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March 3, 1947

Report No. 1098

A progress report on the warm-water fish experiments conducted in hatchery ponds during 1946

by

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With the almost complete cessation of hatchery plantings of warm-water fish in the spring of 1946, it became necessary to provide a substitute program for the utilization of the fish hatchery ponds. Although natural lakes open to public fishing should be used for most warm-water fish experiments, certain important gaps in our knowledge of certain factors limiting fish production may be filled most effectively by the use of hatchery ponds which can be controlled and drained. The warm-water fish experiments described in this report are only a part of the experiments conducted in hatchery ponds during 1946.

Ponds at the Drayton Plains and Wolf Lake Hatcheries and the Fenton and Almena Rearing Ponds were used for the following experiments:

1. CONTROL OF STUNTED FISH POPULATIONS

Growth studies and inventories have indicated that there are many lakes in Michigan containing populations of stunted or slow-growing fish. In the past, many lakes containing badly stunted populations of fish (usually bluegills and perch) have been poisoned and the lakes were then

restocked with more desirable species. No management procedure has yet been proposed to take care of the slow-growing fish populations in larger lakes, or in lakes where some species are readily caught, although one or more other species of slow-growing fish seldom taken by anglers are present. Therefore, the object of the experiments in the hatchery ponds is to produce a stunted population of fish and then to determine efficient methods of control. It is not believed that removal of size, creel and season limits would result in the removal of enough slow-growing fish to improve conditions, so other methods will of necessity have to be devised. Perhaps the first method would be to stock the ponds at varying rates per acre with some predatory game species (such as largemouth bass, walleyes, northern pike). Other methods of population control, such as partial poisoning and destruction of spawning beds, may also be practicable.

Although it should be possible to apply the results obtained to natural waters, it must be borne in mind that some factors in natural lakes, other than those found in hatchery ponds, may be present, and that methods for the control of stunted populations in hatchery ponds may not work in natural lakes. For example, there may be some species of fish (suckers, bullheads, pumpkinseeds, etc.) in a lake not caught by fishermen that seriously competes with the stunted population for food. So, methods devised using fish hatchery ponds may have to work in conjunction with other methods in controlling a population of fish in a natural lake.

We are not certain that stunted populations of perch and bluegills can be controlled by the addition of predatory species because of the

high reproductive potential of these two species. The entire fish population is eradicated when a lake is poisoned and fishing usually cannot be attempted on one of these lakes for one or two years after the lake has been restocked. Therefore it would be simpler, more economical and fishing would be continuous if a predatory species could be added to control a stunted population of fish. If such a method of control works, a great many ponds will be required in the future to produce the fish needed for stocking purposes. In order to control a stunted species of fish the stocking of several hundred (or even thousand) fingerlings or from 25 to 200 adult fish per acre may be required (especially largemouth bass). Bass have been planted in natural lakes for many years, but seldom have enough been planted in any one lake to increase the fish population by more than one or two fish per acre.

It was necessary to have a large number of ponds for the stunting experiments so that several ponds could be stocked with various numbers of predatory fish per acre and still have at least two ponds for control. It is also necessary to know just how many pounds of fish each pond is capable of supporting. For this latter reason it would have been desirable to use fingerling fish for stocking each pond because they can be weighed and measured accurately at the time of stocking. Past experience has demonstrated that a greater poundage of fish can be produced in a pond stocked with yearling fish than are stocked with fry. Therefore, the carrying capacity of each pond could have been determined a year earlier if yearling fish had been available. But there were only enough yearling bluegills on hand to stock three ponds. It was therefore necessary to stock all of the other ponds with bluegill fry in an effort to obtain a sufficient number of fingerling bluegills for stocking ponds in 1947.

Perch could not be located in large enough numbers in 1946 to make it worth while to use this species in the experiments.

