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EVALUATION OF A MULTI-SPECIES CATFISH POND

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ABSTRACT

This study was designed to compare the growth, mortality, and catchability of three species of catfish, blue catfish *(Ictalurus furcatus)*, channel catfish *(I. punctatus)*, and white catfish *(I. catus)*, in an artificially fed fishing pond. After stocking in October, 1968, the pond was fished a total of 35 days in two years (1970 and 1971). All remaining fish were then removed. The pond was "contaminated" primarily by brown bullheads and bluegills, with bullheads accounting for 648 pounds of the 2320 pounds per acre removed at the end of the study. Although 90 pounds of bluegill per acre were harvested during the 1971 fishing season, only 62 pounds per acre were present during eradication.

Catch rates of all three catfish species were low throughout most of the study. Catch rates of blue catfish and white catfish were lower than channel catfish. "Natural" mortality of blue catfish was less than channel or white catfish. Weight attained by white catfish after four years of growth was considerably lower than either blue or channel catfish. Very few young-of-the-year of any species were found during removal operations.

EVALUATION OF A MULTI-SPECIES CATFISH POND

The channel catfish *(Ictalurus punctatus)* is the species most commonly used in heavily fished, artificially fed catfish ponds. In order to provide variety in the fishery, however, it would probably be desirable to stock combinations of various species. This study was undertaken to compare growth, mortality, and catchability of three species of catfish stocked together in a pond. The three species were channel catfish, blue catfish *(Ictalurus furcatus)* and white catfish *(Ictalurus catus)*. As the study progressed, contamination of the pond by bluegills, yellow bullheads, and brown bullheads was discovered. The effect of this "contamination" on the fishery was evaluated.

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MATERIALS AND METHODS

In October, 1968, 7500 fingerlings of each catfish species were stocked in Clay Pit I, a thirteen acre pond with a maximum depth of 18 feet located on the Fort Gordon Military Base near Augusta, Georgia. Because the presence of bluegill was discovered, 650 bass fingerlings were stocked in July, 1969. The pond was opened to fishing 7 June, 1970, and continued on eleven selected Sundays to 25 October. In 1971 the pond was open to fishing every Sunday from 18 April to 26 September, a total of 24 days. Fishing was permitted from 8 a.m. to 4 p.m. each fishing day. Since the pond is enclosed by fences, a total creel census was obtained. A creel limit of five catfish was imposed in 1970. There was no limit in 1971.

Following stocking, periodic samples were taken to estimate growth. Feeding rates were increased until July, 1969. From July, 1969, to the end of the study (October, 1971) a feeding rate of 300 pounds of floating catfish feed/day was used. The fish were not fed on Saturday and Sunday. Feeding rates were reduced as the water cooled.

After termination of fishing, the pond was eradicated using antimycin to remove "scale fish", followed by rotenone to remove catfish and bullheads. Total weights and numbers for each species were tabulated. Individual lengths and weights were collected on the catfish species.

RESULTS

Creel census totals for 1970 and 1971 are compiled in Table 1. In 1970 a total of 1628 fishermen fished Clay Pit I on the 11 fishing days while in 1971, 2210 fishermen were censused on the 24 Sundays open to fishing. Fishing pressure amounted to 500 hrs./acre in 1970 and 650 hrs./acre in 1971. In both years a fishing "trip" averaged near four hours (4.10 and 3.89). In 1970 the total catch (all species) was 283 pounds/acre while 419 pounds/acre were caught in 1971.

A breakdown of the total 1970 catch (Table 1) showed that 143 pounds of the three catfish species, 71 pounds of brown bullheads, 31 pounds of bluegill, and 19 pounds of bass were taken. The 419 pounds/acre harvested in 1971 was composed of 163 pounds of catfish, 154 pounds of brown bullheads, 90 pounds of bluegill, and 5 pounds of bass. More catfish were caught in 1970 on 11 fishing days than in 1971 on 24 days. The pounds of brown bullhead and bluegill harvested per acre increased from 1970 to 1971.

The daily total fishing pressures and catch rates (numbers/hour) for 1970 and 1971 are shown in Table 2. These figures indicate that pressure and the catfish catch per hour declined during the two years of the study. During the same period, however, the daily catch of bluegill tended to increase. The percentage of fishermen catching at least one catfish dropped during the study (Table 2) while the percentage of fishermen catching no fish (S.R.) increased. The percent of fishermen catching only bluegills or bullheads tended to increase through the study. All the criteria of fishing success mentioned above, particularly the catch per hour and the S.R., indicate that fishing, particularly for catfish, became progressively "poorer" throughout the study.

