GROWTH OF FOUR STRAINS OF CHANNEL CATFISH IN COMMUNAL PONDS

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Abstract: Growth studies of channel catfish (*Icatalurus punctatus*) from 2 domestic and 2 wild strains were conducted in ponds. Growth rate, percent survival and size variability were evaluated. Domestic strains had higher growth rates than wild strains. There were no significant differences among strains for survival. Initial variations at stocking in length and weight among strains (as a function of time of spawning) were reduced during the growing season.

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The commercial culture of channel catfish is well established in the southeastern United States. Most domestic stocks have undergone some crude mass selection and selection under domestic conditions, but they have been subjected to various levels of inbreeding. In addition, many of these stocks have been isolated for several generations, and genetically divergent strains may have developed.

Both wild and domestic stocks are available to the commercial producer, but information on the performance of various strains under aquacultural conditions is virtually nonexistent. Preliminary information suggests that domestic strains outperform wild ones (Smitherman et al. 1974, Burnside et al. 1975, Green et al. 1976); however, wild strains may possess certain traits that would be advantageous to the producer and they could serve as a source of genetic variability. Although channel catfish have been cultured for a relatively short period of time, inbreeding depression may have occurred in many domestic stocks (Guidice 1969).

The purpose of this study was to evaluate the performance of 2 domestic and 2 wild strains of channel catfish raised in communal ponds with respect to growth, survival and variability. This research was supported, in part, by the Texas Agricultural Experiment Station under project H-2831.

METHODS

Channel catfish broodstock from 2 domestic and 2 wild strains were maintained at the Aquaculture Research Center of Texas Agricultural Experiment Station. Wild broodfish were obtained from Falcon Reservoir (Rio Grande drainage) in Texas, and from the St. Louis River, Minnesota. Domestic broodfish were obtained from the U.S. Fish and Wildlife Service at Uvalde Texas, and from Auburn University, Alabama.

Broodfish were paired and placed into pens or allowed to spawn freely in ponds; one for each strain. Spawning containers were supplied in each case. The containers were examined at least twice weekly and eggs removed to an indoor hatchery.

After hatching, sac fry were transferred to a 500 l aluminum rearing trough and maintained until they had been on feed (commercial trout starter) for 1 week. A total of 3,000 randomly selected fry from each strain was stocked into 0.05-ha fry rearing ponds. Approximately 1,000 fry from each of 3 spawns were used for each strain, except for the Minnesota strain where 1,500 fry from each of 2 spawns were used. Fish from each strain were reared separately in the fry ponds until they were large enough for marking and stocking into grow-out ponds.

Growth comparisons among strains were made by rearing randomly selected fingerlings from the 4 strains in communal ponds. One hundred fingerlings from each strain were marked and stocked together in triplicate, 0.1-ha ponds. Pelvic fin and dorsal spine clips were used as marks. The Auburn, Uvalde and Minnesota strains were stocked in October and the Rio Grande strain in December 1976. Late stocking of the Rio Grande strain was necessitated when a parasite epizootic occurred in those fish. The sizes of each group of fish on the October evaluation date were utilized for subsequent analyses, even though the Rio Grande fish were actually added to the communal ponds at a later date. Prior to stocking in the communal ponds, the Rio Grande fish were treated for the parasite epizootic and were fed at the same rate as the other groups of fish.

Fish were fed a complete floating ration (36% protein) at up to 4% of total body weight/day as temperature and water quality permitted. A high feeding rate was used to minimize competition among strains.

All ponds were drained and sampled after 225 days (early June 1977). Recovered fish were sorted, counted, remarked, weighed in lots of 50 and restocked. On day 300 (late Aug. 1977), all ponds were harvested. Condition factors (K_{TL}) were calculated according to Carlander (1969).

Analysis of varience was used to determine if significant variation occurred among strains and ponds for initial lengths and weights, 225-day weights, final (300 day) lengths and weights, percent survival, condition factors and instantaneous growth rates (G) using the formula of Ricker (1975). Arcsine transformations were used on all percentage data. Pond-strain interactions were also analyzed. Duncan's New Multiple Range test was used to distinquish means if significant variation occurred. The statistical analysis system, SAS-76 (Barr et al. 1976), GLM procedure was used for all statistical analyses. Significance was expressed at the 0.05 level.

RESULTS

Significant differences among strains occurred for initial, 225 day and final weights; initial and final lengths; and initial and final condition factors (Table 1). The Uvalde strain had the highest final weight and length followed by the Auburn, Minnesota and Rio Grande strains, respectively. The Uvalde strain also had the highest initial and final condition factors. There were no significant differences among strains with respect to percent survival. The Uvalde domestic strain was significantly heavier than any of the other strains at day 300, followed by the Minnesota, Auburn and Rio Grande strains, respectively (Table 1). Thus, while the fish which were initially the largest and smallest remained in those positions upon termination of the study, the Minnesota strain, which was significantly heavier than the Auburn strain on stocking, was significantly less heavy after 200 days in the

Table 1. Means for weight, length, condition factors (K_{TL}), percent survival, and dress-out percent for 4 stains of channel catfish raised in 3 communal ponds.

