Growth, Survival, and Reproduction by Bluegill x Green F_1 Hybrid Sunfish and Largemouth Bass Stocked in Three Small Lakes

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Fisheries Research Report No. 1858
March 22, 1978

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

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GROWTH, SURVIVAL, AND REPRODUCTION BY BLUEGILL × GREEN F_1 HYBRID SUNFISH AND LARGEMOUTH BASS STOCKED IN THREE SMALL LAKES [1]

By Percy W. Laarman

Abstract

Growth, survival, and reproduction were determined for male bluegill × female green sunfish F_1 hybrids and largemouth bass stocked in three small lakes closed to public fishing. After 4.5 years in the lakes, growth and survival rates were satisfactory for the hybrids. Reproduction by F_1 hybrids was extremely limited. Growth of largemouth bass was slower than the statewide average and survival of stocked bass was low. Reproduction of largemouth bass was evident, although survival of the progeny was low.

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[1] Contribution from Dingell-Johnson Project F-35-R, Michigan.

Introduction

Populations of over-abundant, slow-growing panfish are a problem to the fisheries manager. The prolific nature of some centrarchid fishes, especially the bluegill, Lepomis macrochirus Rafinesque, adds to the stunting problem. The ideal sunfish would possess characteristics of reduced fecundity and retain the growth potential of the bluegill. Childers and Bennett (1961) reported on growth, fecundity, and sex ratios of the following sunfish crosses and their reciprocals: male green sunfish, Lepomis cyanellus Rafinesque, × female redear sunfish, Lepomis microlophus (Günther); male green sunfish × female bluegill; male redear sunfish × female bluegill. Crosses between male green sunfish × female bluegill and the reciprocal and the male redear × female green sunfish, have shown promise of retaining desirable growth characteristics but have reduced fecundity (Lewis and Heidinger 1971). Laarman (1974) reported that reproduction was very limited when male bluegill × female green F_1 hybrid sunfish were stocked in ponds and three small reclaimed lakes.

Difficulties in maintaining balanced fish populations of largemouth bass, Micropterus salmoides (Lacépède), and bluegills in small bodies of water have led researchers to experiment with various hybrid sunfish. An excellent fishery was created in a 1-acre pond with the redear × green hybrid and largemouth bass (Childers and Bennett 1967).

The objective of this study was to determine growth, survival, and reproduction of male bluegill × female green F_1 hybrid sunfish in combination with largemouth bass, when stocked as fingerlings in three small lakes closed to public fishing. Hybrids used in this study were produced naturally in ponds at the Wolf Lake State Fish Hatchery under the supervision of James A. Copeland.

Procedures

In this paper, G refers to green sunfish, B to bluegill, and R to redear sunfish. The male fish is given first, thus the cross between

a male bluegill and a female green sunfish is designated as B × G, and the resultant cross is designated as F_1.

The lakes used for this study were: Ford Lake, Otsego County (T. 32 N., R. 1 W., Sec. 8); Sand Lake No. 2, Grand Traverse County (T. 27 N., R. 9 W., Secs. 23, 26); and Sand Lake No. 3, Grand Traverse County (T. 27 N., R. 1 W., Sec. 26). Physical and chemical characteristics of each lake are given in Table 1.

Public fishing was prohibited on the lakes during the study; however, it is known that a limited amount of fishing did occur on the Sand lakes. These two lakes are located in a designated "quiet" area where hiking and camping are permitted but motor vehicles are prohibited. Therefore, the ban on fishing was difficult to enforce.

In September 1972, the lakes were treated with 2 ppm rotenone (Pro-Noxfish) to remove existing fish populations. Largemouth bass fingerlings (mean length 75 mm) and B × G, F_1 fingerlings (mean length 25 mm) were stocked on 2 November 1972. Stocking rates were 1,200 hybrids and 120 largemouth bass per hectare.

Fish populations were sampled with trap nets and by angling in September 1973 for growth data. Population estimates (mark-and-recapture method) were determined from trap-net catches in May of 1975 and 1976, and in the Sand lakes only, in May of 1977. Sand Lake No. 2 and Ford Lake were treated with rotenone in June of 1977. All fish observed were picked up for 2 days after chemical treatment, and representative samples for length measurements and scales were taken. The scale samples provided information on the extent of reproduction as well as growth.

