fish larger than the 40 millimeter group and copepods were not found beyond the 45 millimeter fish size group. The percentage volume of midge larvae and pupae increased in the larger size groups until they were comprising 80 to 90 percent of total volume in the 25-40 millimeter size fish. Adult midges appeared in the diet in the 35 millimeter size group and were comprising 40 to 50 percent of total volume in the 45-55 millimeter size fish. In all, midge larvae, pupae, and adults made up about 80 to 90 percent of the total food volume in the bass fingerlings examined larger than the 20 millimeter size group.

Methods of increasing midge production

A. Effects of phytoplankton types on midge production.

In an attempt to find which species of algae were most productive of midges, four ponds having a dominant Chlorophyceae (green) species and four ponds having a dominant Myxophyceae (blue-green) species were selected for the experiment. Plankton samples were collected from the ponds at 10-day intervals and the dominant species of algae determined. At the end of the first sample period, one of the green-algae ponds had developed a blue-green algae bloom which left three of the experimental ponds with dominant green algae species and five ponds with dominant blue-green algae species. The ponds were production ponds averaging about 0.8 acre in size and containing bluegills and redears.

The multiple-plate sampler described by Hester and Dendy (1962) was used to sample midge production in the ponds. Three samplers were placed in each pond at a depth of 15 to 18 inches at three locations in the pond and left for a period of three weeks. The study period covered three of the three-week periods during the summer of 1962. The samplers were collected by enclosing them in a plastic bag and taking them to the laboratory where a soft-bristled brush was used to dislodge the organisms. Volumes of total periphyton and midges were determined volumetrically by the displacement method and are expressed as milliliters per square foot. The midges were separated and measured after the total periphyton had been measured. Results are shown in Table 1.

The total periphyton and midges produced were averaged from all locations for the three periods. Highest total periphyton from a single pond—14.8 milliliters per square foot—was produced in a pond having *Coelastrum spp.* as the dominant form. Highest average periphyton production, 8.4 milliliters per square foot was obtained from the ponds having a dominant green algae. Highest midge production from a single pond—1.5 milliliters per square foot—was obtained from a blue-green algae (*Anacystis spp.*) dominant pond. The highest average midge production, 0.5 milliliters per square foot was from the ponds having a dominant blue-green bloom.

Two of the ponds having a dominant blue-green bloom produced only a trace of midges. This low production could have been related to the species of algae, but it was thought that most likely it was due to chemical weed control treatments. Pond S-4 was treated with five pounds of Aquathol on each of two days for a total of ten pounds of chemical (near 1.0 p.p.m.) during one three-week test period. The other pond, S-14, received five gallons of Sodium Arsenite (near 4.0 p.p.m.) on two different occasions during the study period and it is believed that these treatments would account for low midge production in the pond.

Surber and Meehean (1931) indicated that midges were killed at concentrations of 2.5 to 4.0 p.p.m. As_2O_3. Lawrence (1958) stated