A total of 11 ponds at the Wolf Lake Hatchery and Almena Rearing Station were stocked with bluegills for the experiments in the control of stunted fish populations. These ponds varied in size from 0.85 to 4.67 acres and had a total area of 28.34 acres. A total of 612 pounds of yearling bluegills and 1,779,000 bluegill fry was stocked in the 11 ponds. Comparison of the production, survival and growth of these bluegills is summarized in Tables 1 and 2.

Bluegill fry were stocked at 25, 50, 100 and 150 thousand per acre, while the three ponds stocked with yearlings received 100, 150 and 200 pounds per acre. It is obvious that stocking with yearling fish is far superior to stocking with fry because the percentage loss varied from 65.5 to 97.5 for the fry as compared with 5.9 to 33.6 percent loss for the ponds stocked with yearling fish. The carrying capacity (for the summer only and should not be construed as maximum carrying capacity) varied from 20.7 to 130.9 pounds of bluegills per acre for the ponds stocked with fry as compared with the 209.5 to 338 pounds per acre for the three ponds stocked with yearling fish. The two ponds stocked at the rate of 25,000 fry per acre yielded the lowest production in pounds per acre. Almost identical production in pounds per acre (130.6 and 130.9) was obtained from one of each of the two ponds stocked with 50,000 and 100,000 fry per acre. It is apparent from the data presented in Table 2 that fry stocking is very inefficient because the production and survival varies greatly and is not dependent upon the rate of stocking.

Table 1.--Number and pounds of yearling bluegills planted in Almena Pond No. 5 and Wolf Lake Pond Nos. 8 and 22 and the number and pounds removed when the ponds were drained.

	Pond No. 22	Pond No. 5	Pond No. 8
Area in acres	2.1	1.5	0.9
Rate of stocking - pounds per acre	100	150	200
Number of fish planted in pond (April 5, 1946)	28,130	30,500	27,100
Pounds of fish planted	207	225	180
Number fish per pound at planting	135.9	135.9	150.5
Number of fish at time of draining[1]	24,990	20,260	25,499
Number pounds of fish at draining	710[2]	314.25	215
Number of pounds per acre at draining	338	209.5	238.9
Number of fish per pound at draining	35.2	64.5	118.6
Total increase in weight (pounds) between April 5 and draining	503	89.25	35.0
Total increase in pounds per acre between April 5 and draining	238	59.5	38.9
Average increase in length (millimeters) " " " "	36.3	16.4	7.4
Total loss of fish between April 5 and draining	3,140	10,240	1,601
Percentage of fish lost between April 5 and draining	11.2	33.6	5.9

[1] Dates of draining were: Pond No. 8 - September 25; Pond No. 22 - October 4; Pond No. 5 - October 7.

[2] In addition there were an estimated 50 pounds of young-of-the-year bluegills. Each pond also produced a number of crayfish and polywogs.

Table 2.--Comparison of the production, survival and growth of bluegills in various ponds stocked at different rates per acre with golden fry.

	Wolf Lake Hatchery Pond Numbers							Almena pond number
	3	14	23	19	18	21	20	4
Area of pond (acres)[1]	0.85 0.85	3.11 3.55	4.13 4.67	3.51 3.40	3.50 3.83	2.35 2.20	1.77 2.34	- 3.00
Proposed rate of stocking (per acre)	25,000	25,000	50,000	50,000	100,000	100,000	150,000	150,000
Actual rate of stocking (per acre)	24,941	21,887	44,111	51,470	91,383	106,818	132,478	150,000
Number of fry planted	21,200	77,700	206,000	175,000	350,000	235,000	265,000	450,000
Date of stocking(1946)	6/19	6/19	6/19	6/19	6/17	6/19	6/19	6/12
Draining record:								
Date	9/25	10/3	9/26	10/3	9/30	9/24	9/24	10/10
Number of fish	1,780	2,910[2]	63,190[3]	14,530	20,610[4]	81,040	6,560	36,400
Total pounds of fish	20.0	73.5	610.0	207.0	259.0	288.0	122.0	181.7
Number per acre	2,094	819.7	13,531.0	4,273.5	5,382.8	36,836.3	2,803.4	12,173
Pounds per acre	23.5	20.7	130.6	60.9	67.6	130.9	52.1	60.6
Number fish per pound	89.0	39.6	103.6	70.2	79.6	281.4	53.8	200.4
Average length (mm.)	66.1	90.2	64.7	75.7	71.9	47.1	78.1	55.8
Size range (mm.)	52-75	77-107	55-78	56-92	50-81	38-58	48-90	38-69
Loss of fish between planting and draining	19,420	74,790	142,810	160,470	329,390	153,960	258,440	413,600
Percentage loss	91.6	96.2	69.3	91.7	94.1	65.5	97.5	91.9

