PRODUCTION OF HYBRID (BLUE × CHANNEL) CATFISH AND CHANNEL CATFISH IN PONDS

by

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ABSTRACT

Hybrid (blue *Ictalurus furcatus* ♂ × channel *I. punctatus* ♀) channel catfish were grown separately at 3000/acre in 0.1-acre ponds for a growth period of 220 days. The average net yield was 3,752 pounds/acre for the hybrid catfish and 3,262 pounds/acre for the channel catfish. This difference was significant ($P<0.01$) with the hybrid catfish averaging 13.5 percent more pounds/acre than the channel catfish. When the two fish were compared in other commercially important aspects, the hybrid catfish was captured more easily by seining, more uniform in size, and had greater dress-out percentage. The channel catfish was slightly lower in fat and moisture percentage. No significant difference ($P<0.05$) was noted between the two catfishes in survival or protein percentage.

INTRODUCTION

The potentials of fish hybrids for increased growth rate, reduced reproduction, and filling unused niches have been recognized (Ricker 1948, Giudice 1965, Childers 1967, and Avault and Shell 1968). In these studies and others hybrid fish were found to display characteristics intermediate between those of the parent species.

Hybridization within the family Ictaluridae in nature has been reported by O'Donnell (1935) and Trautman (1957). Methods for the artificial crossbreeding of many members of this family have been established (Dupree, Green and Sneed 1966). Their report details how 25 different hybrid crosses were made among 7 species of the genera *Ictalurus* and *Pylodictus*.

Giudice (1966) reported on a hybrid (blue *Ictalurus furcatus* ♂ × channel *I. punctatus* ♀) catfish stocked at the rate of 500/acre with the same number of fingerlings of each parent species. During the first year the hybrid catfish grew 11 percent more than the channel catfish and 32 percent more than the blue catfish. In the second year when the fish were stocked at 75/acre each, the hybrid catfish grew 41 percent more than the channel catfish and 32 percent more than the blue catfish. The hybrid catfish were more uniform in size with a coefficient of variation of 17 percent compared to 22 percent for the channel catfish.

Dupree, Green and Sneed (1966) found in aquarium studies that a hybrid (white *I. catus* ♂ × channel ♀) catfish grew approximately 30 percent faster than either parent species.

The purpose of the present study was to evaluate the (blue ♂ × channel ♀) hybrid further by growing it separately at the stocking rate of 3000/acre and comparing its growth to that of channel catfish produced under similar conditions.

Aspects in which the hybrid catfish and channel catfish were compared include net yield, feed conversion, survival, ease of harvest by seining, uniformity of size, weight per unit length, dress-out percentage, chemical composition, and morphology.

MATERIALS AND METHODS

Experimental fish were naturally spawned in ponds in 1973 at the Southeastern Fish Cultural Laboratory, Marion, Alabama, by O. L. Green. The fish were size-graded and shipped to the Auburn University Fisheries Research Unit. At stocking, the hybrid catfish averaged 50.3 pounds/1000 in weight and 5.24 inches in length, while the channel catfish averaged 50.6 pounds/1000 in weight and 5.71 inches in length.

Seven, 0.1-acre earthen ponds were used. Three of these ponds were stocked at 3000/acre with hybrid catfish and 3 were stocked at 3000/acre with channel catfish. A single pond was stocked with a combination of hybrid catfish at 1000/acre and channel catfish at 1000/acre.

The fish were fed floating pellets which contained 35 percent protein. Initially the fish were fed 4 percent of their body weight 7 days per week in the late afternoon. Amounts of feed were recalculated weekly, assuming a 1.5 food conversion. Ponds stocked at 3000/acre received the same amount of feed. This was calculated by averaging the projected amounts of feed for each pond. The projected poundage of feed was corrected twice after seine samples were made in each pond. These samples

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were taken at 2 and 4 months. The ponds stocked at 3000/acre received 5080 pounds/acre/season of feed and the pond stocked at 2000/acre received 4670 pounds/acre/season.