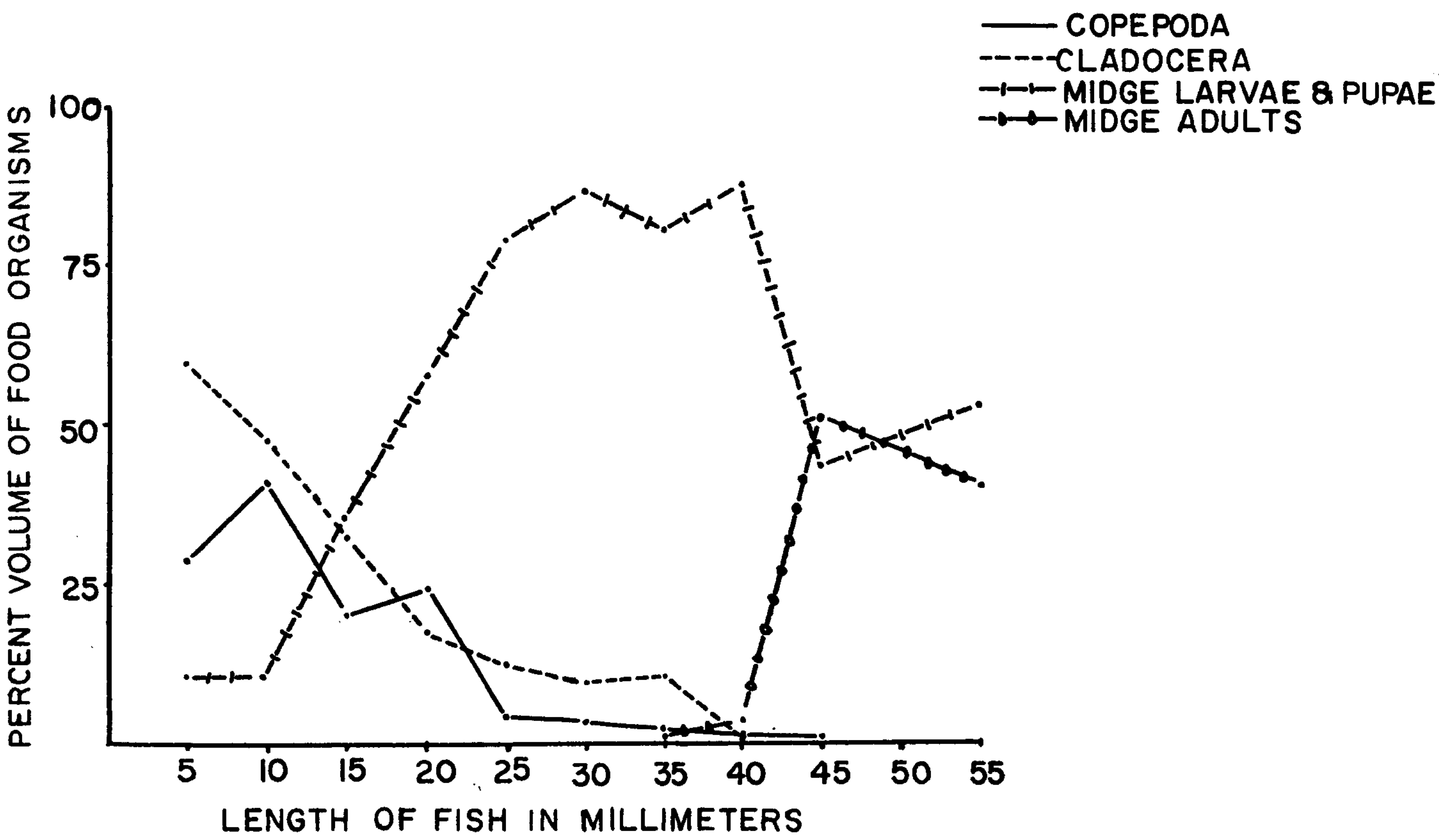

Figure 1 The percent volumes of the major food organisms of the various length groups of young largemouth bass.

TABLE 1. VOLUMES OF PERIPHYTON AND MIDGES PRODUCED AND THE DOMINANT ALGAE FOUND DURING THE STUDY PERIOD

Pond No.	Volume of Periphyton (Ml. per sq. ft.)	Volume of Midges (Ml. per sq. ft.)	Dominant algae during study period		Avg. vol. Periphyton (Ml. per sq. ft.)	Avg. vol. Midges (Ml. per sq. ft.)
S-1	6.2	Tr.[1]	Chlorella	Green algae	8.4	0.2
S-2	4.2	0.1	Oocystis			
S-3	14.8	0.4	Coelastrum			
S-4	5.8	Tr.	Anacystis	Blue-green Algae	6.3	0.5
S-8	3.8	0.5	Anabaena			
S-10	6.4	0.6	Anacystis			
S-12	10.4	1.5	Anacystis			
S-14	5.0	Tr.	Anabaena			

[1] Tr. = Trace - less than 0.05 ml.

that ponds receiving two applications of 4.0 p.p.m. As_2O_3 applied one month apart reduced bottom organisms 34 percent as compared with control ponds.

Pond S-1 (0.9 acres) received a pre-flooding treatment with 16 pounds Simazine 80W approximately two months before the sampling began. Ponds S-1, S-2 and S-3 received near 0.2 p.p.m. "Algae-clear" during the last three-week sample period. Several of the ponds were also sprayed with fuel oil to control bugs.

Fertilizer was applied at weekly intervals as needed to produce and maintain a secchi disc reading of about 15 inches. Secchi disc readings were taken at weekly intervals. On one or two occasions, superphosphate was added to the ponds to increase photosynthesis and prevent oxygen deficiency.

No attempt was made to correlate fish production with midge production.

B. Results of providing attachment material to increase midge production.

In this phase of the study, two general types of material—sheet material and building blocks—were used in attempts to increase midges. The sheet materials tested were: black polyethylene, four mils thick; masonite board, 1/8-inch thick, and cement-asbestos board, 1/4-inch thick. Building blocks tested were concrete blocks and hollow-core tile blocks. Both types of materials were placed in a fish-free fertilized pond and oriented at different positions to determine which position was most productive. All materials tested were placed at approximately the same depth in the same area of the pond. The materials were left in the pond for a period of approximately seven weeks.