[1] The first figure represents the area of the ponds which is recorded in the hatchery files, while the second figure is the actual area of each pond taken from the latest survey. These latter figures were given us in December, 1946.

[2] It was estimated that there were approximately 2 pumpkinseed-sunfish for every bluegill present in this pond. Therefore, the production of fish should be multiplied by two.

[3] A total of 358 adult bluegills (6 inches or over and weighing about 90 pounds) and 226.5 pounds (1,224 per pound or 277,236 fish average length 30.0 mm.) of small bluegills which were believed to be the young of these adults were taken from this pond.

[4] 19 adult bluegills and 46,912 (64 pounds at 733 fish per pound) and 1,783 common suckers weighing 287.6 pounds were also removed from this pond.

Length measurements for growth analysis were made at two-week intervals throughout the summer in each of the three ponds containing yearling bluegills. Most of the growth occurred between April and July. As was expected, the pond that was stocked at the rate of 100 pounds per acre had the greatest increase in total weight during the summer and the individual fish made the best growth. The total increase in pounds per acre between the time the ponds were stocked and the time of draining amounted to 238 pounds for Pond No. 22 (stocked with 100 pounds per acre), 59.5 pounds for Pond No. 5 (stocked at rate of 150 pounds per acre), and 38.9 pounds for Pond No. 8 which was stocked with 200 pounds of bluegills per acre. The average increase in the length of the fish followed the same pattern as the increase in total weight: Pond No. 22 - 36.3 millimeters; Pond No. 5 - 16.4 millimeters; Pond No. 8 - 7.4 millimeters.

Other statistics and various notes of interest for each of the individual ponds are listed below:

Pond No. 22: Area 2.1 acres; stocked with 207 pounds of yearling bluegills; 710 pounds of yearlings plus 50 pounds of young of the year (estimated 50,000 fish) removed at draining. In addition, 3 smallmouth bass, 4 largemouth bass yearlings, and 2 suckers were removed from this pond.

Almena Pond No. 5: Area 1.5 acres; stocked with 225 pounds of yearling bluegills; 314.25 pounds removed at draining. In addition to the bluegills, 2 largemouth bass yearlings and 1 bluntnosed minnow were also taken.

Pond No. 8: Area 0.9 acres; stocked with 180 pounds of yearling bluegills; 215 pounds removed at draining. In addition to the bluegills,

3 brook trout (average length of 7 inches), 13 smallmouth bass (average length 10 inches), 2 largemouth bass (average length 8 inches), 2 common suckers (average length 7 inches) and a number of common shiners were also present in the pond.

Although each of the above ponds was stocked with yearling bluegills, young were found in only Pond No. 22. The yearling bluegills in this pond grew faster and were much larger at spawning time than were those in the other two ponds. Observations made at the time of sampling every two weeks during the summer indicated that large numbers of ripe males and an occasional ripe female were present in Pond 22; some ripe males but no ripe females were present in Pond 5; and only one ripe fish was found in Pond No. 8. It is not uncommon for bluegills to spawn in their second summer of life. The larger the fish, the better the chances are that they will spawn. In other words, sexual maturity seems to be a function of size and not of age.

