Winter Growth of Bluegills and Bluegill x Green Sunfish Hybrids in Mississippi[1]

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Abstract: Winter growth of young-of-the-year bluegills (*Lepomis macrochirus*) and male bluegill × female green sunfish (*L. cyanellus*) hybrids was compared. After 112 days in ponds with a mean afternoon surface water temperature of 10.4° C, and under monospecies and bispecies culture conditions, the hybrids were significantly ($P < 0.01$) longer and heavier than the bluegills, outgrowing the bluegills by a ratio of approximately 2 : 1.

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The growing popularity of hybrid sunfish for stocking southeastern farm ponds (as evidenced by an increasing number of commercial producers) has led to a re-examination of the management potential of these fish. Numerous studies (Childers 1967; Childers and Bennett 1967; Heidinger and Lewis 1972; Ellison and Heidinger 1978) have pointed to the potential which several sunfish hybrids possess for pond management. Perhaps the most promising of these hybrids is the male bluegill (*Lepomis macrochirus*) × female green sunfish (*L. cyanellus*) (hereafter denoted as BG × GS). This hybrid possesses what may be the most desirable combination of characteristics, including rapid growth (Ellison and Heidinger 1978), high percentage of males (Childers 1967; Ellison and Heidinger 1978), ready acceptance of artificial feed (Lewis and Heidinger 1971), and high vulnerability to angling (Crandall and Durocher 1980). Though no documentation is available, it is probably the most commonly stocked hybrid in the Southeast.

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Another desirable attribute of the BG × GS hybrid is its propensity for growth during the winter months. Heidinger (1975) reported a 30% weight gain for young-of-the-year (YOY) BG × GS hybrids during the winter in southern Illinois ponds, and Brunson and Robinette (1982) reported a weight gain of 183% and an increase in length of 44% for YOY BG × GS during the winter in northeast Mississippi ponds.

The obective of this study was to compare the winter growth of YOY bluegill and YOY BG × GS hybrids under both monospecies and bispecies culture conditions in northeast Mississippi.

Methods

The study was conducted in 4 0.04 ha earthen ponds located at Mississippi State University. Two ponds (No. 7, No. 9) were each stocked with 50 bluegills and 50 hybrids, 1 pond (No. 10) was stocked with 100 bluegills, and 1 pond (No. 8) was stocked with 100 hybrids. Fish were individually weighed and fork lengths were measured at stocking (13 December 1982) and again when ponds were drained (4 April 1983). There were no significant ($P > 0.05$) differences in initial mean weight or fork length of fish among the ponds. Afternoon surface water temperatures during the 112-day study period averaged 10.4° C and ranged from 4.0° to 18.0° C.

An Ekman dredge was used to take 5 replicate benthic samples from each pond on the date of stocking. Samples were preserved in 10% buffered formalin and transported to the laboratory where organisms were identified and counted.

Student's *t*-test was used to test for differences in initial and final lengths and weights between treatment fish, and one-way ANOV was used to test for differences in mean density of benthic organisms among treatment ponds.

Results and Discussion

Fish in ponds 10 and 8 were cultured under monospecific conditions only. After 112 days the hybrids were significantly ($P < 0.01$) longer and heavier than the bluegills (Table 1). The hybrids exhibited a 60% increase in mean length, whereas the bluegills increased in mean length only 35%. Hybrids increased 431% in mean weight as compared to an increase of 177% for bluegills. Both ponds contained the same fauna of benthic organisms, and mean densities of natural food organisms were not significantly ($P > 0.05$) different (Table 2). Thus, the higher growth rate of the BG × GS hybrids may be attributed to a more efficient utilization of the available natural food than that exhibited by the bluegills. This increased efficiency may have been in the form of better feed conversion, or perhaps simply greater food consumption by the hybrids. Whichever the case, it is clear that the hybrids made the more effective use of the available food supply.

Table 1. Mean initial and final fork lengths (fork) and weights of bluegills and BG × GS hybrids wintering under monospecies conditions.

Pond	Species	Initial length (mm)	Final length (mm)	% Change	Initial weight (g)	Final weight (g)	% Change	% Survival
8	Hybrid	56.12A[a] (0.04)[b]	90.03A (0.19)	60.2	3.56A (0.01)	18.90A (0.15)	431	81
10	Bluegill	57.48A (0.02)	77.85B (0.11)	35.4	3.84A (0.01)	10.60B (0.05)	177	74

[a] Means within any column not followed by the same letter are significantly ($P < 0.05$) different.
[b] SE of the means are in parentheses.