Earlier tests with the multiple-plate sampler had indicated that it may be somewhat selective, so for this study much larger plates were used to possibly allow a greater variety of organisms to attach. The plates were cut three feet long and one foot wide for a total attachment surface of approximately six square feet. Three plates of each material were oriented horizontally, vertically, and at a 45° slant in the pond. The blocks were placed on end; flat, openings up; and flat, openings to side.

The sheet materials proved to be much more productive of midges than the building blocks. Sheets oriented in a 45-degree slant position proved to be more productive than the other positions (Table 2). The

Figure 2. Masonite plates from the various positions occupied in the pond. This view is of the dorsal surface of plates oriented in the 45-degree and horizontal positions. Note midge cases and colonies of the bryozoan Plumatella.

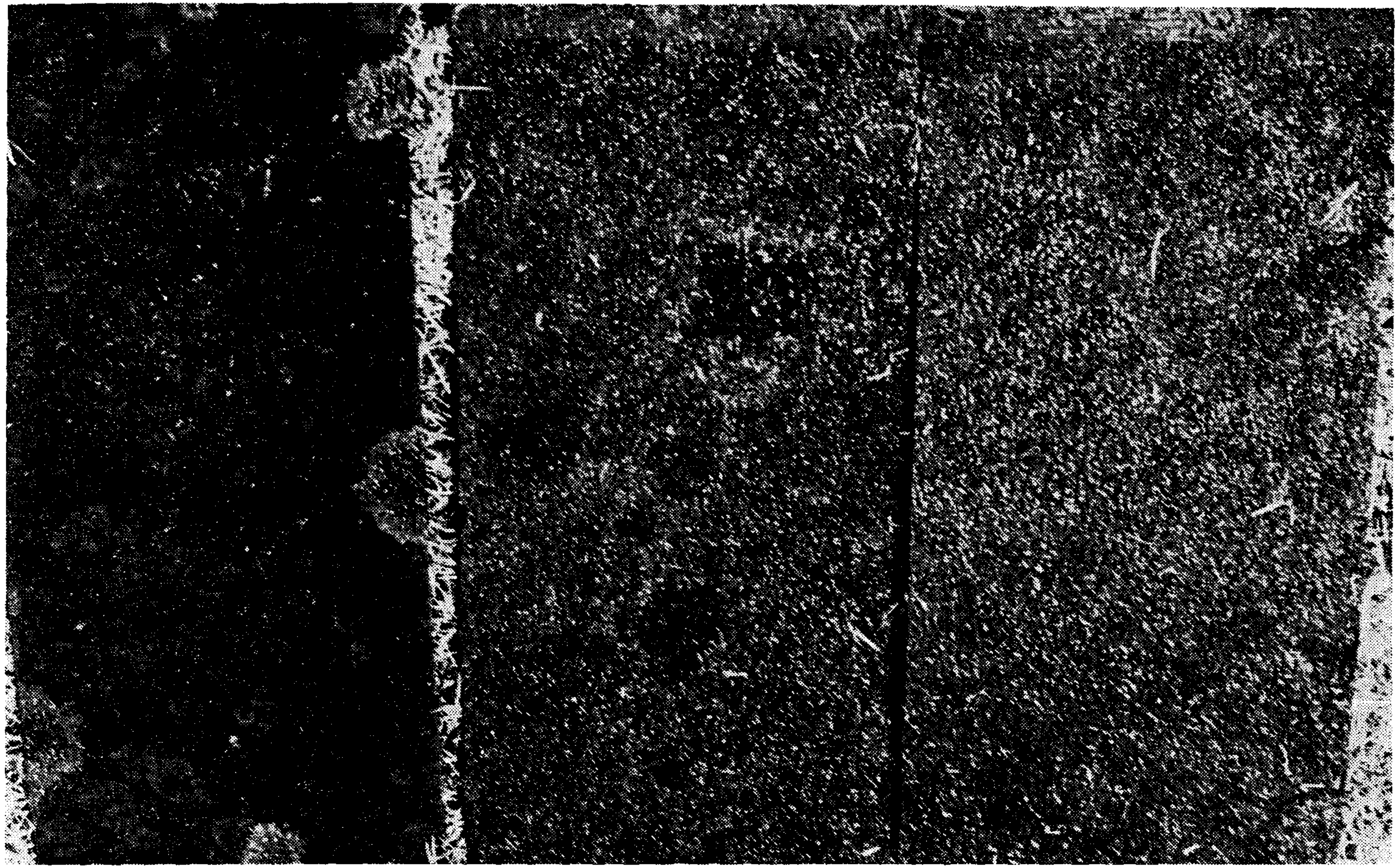

Figure 3. Masonite plates from the various positions occupied in the pond. This view is of the ventral surface of plates oriented in the 45-degree and horizontal positions.