The bluegills in Pond No. 8 had obviously been stunted during the summer because they grew only 7.4 millimeters between April and October. Their general appearance was the same as that of other stunted bluegills I have observed. The same technique was used in draining this pond, handling the fish, etc., that was used on the dozens of other ponds at Wolf Lake and other hatcheries. Yet, better than one half of the bluegills removed from this pond died in the two days between the time the pond was drained, and the time the fish were returned to the pond. Only 11,922 out of the 25,499 fish were planted back in Pond No. 8. It is believed that this loss was due solely to the weakened condition of the fish. Similar losses of fish from other hatchery ponds was not experienced.

Pond No. 3: Area 0.85 acres; stocked with 21,200 bluegill fry; 1,780 fish removed at draining. In addition to the bluegills, 6 largemouth bass (8-12 inches), and 30 common suckers (7.5 inches) were also present when the pond was drained.

Pond No. 14: Area 3.55 acres; stocked with 77,700 bluegill fry; 2,900 were removed at draining. In addition to the bluegills it was estimated that there were about 5,800 pumpkinseed sunfish (2 sunfish for every bluegill--these were probably introduced with the bluegill fry, although none of the other ponds stocked with fry had any pumpkinseeds), 8 largemouth bass and 2 common suckers were also present when the pond was drained.

Pond No. 23: Area 4.67 acres; stocked with 206,000 bluegill fry; 63,190 of these bluegills (average length 65 mm.) were removed when the pond was drained. In addition there were 358 adult bluegills (average 4 to the pound, size range, 6-8 inches) and 226.5 pounds (277,236 fish, average length 30.3 mm.) of young bluegills resulting from the spawning of these adults. Also present in this pond were 110 common suckers ranging in length from 7.25 to 9.5 inches.

Pond No. 19: Area 3.4 acres; stocked with 175,000 bluegill fry; 14,530 removed when the pond was drained. In addition, 8 legal largemouth bass, and a number of crappies and bullheads were also present.

Pond No. 18: Area 3.83 acres; stocked with 350,000 bluegill fry; 20,610 bluegills removed when the pond was drained. In addition, 64 pounds (or 46,912 fish averaging 35.8 millimeters in length) which resulted from the spawning of 19 adult (over 6 inch) bluegills were present in the pond. Also present in this pond were 1,783 common suckers weighing 287.6 pounds.

Pond No. 21: Area 2.2 acres; stocked with 235,000 bluegill fry; 81,040 bluegills were removed when the pond was drained.

Pond No. 20: Area 2.34 acres; stocked with 265,000 bluegill fry; 6,560 fish removed when the pond was drained.

Pond No. 4 (Almena): Area 3.0 acres; stocked with 450,000 bluegill fry; 36,400 bluegills removed when the pond was drained. In addition, 8 largemouth bass (8 inches) and 3 legal brown trout were also present in the pond.

All of the ponds listed above also contained an undetermined number of crayfish, polywogs and Iowa darters. No attempt was made to estimate the total numbers or weight of these organisms because of the difficulty of getting all of them out of each pond drained.

Very little or no difficulty was experienced in sorting out the young-of-the-year bluegills that came from the plantings and those resulting from the spawning of the adults. Apparently the natural spawning in the ponds occurred late in the summer because all of the young resulting from the spawning were less than half the size of the fish resulting from the plantings of fry. (Yearling bluegills did not produce young till late in the summer).

Almost every pond drained at Wolf Lake contained one or more species of fish that had not been stocked in the pond. The suckers entered the ponds through the screened inlets, as fry. The bass and adult bluegills were undoubtedly left in the ponds at the time of draining in the fall of 1945.

After draining, each pond was again filled with water and stocked with the bluegills that survived the draining operations (Table 3).

Table 3.--Comparison of the rates of stocking of all ponds at the Wolf Lake Hatchery, Drayton Plains Hatchery and Almena Rearing Ponds for the winter of 1946-1947.

