Experimental Feeding and Growth of Channel Catfish In Oklahoma Hatcheries

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Introduction

The four hatcheries of the Department of Wildlife Conservation have, for many years, been rearing fingerling-size channel catfish for distribution. Many large new bodies of water, without established populations, have received advanced fry in early summer. Lakes which have been rehabilitated as a result either of draining, rebuilding or poisoning with fish toxicants have been restocked with advanced fry, fingerlings or subadult channel catfish. For the past 10 years, lakes whose management is under the direct jurisdiction of the Department of Wildlife Conservation have received some subadult channel catfish. There has been an increase in demand for larger fish as the state assumes management of more bodies of water.

Fish culturists have often observed that, in all ponds where channel catfish fingerlings are reared, by early winter there are some fish which are much larger than the rest. These oversized fish usually have been destined for special distribution to state-owned lakes. Increased demand for these large fish prompted this study.

Materials and Methods

The ponds used in the rearing experiments are all of earthen construction and have been in use for many years. All were rich and had abundant bottom fauna. None had rooted aquatic vegetation. The water sources varied from hatchery to hatchery and all except the Byron Hatchery, Hatchery Number 3, had exceptional water quality (Table I).

The seven ponds were distributed in the following manner: Hatchery Number 1, at Medicine Park, had two ponds, one a little more than 0.5 acre in size and the other more than one-third acre. These ponds adjoin and are rich in sandy loam alluvium. Walkways over the ponds facilitate feeding and observation. The water derives from Lake Lawtonka by gravity flow. A complete temperature record of the two ponds is given in Table II.

Two adjacent ponds at Hatchery Number 2 at Durant are each one-eighth acre in size and are provided with walkways. The bottom is compact clay loam, a residual soil over limestone. The water source is from spring-fed Blue River, the drainage area of which is mostly limestone (Table I). The water is pumped into a system of canals and a reservoir which supplies the hatchery.

One pond at Hatchery Number 3 (Byron) was used. The soil type of the pond bottom is sandy loam of dune material with little clay or colloidal material. The water is from a large spring and an artesian well with temperatures of 62 to 65 F. Water is circulated from a reservoir to rearing ponds by way of canals, pipes and through other ponds. The water quality is less favorable than the others though it is without biotic contamination, as it comes from underground. Disease outbreaks are virtually unknown at this installation.

TABLE I. ANALYSIS IN PARTS PER MILLION OF WATER SOURCES OF STATE HATCHERIES

CONSTITUENT	MEDICINE PARK	DURANT	BYRON	HOLDENVILLE
Calcium	42	40	10	12
Magnesium	11	53	7	11
Sodium	19	7	15	13
Potassium	3.6	3	2	5
Bicarbonate	163	61	18	24
Carbonate	0	0	0	0
Chloride	20	10	8	4
Fluoride	0.75	—	—	—
Nitrate	0.6	—	—	—
Iron	0.7	—	—	—
Sulfate	20	—7	6	10
Specific conductance	—	30	11	13
Dissolved solids	220	—	—	—
Total dissolved salts	—	192	70	83
Total hardness	150	—	—	—
Calcium hardness	106	—	—	—
Non-carbonate hardness	16	—	—	—
Total alkalinity	134	—	—	—
pH	7.3	8.1	6.8	8.7

TABLE II. POND WATER SURFACE TEMPERATURES AT MEDICINE PARK HATCHERY

DEGREES F.	POND 9 NUMBER OF DAYS	POND 10 NUMBER OF DAYS
32-39	5	6
40-49	54	56
50-59	47	59
60-69	57	47
70-79	78	84
80-89	47	32
TOTAL	288	284

Hatchery Number 4, at Holdenville, located below Holdenville City Lake, provided two experimental ponds. The bottom soil of both is compact, colloidal, residual material which holds water excellently. Water is drawn by gravity from Holdenville City Lake and piped to all ponds of the hatchery. Water quality is good though turbidity sometimes is above 60 ppm. This does not interfere with channel catfish culture. The ponds are provided with walkways for feeding and observation.