TABLE 2. PERIPHYTON AND MIDGE PRODUCTION FROM SHEET MATERIALS ORIENTED IN A POND IN VARIOUS POSITIONS FOR A PERIOD OF APPROXIMATELY SEVEN WEEKS

Material	Position	Total Periphyton (Ml. per sq. ft.)	Total Midges (Ml. per sq. ft.)
Polyethylene	Vertical	3.8	Tr.[1]
	Horizontal	8.3	0.3
	45° Slant	18.7	1.7
Masonite	Vertical	2.7	Tr.
	Horizontal	8.8	0.5
	45° Slant	14.3	1.8
Cement-asbestos	Vertical	6.9	0.1
	Horizontal	7.4	0.2
	45° Slant	6.1	0.4

[1] Tr. = Trace - less than 0.05 ml.

horizontal position was next most productive and sheets placed vertically produced very few midges. Of the materials tested, the masonite sheets produced the greatest amount of midges (1.8 milliliters per square foot from the 45° position) followed closely by the polyethylene sheets (1.7 milliliters per square foot). Highest periphyton production was obtained from the polyethylene sheets at 45-degree slant with masonite sheets at 45-degree slant next. Little difference was noted in production from the three positions of the cement-asbestos sheets. Although the masonite and asbestos materials had a smooth and rough side, no difference was noted in the production of periphyton and midges from the two sides. On the under surface of all plates which were oriented in the 45-degree and horizontal positions, there was a large population of midges associated with dense colonies of the bryozoan *Plumatella*. Figures 2 and 3 show the concentrations of midges and bryozoans on the dorsal and ventral surfaces, respectively, of the masonite plates from the various positions.

Of the two types of building blocks tested, the concrete blocks were most productive of midges (Table 3). The highest periphyton production, 11.9 milliliters per square foot, was obtained from the concrete blocks placed on end. Next highest periphyton production—4.1 milliliters per square foot—was obtained from the concrete blocks placed flat with openings to the side. This position also produced the greatest amount of midges from the blocks—0.9 milliliter per square foot—with the greatest concrete blocks placed on end producing the next greatest amount—0.8 milliliters per square foot. Total periphyton production was low from the tile blocks in all positions. The tile blocks placed flat with openings to side were the only tile blocks to produce a measurable amount of midges—0.1 milliliters per square foot. The block materials

TABLE 3. PERIPHYTON AND MIDGE PRODUCTION FROM BUILDING BLOCKS PLACED IN A POND AT VARIOUS ANGLES FOR A PERIOD OF APPROXIMATELY SEVEN WEEKS

Material	Position	Periphyton (Ml. per sq. ft.)	Midges (Ml. per sq. ft.)
Concrete building blocks	On end	11.9	0.8
	Flat-openings up	1.2	Tr.[1]
	Flat-openings to side	4.1	0.9
Hollow-core tile building blocks	On end - openings up	2.3	Tr.
	On edge - openings to side	4.5	Tr.
	Flat-opening to side	2.0	0.1

[1] Tr. = Trace = less than 0.05

tested were not as productive of midges as the sheet materials and in addition, were much more difficult to handle in the pond.

Unfortunately, no samples were taken for comparison of normal midge production and midge production from the block and sheet materials. It appears, however, that midges produced by adding materials to a pond for increased midge attachment area, is production above and beyond the normal midge production and would subsequently increase fish production.

SUMMARY

1. Midges constituted the greatest percentage of food volume in largemouth bass fingerlings ranging from 20 to 55 millimeters in length.
2. Highest midge production was obtained from ponds having a dominant blue-green algae bloom.
3. The sheet materials oriented at a 45-degree slant in the pond produced the most midges and total periphyton.
4. Highest midge production was obtained from the 1/8-inch masonite boards placed at the 45-degree slant.
5. The use of building blocks as attachment area to increase the midge crop did not appear to be either practical or productive.

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PARASITE EPIDEMICS AFFECTING CHANNEL CATFISH

RAY ALLISON
Agricultural Experiment Station
of
Auburn University
Auburn, Alabama

ABSTRACT

The prevalence of parasitic epidemics is dependant, to a large extent, upon the density of the host population. Through the application of recent research, up to 2,400 pounds of channel catfish can be produced per acre of water, thus placing their commercial culture on a basis comparable to production of other farm animals. Since fish are confined to a limited environment in ponds without flowing water, they are surrounded by their own metabolic wastes throughout the production period. Such an environment is ideal for the propagation and development of parasitic populations.

The great majority of epidemics are caused by external protozoan and helminth parasites that are transferred by contact and have simple life cycles. The species causing epidemics in channel catfish production ponds in Alabama are presented in Table I.

These epidemics can be controlled in ponds with the application of low concentrations of certain chemicals. These treatments are