Pond number	Species	Date stocked	Area (acres)	Total number of fish	Total pounds of fish	Number fish per pound	Number pounds per acre	Age of fish (months)	Average length (millimeters)	Size range (millimeters)
Wolf Lake Hatchery and Almena Rearing Ponds										
22	Bluegill	October 7	2.11	24,890	707.0	35.2	335.1	16	98.3	85-126
5[1]	Bluegill	October 10	1.50	20,010	310.2	64.5	206.8	16	78.4	66-99
8	Bluegill	September 26	0.90	11,922	100.5	118.6	111.7	16	65.7	51-85
3	"	September 26	0.85	1,680	18.9	89.0	22.2	4	66.1	52-75
14	"	October 4	3.55	2,910	73.5	39.6	20.7	4	90.2	77-107
23	"	September 29	4.67	62,190	600.4	103.6	128.6	4	64.7	55-78
19	"	October 4	3.40	14,530	207.0	70.2	60.9	4	75.7	56-92
18	"	October 1	3.83	18,675	234.7	79.6	61.3	4	71.9	50-81
21	"	September 25	2.20	72,457	257.5	281.4	117.0	4	47.1	38-58
20	"	September 24	2.34	4,946	92.0	53.8	39.3	4	78.1	48-90
4[1]	"	October 15	3.00	35,400	176.7	200.4	58.9	4	55.8	38-69
2[1]	"	October 16	4.00	13,377	239.2	55.9	59.8	4	81.5	58-102
3[1]	Largemouth bass	October 16	5.50	10,392	184.2	56.4	33.5	4	87.9	72-138
11	"	September 27	1.38	200	4.0	50.0	...	4	94.7	84-105
10	"	September 27	1.38	200	37.7	5.3	...	4	175.6	153-207
7	"	September 30	1.54	3,493	98.5	35.5	64.0	4	102.7	81-151
13	Smallmouth bass	October 2	5.15	6,874	305.5	22.5	59.3	4	121.6	104-141
5	"	October 2	1.20	150	17.0	...	...	4	155.1	142-168
4	"	October 2	1.00	150	7.0	...	...	4	116.9	95-133
Total - Wolf Lake and Almena - 19 ponds			49.50	304,446	3,671.5	...	...	...	...	...
Drayton Plains Hatchery										
7	Bluegills	September 6	6.48	101,923[2]	227.0	449.0	35.0	4	44.1	34-63
9	Largemouth bass	October 24	6.72	171	16.2	...	...	4	145.3	127-176
10	"	October 24	7.13	3,430	60.2	57.4	8.4	4	84.8	58-121
11	"	October 24	7.72	171	1.3	...	...	4	64.3	55-70
Total - Drayton Plains - 4 ponds			28.05	105,695	304.7	...	...	...	...	...
Grand total - all hatcheries - 23 ponds			77.55	410,141	3,976.2	...	...	...	...	...

[1] Almena Rearing Ponds

[2] Only 91,731 of these fish were bluegills and the rest were pumpkinseed sunfish (9,173) and green sunfish (1,019).

All of these ponds should be drained again early in April, 1947. Ponds that are to be used next summer for the continuation of these experiments should be stocked with 200 pounds of bluegills per acre, except for Pond No. 22 at Wolf Lake and No. 5 at Almena. These latter two ponds should be restocked with at least 335 and 206.8 pounds respectively. As there will undoubtedly be some over-winter mortality, there will not be enough bluegills to restock all of the ponds now used. By using some smaller ponds it may be possible to restock perhaps 10 ponds with yearling and two-year-old bluegills. Some additional bluegills may be obtained from various ponds at the Wolf Lake and Drayton Plains Hatcheries which have not been mentioned above. (Ponds 7, 10, 11, 13 and 24 at Wolf Lake and 7 and 8 at Drayton Plains and Pond 3 at Fenton also contain bluegills).

By stocking all ponds with at least 200 pounds of bluegills per acre, it is possible that the fish in some of the ponds may become stunted sometime during the summer of 1947. A close check should be made on the growth of these bluegills during the summer.