Stocking Material—The fingerlings used in the test were spawned at the Durant Hatchery in the spring of 1965 and fed commercial fish food until distribution in January 1966. They ranged in length from three to six inches with an average of 4.24 inches. The average weight of 0.019 lb. is somewhat greater than the average for wild fish of that length (Houser and Bross, 1963). The length-frequency plotting indicates that the bulk of the fish were from 3.6 to 5.0 inches in length, and that more than 60% were from 3.0 to 4.4 inches long. Table III displays a bimodal distribution of the lengths with one peak at approximately 3.9 inches and another at approximately 4.6 inches. These two modes occurring in channel catfish of this length range suggests an early sexual dimorphism, as proposed by Beaver, Sneed and Dupree (1966). These fish were considered to be free from parasites and disease and acceptable as experimental units.

TABLE III. LENGTH-FREQUENCY DISTRIBUTION OF FINGERLINGS STOCKED. AVERAGE TOTAL Length, 4.24 inches; Average Weight, 0.019 lb.

TOTAL LENGTH IN INCHES	NUMBER OF FISH	PERCENT
3.0	1	.33
.1		
.2	1	.33
.3		
.4	1	.33
.5	2	.67
.6	22	7.41
.7	20	6.74
.8	31	10.45
.9	35	11.59
4.0	24	8.09
.1	18	6.07
.2	17	5.63
.3	8	2.70
.4	1	.33
.5	14	4.72
.6	25	8.42
.7	13	4.38
.8	18	6.07
.9	17	5.63
5.0	11	3.70
.1	9	3.03
.2	4	1.34
.3	1	.33
.4	1	.34
.5	1	.34
.6		
.7		
.8		
.9		
6.0	1	.34
TOTAL	296	99.31

All stocking densities were high, ranging from 10,000 to 50,000 fish per acre. Previous channel catfish production in all state hatcheries have resulted in densities at the time of harvest greater than the densities of the present study. For this reason, young-of-the-year fingerlings were carried over with an intensified feeding program.

Food—The food materials used for the study consisted of two items: a commercially produced fish culture formulation, and a mixture of 60% cottonseed meal and 40% shorts. The commercial formulation contained 40% protein, a content of not less than 2.5% fat and crude fibre not more than 5.5%. The producer states that not more than 13.0% ash and 3.0% minerals were added. The manufacturer stated that all vitamins needed were supplied by the food. The cottonseed meal used contained not less than 41.0% crude protein and 3.0% crude fat and with not more than 14.0% crude fibre. The shorts contained 16.0% crude protein, 3.5% crude fat and 7.0% crude fibre.

Feeding Program—At Hatchery Number 1 initial feeding was started in January at a daily rate of approximately 5.0% of the weight of the fish stocked. All feeding was suspended for a period of 17 days during very low temperatures. When feeding was resumed, 2.5% of the original weight of fish stocked was fed. This feeding regime was continued until the higher temperatures of spring and summer, when the daily ration was divided equally between the regular morning feeding and one in late afternoon. In June, the 5% feeding ration was resumed with two equal feedings. In July, the ration was increased to accommodate the observed increase in fish size, and continued until the fish were harvested at the end of the test. This period extended more than 280 days (Table IV).

At Hatchery Number 2 feeding was started on 7 January and continued for a period of 314 and 318 days for the two ponds. Pond Number 47 received a commercial ration of a little more than 2.5% of fish body weight. Because of lower temperatures in February, the amount fed was 28 lb. In March this was increased to 36 lb. By 27 May a dissolved oxygen problem arose because of the high fertility of the water. Potassium permanganate was used but approximately 2,000 fish were lost. Feeding was reduced to compensate for loss in population. The size of the pellet had been increased before the oxygen problem occurred, and this pellet size was continued to the end of the study. A total of 689 lb. of commercial food was used over a period of 314 days.

