bypass agitation was not sufficient to keep the particles from settling out in the bottom of the tank and eventually clogging the spray nozzles. Except for this difficulty, the apparatus has given excellent service during a season of testing. To minimize foreign materials clogging the nozzles, all solutions are strained through a fuel funnel as they are poured into the tank.

SUMMARY AND CONCLUSIONS

It was found that devices to apply both dry and liquid herbicides could be assembled from commercially available components to give machines that would do a satisfactory job of applying the materials to small ponds at a uniform rate. Both machines could be operated by one man although the dry materials spreader needed a two-man crew where the rate of application was several hundred pounds per acre. Field testing indicated that both machines were reasonably durable and could be expected to give several years of service when given ordinary care and maintenance. It is believed that both machines may have an application in the management of both public and private fish hatcheries and by custom operators or biologists assisting with the management of farm fish ponds.

ACKNOWLEDGMENTS

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STUDY OF THE VALUE OF NAVIGATION LOCKS FOR THE PASSAGE OF ANADROMOUS FISH [1]

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Successful passage of American shad (*Alosa sapidissima*) by fishways on dams in the Columbia River in the Pacific Northwest and the Neuse River in North Carolina, and by a trap and bucket lift on the Connecticut River in Massachusetts stimulated efforts for workable fish passage devices to restore anadromous fish runs above other existing and proposed barriers.

In the spring of 1962 studies were made by the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N. C., in cooperation with the Corps of Engineers and the North Carolina Wildlife Resources Commission, at Lock and Dam No. 1 on the Cape Fear River in North Carolina to determine the practicability of locking anadromous fishes upstream during their spawning migration.

The lock and dam are located at river mile 65. They prevent fish from entering the river above, except during boat lockages and periods of extended high flow. The dam is 12 feet high and the inside dimensions of the lock chamber are: width, 40 feet; length, 240 feet; depth, 32 feet; with the downstream entrance 160 feet from the base of the dam. The lock gates and gate valves

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are manually operated. Differences between water levels in the lower and upper pools varied from 0.5 to 11.0 feet during the study period.

The technique for lockage of fish upstream is as follows:

1. Open the lower lock gate and then open valves in the upper lock gate so as to create a flow of water through the lock chamber at a velocity of 2 to 3 ft./sec. Leave the lock in this position for 1 hour to allow fish to enter the lock chamber from the river below the dam.

2. Close the upper lock gate valves and the lower lock gate to trap fish in the lock chamber.

3. Open the valves in the upper lock gate to raise water in the lock chamber to upper pool level. Open the upper lock gate and then open valves in the lower lock gate so as to create a flow of water through the lock chamber at a velocity of 1 to 2 ft./sec. Leave the lock in this position for 45 minutes to allow fish to move out of the lock chamber into the river above the dam.

4. Close the valves in the lower lock gate and then close the upper lock gate. Reopen the lower lock gate valves to lower water in lock chamber to lower pool level.

5. Repeat the cycle.

The Corps of Engineers would not permit the water level in the upper pool to be reduced below elevation 15.5 feet due to the adverse effect on navigation. No lockages were made for the purpose of passing fish on Saturdays, Sundays, and holidays, since normal boat traffic made this impracticable.

Periodic sampling of fish in the lock was begun on April 2 and continued to June 4 to determine the efficiency of the lock as a fish passing device. After the lock had operated at the lower pool water level for 1 hour the number and species of fish trapped in the lock chamber were sampled by a haul seine 40 feet long, 18 feet deep, with 2-inch stretched mesh, equipped with rigid float and lead line to prevent the net from fishing in a bowed position when hauled through the lock chamber. Results of the experiment are given in the following table. In addition to the anadromous fish sampled, others included suckers, catfish, largemouth bass, sunfishes, and gizzard shad.

