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THE TOXICITY OF NOXFISH AND PRO-NOXFISH TO EGGS OF COMMON CARP AND FATHEAD MINNOWS

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ABSTRACT

Laboratory experiments were conducted to determine the toxicity of Noxfish (an emulsifiable formulation containing 5 percent rotenone) and Pro-Noxfish (an emulsifiable formulation containing 2.5 percent rotenone plus 2.5 percent Sulfoxide as a synergist) to eggs of common carp (*Cyprinus carpio*) and fathead minnows (*Pimephales promelas*). Spawning devices were added to brood ponds and examined daily to obtain eggs of known age for testing. The

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carp eggs were 24 to 48 hours old when treated. Ninety percent of the carp eggs in control containers hatched. The LD_{50}'s obtained for carp eggs at approximately 75° F. were: Noxfish, 0.091 p.p.m., Pro-Noxfish, 0.178 p.p.m. Fathead minnow eggs less than 31 hours old or 101 to 120 hours old were equally susceptible to the poisons. Ninety percent of the fathead minnow eggs in control containers hatched. The LD_{50}'s obtained for fathead minnow eggs at 70° to 76° F. were: Noxfish, 0.142 p.p.m.; Pro-Noxfish, 0.233 p.p.m.

INTRODUCTION

Attempts to eradicate entire fish populations from ponds and lakes by the use of rotenone-containing formulations have been unsuccessful in many instances (Krumholz, 1948, 1950; Clemens and Martin, 1953; Ball, 1948). Where complete fish removal appeared to have been accomplished, the same species frequently have repopulated the areas in the absence of additional stocking or evident invasion through water courses (Krumholz, 1948, 1950; Ball, 1948). The presence of fish in such seemingly impossible places has caused speculation as to the method of survival during the toxic period. One possible method of repopulation appeared to be the survival of fish eggs that might hatch after dissipation of the poison (Clemens and Martin, 1958; Leonard, 1939).

Leonard (1939) reported (page 277), "Eyed brown trout [eggs] were not killed in a derris concentration of 0.50 p.p.m., but the fry perished as they broke the shell, even though the toxicity had by that time dropped below the point lethal to small bluegills."

Laboratory experiments were conducted to determine the toxicity of Noxfish (an emulsifiable formulation containing 5 percent rotenone) and Pro-Noxfish (an emulsifiable formulation containing 2.5 percent rotenone plus 2.5 percent Sulfoxide as a synergist) to eggs of common carp (*Cyprinus carpio*) and fathead minnows (*Pimephales promelas*).

CARP EGGS

To collect carp eggs of known ages, brood fish were placed in freshly filled, small concrete ponds. Since aquatic vegetation was absent in these ponds, bundles of excelsior were added as spawning mats for carp. The excelsior and eggs were brought into the laboratory, and small pieces of excelsior with the eggs attached were added to plastic dishes containing pond water.

Ten eggs were placed in a container (3.5 inches in diameter, 1.25 inches in depth, and approximately 200 milliliter volume). The eggs were not examined to determine viability prior to treatment. To each container 100 milliliters of pond water was added by volumetric pipette. The amount of stock solution required to give the desired concentration in p.p.m. was added to each container after an equal volume of water was removed with a pipette. No aeration of the eggs in the containers was provided.

The carp eggs were 24 to 48 hours old when treated. The eggs were observed at approximately 24-hour intervals after treatment, and records were kept of the number of fish that hatched in each container. At a room temperature of approximately 75° F., a few carp eggs hatched as soon as 28 hours after treatment and hatching continued for several days. Most of the eggs that remained alive hatched within 3 days after treatment. The tests with carp eggs were limited to 7 days, at which time the hatching appeared completed.

In all experiments with carp eggs and also in those with fathead minnow eggs, the egg was considered as hatched if the embryo was able to escape from the egg. Not all of the newly hatched fish appeared to be normal (crooked vertebral columns, constant swimming upside-down, or on one side). Some eggs seemed to have hatched prematurely. These abnormalities occurred both in control and treated containers of each species.

The results of experiments with carp eggs are presented in Figure 1. Each point represents the average of three replications at each concentration. In the control containers, 90 percent of the eggs hatched, and 88 percent appeared normal. From the computed regression lines presented in Figure 1, the follow-

ing LD_{50}'s were estimated for carp eggs: Noxfish, 0.091 p.p.m.; Pro-Noxfish, 0.178 p.p.m. In previous experiments (Hester, 1959) using carp fingerlings (1.5 to 2.5 inches in length), Noxfish was also approximately twice as toxic as Pro-Noxfish. Furthermore the concentration of each poison that was required for LD_{50} was about the same as that required for the carp eggs:

Material	*Eggs*	*Fish*
Noxfish	0.091 p.p.m.	0.081 p.p.m.
Pro-Noxfish	0.178 p.p.m.	0.163 p.p.m.