Pond Number 48 did not experience a drastic population reduction and its ration increase resulted in a total consumption of commercial feed of 1,101 lb.

At Byron Hatchery 2,026 lb. of commercial feed were used, 126 lb. of which were a number four size pellet, the rest, 1,900 lb being number three size granulation. The feeding extended over a period of 184 days, at which time the pond was drained and the fish harvested.

At Holdenville Hatchery, the fish in both ponds were fed the number three size granulation, and the daily ration at the start was 1.5% of the fish weight. In June the fish were fed size number one granules every other day, using the 1.5% ration. The July ration was increased and the pellet size was increased though the feed was given only every other day. This program was followed until the fish were harvested.

Preharvest Observations on Growth—At feeding time, most fish surface and present themselves conveniently for capturing. At Hatchery Number 1 and Number 3, observations were made on the developing fingerlings. At the Medicine Park Hatchery, 450 fingerlings were examined on 27 June. At that time the fish had gained in weight and length and seemed free of parasites and disease. The Byron Hatchery pond was sampled nine times and the fish measured and found to be gaining in both length and weight (Table V).

The loss of fish at Hatchery Number 2 on 27 May resulted in the examination of approximately 2,000 fish ranging between four and six inches and weighing 50 lb.

TABLE IV. STOCKING, RECOVERY AND FEEDING RECORD

HATCHERY	NUMBER 1		NUMBER 2		NUMBER 3	NUMBER 4	
POND NUMBER	9	10	47	48	4	26	29
Number stocked	8,750	9,395	6,250	6,250	6,300	2,000	3,500
Pounds stocked	194.0	191.75	125.0	125.0	126.0	20.00	25.00
Number recovered	4,010	3,090	2,982	5,022	5,354	460	1,296
Pounds recovered	141.77	143.50	393.2	558.21	1,255.43	198.42	268.32
Percent recovered (no.)	45.95	32.82	47.71	80.35	85.06	23.00	37.02
Pond size—acres	.51	.33	.125	.125	.20	.20	.18
Date stocked	1/10/66	1/10/66	1/7/66	1/7/66	4/11/66	1/6/66	1/6/66
Number of days fed	288	284	314	318	184	326	326
Cottonseed meal Total pounds	1,395	1,359					
Shorts Total pounds	930	906					
Prepared food Total pounds			689	1,101	2,026	750	750

TABLE V. RESULTS OF SEINING SAMPLES AT HATCHERIES 1 AND 3

HATCHERY NUMBER 1

Date	Pond Number	Number of Fish	Length Range In Inches	Average Total Length	Average Weight In Pounds
6/27/66	9	225	3.6-7.3	4.48	.025
6/27/66	10	225	3.6-7.4	4.59	.030

HATCHERY NUMBER 3

Date	Number of Fish	Length Range In Inches	Average Total Length	Average Weight In Pounds
8/2/66	50	5.6-10.1	7.68	.147
8/9/66	77	4.3-10.8	6.92	.122
8/16/66	60	5.0-10.3	7.55	.169
8/23/66	30	6.0 - 9.5	7.71	.167
8/30/66	93	5.7-11.5	7.72	.190
9/6/66	21	7.0-10.1	8.59	.227
9/13/66	83	4.9-12.8	8.64	.259
9/20/66	61	6.9-11.5	9.04	.279
9/27/66	52	5.9-13.4	9.50	.311

Length of Experiment—The stocking time varied. At Medicine Park fish were stocked on 10 January 1966 and removed 1 November 1966, after 288 days. At Durant the dates were 7 January, 17 and 22 November, a feeding period of 314 days and 318 days respectively. At Byron the dates were 11 April and 10 October, 184 days. At Holdenville the dates were 6 January and 28 November, a period of 326 days (Table IV).