Occasionally, feeding was discontinued because of low dissolved oxygen (DO). This usually occurred after a series of cloudy, calm days. On such occasions none of the ponds were fed.

A fertilization program was initiated in April to stimulate a phytoplankton bloom. Submergent weeds became a problem in ponds that did not develop adequate blooms. *Chara* sp. and *Najas* sp. were identified as the most abundant weeds. *Wolffia columbiana* (watermeal) became a problem in 4 of the ponds. This minute floating plant multiplied rapidly and on calm days completely covered the surfaces of the ponds. When this occurred, low DO resulted due to poor light penetration, and diminished photosynthesis. Grass carp (*Ctenopharyngodon idellus*) were used in an attempt to control the weeds and were stocked at 100/acre in all ponds. They were unable to control the watermeal, but eradicated the submergent plants.

The fish from each pond were placed in separate holding tanks after harvesting until they could be sorted into "inch groups", and weighed. While the fish were in the holding tanks, samples were taken to evaluate dress-out percentage and chemical compositon.

Five fish were selected at random from each replicate to evaluate dress-out percentage. The fish were weighed and cleaned. The dressed carcass was then weighed and the dress-out percentage was calculated by dividing this value by the total weight.

From the pond stocked with both hybrid and channel catfish, 4 of each group were selected at random. These fish were dressed with care to collect all processing wastes (skin, viscera, head, and fluids). The carcass and processing wastes from each fish were placed into separate plastic bags and frozen for later analysis.

The percent moisture was evaluated for each sample by placing approximately 30 grams of the fresh material into a tared container, weighing the sample and container, and drying the sample in an oven at 100°C. After the sample was dried it was again weighed, and the percent moisture was calculated. The percentage of protein was evaluated by the Kjeldahl method for determination of nitrogen, and percentage of fat (lipids) was determined by the ether extraction method as described by Lovell (1974).

RESULTS AND DISCUSSION

The net yield and feed conversion of the 6 replicates stocked at 3000/acre are summarized in Table 1. The hybrid catfish averaged 490 pounds/acre more gain. This is 13.5 percent higher than the channel catfish and was significantly different ($P<0.01$) when the two treatments were compared using a t-test. The coefficient of variation (CV) was 6 percent for the hybrid catfish and 4 percent for the channel catfish. Surprisingly, in the pond stocked with hybrid catfish at 1000/acre and channel catfish at 1000/acre, the net yields were almost identical for the two groups of fish. The feed conversion was 1.69:1 for this treatment which is considerably higher than the other treatments. Though no conclusion can be drawn from this unreplicated treatment, the higher feed conversion raises the possibility that overfeeding might diminish the advantage of the hybrid catfish.

Table 1. Net Yield and Feed Conversion of Hybrid Catfish and Channel Catfish Stocked at 3000/Acre in 0.1-Acre Earthen Ponds

E-pond	*Stocked (lb/acre)*	*Harvested (lb/acre)*	*Gain (lb/acre)*	*Feed conversion*
		Hybrid		
37	160	3830	3670	1.38:1
39	144	3799	3655	1.39:1
45	149	4080	3931	1.29:1
Average	151	3903	3752	1.35:1
		Channel		
38	147	3343	3196	1.59:1
40	150	3673	3523	1.44:1
46	158	3224	3066	1.66:1
Average	152	3413	3262	1.56:1

Sample and harvest averages were used to establish rate of growth. Figure 1 compares growth of the hybrid catfish and channel catfish stocked at 3000/acre.

There was no significant difference $P<0.05$ in survival between the hybrid catfish and channel catfish with both treatments having approximately 99 percent survival. The majority of the mortality occurred during the week following each sampling.

While fish were being sampled, it was noted that the hybrid catfish were easier to capture by seine than the channel catfish. After the ponds had been lowered at harvest to approximately ½ the original depth, approximately ¾ of the hybrid catfish were captured in 1 seine haul while at least 2 hauls were required to capture an equal number of channel catfish.