Month and Day	*8:00 A.M. Water Temp. (°F.)*	*Lock Water Level Upper (Feet)*	*Lock Water Level Lower (Feet)*	*No. of Hours Operated*	*No. of Lockages*	*No. of Fish Sampled: Shad*	*Herring*	*Striped Bass*	*Others*
April 2	58	18.1	11.6	8	4	1	154	–	22
3	58	19.7	15.8	5	3	10	470	1	14
16	56	20.8	20.3	3½	2	–	6	–	3
20	56	17.4	12.0	8	5	–	61	–	20
23	60	16.7	10.1	3½	3	6	79	–	19
24	60	16.2	7.8	5½	3	17	90	–	17
30	70	16.0	7.0	4	2	130	58	–	10
May 7	74	15.5	5.5	5	2	24	14	–	7
14	74	15.6	5.6	1½	1	25	–	–	–
June 4	80	15.8	5.8	4	2	–	–	–	28
TOTAL				48	27	213	932	1	140

Repeated sampling of the lock chamber and holding removed fish in a live car indicated that the sampling gear removed roughly 50 percent of the fish present. The fish netted were released back into the lock chamber. After the lock had been operated in the position to allow the trapped fish to move out into the river above the dam, the upper lock gate was closed and the water in the lock chamber was lowered to the lower pool level. The lock chamber was then resampled using the same technique as before to determine if the trapped fish moved out of the lock chamber into the river above the dam. Repeated sampling indicated that at least 95 percent of the shad and 70 percent of the herring moved out within 45 minutes.

Based on the above estimates a total of 2,171 anadromous fish, including 1,030 shad, 1,140 herring, and 1 striped bass, were locked upstream during 60 hours the lock was operated for fish passage and 48 hours sampling period.

In this experiment the following difficulties were encountered:

1. The lock was effective for passage of fish upstream only when there was light boat traffic. Operations ceased temporarily when the lock was used for navigation.

2. The lock is located so as not to be attractive to fish. They are attracted to the base of the dam approximately 160 feet upstream from the lower lock opening. In the future, where it might be desirable to pass fish with a lock, it would be more effective as a passing device to locate the lower entrance near the dam base so that fish could find the opening to the lock more easily.

3. There was not enough water to operate the lock for passage of fish upstream during most of the scheduled period. However, during this time there was at least a 4-inch water spillage over the entire crest of the dam. The effectiveness of the lock as an upstream fish passing device would be greatly increased by erecting flash boards on the dam. They would increase the water capacity of the pool above the dam and permit draw-down for fish lockage upstream during times of critical low river flow. Also, with less spillage over the dam, the lower lock entrance would become more attractive to fish.

This experiment offers evidence that anadromous fish can be passed upstream with navigation locks and that a secondary use can be made of the lock to restore the spawning runs above such barrier.

THE ESTIMATION OF CHANNEL CATFISH (Ictalurus Punctatus Rafinesque) POPULATIONS IN FARM PONDS FROM CATCH STATISTICS [1]

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ABSTRACT

The Delury Method was used to estimate the number of channel catfish in three ponds of different years from the catch records of 20,790 anglers at the Farm Pond Project, Auburn, Alabama. The ponds were drained, and the accuracy of the estimates was determined.

Estimates for each pond were made using the average number of channel catfish caught per angler per hour at intervals of: 1 day, 500 angling hours, 800 angling hours, 1,000 angling hours, and one week. The error of these estimates varied between 0.0 and 10.3 percent from the theoretical true number (the total cumulative catch plus the number recovered upon draining). Estimates obtained using the average catch per unit of effort for the different intervals of effort were not significantly different.

The assumptions of the Delury Method were investigated. The assumptions of non-recruitment, the taking of a significant proportion of the population, and constant catchability had to be satisfied to achieve estimates of the above accuracy. The assumption of non-competing units of fishing gear and constant fishing pressure apparently did not have to be fully satisfied to achieve estimates of the above accuracy.

INTRODUCTION

The facilities of the Farm Pond Project of the Auburn University Agricultural Experiment Station offered a unique opportunity for investigation of certain principles of the Delury Method (Delury, 1947), especially in its application to the estimation of populations in which the fish were removed by angling. Experimental channel catfish fishing ponds on the Experiment Station were especially adaptable to a study of the Delury Method since several of the basic assumptions of the method were either met, or the degree of departure from the assumptions could be measured. Complete creel records were available

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