2. FISH COMBINATIONS--CARRYING CAPACITY

It is quite important for the fishery biologist to know whether a large variety or a smaller number of species give the greatest yield of game fish, and whether minnows are necessary for the best production of bass, walleyes, northern pike, pan fish, etc. The Department is continually being urged to plant new species to add variety to the catch. We should also know which species should be planted in newly created impoundments and in lakes in which the fish population has been removed by poison.

Three species of fish were used for this experiment, namely the largemouth bass, smallmouth bass and bluegill. Each of these three species occupied separate ponds. These ponds are to be drained each spring and fall and all fish present will be weighed, counted and measured. After several years, when maximum carrying capacity has been reached, an additional species should be added to each pond (for example, largemouth bass will be added to the bluegill pond). Later on when maximum carrying capacity has been reached, third, fourth and perhaps more species should be added. These experiments should tell us whether it is possible to produce a higher poundage of fish per acre using one, two, or more species and the results can be applied to natural lakes.

Four ponds were stocked with largemouth bass fry for these experiments on fish combinations and carrying capacity (Table 4). Two of these ponds were located at the Wolf Lake Hatchery (6 and 16), one at the Almena Rearing Ponds (No. 3) and one at the Drayton Plains Hatchery (No. 11). The stocking ratio varied from 4,213 to 24,909 fry per acre in these four ponds. The two ponds that were stocked with the largest number of fry per acre produced the greatest number of pounds of fish per acre. The greatest loss of fish occurred in the two ponds stocked with the largest number of fish per acre.

All of the largemouth bass taken from Pond No. 3 at Almena at the time of draining were returned to the same pond as soon as weights, measurements and counts were completed (Table 3). Most of the bass removed from Pond 16 at Wolf Lake were planted in various lakes in Districts No. 8, 9 and 10 (plantings recommended by the Institute). The few that were left were combined with the fish from Pond No. 6. The largest and the smallest bass (200 of each) were then sorted out and placed in separate ponds and the remaining fish were planted in Pond No. 7 for the

Table 4.--Summary of the rate of stocking, production, survival and growth of bluegills, largemouth and smallmouth bass in ponds at the Wolf Lake and Drayton Plains Hatcheries and the Almena Rearing Ponds in 1946.

Pond number	16	11	6	3	2	7	13
Hatchery or rearing pond	Wolf Lake	Drayton	Wolf Lake	Almena	Almena	Drayton	Wolf Lake
Species stocked	Largemouth	Largemouth	Largemouth	Largemouth	Bluegill	Bluegill	Smallmouth
Area of pond (acres)	3.56	7.72	3.43	5.5	4.0	6.48	5.15
Rate of stocking per acre	4,213	6,138	16,531	24,909	25,000	25,463	4,863
Number fry planted	15,000	47,387	56,700	137,000	100,000	165,000	25,000
Date of stocking	6/11	7/9	6/14	6/10	6/17	6/27	6/28
Draining record:							
Date	9/23	10/24	9/27	10/14	10/15	9/6	10/1
Number of fish	4,479	9,455	2,669	10,392	13,877	101,923[1]	7,174
Total pounds of fish	81.0	177.1	115.5	184.2	248.2	227.0	329.5
Number fish per acre	1,258	1,225	778	1,889	3,469	15,729	1,393
Pounds per acre	22.7	22.9	33.7	33.5	62.1	35.0	64.0
Number fish per pound	56.4	53.4	23.1	56.4	55.9	449.0	21.8
Average length (mm.)	92.7	82.1	108.0	87.9	81.5	44.1	118.4
Size range (mm.)	83-151	55-176	81-203	72-138	58-102	34-63	95-168
Loss of fish between stocking and draining	10,521	37,932	54,031	126,608	86,123	63,077	17,826
Percentage loss	70.1	80.0	95.3	92.4	86.1	38.2[2]	71.3

[1] From a preserved sample of the fish taken at draining it was found that green and pumpkinseed sunfish were present. Revised figures are as follows: bluegills, 91,731; pumpkinseeds, 9,173; green sunfish, 1,019.