	Weight (g)					Length (mm)				K_{TL}		
Strain	mean initial	day 225	mean final	C.V. initial	C.V. final	mean initial	mean final	C.V. initial	C.V. final	initial	final	Survival (%)
Auburn	36.9 C[a]	243.7 B	465.5 B	52.0	38.4	166.2 B	354.2 B	16.6	12.3	0.73 C	1.01 B	94 A
Uvalde	52.8 A	399.2 A	696.2 A	53.5	29.2	181.6 A	389.9 A	17.8	9.9	0.81 A	1.15 A	89 A
Minnesota	45.3 B	239.0 B	429.1 C	33.2	24.0	183.9 A	357.7 B	11.3	9.0	0.70 D	0.94 C	90 A
Rio Grande	22.1 D	137.3 C	294.0 D	29.5	34.0	140.0 C	297.2 C	9.5	10.5	0.78 B	1.11 A	93 A

[a] Means with the same letter are not significantly different ($\alpha = 0.05$)

communal ponds. There were no significant pond-strain interactions for any of the parameters evaluated.

Mean instantaneous growth rates (G) for the 4 strains of channel catfish raised in communal ponds are presented in Table 2. During the 1st 225 day period, the Uvalde strain had the highest G followed by the Auburn, Rio Grande and Minnesota strains, respectively. During the last 75 days of the study, the Rio Grande strain had the highest G followed by the Auburn, Uvalde and Minnesota strains. For the entire 300 day period only the Minnesota strain had a significantly lower G than the other 3 strains.

Survival in the 3 ponds averaged 91.5%. Mean standing crop at harvest was 1,710 kg/ha.

Table 2. Mean instantaneous growth rates (G) for 4 strains of channel catfish raised in communal ponds.

	$G \times 10^3$		
Strains	1 - 225	225 - 300	1 - 300
Auburn	7.90 AB[a]	10.13 AB	8.44 A
Uvalde	8.55 A	9.03B	8.59 A
Minnesota	7.05 C	8.41 B	7.50 B
Rio Grande	7.58 BC	11.85 A	8.62 A

[a] Means with the same letter are not significantly different ($\alpha = 0.05$).

DISCUSSION

Growth is affected by environmental conditions, and while it may be subject to inbreeding depression, it may also demonstrate heterosis. In comparing genetic stocks, interpretation of growth data under various conditions may be a complex problem. Genotype-environment interactions may occur. Thus the performance of different genetic stocks may change with culture conditions (Wohlfarth and Lahman 1964, Gall 1969, Moav et al. 1975).

In comparing growth of various strains of channel catfish in communal ponds, instantaneous growth rates (G) were used in an attempt to adjust means for differences in initial weights. G are not constant throughout the life of the fish; beyond a certain weight, G tend to decrease. Thus, comparisons of G for fish of different sizes could be biased in faver of the smaller fish.

Growth studies in ponds generally require large numbers of replicates because of pond variations. Communal ponds have been used by several investigators to compare fish from different genetic stocks, however, there are some problems with this method. In particular, intial weights have large influence on final weight (Wohlfarth et al. 1965). Moav and Wohlfarth (1966) used a regression model to correct for differences in initial weight. In the same study, the authors demonstrated that growth in communal ponds was correlated with growth in separate ponds; progeny that grew faster in communal ponds also grew faster in separate ponds. Moav and Wohlfarth (1974) found a magnification of genetic differences between stocks reared in communal ponds.

In comparing the 4 strains of channel catfish in communal ponds, the G for the 300 day period showed only the Minnesota strain to be significantly lower than the other 3 strains (Table 2). The Uvalde strain had the highest G during the 1st 225

days of the study; however, the Auburn and Rio Grande strains had achieved the same level by day 300. During the last 75 days of the study, the Uvalde strain may have reached or exceeded the weight where G inately decreased. If that occurred, comparison of G between the Uvalde and other strains for the 300 day period may be biased in favor of the smaller strains.

Several investigators have evaluated the growth of wild and domestic strains of salmonids under various conditions (Rawston 1973, Ayles 1975, Reinitz et al. 1978). In most cases wild strains had superior growth under wild conditions and domestic strains had superior growth under culture conditions. However, highly selected domestic strains generally outgrew all other strains. Smitherman et al. (1974) reported significant differences among several domestic and wild strains of channel catfish under 3 different conditions. In every case a domestic strain outgrew all others. Burnside et al. (1975) reported that domestic strains of channel catfish outgrew wild strains in ponds. In the present study, domestic strains appeared to be superior in growth to wild strains.

Another important trait is survival. Several investigators have found differences in survival among wild and domestic strains of salmonids (Flick and Webster 1964, Rawstron 1972, Ayles 1975, Reinsenbichler and MacIntyre 1977). Survival is a trait affected by inbreeding (Moav and Wohlfarth 1966; Kincaid 1976*a*, 1976*b*) but there were no significant differences in survival among strains in the present study.

Initial coefficients of variation for length and weight of domestic catfish strains were somewhat higher than for wild strains (Table 1) Coefficients of variation for final lengths and weights were lower, reducing the impact of initial differences. High initial variation might be expected to lead to higher final variation so larger fish would outcompete smaller ones. This did not occur in the present study where final coefficients of variation were lower than initial ones. Simialr results were reported by Konikoff and Lewis (1974) for channel catfish raised in cages. Apparently, smaller fish have a higher relative growth rate. Joyce (1973) found reduction in size variability in cages by feeding at 4% rather than 3% body weight/day. During the present study, fish were fed at approximately 4% of body weight/day in order to minimize competition for food. This high feeding rate apparently influenced final size variation.

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