

THE EFFECT OF STOCKING ON THE MERISTIC COMPLEMENT OF THE NEOSHO SMALLMOUTH BASS

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ABSTRACT

Neosho smallmouth bass were collected from 1962-64 in tributaries of the Arkansas River in northwest Arkansas and southern Missouri. Counts were made of dorsal spines and soft-rays, anal spines and soft-rays, pectoral fin-rays and lateral-line scales. The data were compared with that for intergrade smallmouth from other drainages in Arkansas and with data given by Castro (1963) and Hubbs and Bailey (1940). Neosho smallmouth in this study had significantly higher mean counts than those reported in 1940. Each stream having higher counts had been stocked with the intergrade form of smallmouth from the White River in Arkansas.

INTRODUCTION

The introduction of alien fishes into water bodies in North America has been extensive since the turn of the century and is continuing at an intensive rate. Many of these stockings have produced profound effects upon the endemic fauna through predation, competition, hybridization and habitat alteration (Miller, 1961), and in some cases have been so successful that introduced species now form a significant percentage of the ichthyofauna in several states (Lachner, et. al., 1970). The majority of all fish transplantings, however, are evidenced only by discrete but subtle changes in the native fish community and for the most part go unnoticed. This study illustrates such a change and presents data which describes the alteration of the meristic complement of the Neosho smallmouth bass in Arkansas since 1940 when Hubbs and Bailey concluded their study of basses. The most plausible explanation for this change appears to be related to the stocking of an intergrade form from the White River drainage in Arkansas.

The current literature recognizes two subspecies of the smallmouth bass, the northern smallmouth *Micropterus dolomieu dolomieu* Lacepede, and the Neosho or southwestern smallmouth *Micropterus dolomieu velox* Hubbs and Bailey. The Neosho smallmouth is the most extreme variant from the northern smallmouth being characterized by a more terete, elongate body, a homogeneous greenish-brown to white dorso-ventral color pattern in the adult and lower mean values for certain meristic characters. It occurs in upland tributaries of the Arkansas River in Arkansas, Oklahoma, Missouri and presumably Kansas. Intergrades between the northern and southwestern forms, *Micropterus dolomieu: dolomieu X velox*, have been reported from the White, Red and Ouachita River drainages in Arkansas (Hubbs and Bailey, 1940). This form reportedly has a color pattern, body form and mean meristic character values intermediate in number to those of the northern and southwestern forms.

The Neosho smallmouth bass is a renowned and highly sought after game fish. As noted by Hubbs and Bailey (1940) in their description of the subspecies, a great deal has been written about this inhabitant of swift-flowing Ozark streams, mostly from the sportsman's viewpoint. It is because of this reputation that attempts have been made to manage this form through stocking practices.

I wish to express my gratitude to Dr. Kirk Strawn for his supervision of this study. I also wish to thank Mr. Andrew Hulsey of the Arkansas Game and Fish Commission and the Sport Fishery Institute for their financial assistance in making this study possible.

MATERIALS AND METHODS

Smallmouth bass were collected during the period 1962-64 from tributaries of the Arkansas River in Arkansas and Missouri. The collections totaled 378 fish from 16 locations on 12 streams in Arkansas and one stream in Missouri (Fig. 1; Table 1). Specimens were collected with electro-fishing gear, hook and line, seine and rotenone.

Meristic characters counted were dorsal spines and soft-rays, anal spines and soft-rays, pectoral fin-rays, and lateral-line scales on the left side. Counting methods used were those outlined by Hubbs and Lagler (1947).

For purposes of comparison, the meristic characters of the Neosho smallmouth were compared statistically with intergrades taken from the White River and Ouachita-Red River systems, with data gathered by Castro (1963) from tributaries of the Arkansas River in northwest Arkansas, and with data presented by Hubbs and Bailey (1940). The data were programmed and processed on a 7040 and PDP-8 computer. The analysis was arranged in a hierarchical fashion with the data categorized according to drainage basin and location or locations on a stream. An analysis of variance test was performed on each meristic character in each category. The Duncan's Multiple Range test (0.05 level, Kramer, 1956) was used to illustrate the relationship of character means within a category when significance was shown by the AOV test. Coefficients of Difference were calculated to assist in the determination of the subspecific status of the nominal forms (Mayr, et. al., 1953).