[2] This percentage loss is lower than that for any other ponds stocked with bluegill fry. It is believed by Mr. Applegate who was present at the time that the original stocking was much greater than 165,000.

carrying capacity-species combination experiment. The largest and the smallest bass (171 of each size) taken from Pond No. 11 at Drayton Plains were also sorted out and placed in separate ponds. The remainder of the fish were divided up and 3,430 were stocked in Pond No. 10 for the carrying capacity and species combination experiment and the rest were planted in Districts No. 2 and 11, (winter-kill lakes which were recommended by the Institute). Therefore, three ponds (No. 3 at Almena, No. 7 at Wolf Lake, and No. 10 at Drayton Plains) stocked with largemouth bass have been set aside for the carrying capacity and species combination experiments.

Two ponds, No. 2 at Almena and No. 7 at Drayton Plains, were stocked with bluegills for the carrying capacity-species combination experiments. These two ponds were stocked with approximately 25,000 bluegill fry per acre. Pond No. 2 at Almena produced a total of 248.2 pounds of fish (62.1 pounds per acre). Pond No. 7 at Drayton Plains produced a total of 227 pounds of fish, but only 90 percent of these were bluegills while 9 percent were pumpkinseeds and 1 percent green sunfish. Therefore, the total production of bluegills in this pond amounted to only 204.3 pounds, or 91,731 fish. Because of their small size, it was impossible to sort the green sunfish and pumpkinseeds from the bluegills. Therefore, all three species were returned to the pond after draining. It is known that many small fish enter all of the ponds at Drayton Plains through the inlet from the Clinton River. But observations made on other ponds at Drayton Plains at the time of draining revealed that although a few green sunfish and pumpkinseeds were present in each pond, they made up only a very small percentage of the total number. Therefore, it is believed that most of the green sunfish and pumpkinseeds found in Pond No. 7 were introduced with the bluegills. It is believed that an inexperienced man at the Drayton Plains Hatchery collected all of the bluegill fry.

Pond No. 13 at the Wolf Lake Hatchery was stocked with 25,000 smallmouth bass fry (4,863 fish per acre). When this pond was drained, a total of 7,174 bass, weighing 329.5 pounds, (64.0 pounds and 1,393 fish per acre) was removed. A total of 150 of the largest and 150 of the smallest bass was sorted out of this lot of fish and placed in separate ponds and the remainder of the fish were replaced in Pond No. 13 for the carrying capacity-species combination experiment. Therefore, a total of 6,874 bass weighing 305.5 pounds was placed in Pond No. 13.

3. TEST OF THE THEORY THAT FAST GROWING FISH HAVE AN EARLY MORTALITY

In the past a number of fishery workers (among these were Ralph Hile and R. W. Eschmeyer) have proposed the theory that fast growing fish ("cannibals") have an early mortality. These fishery workers based their theory on evidence obtained from studies on growth using the scale method of estimating the age of fishes. Several lakes in Michigan (among them Deep Lake, Oakland County) have been stocked with fast growing bass in past years and the species failed to survive. Although other factors could have been responsible for their disappearance, it is believed that it may have been due to the early mortality of fast growing fish. Therefore, actual experiments have been set up at the Wolf Lake and Drayton Plains Hatcheries in an effort to obtain more direct and conclusive evidence to prove or disprove this theory.

