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POLYCULTURE STUDIES WITH CHANNEL CATFISH AND BUFFALO

by

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ABSTRACT

Polyculture studies were conducted in coastal brackish ponds evaluating buffalo *(Ictiobus* spp.) and channel catfish *(Ictalurus punctatus)* combinations. The 1973 and 1974 southwest Louisiana studies demonstrated feeding to be necessary, without it, buffalo were found to compete with catfish for natural foods. Bigmouth buffalo *(I. cyprinellus)*, black buffalo *(I. niger)* and bigmouth x black hybrid buffalo when stocked at 100 per acre with 1,600 and 2,000 catfish did not compete to any extent for supplemental feed. Addition of buffalo in some ponds actually resulted in increased catfish production. Results showed average buffalo production ranged up to 300 pounds per acre in addition to catfish production. The stocking of buffalo will supplement incomes where the demand for this fish is high.

INTRODUCTION

In the southeastern United States, polyculture of catfish *(Ictalurus* spp.) with buffalo *(Ictiobus* spp.) probably originated in Arkansas in the early 1950's. Early reports indicate pioneer farmers stocked from 30 to 100 buffalo fingerlings with 20 to 75 catfish fingerlings per acre (Stevenson, 1958). Harvest of the unfed ponds began in 15 to 18 months, with total production ranging from 200 to 1,000 pounds per acre. White (1971) reported catfish farmers stocking catfish, buffalo and minnows annually harvest approximately 500 pounds catfish and 500 pounds buffalo per acre without feed. Another report described a total production of 709 pounds per acre without feed. The pond had been stocked at a rate per acre of 125 bigmouth buffalo *(I. cyprinellus)*, 50 channel catfish *(Ictalurus punctatus)*, 50 white catfish *(I. catus)*, 100 crappie *(Pomoxis sp.)*, 25 flathead catfish *(Pylodictis olivaris)* and five Israeli carp *(Cyprinus carpio)* for approximately 1 ½ years (Bureau of Sport Fisheries and Wildlife, 1965). They also reported a harvest of 3,000 pounds per acre when higher stocking rates were used and fish fed.

Popular belief was that buffalo grown with catfish utilize a variety of fish food organisms not eaten by catfish. Moreover, because of a short food web, they consume plankton and recover fines or wasted feed, and this policing action improves water quality.

Often in catfish-buffalo ponds grown on a 2 to 3 year rotation, the buffalo spawn. Farmers have been able to control buffalo fry with some success by stocking from 25 to 50 fingerling largemouth bass *(Micropterus salmoides)* per acre. Others suppress spawning by lowering water levels in early spring. If the fish are cultured in coastal or saline areas, possibly water salinity may prevent unwanted spawning. Laboratory tests indicate that buffalo eggs hatch and fry tolerate up to 9 ppt (parts per thousand) salinity. Effects of salinity on the actual spawning act is unknown (Hollander and Avault, 1975). Spawns have been reported for bigmouth and black buffalo *(I. niger)* in brackish water ponds in up to 2.0 ppt salinity (Perry, in review).

Since 1966, the Louisiana Wildlife and Fisheries Commission has studied brackish water pond culture of blue *(Ictalurus furcatus)*, channel, and white catfish. These experiments have demonstrated that catfish will grow in salinities ranging up to 11 ppt (Perry and Avault, 1968, 1969). Blue and channel catfish have spawned in ponds with salinities ranging up to 2 ppt (Perry, 1973), and top production has ranged up to 2,684 pounds per acre of market size fish using standard stocking and culture procedures (Perry and Avault, 1973).

This study was conducted to determine the feasibility of growing channel catfish and buffalo together in brackish water ponds.

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EXPERIMENTAL PROCEDURES AND RESULTS

Initial studies were conducted in identical 0.1 acre ponds at Rockefeller Wildlife Refuge, Grand Chenier, Louisiana. The research ponds have an average depth of approximately 4 feet and are constructed above marsh floor. Filtered slightly brackish surface water was used in the ponds (salinities ranged from 0.4 to 6.4 ppt).

Channel catfish were obtained from Richland Development Corporation Fish Farm, Monroe, Louisiana. The buffalo originally came from the Fish Farming Experiment Station, Stuttgart, Arkansas. A prophylactic treatment of 15 ppm (parts per million) formalin and 1 ppm acriflavine was given to catfish during transport to the ponds. The buffalo were held in a saline solution (1.6 lb./10 gal.) for approximately 2 minutes before stocking.