Temperatures—At the Medicine Park Hatchery, the temperatures were in the lower forties at the start of the feeding experiment and continued to rise with the advance of the season to the fifties and sixties in late March. The record shows that only 62 days had temperatures below 50 F. The rest of the growing season had high temperatures, with 47 days of 80 F or higher (Table II).

There is an incomplete temperature record at the other hatcheries though it is known that the Durant water warms earliest and cools last of all the installations. The Byron Hatchery, the most northerly one, is last to warm in the spring and first to cool in the fall.

RESULTS

The two ponds at Medicine Park yielded poor results even though 39.0% of the fish stocked were recovered. The average weight for the group was 0.04 lb. Most fish were less than six inches in length and only eight fish were longer than 10 inches. It is concluded that the ration used was inadequate to grow fingerlings to the size of subadults (Table VI).

The ponds at Durant both produced about the same quality of fish though pond number 48 produced about 1.67 times the number produced by pond number

TABLE VI. NUMBERS OF FISH, BY INCH CLASSES, PRODUCED IN PONDS

Hatchery	Number 1		Number 2		Number 3	Number 4		
Pond Number	9	10	47	48	4	26	29	Total
Inch Class								
4	1881	796			18			2695
5	1504	1186	132	586	219			3627
6	373	683	753	1752	452		8	4021
7	113	247	991	1481	772	8	233	3845
8	77	116	681	765	1231	33	466	3369
9	49	40	261	297	1242	73	328	2290
10	13	14	128	107	812	94	156	1324
11		6	25	24	395	92	53	595
12		1	11	9	157	68	39	285
13		1		1	52	51	9	114
14					4	30	3	37
15						10	1	11
16						1		1
Total	4010	3090	2982	5022	5354	460	1296	22214

47. In both cases most fish were less than nine inches in length, with only 70 fish above 11.0 inches. No fish of less than five inches were produced in either of the ponds.

At Byron the fish displayed the most normal distribution of sizes with 76% being from 7 to 11 inches, and 608 from 11 to 15 inches, and 689 from 4 to 7 inches.

The Holdenville ponds did not produce a fingerling less than six inches in length, and only eight fish less than seven inches. Pond number 26 had 71% of its production from 9 to 13 inches. Pond 29 had 91% of its fish from 7 to 11 inches.

The total test produced 22,214 fish of which 8,026 were above eight inches in length. Of these, 1,043 were over 11 inches long.

CONCLUSIONS

The actual amount of food required for maintenance of advanced fingerling and subadult catfish is not known for the State Hatcheries of Oklahoma, since in all the experiments earthen culture ponds were used. Natural food existed in all ponds and was used by the fish. It is assumed that all ponds contributed materially to the total food ration. It must be concluded that feeding the cottonseed meal ration did not provide a sufficient diet after the fish were seven inches long. There was good return in numbers, yet the condition of the fish was poor in the ponds where this ration was used.

The pellet size of the commercial feed used was probably too large for most of the fish, and much of it was not utilized. It is felt that the fish should have been kept on the smaller grades for a longer time. To change or go from one particle size to the next size larger requires a response on the part of the fish which may not be possible for a substantial part of the population. Feeding was observed in all cases, but the number four pellet sinks rapidly, and much of it

may be lost by spoilage or be picked up by something other than the cultured species.

The stocking densities, though not excessive at the opening of the experiment, may have been too great for the development of larger fish.

No fish, fed on the commercial preparation, showed disease symptoms during the period of study and all fish were clean and displayed vigorous activity during and after the process of draining and working the catch.

Literature Cited

Beaver, John A., Kermit E. Sneed, and Harry K. Dupree. 1966. The difference in growth of male and female channel catfish in hatchery ponds. Prog. Fish Cult. 38 (1):47-50.

Houser, Alfred and Michael G. Bross. 1963. Average growth rates and length-weight relationships for fifteen species of fish in Oklahoma waters. Okla. Fish. Res. Lab. Rep. 85.