RESULTS

The Neosho smallmouth had significantly lower mean values than the intergrade smallmouth bass for all meristic characters tested, except anal spines and pectoral fin-rays (Table 2). When data for the Neosho smallmouth reported by Castro (1963), Hubbs and Bailey (1940) and that obtained in this study were compared with data given for the northern smallmouth (Hubbs and Bailey, 1940), the 1940 Neosho data was found to be significantly lower for all characters compared except anal spines and pectoral fin-rays (Table 3). The northern smallmouth bass, reputed to have higher mean values for all characters, except pectoral fin-rays (Hubbs and Bailey, 1940), had a significantly high mean value only for dorsal soft-rays (Table 3).

The data taken from each stream sample in this study were compared and significant differences were observed for each character counted (Table 4). Streams 1, 3, 10 and 13 had the lowest or lower mean values for most characters studied.

Smallmouth bass stocking records from the Arkansas Game and Fish Commission for the period 1944-61 showed 143,900 smallmouth being stocked in 9 of the 13 streams sampled plus an additional 82,000 in other streams in the same drainages.

Coefficients of difference were determined for comparisons of various subspecies combinations for all meristic characters counted. Values warranting subspecific taxonomic status were found only between the Neosho and northern smallmouth data presented by Hubbs and Bailey (1940) for dorsal soft-rays. General data trends indicated by the tests include: similarity between the 1965 Neosho data and the 1940 northern smallmouth data; greater similarity between the Neosho smallmouth and intergrade form from the White River; and a lesser similarity between the 1940 and 1965 Neosho forms.

DISCUSSION

The smallmouth bass in Arkansas represent two statistically distinct populations, one inhabiting the Arkansas River drainage in northwest Arkansas and the other in the White—Ouachita-Red River systems. This distinction is similar to that reported by Hubbs and Bailey (1940) with two notable exceptions, data for the intergrades is equal to or greater than data for the northern smallmouth rather than being intermediate, and data for the southwestern smallmouth were significantly higher in 1965 than 1940. Similar findings were reported for the Arkansas smallmouth by Castro (1963).

Significant differences were observed when means of meristic characters of Arkansas River smallmouth samples were compared. Four streams, Shoal Creek, Butler Creek, Fall Creek and South Fork of Fourche La Pave generally had low or significantly lower mean values than the other stream populations. Stocking records of the Arkansas Game and Fish Commission made available to the author by Mr. Andrew Hulsey, indicated that during the period 1944-61, when smallmouth bass stocking was extensive in this region, the above mentioned streams were not stocked. Each of the streams having significantly higher means received from as few as 800 to as many as 44,000 stocked bass during this period.

It has been well documented that environmental factors exert an influential force upon the developmental rate and subsequent meristic complement early in ontogeny (Barlow, 1961; Hubbs, 1922; Heuts, 1949; Taning, 1952; Lindsey, 1954; 1958; Garside, 1959; and Schmidt, 1917). Temperature appears to be the most important agent in altering developmental rates and was not completely discounted in the consideration of these meristic changes. However, in view of the short span of time involved, 25 years, the absence of a marked regional climatic change during this period, and the verification of stocking in these streams, environmental forces were not considered as being responsible for this meristic alteration.

The source of the broodstock used in the smallmouth stocking during this period was not definitely established. Mr. Andrew Hulsey suggested that the broodstock was probably of intergrade origin, but could possibly have included some of Ohio, or northern smallmouth, parentage. Mr. Robert Martin, manager of the Centerton Fish Hatchery, the major source of stocked smallmouth, also suggested a predominantly intergrade background for the broodstock. If the assumption that hybridization between forms of black bass produces intermediacy in some traits is valid (Hubbs and Bailey, 1940), then the data from this study also substantiates the intergrade origin of the broodstock used in the stocking. *Intergrade forms were observed in this study and by Castro (1963) to have higher mean meristic values than the northern and southwestern smallmouth for most characters, with the northern form generally being intermediate. If intergrade broodstock was used in the stocking, then the hybrid offspring would be expected to have mean values intermediate to those of the southwestern and intergrade forms and similar to the northern form. Coefficients of difference support the above hypothesis by indicating a closer relationship between the northern smallmouth and the Neosho smallmouth sampled in this study than between the Neosho data reported by Hubbs and Bailey in 1940 and that in this study. However, while this reasoning adequately explains the present intermediacy of traits in the southwestern smallmouth, it does nothing to explain the greater mean values of the intergrade form. This aspect of the meristic complement of the smallmouth bass represents another problem and is not the topic of this paper.*

Intergrade smallmouth upon being stocked in large numbers as they were in Neosho streams either completely replaced the native Neosho bass (streams 2

and 7), or hybridized with them producing a variable intermediacy of characters similar to the northern smallmouth (streams 4, 5, 6, 8, 9, 11 and 12). The effect of stocking intergrade forms into Neosho streams would be expected to be observable at points far removed from the stocking sites and eventually throughout the entire drainage. Smallmouth bass alien to the stream in which they are placed move great distances, up to 70 miles from their point of release (Brown, 1961). On this basis then, it is understandable that the releases of smallmouth bass into Neosho streams in northwest Arkansas would have a profound effect upon the native fish throughout the entire drainage.