After the fish were harvested, each was inch-grouped and placed with the other fish of the same size. The fish in each inch group were weighed together and counted. When the number in each inch group was divided by the number of fish per treatment, the hybrid catfish was found to be more uniform in size. When considering the 3 major inch groups (14, 15, and 16 inches), 87 percent of the hybrid catfish were included, compared to 76 percent of the channel catfish.

The weight per unit length was obtained for each treatment by dividing the total number in each inch group by the total weight of the inch group. The deep-bodied conformation of the hybrid was evident when the two fish were visually compared. The hybrid catfish averaged 0.2 pounds heavier per inch group. The means for hybrid catfish were 15.12 inches and 1.30 pounds, and for channel catfish were 15.17 inches and 1.15 pounds.

The average dress-out percentage for the hybrid catfish was 64.5, while the channel catfish averaged 61.2. Statistical tests indicate this difference was highly significant ($P<0.01$) with a CV of 8 percent for the hybrid catfish and 11 percent for the channel catfish.

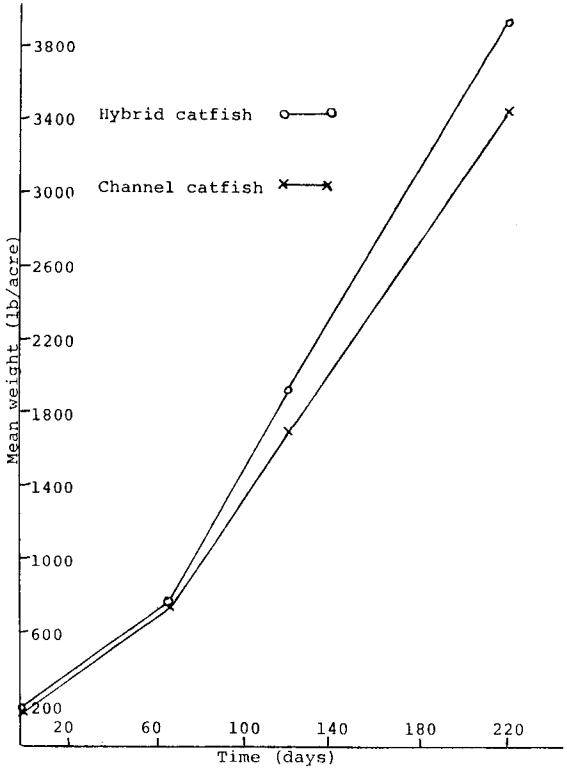

Figure 1. Growth of hybrid catfish and channel catfish stocked at 3000/acre, in 0.1-acre earthen ponds for 220 days.

Table 2. Average Chemical Composition (Whole Body, Dressed Carcass, and Processing Waste) of Hybrid Catfish and Channel Catfish Fed Intensively for 220 Days in a 0.1-Acre Pond

Evaluation	*Component*	*Hybrid*	*Channel*	*Statistical Test**
Whole body	Moisture	64.8	67.8	Sign. (P<0.01)
	Fat	14.8	12.3	Sign. (P<0.01)
	Protein	15.8	15.8	N.S. (P<0.10)
Dressed carcass	Moisture	66.8	69.0	Sign. (P<0.01)
	Fat	13.5	12.6	Sign. (P<0.10)
	Protein	16.6	16.1	N.S. (P<0.10)
Processing waste	Moisture	61.0	65.8	Sign. (P<0.01)
	Fat	17.0	12.4	Sign. (P<0.01)
	Protein	14.6	15.4	Sign. (P<0.10)

*t-Test

The hybrid catfish, when evaluated for chemical composition of the whole body, dressed carcass, and processing waste, tended to be lower in moisture and higher in fat than that of the channel catfish (Table 2). There was little difference in the average protein percentages. The channel catfish in this project were lower in moisture and higher in fat than the range given by Lovell and Ammerman (1974), however, the percent of protein was comparable. This again indicates the possibility that the fish in this pond were overfed, or perhaps overfed in energy in proportion to dietary protein.