1973 STUDIES

Fed Ponds

Initial polyculture studies began March 2, 1973. Six 0.1 acre ponds were each stocked at a rate of 2,000 8-inch fingerling channel catfish per acre. Three of these ponds were also each stocked at a rate of 100 6-inch bigmouth buffalo per acre. Ponds with catfish only were each stocked with a total of 27.8 to 28.6 pounds of fish averaging 0.14 pound a piece. Ponds with buffalo and catfish were each stocked with a total of 24.7 to 26.1 pounds of catfish each averaging 0.12 pound; and with 1.1 to 1.3 pounds of bigmouth buffalo per pond, averaging 0.1 pound.

Feeding began March 5, 1973. The fish were fed 3% of their body weight daily, 7 days a week. A popular sinking ration of approximately 30% crude protein was fed. Ponds were seined bi-monthly, and the feeding rates were adjusted according to catfish growth.

Tropical Storm Delia struck after only 143 days of feeding, causing the study to end two months earlier than planned. However, at this time some growth trends were evident (Table 1). An average of 1,657 pounds of catfish per acre were harvested from catfish only ponds. Survival averaged 92%, and 89% of the fish were considered to be of a harvestable size (over 3/4 pound).

An average of 1,902 pounds of catfish were harvested from catfish-buffalo ponds. In addition to producing a higher catfish poundage, these ponds also produced more fish of a harvestable size (96%). There were 148 pounds per acre of buffalo produced, averaging 2.0 pounds each. The total fish production of these ponds totaled 2,050 pounds during this relatively short gowing period.

Table 1. Growth data for channel catfish polyculture studies with bigmouth buffalo, Rockefeller Wildlife Refuge, 1973.

	Treatment			
Pond No.	B-27	B-29	B-32	Ave.
Catfish stocked/A.	2,000	2,000	2,000	2,000
Buffalo stocked/A.	100	100	100	100
Av. size catfish stocked (lbs.)	0.13	0.12	0.12	0.12
Catfish production (lbs./A.)	1,962	1,977	1,767	1,902
Av. size (lbs.)	1.0	1.1	1.1	1.1
% survival	93	94	84	90
% over 3/4 pound	96	100	92	96
Av. size buffalo stocked (lbs.)	0.11	0.11	0.13	0.12
Buffalo production (lbs./A.)	87	134	223	148
Av. size (lbs.)	1.7	1.9	2.5	2.0
% survival	50	70	90	70
S-factor (catfish)	1.9	1.8	1.8	1.8
S-factor (catfish-buffalo)	1.8	1.7	1.6	1.7
Total fish lbs./A. in 143 feeding days	2,049	2,111	1,990	2,050
	Control			
Pond No.	B-20	B-21	B-26	Ave.
Catfish stocked/A.	2,000	2,000	2,000	2,000
Buffalo stocked/A.	—	—	—	—
Av. size catfish stocked (lbs.)	0.14	0.13	0.14	0.14
Catfish production (lbs./A.)	1,545	1,813	1,613	1,657
Av. size (lbs.)	0.8	1.0	0.9	0.9
% survival	92	91	93	92
% over 3/4 pound	84	96	88	89
Av. size buffalo stocked (lbs.)	—	—	—	—
Buffalo production (lbs./A.)	—	—	—	—
Av. size (lbs.)	—	—	—	—
% survival	—	—	—	—
S-factor (catfish)	1.7	1.6	1.6	1.6
S-factor (catfish-buffalo)	—	—	—	—
Total fish lbs./A. in 143 feeding days	1,545	1,813	1,613	1,657

Unfed Ponds

In addition to this study, ponds were stocked to determine more about production of catfish and buffalo on natural forage. Three ponds were each stocked with 300 8-inch channel catfish per acre and with 100 10-inch black buffalo per acre. As a control, three ponds were each stocked with 300 8-inch channel catfish per acre. After 284 days in these unfed ponds, catfish production in control ponds averaged 173 pounds per acre (Table 2). Average weight per fish was 0.7 pound. Percent survival was low, 88%.

Catfish production in the catfish-buffalo ponds was extremely low, only 76 pounds per acre. Average weight per catfish was 0.3 pound. Survival was 79%. Buffalo production equaled 191 pounds per acre, and fish averaged 2.0 pounds each. Survival was 93%. Total production in these three ponds averaged 267 pounds per acre.