Comparisons of these data to other published information on "fed" catfish ponds indicate that the catch rate of catfish was lower than in other studies. Prather (1969) reports "good" fishing with catch rates of 0.46 and 0.47 pounds/hour in two ponds. For 1970 and 1971 we calculated a catch of 0.28 and 0.25 pounds of catfish per hour, respectively. Prather (1959) also reports a "poor" fishing pond which had a catch rate of 0.3 pounds per hour.

The fish removed from Clay Pit I following the two years of fishing are tabulated by numbers and weights in Table 3. A total of 31,088 pounds of fish were removed from the pond. The standing crop of 2320 pounds per acre may be subdivided into 1573 pounds of catfish, 648 pounds of brown bullheads, and 90 pounds of "scaled" fish. Very few young-of-the-year of any species were found during removal.

A total of 2390 channel catfish, 5299 blue catfish, and 3594 white catfish were removed. An additional 1408 channel catfish, 580 blue catfish, and 711 white catfish were caught during the two years of fishing. These totals leave a "natural" (unaccounted for) mortality of 3702 channel catfish, 1631 blue catfish, and 3195 white catfish out of the original 7500 of each species stocked. There was no evidence of differential mortality following stocking. We hypothesize that hooking mortality is partly responsible for these differences, since the number of each species unaccounted for is proportional to the number of each species caught by fishermen.

During removal, all individuals of the three catfish species were measured and a number were weighed in order to calculate average weights for each inch class. These data are summarized in Table 4. Since the fish were stocked at the same time and were approximately the same size, an estimate of the growth through three growing seasons was made. White catfish averaged 12+ inches and 0.98 pounds at the time of removal while channel and blue catfish averaged over 17 inches (2.13 pounds) and 18+ inches (2.35 pounds), respectively,

Table 1. Creel Census Results for 1970 and 1971.

	1970	1971
Total Number of Anglers	1628	2210
Total Hours Fished	6774	8591
Total Number Fish Caught	8930	11363
Total Number Catfish Caught	1540	1159
Channel Catfish	875	533
Blue Catfish	255	325
White Catfish	410	301
Total Number Brown Bullhead Caught	3179	3725
Total Number Bluegill Caught	3289	6236
Total Number Bass Caught	195	44
Total Weight of Fish Caught Per Acre	283	419
Catfish Weight Per Acre	143	163
Channel Catfish	86	90
Blue Catfish	24	45
White Catfish	33	28
Brown Bullhead Weight Per Acre	71	154
Bluegill Weight Per Acre	31	90
Bass Weight Per Acre	19	5

Table 2. Daily creel census results for 1970 and 1971.

Date	Number of Anglers	Average Time Fished	Numbers caught per hour						% of Anglers catching:		
			CC	BC	WC	Total	BG	BB	One or More Catfish	BB or BG Only	No Fish
1970											
6-7	132	4.00	0.65	0.30	0.16	1.12	1.85	0.29	96.2	3.8	0.0
6-21	338	3.58	0.14	0.02	0.07	0.22	0.51	0.93	56.5	27.0	16.6
7-5	202	4.72	0.05	0.01	0.02	0.07	0.28	0.50	32.7	40.6	26.7
7-19	189	3.80	0.07	0.02	0.06	0.15	0.41	0.53	47.1	31.8	21.2
8-2	139	4.20	0.05	0.02	0.04	0.11	0.43	0.18	41.7	18.7	39.6
8-16	93	4.17	0.05	0.00	0.01	0.06	0.64	0.40	36.6	28.0	35.5
8-30	104	4.19	0.16	0.00	0.03	0.19	0.45	0.27	60.6	8.7	30.8
10-4	60	4.33	0.15	0.04	0.12	0.31	0.35	0.83	55.0	31.7	13.3
10-11	124	4.79	0.06	0.04	0.07	0.17	0.27	0.33	36.3	355	28.2
10-18	118	4.42	0.09	0.01	0.05	0.14	0.23	0.19	43.2	21.2	35.6
10-25	129	4.05	0.07	0.02	0.08	0.17	0.17	0.30	46.5	12.4	41.1
TOTALS	1628	4.13	0.13	0.04	0.06	0.23	0.49	0.47	--	--	--
1971											
4-18	193	4.17	0.05	0.08	0.01	0.14	0.22	0.53	43.5	22.8	33.7
4.25	142	5.11	0.09	0.06	0.02	0.17	0.16	0.69	52.8	23.9	23.2
5-2	135	3.82	0.03	0.02	0.01	0.07	0.35	0.53	31.9	38.5	29.6
5-9	133	3.95	0.13	0.01	0.03	0.17	0.58	0.60	44.3	34.4	21.4
5-16	143	3.62	0.09	0.01	0.05	0.15	0.64	0.48	38.5	30.1	31.5
5-23	103	4.68	0.07	0.01	0.05	0.13	0.74	0.72	33.0	41.8	25.2
5-30	157	4.83	0.06	0.01	0.05	0.13	0.47	0.34	46.5	22.9	30.6