Results and discussion

Stocked hybrids grew rapidly in all three lakes (Table 2). The mean length of 20.3 cm (range 15.2-22.6 cm) in the three lakes at age V for hybrids was greater than the statewide mean length of 17.8 cm for age-V bluegills. Stocking largemouth bass with the hybrids did not suppress hybrid growth rates the first year in the lakes. Mean length of hybrids

1 year subsequent to stocking was 13.4 cm. The same hybrid cross, when stocked at identical densities, in the same lakes without largemouth bass averaged 12.4 cm after 1 year (Laarman 1974).

Trap nets were not effective for capturing largemouth bass so data on bass were collected when Ford Lake and Sand Lake No. 2 were treated with rotenone in 1977. One stocked bass, 42.7 cm long, was recovered from Sand Lake No. 2 and two stocked bass, 42.2 cm long, were found in Ford Lake. These three bass were growing rapidly. Other bass present as a result of natural reproduction were growing slightly slower than the statewide average. In Sand Lake No. 2 mean lengths were: age-group I--10.4 cm (20 bass), age-group II--20.3 cm (110 bass), and age-group III--25.4 cm (188 bass). In Ford Lake, 39 bass in age-group II averaged 18.0 cm and 78 bass in age-group III averaged 24.9 cm.

Population estimates of stocked hybrids are given in Table 3. Estimates of survival in 1975 after 2.5 years in Ford Lake, Sand Lake No. 2, and Sand Lake No. 3 were 19.4%, 6.1%, and 19.3%, respectively. In a previous experiment, survival rates after 2 years of B $\times$ G, F_1 hybrids, stocked as fingerlings without largemouth bass in Ford, Sand No. 2, and Sand No. 3 lakes were 33%, 15%, and 7.7%, respectively (Laarman 1974). In that study, the relatively low rate of survival of stocked hybrids in Sand Lake No. 3 was probably due to heavy contamination by bluegills. In the current study, no explanation is available for the comparatively low survival rate of 6.1% in Sand Lake No. 2. Survival of stocked hybrids was not significantly different when stocked alone or with largemouth bass.

Examination of scale samples showed that hybrids greater than 15.2 cm in length were stocked fish. In Ford Lake, 1,088 stocked hybrids were recovered after the rotenone treatment in 1977, so it is obvious that the population estimate of 702 hybrids in 1976 was low. Based on the number of hybrids recovered, survival rate was 20.5% after 4.5 years in Ford Lake. In Sand Lake No. 2, 299 hybrids from the original planting were recovered after treatment with rotenone. This is fewer hybrids than the point estimate of 425 made by trap netting, but the number recovered falls within the confidence limits determined for the population estimate from trap netting.

Survival of stocked largemouth bass was poor. After about 4.5 years, only two were recovered from Ford Lake and one from Sand Lake No. 2. Survival of stocked bass in Sand Lake No. 3 is not known since the lake was not treated with rotenone.

Data on reproduction of hybrids were obtained in Ford Lake and Sand Lake No. 2 from recovered fish after the rotenone treatment in June 1977. In Ford Lake, only 31 hybrids resulting from reproduction were recovered; 3 were age I and the remaining 28 belonged to age-group II. In Sand Lake No. 2, 487 F_2 hybrids were recovered. About 70% were age I and the remainder belonged to age-group II.

The very limited reproduction of B × G, F_1 hybrids agrees with other studies. Childers and Bennett (1961) reported no F_2's when B × G, F_1 adult hybrids were stocked in a pond containing no other fish. Lewis and Heidinger (1971) reported no F_2's when B × G, F_1 hybrids were stocked with largemouth bass. I found in the earlier study very little reproduction where, without largemouth bass, two lakes were stocked with B × G, F_1 hybrid fingerlings and six ponds were stocked with adult B × G, F_1 hybrids (Laarman 1974).

Largemouth bass did reproduce in Ford and Sand No. 2 lakes. A total of 119 bass were recovered from Ford Lake. Of the total, 39 were 2-year-olds, 78 were 3-year-olds, and 2 were from the original plant. In Sand Lake No. 2, 850 bass were recovered. Five hundred thirty-one were young-of-year, 20 were 1-year-olds, 110 were 2-year-olds, 188 were 3-year-olds, and 1 was a stocked bass.

Stocking largemouth bass fingerlings with B × G, F_1 hybrids would not have provided a sport fishery if the study lakes had been open to fishing. After 4.5 years of essentially no fishing, only 1.7% of the bass in Ford Lake and 0.1% of the bass in Sand Lake No. 2 exceeded the minimum legal size in Michigan of 30.5 cm. Growth rates of bass were not rapid even though density of the fish population was low. The very limited reproduction of hybrids and lack of other prey species of fish undoubtedly resulted in a paucity of food for bass.