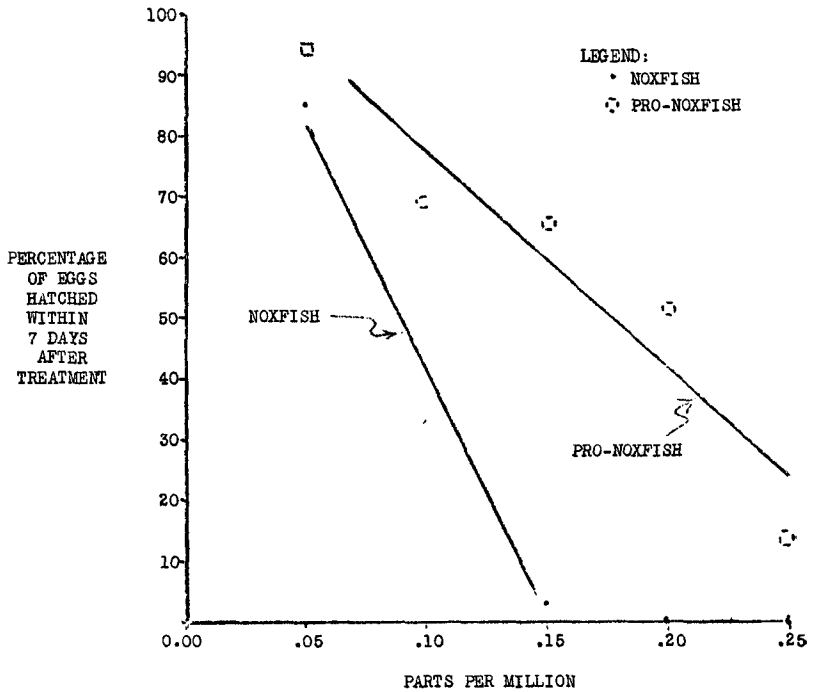

Figure 1. The toxocity of Noxfish and Pro-Noxfish to carp eggs. The eggs were 24 to 48 hours old when treated, and were 192 to 216 hours old when toxicity was evaluated. Each point on the curve represents percent mortality of 30 eggs.

FATHEAD MINNOW EGGS

To obtain fathead minnow eggs of known ages, spawning devices (constructed of small masonite boards) were placed in brood ponds and examined daily. The fatheads deposited their eggs in clusters on the under side of these boards. These spawning devices were removed from the ponds at intervals and carried in pond water to the laboratory. The eggs were removed from the board with a spatula and transferred individually with forceps to plastic dishes containing pond water.

Two experiments were conducted with fathead minnow eggs. In the first experiment, the eggs were less than 24 hours old when treated. At a temperature of 75° to 76° F., the eggs began to hatch 4 days after treatment, and hatch-

ing appeared complete by the 9th day, at which time the experiment was terminated.

In the second experiment with fathead minnow eggs, the first group of eggs was treated when they were 12 to 31 hours old, and the second group when 101 to 120 hours old. The temperature remained between 70° and 72° F. throughout the experiment.

The results of experiments using eggs less than 31 hours old are summarized in Figure 2, in which each point represents the average of 4 replications. Twelve control containers were used with a total of 120 eggs, of which 90 percent hatched. From the computed regression lines presented in Figure 2, the following LD_{50}'s were estimated for fathead minnow eggs: Noxfish, 0.142 p.p.m.; Pro-Noxfish, 0.233 p.p.m. In previous experiments with small fish (Hester, 1959), the concentrations of these poisons required to kill fathead minnow fingerlings (1.0 to 2.8 inches in length) were about equal to the concentrations required to kill the eggs:

Material	*Eggs*	*Fish (1.0 to 2.8 Inches)*
Noxfish	0.142 p.p.m.	0.159 p.p.m.
Pro-Noxfish	0.233 p.p.m.	0.191 p.p.m.

