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USE OF TOTAL MYOMERE NUMBERS TO DIFFERENTIATE LARVAE OF THREADFIN AND GIZZARD SHAD[1]

Victor J. Santucci, Jr.[2]
and
Roy C. Heidinger
Cooperative Fisheries Research Laboratory and Department of Zoology
Southern Illinois University-Carbondale
Carbondale, Illinois 62901

ABSTRACT

Threadfin shad *(Dorosoma petenense)* and gizzard shad *(D. cepedianum)* 6-20 mm total length were differentiated by total myomere number within specific length intervals. Over the entire 6-20 mm range in length, known threadfin and gizzard shad from Rend Lake, Illinois, had ranges in myomere numbers of 40-46 and 46-54, respectively. Identification of all larvae was possible because no overlap of myomere numbers occurred between species within 1 mm length groups. A limited number of known shad larvae from northern Illinois, Colorado, Florida, and California were examined to determine whether threadfin and gizzard shad larvae from other geographic locations could be differentiated using the charactistics developed from Rend Lake fish. Although the range of total myomeres was different at each location, the values were within the ranges developed from Rend Lake threadfin and gizzard shad.

INTRODUCTION

Gizzard shad *(Dorosoma cepedianum)* and threadfin shad *(D. petenense)* often occur sympatrically in reservoirs and rivers of the United States. In these waters the larvae of both species are commonly captured in the same samples. Difficulties and inconsistencies with the differentiation of larval threadfin and gizzard shad have resulted in many researchers simply grouping the two species into a single category, *Dorosoma* spp. Combining the shad larvae has led to the loss of significant informa-

[1]Based in part on a thesis submitted by V.J. Santucci, Jr., in partial fulfillment of the requirements of the Master of Arts degree, Southern Illinois University, Carbondale, Illinois 62901.
[2]Present address: Illinois Natural History Survey, RR #1 Box 233, Charleston, IL 61920.

tion concerning distributional patterns and niche requirements of the individual species.

Not all length groups of shad larvae are difficult to differentiate. Larval threadfin shad and gizzard shad (<6 mm total length (TL)) are separated by the presence or absence of eye pigment (Shelton 1972). Larval shad (16-20 mm TL) can be differentiated by vertebrae number, and late larval threadfin shad can be distinguished from gizzard shad by anal fin ray number (Kersh, 1970; Lippson and Moran, 1974). The full complement of anal rays is formed when larvae are about 20 mm TL (Hogue et al., 1976). An accurate method of differentiating 6-15 mm shad larvae is not obvious from the literature. Kersh (1970) reported that 6-15 mm threadfin and gizzard shad from Beaver and Bull Shoals Reservoirs had <40 and >40 total myomeres, respectively. Shelton (1972) found an overlap in the range of myomeres of Lake Texoma gizzard shad (39-43) and threadfin shad (36-40). In a review of the literature, Heidinger (1983) reported that ranges in myomere number overlap for shad larvae 6-15 mm in length. The objective of the present study was to develop a method to consistently differentiate 6-20 mm threadfin and gizzard shad larvae.

MATERIALS AND METHODS

Shad larvae were collected from Rend Lake, Illinois, using a meter net. Differences in the temporal occurrence of larvae were used to distinguish between threadfin and gizzard shad. Larvae collected on 25 May and 6 June 1983 were considered to be gizzard shad, because threadfin shad winterkill in Rend Lake, and adults were not stocked until 21 May 1983. Thus, the length of time required for spawning, hatch, and growth of larvae precludes the presence of 6mm or longer threadfin shad in the 25 May and 6 June collections. Shad larvae collected in September 1983 were considered to be threadfin shad bacause: 1) larvae with morphometric characters similar to gizzard shad were not present in collections made after 15 August 1983; 2) gizzard shad have one predominant spring spawning peak (Bodola, 1966; Taber, 1969; Shelton, 1972), whereas threadfin shad spawn throughout the summer and fall (Taber, 1969; Shelton, 1972; Heidinger, 1977).