6-6	122	3.89	0.05	0.03	0.05	0.12	0.81	0.43	29.5	41.8	28.7
6-13	116	3.74	0.04	0.06	0.02	0.12	1.06	0.35	23.3	40.5	36.2
6-20	106	3.94	0.07	0.01	0.04	0.12	0.98	0.40	42.5	36.8	20.8
6-27	106	3.92	0.07	0.03	0.03	0.13	0.64	0.30	27.4	26.4	46.2
7-4	32	3.22	0.08	0.17	0.00	0.25	3.29	0.20	21.9	65.6	12.5
7-11	62	3.08	0.03	0.08	0.07	0.18	0.73	0.30	30.6	27.4	41.9
7-18	72	3.65	0.09	0.05	0.02	0.16	1.15	0.21	33.3	29.2	37.5
7-25	69	2.94	0.05	0.02	0.02	0.09	3.55	0.17	17.4	43.5	39.1
8-1	126	3.55	0.04	0.02	0.03	0.10	0.82	0.13	23.8	27.0	49.2
8-8	34	3.55	0.02	0.05	0.04	0.11	2.08	0.22	35.3	32.4	32.3
8-15	74	2.74	0.02	0.04	0.03	0.09	1.00	0.05	18.9	23.0	58.1
8-22	33	2.42	0.05	0.00	0.13	0.18	1.01	0.16	24.2	24.2	51.5
8-29	32	3.39	0.11	0.07	0.05	0.23	0.76	0.45	37.5	9.4	53.1
9-5	71	2.81	0.03	0.07	0.01	0.11	0.45	0.27	22.5	32.4	45.1
9-12	39	3.76	0.01	0.08	0.05	0.14	0.25	0.42	35.9	20.5	43.6
9-19	45	3.18	0.05	0.01	0.15	0.21	0.60	0.80	44.4	22.2	33.3
9-26	65	3.45	0.02	0.03	0.09	0.14	0.77	0.46	43.1	21.5	35.4
TOTALS	2210	3.89	0.06	0.04	0.03	0.13	0.73	0.43	--	--	--

Legend: CC = Channel Catfish, BC = Blue Catfish, WC = White Catfish, BG = Bluegill, BB = Brown Bullhead.

Table 3. Numbers and weights of species removed at end of study, October 1971.

Species	Number	Weight	Weight Per Acre	Mean Weight
Channel Catfish	2390	5092	380	2.13
Blue Catfish	5299	12461	930	2.35
White Catfish	3594	3529	263	0.98
Subtotal	11283	21082	1573	1.87
Brown Bullhead	45515	8683	648	0.19
Bluegill	10151	829	62	0.08
Largemouth Bass	181	368	28	2.03
Others	679	126	9	–
TOTAL	67809	31088	2320	–

Table 4. Numbers and average weight in each length group at removal. October 1971.

	Channel Catfish		Blue Catfish		White Catfish	
Inch Groups	Number	Average Weight	Number	Average Weight	Number	Average Weight
7					1	0.10
8					4	0.20
9					14	0.36
10	3	0.36			187	0.44
11	66	0.43	1	0.30	688	0.59
12	38	0.60	6	0.63	840	0.83
13	91	0.74	27	0.84	848	1.05
14	186	0.94	89	0.98	553	1.26
15	233	1.25	273	1.22	304	1.50
16	349	1.54	549	1.53	112	1.82
17	390	1.94	863	1.76	36	2.10
18	387	2.37	1064	2.11	5	2.40
19	296	2.71	952	2.49	2	2.35
20	202	3.21	716	2.88		
21	103	3.78	387	3.34		
22	72	4.27	196	3.97		
23	23	4.87	97	4.61		
24	7	5.77	55	5.58		
25	3	4.77	18	6.20		
26	1	7.40	6	7.53		
TOTALS	2390		5299		3594	

DISCUSSION

Results of this study demonstrate that white catfish did not attain the size that either the blue or channel catfish attained. "Natural" mortality of the white catfish was slightly less than channel catfish and almost twice that of blue catfish. Fishermen caught approximately twice as many channel catfish as white catfish. This observation confirms Prather's (1964, 1969) results that white catfish are more difficult to catch than channel catfish. It appears to us that the white catfish may be adversely affected by competition from the other catfish and the brown bullhead.