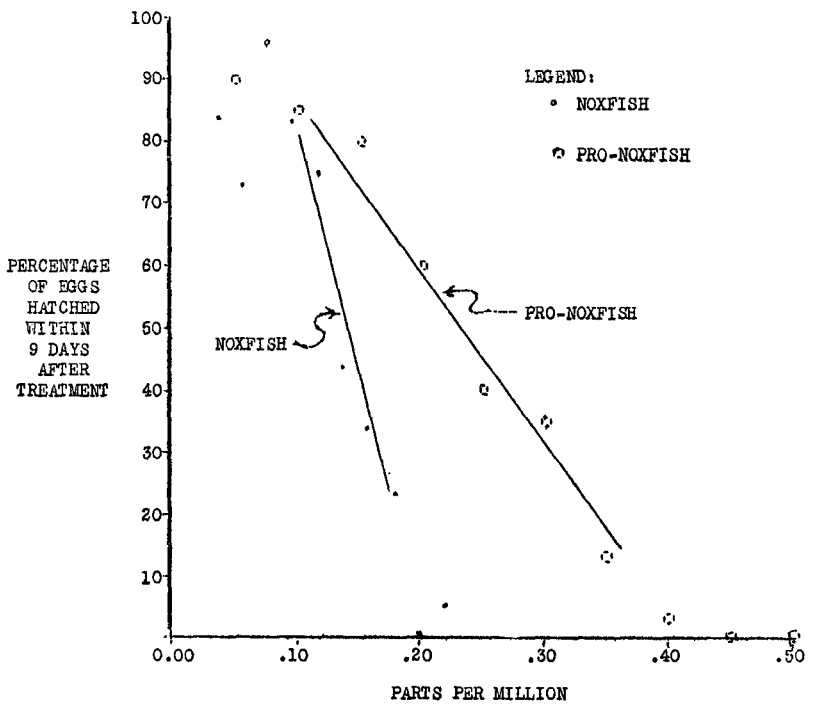

Figure 2. The toxicity of Noxfish and Pro-Noxfish to fathead minnow eggs. The eggs were less than 31 hours old when treated and were 216 to 247 hours old when toxicity was evaluated. Each point on the curve represents percent mortality of 40 eggs.

Some of the eggs in the second experiment had hatched prior to treatment; therefore, the results could not be measured in terms of the percentage of eggs that hatched within a specified time after treatment. The comparison, therefore, was based upon the percentage of eggs that yielded fry living at a specified time. Since all of the living eggs had apparently hatched by the time they were 180 to 199 hours old, this time was chosen for the comparison. When compared to this manner (Figures 3 and 4), it was evident that the time of treatment had no effect upon survival of the fry.

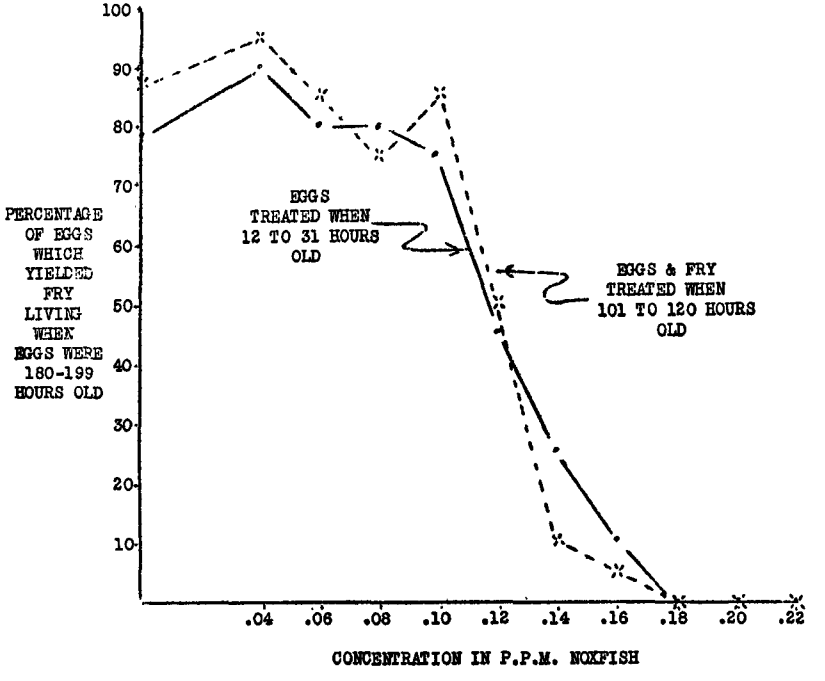

Figure 3. The toxicity of Noxfish to eggs and fry of fathead minnows. Each point represents the average of two replications at 70° to 72°F.