Largemouth and smallmouth bass are being used for these experiments as follows:

Species	Pond number	Number of fish	Weight (pounds)	Size (millimeters) Average	Range
Largemouth bass ("cannibals")	10-Wolf Lake	200	37.7	175.6	153-207
Largemouth bass (small fish)	11-Wolf Lake	200	4.0	94.7	84-105
Largemouth bass ("cannibals")	9-Drayton Plains	171	16.2	145.3	127-176
Largemouth bass (small fish)	11-Drayton Plains	171	1.3	64.3	55-70
Smallmouth bass (small fish)	4-Wolf Lake	150	7.0	116.9	95-133
Smallmouth bass ("cannibals")	5-Wolf Lake	150	17.0	155.1	142-168

Each of these ponds should be drained twice each year (spring and fall) and all bass should be counted, weighed and measured. The data obtained at each draining should be important in determining whether the fast growing fish ("cannibals") have a higher mortality than the slow growing fish. Data that will provide information on the growth, growth potential, annulus formation and the characteristics of the first annulus may also be obtained. For further controls on the above experiments, survival data obtained from the draining of Ponds No. 7 and 13 (stocked with largemouth and smallmouth bass respectively) at Wolf Lake and Pond No. 10 (largemouth bass) at Drayton Plains can be used.

To be certain that the bass had plenty of food so that they would not die of starvation, small bluegills were placed in the following ponds at the Wolf Lake Hatchery:

Pond No. 10 - 15.5 pounds (average 35.8 millimeters)

Pond No. 11 - 16.0 pounds (average 35.8 millimeters)

Pond No. 7 - 150 pounds (average 30.3 millimeters)

Pond No. 13 - 15 pounds (average 30 millimeters)

All of the bass ponds in this series of experiments were to be stocked with lake emerald shiners as soon as these minnows were available.

Pond No. 24 (36.3 acres) at the Wolf Lake Hatchery was stocked with largemouth bass and bluegill fry during June, 1946. This pond was not drained in the fall of 1946. The fish that are in this pond can be used for stocking the Hillsdale ponds in the fall of 1947, or the spring of 1948, and may also provide some bluegills for the stunting experiments and bass for the control of the stunted bluegills.

Two further experiments that were to have been conducted at the Drayton Plains Hatchery were not successful. In one case this was due to the fact that fish were not available for stocking the pond, and the experiment planned for the experimental ponds was a failure because we could not attain a supply of bluegill breeders.

Ponds No. 1 and 2 at the Fenton Rearing Ponds were stocked with walleyed pike fry. When these ponds were drained in October, Pond No. 1 contained 652 fish weighing 17.8 pounds and Pond No. 2 yielded 2,444 fish weighing 78.3 pounds.

Pond No. 3 at Fenton was stocked with adult bluegills. These fish were to have been used for marking experiments in lakes that were to be poisoned. As these bluegills were not needed for this purpose, some were used for restocking several winter-kill lakes and the balance were returned to the pond.

Pond No. 7 at the Drayton Plains Hatchery produced two different batches of fish in 1946. Besides the bluegills that were raised in the pond as described previously, northern pike were also produced. A total of 775 two-month-old northern pike weighing 15 pounds was removed from Pond No. 7 before the bluegills experiment was started.

Recommendations for 1947

The following recommendations are made for the use of the ponds at the Drayton Plains Hatchery in 1947:

1. The fish that now occupy Ponds No. 9, 10 and 11, should be transferred to smaller ponds.

2. The bass in Ponds No. 7, 10 and 11, at the Wolf Lake Hatchery should be transferred to three smaller ponds at Drayton Plains. This will make three more ponds available at Wolf Lake for experiments on fertilization and minnow culture.

3. Several of the largest ponds at Drayton Plains should be stocked with fish for listing the accuracy of present methods of fish population estimates and the effectiveness of the different methods of sampling fish populations.

4. If a trained observer is available, experiments should be conducted to determine whether a female bluegill will spawn more than once during one spawning season. The experimental ponds could be used for this experiment.

5. The bluegills in Pond No. 7 at Drayton Plains and No. 3 at Fenton can be transferred to the Wolf Lake Hatchery to supplement the stock available for the bluegill stunting experiments.

The writer wishes to acknowledge the very able assistance rendered during the course of these experiments by Vernon C. Applegate, Troy Yoder, George Fukano, Henry Hatt and the personnel of the Wolf Lake and Drayton Plains Hatcheries.

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