1974 STUDIES

Fed Ponds

In the spring of 1974 (March 6, 1974) catfish-buffalo polyculture studies were continued. The first experiment involved two treatments and a control. Treatment number 1 consisted of three ponds each stocked at a rate per acre of 1,600 8.5-inch channel catfish and 100 bigmouth x black buffalo hybrids averaging 6.25 inches. Treatment 2 consisted of three ponds each stocked at a rate per acre of 1,600 8.5-inch channel catfish and 100 1.7-pound black buffalo. As a control, three ponds were each stocked at a rate of 1,600 8.5-inch channel catfish per acre. All catfish were graded before stocking and averaged 0.14 pound.

Table 2. Growth data for channel catfish polyculture studies with black buffalo in unfed ponds, Rockefeller Wildlife Refuge, 1973.

	Treatment			
Pond No.	B-33	B-34	B-35	Ave.
Catfish stocked/A.	300	300	300	300
Buffalo stocked/A.	100	100	100	100
Av. size catfish stocked (lbs.)	0.11	0.13	0.13	0.13
Catfish production (lbs./A.)	76	92	60	76
Av. size (lbs.)	0.3	0.3	0.3	0.3
% survival	87	90	60	79
% over 3/4 pound	4	4	0	3
Av. size buffalo stocked (lbs.)	0.6	0.6	0.6	0.6
Buffalo production (lbs./A.)	146	192	236	191
Av. size (lbs.)	1.8	1.9	2.4	2.0
% survival	80	100	100	93
Total fish lbs./A. in 284 days	222	284	296	267
	Control			
Pond No.	B-48	B-50	B-56	Ave.
Catfish stocked/A.	300	300	300	300
Buffalo stocked/A.	—	—	—	—
Av. size catfish stocked (lbs.)	0.15	0.13	0.18	0.15
Catfish production (lbs./A.)	119	186	214	173
Av. size (lbs.)	0.4	0.7	0.8	0.7
% survival	90	83	90	88
% over 3/4 pound	7	44	48	33
Av. size buffalo stocked (lbs.)	—	—	—	—
Buffalo production (lbs./A.)	—	—	—	—
Av. size (lbs.)	—	—	—	—
% survival	—	—	—	—
Total fish lbs./A. in 284 days	119	186	214	173

Fingerling catfish were fed a 30% protein sinking ration at 3% body weight daily, 7 days a week. Ponds were seined bi-monthly and the feeding rates adjusted according to growth of catfish.

After 197 feeding days, ponds were harvested (Table 3). Results showed that catfish production was practically the same in ponds stocked with catfish only as in ponds stocked with catfish and buffalo. Catfish production varied little between the ponds. An average of 2,180 pounds of catfish per acre was harvested from the ponds containing hybrid buffalo. The fish averaged 1.4 pounds. Control ponds were second with 2,083 pounds of catfish per acre, and an average of 2,073 pounds per acre of catfish were recovered from ponds stocked with black buffalo and catfish. Catfish averaged 1.3 pounds in these two treatments. Survival of catfish was excellent in all ponds, ranging from 96% for those with black buffalo to 97% for catfish in the other two treatments. An average of 85% of the catfish grown with hybrid buffalo exceeded one pound, whereas, 87% of the catfish in each of the other two treatments exceeded this. In other words, addition of buffalo did not seriously alter catfish growth.

Buffalo production was very good. Hybrids stocked at 0.2 pound a piece produced an average of 220 pounds of fish per acre; fish averaged 2.4 pounds. Production of hybrids which had been stocked as fingerlings approached that of black buffalo, yielding 300 pounds per acre; fish averaged 3.5 pounds. Hybrid buffalo survival was 93% and black buffalo survival was 87%.

Treatment 1, consisting of hybrid buffalo and catfish, yielded an average total fish production of 2,400 pounds per acre. The ponds with the black buffalo-catfish combination (Treatment 2) recorded an average of 27 pounds less, 2,373 pounds per acre.

The food conversion factors ranged from 1.8 for the catfish in the hybrid combination to 1.9 in the black buffalo ponds. The controls experienced a 2.1 S-factor. Factors determined considering total fish production ranged from 1.6 for hybrid buffalo-catfish combinations to 1.8 for black buffalo-catfish.

Table 3. Growth data for channel catfish polyculture studies with bigmouth x black hybrid and black buffalo, Rockefeller Wildlife Refuge, 1974.

