($2,800. for 70 gal less $80. for 2 gal actually used in the testing). Further, no time was lost because of unfavorable weather or the lack of flying time.

Use of the box indicated that it should be made of heavier material (⅜ or ½-in plexiglass) for greater structural strength. The top of the box should slope to the rear to eliminate the need for the internal roof, and slanting the bottom of the box to the front would facilitate draining. Of greater importance is the need to remount the motor at a point closer to its center of gravity to lessen stress on the support brackets. Finally, there should be an effective cooling system for the motor since stress on the motor was indicated by an increase in the amperage that it drew.

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DISPERSAL OF MOSQUITOFISH, *GAMBUSIA AFFINIS*, IN ARKANSAS RICE FIELD[1]

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Among reports on the use of mosquitofish, *Gambusia affinis* (Baird and Girard), as predators of mosquito larvae in rice fields are those of Craven and Steelman 1968, Hoy and Reed 1971, Hoy et al. 1971; Meisch and Coombes 1974, and Davey et al. 1974. There are, however, few records of fish dispersal within a rice field. Hoy and Reed (1970) and Hoy et al. (1971) described stocking procedures for mosquitofish in California rice fields from a helicopter or by manually emptying fish from buckets into the field. However, speed of dispersal after stocking was not considered. Reed and Bryant (1974) stocked mosquitofish in alternate paddies within a rice field. Minnow traps were placed at the opposite end of both stocked and unstocked paddies from where the fish were released. They reported that 90% of all mosquitofish captured after 24 hr were in stocked paddies, thus indicating movement of fish the length of the paddy. After 3 days, 59% of the fish captured were in stocked paddies, indicating further movement downstream from the stocking and some possible movement upstream. This is a report on studies to determine the dispersal of mosquitofish in rice fields. The effect of parathion application on dispersal was also observed.

Studies were conducted during the summers of 1974–76 in privately owned rice fields near Stuttgart, AR. All fields tested were constructed in the following manner: rice was planted on flat pan areas which were bordered by raised earthen dikes (levees) which retained the flood water. The trenched areas on either side of the levees formed levee ditches. Access between pan areas was made by cutting gates in the earthen levees, thus allowing water to flow from the high end of the field to the low end. Mosquitofish were stocked in rice fields and Gee's Improved Wire Minnow Traps® were placed at various points within the fields. Traps were placed in levee ditches so that ca two-thirds of the trap was below water level. No traps were placed on the pan since water was not deep enough to facilitate trap placement; however, observations on the presence of mosquitofish on the pan were recorded.

Preliminary investigations were made in 1974 in 0.5 acre rice plots. Fish were stocked at 1 end of each plot and records were taken to determine the time required for the fish to disperse throughout the plot. Four minnow traps were placed in the levee ditches at 200 ft intervals from the point at which fish were stocked. Further investigations were conducted in 1974 in a rice field of ca 100 acres. Three hundred lbs of mosquitofish were stocked in 50 lb increments at 6 different locations within the field. Fish were released in 3 different pan areas along the western boundary and 3 different pan areas along the eastern boundary. Six minnow traps were placed within the field (3 along the northern boundary and 3 along the southern boundary). The traps were monitored for 14 days after stocking.

In 1975 a 30 acre rice field was used to determine the rapidity of fish dispersal as the field was being flooded and also to determine if fish would disperse across the levee gates. Approximately 40 lbs of mosquitofish were stocked in the field at the point where water entered. There was only 1 water source for the entire field. Minnow traps were placed on either side of the levee gate on the downstream side in the levee ditches. Fish dispersal was observed as water moved from pan to pan. The field contained 16 pans and 15 levee gates.

Parathion commonly is used in Arkansas rice

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fields to control mosquito larvae (Meisch and Coombes 1975). Therefore, we attempted to evaluate the effects of this insecticide on fish dispersal. In 1976 a 15 acre field stocked with mosquitofish was treated with parathion while the field was being flooded. This was done by placing a 1 gal plastic container at the levee gate and dripping parathion into the water with a 22 gauge needle at the recommended rate of 0.028 lb ai/acre.

All traps placed in the 0.5 acre plots in the 1974 preliminary studies caught fish within 2 hr after introduction. Within 24 hr of fish introduction the trap farthest from the point of stocking (> 400 ft) captured almost as many fish as traps nearer the point of release (> 200 ft), indicating that fish were well dispersed within the levee ditches. Mosquitofish were also observed on the top pan area in the early morning and on cloudy days when the water temperature was not excessively high and adequate oxygen was available.

Twenty-four hr after stocking the 100 acre field, 3 of the 6 traps had captured fish (2 on the southern boundary and 1 on the northern boundary). After 4 days it was found that 4 of the 6 traps contained fish. After 14 days all traps had captured fish. This indicated that fish dispersal had occurred within the large field where no barriers limited movement. The fish apparently had no difficulty crossing from 1 pan to another through the levee gates, although their actual movement was not observed.

In 1975 observations and trapping results proved that the fish did cross the levee gates without difficulty. Fish were observed to swim into the current and orient themselves upstream in the swift moving current. As they were swept backwards past the levee gate into the downstream pan they reversed direction and swam with the current as it moved down the levee ditch. It was observed that the fish made their way to the 1st levee gate (a distance of ca 100 ft) and across to the 2nd pan within 2 min after stocking. Within 24 hr the flooding water had progressed to the 4th pan and all traps in the 4 levee ditches captured fish, indicating the fish were dispersing as rapidly as the water. After 36 hr the fish had again progressed with the water, and traps contained fish up to the 8th levee.

Results from the 1976 investigations indicated that the fish readily dispersed past the point at which the parathion was applied and were moving throughout the field without any obvious ill effects. These results compared favorably with those of Davey et al. (1976) who reported that fish were not adversely affected by herbicides or insecticiaes normally applied to rice, if applied at recommended dosages.

We concluded that mosquitofish readily dispersed throughout a rice field, and when they were stocked at the water source they moved as rapidly as the water. Thus fish would be present in mosquito producing areas at the time the mosquito eggs hatched. The ease with which fish could be introduced and their ability to quickly disperse throughout a rice field made the biological control approach very attractive for a pest management system. Also, since parathion at recommended dosages did not apparently inhibit dispersal of the fish the potential for using a combination of biological and chemical control exists.

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