An organoleptic evaluation was done in an attempt to determine if a difference in tastes could be determined, but none could be detected between hybrid and channel catfish.

The morphological differences between the hybrid catfish and the channel catfish were consistent with the findings of Giudice (1966). When stocked the hybrid catfish had fewer (1 or 2) and larger spots than the channel catfish. The body conformation of the hybrid catfish was intermediate between the parent species. The characteristic dorsal "hump" at the insertion of the dorsal fin of the blue catfish was present but not as pronounced. The number of anal fin rays ranged from 28 to 31. This is also intermediate between the parent species. The standard anal ray count for the blue catfish is 30 to 36, and for the channel catfish it is 24 to 29.

During sampling and when the fish were harvested, many additional small spots were apparent on the hybrid catfish. It was also noted at this time that the dorsal surface of the hybrid catfish had slight bluish coloration compared to the brownish appearance of the dorsal surface of the channel catfish. The hybrid catfish seemed to have sharper spines than the channel catfish, and injured each other more frequently when the fish were being sampled.

At harvest, the fish were easy to separate on the basis of the "hump", color, and deep-bodied conformation. The most positively identifiable characteristics involved the two long lateral barbels and the two medial chin barbels. The lateral barbels of the hybrid catfish were shorter in length and smaller in diameter at the base than those of the channel catfish of similar size. The two medial chin barbels were white in the hybrid catfish and black in the channel catfish.

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FOOD HABITS OF HYBRID BUFFALOFISH, TILAPIA, ISRAELI CARP AND CHANNEL CATFISH IN POLYCULTURE

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ABSTRACT

Channel catfish were cultured alone, and in combination with *Tilapia aurea*, Israeli carp, and hybrid buffalofish in 0.1-acre earthen ponds. Studies were conducted on the stomach contents of these species in May, July, and October. During the study the stomachs of 243 channel catfish, 17 adult hybrid buffalofish, 85 fingerling hybrid buffalofish, 157 tilapia, and 7 Israeli carp were examined. Supplemental feed comprised 87% of the channel catfish diet, 58% in the tilapia, 42% in the adult hybrid buffalofish, 56% in the hybrid buffalofish fingerlings, and 87% in the Israeli carp. Net yields of channel catfish were reduced with the polyculture combinations used.

INTRODUCTION

Most commercial fish production in the United States has been devoted to monoculture. Recently, however, fish culturists have become interested in polyculture of hybrid buffalofish *(Ictiobus cyprinellus* x *I. niger), Tilapia* spp., and Israeli strain of common carp *(Cyprinus carpio)* as accessory species with channel catfish *(Ictalurus punctatus).* The goal of such polyculture is more efficient utilization of the food niches within the pond ecosystem. No research has been conducted to determine if there is competition among the channel catfish, hybrid buffalofish, *Tilapia aurea* and the Israeli carp.

The purpose of this study was to determine (1) competition for supplemental feed added to the ponds, and (2) utilization of natural fish food organisms.

MATERIALS AND METHODS

Twenty-two, 0.1-acre earthen ponds averaging three feet deep were used for this study during the months of March through October, 1974. These ponds are part of the R-series of the Fisheries Research Unit of the Auburn University Agricultural Experiment Station, Auburn, Alabama.

Treatments

Channel catfish and *Tilapia aurea* were obtained from holding ponds and tanks on the Auburn Station. Adult and fry of hybrid buffalofish and Israeli carp were obtained from the Fish Farming Experimental Station, Bureau of Sport Fisheries and Wildlife, Stuttgart, Arkansas. Data indicating stocking combinations, rates per pond, and dates are shown in Table 1.

Auburn No. 4 catfish feed (sinking pellets, 36% protein) was fed to channel catfish only six days per week from March 30 to September 9. Fish were fed seven days per week from September 10 to October 16. Amount of feed fed was based on 3-5% of the estimated weight of the catfish, with maximum daily allowance of 35 pounds per acre. All ponds received equal amounts of feed.

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