	Treatement 1			
Pond No.	B-50	B-45	B-44	Ave.
Channel catfish stocked/A.	1,600	1,600	1,600	1,600
Hybrid buffalo stocked/A.	100	100	100	100
Black buffalo stocked/A.	—	—	—	—
Av. size catfish stocked (lbs.)	0.14	0.13	0.15	0.14
Catfish production (lbs./A.)	2,300	2,120	2,120	2,180
Av. size (lbs.)	1.5	1.3	1.4	1.4
% survival	96	100	96	97
% over one pound	96	88	72	85
Av. size buffalo stocked (lbs.)	0.1	0.2	0.2	0.2
Buffalo production (lbs./A.)	260	190	210	220
Av. size (lbs.)	2.9	2.1	2.1	2.4
% survival	90	90	100	93
S-factor (catfish)	1.7	1.8	1.9	1.8
S-factor (catfish-buffalo)	1.5	1.6	1.7	1.6
Total fish lbs./A. in 197 feeding days	2,560	2,310	2,330	2,400
	Treatment 2			
Pond No.	B-14	B-46	B-55	Ave.
Channel catfish stocked/A.	1,600	1,600	1,600	1,600
Hybrid buffalo stocked/A.	—	—	—	—
Black buffalo stocked/A.	100	100	100	100
Av. size catfish stocked (lbs.)	0.14	0.14	0.14	0.14
Catfish production (lbs./A.)	1,870	2,040	2,310	2,073
Av. size (lbs.)	1.2	1.3	1.5	1.3
% survival	96	95	97	96
% over one pound	76	84	100	87
Av. size buffalo stocked (lbs.)	1.7	1.7	1.6	1.7
Buffalo production (lbs./A.)	350	330	220	300
Av. size (lbs.)	3.5	4.1	2.8	3.5
% survival	100	80	80	87
S-factor (catfish)	1.9	2.0	1.9	1.9
S-factor (catfish-buffalo)	1.7	1.8	1.8	1.8
Total fish lbs./A. in 197 feeding days	2,220	2,370	2,530	2,373
	Control			
Pond No.	B-21	B-42	B-54	Ave.
Channel catfish stocked/A.	1,600	1,600	1,600	1,600
Hybrid buffalo stocked/A.	—	—	—	—
Black buffalo stocked/A.	—	—	—	—
Av. size catfish stocked (lbs.)	0.14	0.14	0.14	0.14
Catfish production (lbs./A.)	2,040	1,910	2,300	2,083
Av. size (lbs.)	1.3	1.2	1.5	1.3
% survival	99	96	96	97
% over one pound	88	76	96	87
Av. size buffalo stocked (lbs.)	—	—	—	—
Buffalo production (lbs./A.)	—	—	—	—
Av. size (lbs.)	—	—	—	—
% survival	—	—	—	—
S-factor (catfish)	2.0	2.3	2.0	2.1
S-factor (catfish-buffalo)	—	—	—	—
Total fish lbs./A. in 197 feeding days	2,040	1,910	2,300	2,083

Table 4. Growth data for catfish polyculture studies with bigmouth, black and bigmouth x black hybrid buffalo in unfed ponds, Rockefeller Wildlife Refuge, 1974.

	Treatment 1	*Treatment 2*
Pond No.	B-15	B-34
Channel catfish stocked/A.	150	150
Black buffalo stocked/A.	—	100
Bigmouth buffalo stocked/A.	—	—
Hybrid buffalo stocked/A.	—	—
Av. size catfish stocked (lbs.)	0.15	0.19
Catfish production (lbs./A.)	160	63
Av. size (lbs.)	1.1	0.5
% survival	93	93
% over 3/4 pound	64	7
Av. size buffalo stocked (lbs.)	—	2.6
Buffalo production (lbs./A.)	—	260
Av. size (lbs.)	—	2.9
% survival	—	90
Total fish production (lbs./A.)	160	323

	Treatment 3		
Pond No.	B-27	B-35	Ave.
Channel catfish stocked/A	—	—	—
Black buffalo stocked/A.	—	—	—
Bigmouth buffalo stocked/A.	100	100	100
Hybrid buffalo stocked/A.	—	—	—
Av. size catfish stocked (lbs.)	—	—	—
Catfish production (lbs./A.)	—	—	—
Av. size (lbs.)	—	—	—
% survival	—	—	—
% over 3/4 pound	—	—	—
Av. size buffalo stocked (lbs.)	2.7	2.8	2.7
Buffalo production (lbs./A.)	350	320	335
Av. size (lbs.)	3.5	3.2	3.3
% survival	100	100	100
Total fish production (lbs./A.)	350	320	335

	Treatment 4		
Pond No.	B-20	B-48	Ave.
Channel catfish stocked/A.	—	—	—
Black buffalo stocked/A.	—	—	—
Bigmouth buffalo stocked/A.	—	—	—
Hybrid buffalo stocked/A.	100	100	100
Av. size catfish stocked (lbs.)	—	—	—
Catfish production (lbs./A.)	—	—	—
Av. size (lbs.)	—	—	—
% survival	—	—	—
% over 3/4 pound	—	—	—
Av. size buffalo stocked (lbs.)	0.15	0.15	0.15
Buffalo production (lbs./A.)	150	100	125
Av. size (lbs.)	1.9	1.2	1.6
% survival	80	80	80
Total fish production (lbs./A.)	150	100	125

Unfed Ponds

A second experiment was conducted in which ponds were stocked to determine fish production on natural forage. Lack of additional ponds and fish prohibited replicated stocking rates in some treatments; however, results were interesting and are included.