The taxonomic status of the Neosho smallmouth is presently questionable. According to Mayr, et. al., (1953), subspecies status is debatable, but generally acceptable at a level of 90% nonoverlap of characters between two populations, or a Coefficient of Difference of 1.28 or above. The 75% Rule, or 75% nonoverlap of characters has even been accepted by some authors and was apparently used by Hubbs and Bailey (1940) in distinguishing the Neosho smallmouth bass from the typical smallmouth. No two populations of smallmouth bass observed in this study achieved subspecies status above the 75% level. Based on these findings, the smallmouth bass in Arkansas is considered to be presently composed of two statistically distinct geographic forms that do not merit taxonomic status.

A major point to be drawn from these data is that knowledge of the taxonomic status of hatchery broodstock and of the native species subject to management practices would prevent the mixing of a desirable, naturally occurring native population.

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Table I. Collection sites of Neosho smallmouth bass.

Map Number	Stream	Number of Fish	Reference
1	1*Shoal Creek	5	4 mi. E. Rocky Comfort
2	2 Little Sugar Creek	13	1.5 mi. NW Bella Vista
3	2 Little Sugar Creek	87	3 mi. N Bella Vista
4	3 Butler Creek	6	½ mi. N Sulphur Springs
5	4 Spavinaw Creek	34	2 mi. S Gravette
6	4 Spavinaw Creek	35	6 mi. W Decatur
7	5 Illinois River	3	Upstream from Moffitt
8	5 Illinois River	3	At Hgwy. 62 bridge
9	6 Muddy Fork Illinois River	10	6 mi. N Prairie Grove
10	7 Clear Creek	5	At Savoy
11	8 Barren Fork Illinois River	31	At Hgwy. 45 bridge
12	9 Lee Creek	14	3.5 mi. NE Lee Creek, Arkansas
13	9 Lee Creek	9	Below mouth of Fall Creek
14	10 Fall Creek	40	¼ mi. up from mouth
15	11 Mulberry River	37	1 mi. down from mouth of Little Mulberry River
16	12 Illinois Bayou	34	2 mi. N Scottsville
17	13 South Fork Fourche La Fave	11	6.5 mi. SE Nimrod Dam

*This collection from Barry County, Missouri, all others from Arkansas.

Table 2. Duncan's comparison of meristic character means of 1965 Neosho smallmouth bass and intergrade smallmouth bass data from the White and Ouachita-Red River drainages. Any two means not spanned by the same line are significantly different.

DORSAL SOFT RAYS		
Population	Mean	Significance
Neosho smallmouth	13.40053	
Ouachita-Red River Intergrades	13.68899	
White River Intergrades	13.80232	
ANAL SOFT RAYS		
Population	Mean	Significance
Neosho smallmouth	10.39257	
White River Intergrades	10.89922	
Ouachita-Red River Intergrades	10.99521	
LATERAL-LINE SCALES		
Population	Mean	Significance
Neosho smallmouth	74.15094	
Ouachita-Red River Intergrades	76.82125	
White River Intergrades	77.79661	

Table 3. Duncan's comparison of the means of meristic characters of 1940, 1963, and 1965 Neosho smallmouth data and 1940 northern smallmouth bass data. Any two means not spanned by the same line are significantly different.