The blue catfish attained the largest size and had the lowest "natural" mortality. It was, however, the most difficult of the three species to catch. At least a part of this difficulty may be due to the methods employed by fishermen. We feel that the blue catfish is the most pelagic of the three species and tends to stay near (within 4 feet) the surface. Conventional bottom fishing methods would, therefore, tend to catch other species. The channel catfish was readily caught and grew to a large size. However, we recorded a channel catfish "natural" mortality of about 50% in Clay Pit I.

The feeding rates used in this study were approximately 1% of total fish body weight per day and 0.7% per day averaged over the week. At this feeding rate there was probably severe competition for food which may have affected the white catfish more than the other species. Perhaps because of their larger average size, the blue and channel catfish were better able to compete for food.

It is also evident from this study that a number of fish, probably large blue and channel catfish, became piscivorous. Very few young-of-the-year of any species were found during eradication. A total of 90 pounds of bluegill per acre were harvested in 1971, while only 62 pounds/acre were removed at the end of the study. Most of the bluegill found during the eradication were adults, indicating that bluegill would have been even less important in the creel in 1972 than they were in 1971. The combination of piscivorous catfish and fishing was undoubtedly over exploiting the bluegill population. The 181 bass recovered during eradication probably could not account for this reduction in the bluegill population.

A large number of the brown bullheads found during eradication were yearling fish that would have entered the fishery in 1972 had the pond not been poisoned. We feel that the large piscivorous catfish would have eliminated bullhead reproduction in 1972 as they did in 1971. As long as the catfish controlled bullhead reproduction, a satisfactory fishery for brown bullhead and large catfish would remain. We believe this fishery would be a feasible management design, particularly in situations where the fishing for catfish is as "poor" as it was in this study. The design would become a "trophy" catfish fishery with bullheads providing the bulk of the harvest.

Since this project began we have initiated other studies. We are continuing to study the blue catfish in order to assess its potential as a sport fish in heavily fished ponds. We will also determine at what size blue cats begin to be effective piscivores. We are also evaluating the three species of catfish in a pond without the "contamination" of brown bullheads and bluegills.

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UTILIZATION OF RAINBOW TROUT, *SALMO GAIRDNERII* RICHARDSON, IN A DOUBLE-CROP FISH CULTURE SYSTEM IN SOUTH GEORGIA

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ABSTRACT

Techniques were investigated for growing rainbow trout, *Salmo gairdnerii* Richardson, from fingerlings to market size during the winter months in a recirculation, flowing water fish culture system where channel catfish, *Ictalurus punctatus* (Rafinesque) are grown in summer. Trout stocked having a mean weight of 0.1 lb had a mean weight of 0.7 lb in approximately 100 days with a feed conversion ratio of 1.29 to 1. Survival of the fish was 82%. Water quality parameters and control of parasite infestations during the culture period are also discussed.

INTRODUCTION

Rainbow Trout, *Salmo gairdnerii* Richardson, have traditionally been grown in areas where cold water is available on a year-round basis. In nature, trout require an abundance of clean, cold, well-aerated water and where these conditions are duplicated artificially by man, trout usually flourish.

Raceways have been utilized for trout culture for a number of years both in Europe and the United States. Most of the raceways in which trout are grown are of the open system type where water flows through and downstream without being recycled.

In 1969, closed flowing water systems were first introduced in Georgia by the Soil Conversation Service for the primary purpose of culturing channel catfish, *Ictalurus punctatus* (Rafinesque). In this type installation, the water is stored in a reservoir, routed through raceways containing fish and back into the reservoir. A facility consisting of eight 100 ft raceways, a 500 ft deep well, and a 5 acre reservoir was constructed at the Coastal Plain Experiment Station, Tifton, Georgia, in 1971. The primary purpose for the facility was for researching the culture of channel catfish in flowing water.

Temperatures of impounded water recorded during the winter of 1970-1971 at this station indicated ranges favorable for trout survival and growth. The object of this investigation was to evaluate the biological feasibility of utilizing rainbow trout in the winter in a double-crop fish culture system in South Georgia.