Hybrid sunfish, other than the B × G, may possess reproductive characteristics better suited to stock with largemouth bass. Varying results

on reproduction of R × G, F_1 hybrids have been reported. Large numbers of F_2 hybrids were produced when R × G, F_1 hybrids were stocked in a small pond with no other fish (Childers and Bennett 1961). On the other hand, no recruitment of F_2's was evident in one pond containing only R × G, F_1 hybrids and in three ponds where largemouth bass and the hybrid were together (Heidinger and Lewis 1972). I found (Laarman 1977) that R × G, F_1 hybrids appear to have a greater reproductive potential than B × G, F_1 hybrids but less than the bluegills studied by Latta and Merna (1977) in the same ponds.

The greatest potential use of hybrid sunfish appears to be in ponds and small reclaimed lakes where limited reproduction of panfish is desired and manipulation of the fish population is feasible. A fishery could be developed through intensive management practices such as annual stocking of fingerling hybrids. Stocking rates of 1,200 per hectare resulted in good growth rates in the experimental lakes. The stocking rates could be adjusted depending on the growth rates in a particular body of water. Closing the lake to fishing for 2 years after the initial stocking would allow the fish to reach "catchable" size. A minimum size limit of 16 cm or higher would provide a desirable size fish for the angler. Since there is some indication that hybrid sunfish are very vulnerable to angling at certain times of the year, a creel limit might be necessary. Stocking hybrid sunfish in bodies of water where other panfish are present would serve no useful purpose, since the advantage of limited reproduction of hybrids would soon be lost.

Acknowledgments

J. R. Ryckman advised on statistical procedures and M. H. Patriarche reviewed the manuscript.

Table 1.--Physical and chemical characteristics of Ford Lake and Sand Lakes Nos. 2 and 3.

Lake	Size (ha)	Maximum depth (m)	Mean depth (m)	Surface alkalinity (ppm)
Ford	4.3	8.8	2.7	127
Sand No. 2	7.0	8.5	3.0	71
Sand No. 3	6.0	5.2	1.6	55

Table 2.--Growth of bluegill × green F_1 hybrid sunfish stocked as young-of-year on 2 November 1972.

Lake, and date of collection	Number of fish	Mean length (cm)
Ford		
September 1973	78	13.9
May 1975	404	17.5
May 1976	511	19.2
June 1977	40	20.0
Sand No. 2		
September 1973	346	12.6
May 1975	236	17.0
May 1976	291	19.3
June 1977	135	20.8
Sand No. 3		
September 1973	207	13.6
May 1975	750	16.5
May 1976	550	18.8
May 1977	215	20.0

Table 3.--Population estimates, with 95% confidence limits, of stocked bluegill × green hybrid sunfish.

Lake and year	Number stocked[a]	Population estimate	Percent survival
Ford	5,300		
1975		1,030 ± 354	19.4
1976		702 ± 84	13.2[b]
Sand No. 2	8,650		
1975		525 ± 345	6.1
1976		424 ± 99	4.9
1977		425 ± 292	4.9
Sand No. 3	7,450		
1975		1,441 ± 193	19.3
1976		917 ± 196	12.3
1977		435 ± 91	5.8

[a] Stocked as young-of-year in November 1972.

[b] Data from a 1977 rotenone treatment indicated survival actually exceeded 20%.

Literature cited

Childers, William F., and George W. Bennett. 1961. Hybridization between three species of sunfish (Lepomis). Ill. Nat. Hist. Surv. Biol. Notes No. 64, 15 pp.

Childers, William F., and George 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.

Heidinger, Roy C., and William M. Lewis. 1972. Potentials of the redear sunfish × green sunfish hybrid in pond management. Prog. Fish-Cult. 34(2): 107-109.

Laarman, Percy W. 1974. Growth, survival, and reproduction of bluegill × green sunfish hybrids. Mich. Dep. Nat. Resources, Fish. Research Rep. 1810, 10 pp.

Laarman, Percy W. 1977. Reproduction of redear × green hybrid sunfish in ponds. Mich. Dep. Nat. Resources, Dingell-Johnson Study Final Rep. F-35-R-3, Michigan, pp. 73-76.

Latta, W. C., and J. W. Merna. 1977. Some factors influencing size of the year class of bluegills (Lepomis macrochirus) in ponds. Mich. Academician, 9(4): 483-502.

Lewis, William M., and Roy Heidinger. 1971. Aquaculture potential of hybrid sunfish. Am. Fish Farmer and World Aquacult. News 2(5): 14-16.

Report approved by W. C. Latta

Typed by M. S. McClure