DORSAL SPINES			DORSAL SOFT RAYS		
Population	Mean	Significance	Population	Mean	Significance
1940 Neosho	9.8506	 	1940 Neosho	13.3164	
1965 Neosho	9.9363		1965 Neosho	13.4005	
1963 Neosho	9.9502		1963 Neosho	13.5000	
Northern	9.9825		Northern	14.0083	
ANAL SPINES			ANAL SOFT RAYS		
Population	Mean	Significance	Population	Mean	Significance
1965 Neosho	2.9841		1940 Neosho	10.7767	
1940 Neosho	2.9906		1963 Neosho	10.8000	
1963 Neosho	2.9909		Northern	10.9343	
Northern	3.0000		1965 Neosho	11.3925	
PECTORAL FIN RAYS			LATERAL-LINE SCALES		
Population	Mean	Significance	Population	Mean	Significance
1963 Neosho	16.3348	 	1940 Neosho	71.8581	
1965 Neosho	16.5026		1965 Neosho	74.1805	
Northern	16.7472		Northern	74.3695	
1940 Neosho	17.0562		1963 Neosho	74.4952	

Table 4. Duncan's comparison of means of meristic characters of Neosho smallmouth bass collected from streams in northwest Arkansas and southern Missouri, 1962-64.

DORSAL SPINES			DORSAL SOFT RAYS			ANAL SPINES		
Stream Number	Mean	Significance	Stream Number	Mean	Significance	Stream Number	Mean	Significance
8	9.7096		13	12.7272		12	2.8529	
10	9.8250		3	13.0000		6	2.9000	
3	9.8333		8	13.0967		1	3.0000	
12	9.9117		11	13.1351		7	3.0000	
4	9.9420		5	13.1667		3	3.0000	
11	9.9459		1	13.2000		5	3.0000	
2	9.9900		9	13.2608		13	3.0000	
1	10.0000		12	13.2941		9	3.0000	
5	10.0000		10	13.4000		8	3.0000	
6	10.0000		6	13.5000		11	3.0000	
9	10.0434		4	13.5362		10	3.0000	
13	10.0909		7	13.6000		4	3.0000	
7	10.2000		2	13.6700		2	3.0000	

ANAL SOFT RAYS

Stream Number	Mean	Significance
1	10.4000	
13	10.4545	
11	10.5135	
12	10.5882	
10	10.7250	
8	11.6451	
2	11.7700	
7	11.8000	
6	11.8000	
3	11.8333	
4	11.8405	
5	12.0000	
9	12.0000	

PECTORAL FIN RAYS

Stream Number	Mean	Significance
1	15.8000	
8	16.2580	
13	16.3636	
11	16.4729	
9	16.4782	
2	16.4950	
10	16.5256	
4	16.5434	
12	16.6176	
5	16.7500	
3	16.7500	
7	16.8000	
6	16.8000	

LATERAL-LINE SCALES

Stream Number	Mean	Significance
13	71.0909	
1	71.6000	
3	72.5000	
5	72.6667	
9	73.0000	
10	73.0263	
11	73.6486	
12	73.7059	
8	73.8710	
4	74.6029	
6	75.0000	
2	75.3061	
7	77.6000	

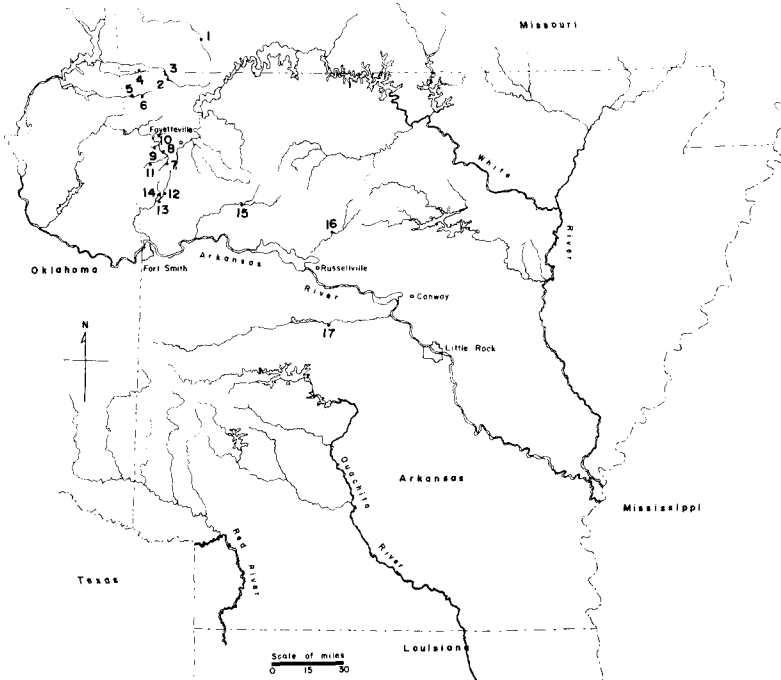


Figure 1. Map showing collection sites of Neosho smallmouth bass analyzed for meristic character complement, 1962-64.