At harvest hybrids in ponds 7 and 9, which were used for the bispecies combination stocking experiment, were significantly ($P < 0.01$) longer and heavier than bluegills (Table 3). The hybrids increased in mean length 52% and in mean weight 332%, whereas the bluegills increased in mean length 24% and in mean weight 129% during the study period. Since there was no significant ($P > 0.05$) difference in mean density of benthic food organisms among ponds, and food organisms were presumably equally available to both species within a given pond, the superior growth of the hybrids can again be attributed to a more efficient utilization of the natural food organisms. Under these conditions of bispecies culture, the mean growth of both groups of fish was reduced as compared to growth under monospecies culture conditions. This might indicate a competition interaction between the bluegill and hybrid, but an alternative explanation for this difference could be differential survival rates between fish in the 2 treatments (Table 1, 2). Survival of hybrids in the

Table 2. Mean density (number organisms/m^2) of benthic organisms in experimental sunfish ponds.[a]

Taxon	Pond 7	Pond 8	Pond 9	Pond 10
Chironomidae	148 (30)[b]	159 (50)	144 (28)	163 (23)
Oligochaetae	104 (17)	104 (8)	182 (69)	138 (35)
Sphaeridae	70 (18)	108 (28)	70 (36)	74 (48)

[a] Means represent mean of five replicate samples/pond. There was no significant ($P > 0.05$) difference in density of organisms among ponds in either total number of organisms/pond or number of organisms at each taxonomic level.
[b] SE of the means are in parentheses.

Table 3. Mean initial and final fork lengths and weights of bluegills and BG × GS hybrids wintering under bispecies culture conditions.

Pond	Species	Initial length (mm)	Final length (mm)	% Change	Initial weight (g)	Final weight (g)	% Change	% Survival
7	Bluegill	56.27A[a]	67.69A	20.3	3.80A	8.41A	121	98
		(0.03)[b]	(0.29)		(0.02)	(0.16)		
	Hybrid	57.20A	84.46B	47.7	3.87A	13.70B	254	100
		(0.06)	(0.30)		(0.02)	(0.17)		
9	Bluegill	56.07A	71.20A	27.0	3.79A	9.00A	137	90
		(0.05)	(0.17)		(0.01)	(0.06)		
	Hybrid	56.53A	87.92B	55.5	3.80A	19.33B	409	96
		(0.07)	(0.26)		(0.02)	(0.21)		

[a] Means within any column not followed by the same letter are significantly ($P < 0.05$) different.
[b] SE of the means are in parentheses.

monospecies culture pond was 81%, while hybrids in the bispecies culture ponds had a 98% survival rate. The same trend can be see with the bluegills, as survival was 74% in the monospecies culture, and 94% in the bispecies culture ponds. These reduced densities in the monospecies culture ponds may have resulted in accelerated growth for both hybrids and bluegills. However, in both types of culture conditions, the growth of hybrids in length and weight was significantly greater than growth of bluegills. Though the predominate view in the literature has been that the superior growth of the hybrid is largely due to the lower population densities which result from its low reproductive potential, these data suggest that the hybrid possesses a competitive advantage and exhibits a faster growth rate when existing under similar population densities with the same available food supply. Thus it appears that hybrid vigor exhibited by the BG × GS hybrids in actual farm pond situations is likely the combined result of reduced population densities and an inherently greater growth rate than could be realized with bluegills.

Growth of the hybrids was somewhat higher than that reported by Brunson and Robinette (1982) for the same hybrid during the winter of 1980–81. This difference probably resulted because the current study used fish of a smaller initial size (56.0 mm, 3.74 g) than the previous study (84.9 mm, 12.1 g), the current study lasted for 112 days as compared with 90 days for the previous study, and mean afternoon surface water temperatures were significantly ($P < 0.05$) higher during the current study (10.5° vs. 5.7° C).

BG × GS hybrids outgrew bluegills approximately 2 to 1 in percent increase in body length and weight in each instance in this study. Greater winter growth rate for YOY hybrids should result in a population of catchable size fish in a shorter period of time than can be achieved with bluegills, and might result in a larger ultimate size of individual hybrids as compared to individual bluegills of the same age class when existing under similar conditions.

Literature Cited

Brunson, M. W. and H. R. Robinette. 1982. Supplemental winter feeding of hybrid sunfish in Mississippi. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. Jacksonville, Fla. 36:155–159.

Childers, W. F. 1967. Hybridization of four species of sunfishes (*Centrarchidae*). Ill. Nat. Hist. Surv. Bul. 29(3):159–214.

——— and G. W. Bennett. 1967. Hook and line yield of largemouth bass and redear × green sunfish hybrids in a one-acre pond. Prog. Fish-Cult. 29(1): 27–35.

Crandall, P. S. and P. P. Durocher. 1980. Comparison of growth rates, sex ratios, reproductive success and catchability of three sunfish hybrids. Annu. Proc. Tex. Chap. Am. Fish. Soc. 2:88–104.

Ellison, D. G. and R. C. Heidinger. 1978. Dynamics of hybrid sunfish in southern Illinois farm ponds. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 30:82–87.

Heidinger, R. C. 1975. Growth of hybrid sunfishes and channel catfish at low temperatures. Trans. Am. Fish. Soc. 104(2):333–334.

——— and W. M. Lewis. 1972. Potentials of the redear sunfish × green sunfish hybrid in pond management. Prog. Fish-Cult. 34(2):107–109.

Lewis, W. M. and R. C. Heidinger. 1971. Supplemental feeding of hybrid sunfish populations. Trans. Am. Fish. Soc. 100(4):619–623.

——— and ———. 1978. Use of hybrid sunfishes in the management of small impoundments. *In* New approaches to the management of small impoundments. NCD-AFS Spec. Publ. 5.