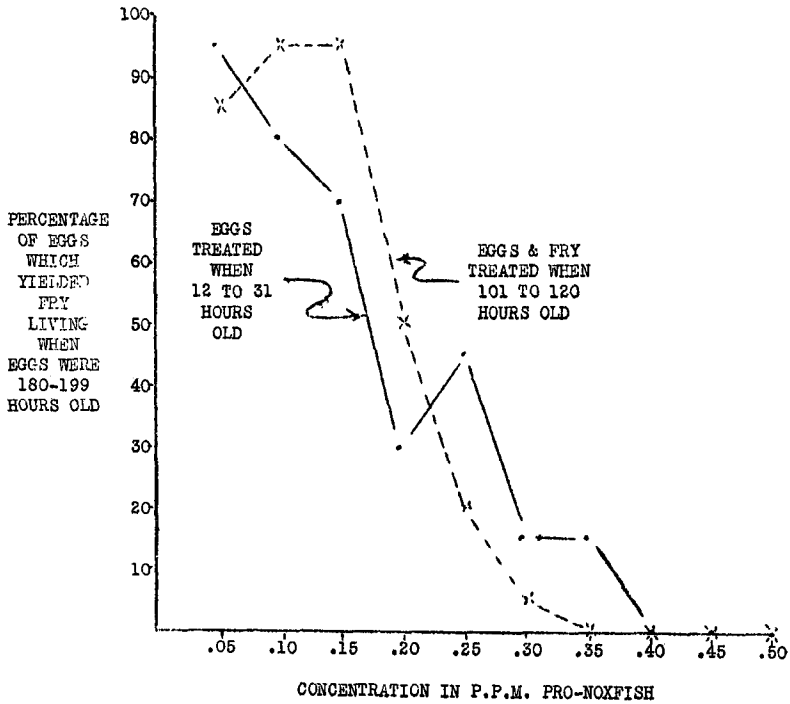

Figure 4. **The toxicity of Pro-Noxfish to eggs and fry of fathead minnows. Each point represents the average of two replications at 70° - 72°F.**

SUMMARY

The results obtained with both carp and fathead minnow eggs, like those obtained in previous tests with fingerling fish of these species (Hester, 1959), indicate that Noxfish is more toxic than Pro-Noxfish. In addition, the estimated LD_{50}'s obtained with the fish eggs are very similar to those obtained with fingerling fish of the same species:

Species—Material	*Eggs*	*Fish (1.0 to 2.8 Inches)*
Carp—Noxfish	0.091 p.p.m.	0.081 p.p.m.
Carp—Pro-Noxfish	0.178 p.p.m.	0.163 p.p.m.
Fatheads—Noxfish	0.142 p.p.m.	0.159 p.p.m.
Fatheads—Pro-Noxfish	0.233 p.p.m.	0.191 p.p.m.

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THE USE OF CHANNEL CATFISH AS SPORT FISH

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ABSTRACT

The channel catfish (*Ictalurus punctatus*) has proved to be a very promising sport fish in ponds. Fingerlings stocked in February 1958 in a 12.4-acre pond at the rate of 2,000 per acre in combination with fathead minnows and largemouth bass, and given supplemental feeding daily except Sunday, averaged 0.7 pounds by September. During the following periods, September 24 to December 8, and March 14 to October 6, fishermen caught per acre 1,292.5 pounds of channel catfish, 36.9 pounds of largemouth bass, and 27.0 pounds of miscellaneous sunfish. The number of fishing trips per acre averaged 579 with a catch of 2.3 pounds per trip. Fishermen harvested 62 percent of the catfish stocked.

The pond was drained November 17, 1959 and 180 channel catfish weighing 391.2 pounds, 51 largemouth bass weighing 34.5 pounds, 907 fatheads weighing 2.4 pounds, and 80.2 pounds of "wild" fish were recovered per acre.

The mortality of the channel catfish was 29 percent, which is about 20 percent higher than in ponds that are not fished.

The channel catfish reproduced very little and less than one young catfish per acre was present when the pond was drained.

At $1 per fishing permit, fishermen paid 35 cents to $2.41 per pound for the catfish they caught; the average price paid was 46 cents per pound. The costs of production for fertilizer, feed, and fingerlings was 37 cents per pound.

The income per acre from fishing was $593.37, and the income from 391.2 pounds of catfish recovered when the pond was drained was $140.83 (234.7 pounds dressed weight at 60 cents per pound). This provided a total income of $734.20. The total cost per acre for fertilizer, feed, and fingerlings was $481.46. This leaves a return of $252.74 per acre for labor and capital.

INTRODUCTION

Fishermen in various sections of the United States have for many years considered the channel catfish (*Ictalurus punctatus*) a highly desirable fish. Although generally classified as a non-game or commercial species, this fish is highly esteemed for its fighting characteristics and for its flavor. In many streams, rivers, and large impoundments, the channel catfish is often one of the most popular and most important species present. Anglers have found that this fish readily takes a wide variety of baits in many areas where game fish are less abundant.

Because of its popularity, several states including Arkansas, Oklahoma, Kansas, Missouri, Texas, and California have raised channel catfish in hatcheries and have stocked them in streams, rivers, and lakes in rather large numbers. However, a search of the literature reveals little data on the value of this species as a sport fish in ponds. Swingle summarized results obtained with this