Treatment 1 consisted of an unfed pond stocked at a rate of 150 8.5-inch channel catfish per acre. Treatment 2 was a pond stocked with 150 8.5-inch channel catfish and with 100 2-year old black buffalo per acre. Treatment 3 consisted of two ponds each stocked with 100 2-year old bigmouth buffalo, and Treatment 4 was two ponds each stocked with 100 6.25-inch bigmouth x black buffalo hybrids. The ponds were harvested at the same time as the fed polyculture ponds. At this time, the catfish had been in the ponds for 223 days, the hybrid buffalo for 208 days, and the 2-year black and bigmouth buffalo for 226 days.

The channel catfish only pond (Treatment 1) yielded a harvest of 160 pounds of fish per acre, averaging 1.1 pound (Table 4). Sixty-four percent of these fish were 3/4 pound or better. Catfish survival was 93%.

When data from Treatment 2 were analyzed it was obvious that addition of buffalo lowered catfish production. The buffalo which were in competition with catfish for natural food only gained 0.3 of a pound for a production of 260 pounds. Catfish production in this treatment was 63 pounds per acre, and only 7% were of a harvestable size.

Production in the buffalo only ponds (Treatment 3 and 4) was almost identical to that in both fed and unfed polyculture ponds previously described. Bigmouth buffalo only averaged 5 pounds per acre more (335 pounds per acre) in the unfed monoculture pond than black buffalo in the fed polyculture ponds. Fed hybrid fingerlings seemed to benefit from combined stocking (220 pounds per acre). Though survival was 80 percent, production in the unfed monoculture ponds averaged 125 pounds per acre.

DISCUSSION

Indications are that buffalo do not compete seriously with catfish when stocked at low rates and fed. Experiments in 1973 actually resulted in an average of 245 pounds more catfish production per acre in polyculture ponds than in ponds containing only catfish. Bigmouth buffalo stocked at 100 per acre increased total pond yields 148 pounds per acre. When the study was repeated in 1974, catfish stocked with hybrid buffalo yielded 97 pounds per acre more than catfish only ponds and hybrid production averaged 220 pounds per acre. Catfish stocked with 2-year old black buffalo gave slightly less production than catfish in the control ponds (10 pounds per acre less). However, these buffalo grew from an average of 1.7 pounds to 3.5 pounds yielding a total production of 300 pounds per acre in 197 feeding days.

Addition of buffalo to catfish ponds did not increase food conversion factors significantly. In 1973, the bigmouth buffalo and catfish treatment had S-factors of 1.7 versus 1.6 for the catfish in the control ponds. Polyculture treatments in 1974 had slightly lower S-factors than the control ponds.

Financial benefits from buffalo-catfish multiple stocking look promising, especially when a demand for both fish is present. If buffalo raised in the 1973 study had been marketed for $.30 a pound, approximately $45.00 more per acre would have been realized. Also, as mentioned earlier, catfish production seemed to have been stimulated by about 245 pounds. In the 1974 study, the gross income would have increased $66.00 per acre for the hybrid and $90.00 per acre for the bigmouth buffalo.

Results of these brackish water tests agree with and support data by Hastings and Simco (1973). When bigmouth x black hybrids were stocked at 200 per acre with 2,000 catfish, total production was increased 308 pounds in 182 days. They later reported that stocking 200 hybrids with 1,600 catfish increased total production by 648 pounds per acre in fed ponds (Hastings, 1974). The size of the buffalo stocked was not included in their report, but it is assumed that they were 2-year-old fish as were the catfish. Data also show that buffalo, like other pond fish, grow in proportion to stocking density.

CONCLUSIONS

1. Feeding is beneficial; without it, buffalo compete with catfish for natural foods.
2. In fed catfish-buffalo ponds, a harvest may be obtained in one to one and one-half years, depending upon the popular market size of buffalo and size stocked.
3. Buffalo when stocked at 100 per acre with 1,600 to 2,000 catfish do not compete to any extent for supplemental feed.
4. Stocking buffalo will supplement incomes where the demand for this fish is high.

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