Shad from meter net samples were immediately preserved in 10% formalin. In the laboratory, larval shad were separated from plankton and debris and stored in a 5% buffered formalin solution. To eliminate differences in morphometric characteristics based on fish size, 6-20 mm larvae were measured to the nearest millimeter and meristic counts were compared between species for 1 mm length groups.

Larvae were examined using polarized light microscopy. Myomeres were counted according to Siefert (1969). The most anterior myomere counted is immediately posterior to the occiput. The most posterior myomere counted is completely bordered posteriorly by a myoseptum. Incomplete myosepta were often observed between the last complete myoseptum and the urostyle of both threadfin and gizzard shad.

RESULTS AND DISCUSSION

Larval shad 6-20 mm in length were differentiated by total myomere number. Ranges of total myomere numbers for Rend Lake threadfin and gizzard shad were 40-46 and 46-54 myomeres, respectively (Table 1). Identification of all larvae was possible because no overlap of myomere numbers occurred between species within

1 mm length groups. Previously, identification of all 6-15 mm shad was not possible because of overlapping ranges in myomere number (Heidinger, 1983).

Vertebrae number has been used to identify 16-20 mm shad (Kersh, 1970); however, the results of this study indicate that myomere number can be used to differentiate shad larvae up to 22 mm or until a full complement of anal fin rays has developed. Polarized light microscopy provides a means of distinguishing myomeres without having to clear and stain specimens for enumeration of vertebrae.

A summary of characteristics which distinguish between larval threadfin and gizzard shad is given in Table 2. The myomere numbers for Rend Lake shad differ from those reported in previous studies (Kersh, 1970; Shelton, 1972). Disagreement between studies may result when different techniques are used to examine and enumerate myomeres. Rend Lake larvae were examined with polarized light microscopy, whereas, Shelton (1972) and Kersh (1970) examined clear and stained specimens.

Geographic location is another possible source of variation in shad myomere number. Total myomere number for other species, freshwater drum *(Aplodinotus grunniens)*, *river carpsucker (Carpiodes carpio)*, bluegill *(Lepomis macrochirus)*, and brook silverside *(Labidesthes sicculus)* varied at different geographic locations (Rasmussen, 1980; Bosley and Conner, 1984). Variation in serial elements may be a result of different parental stocks and/or differing environmental conditions during larval development. Regardless of the causes, examination of larval threadfin and gizzard shad from other areas of the country was necessary to determine whether shad larvae from other geographic locations could be differentiated using the characteristics developed from Rend Lake fish.

It was possible to obtain a limited number and size range of known threadfin or gizzard shad larvae from Florida, California, Colorado and northern Illinois. These larvae were examined in the manner previously described for Rend Lake shad larvae. Larval gizzard shad from northern Illinois and Colorado were found to have ranges in total myomere numbers from 48-53 and 47-52, respectively (Table 1). Ranges in myomere number for Florida and California threadfin shad were 39-44 and 38-45 myomeres, respectively. Although myomere numbers differed between geographic locations, the values for each mm length group were within the ranges from Rend Lake threadfin and gizzard shad.

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Table 1. Total myomere number for gizzard shad and threadfin shad larvae of different total lengths from various locations throughout the United States.

	Gizzard shad									Threadfin shad								
	Bend Lake			Northern Illinois			Colorado			Bend Lake			Florida			California		
Total length (mm)	Number examined	Total myomere Mean	Range	Number examined	Total myomere Mean	Range	Number examined	Total myomere Mean	Range	Number examined	Total myomere Mean	Range	Number examined	Total myomere Mean	Range	Number examined	Total myomere Mean	Range
5				10	50	48-51										20	42	38-45
6	12	49	46-50	4	50	49-51				—						5	42	41-44
7	24	49	46-52	15	50	49-52				4	44	43-45				—	—	—
8	25	50	47-51	9	50	49-52				22	44	43-46				2	41	40-42
9	25	50	47-51	7	51	49-52				25	44	42-46						
10	25	50	47-52	9	51	50-53				25	44	41-45						
11	25	50	48-52	8	52	50-53				25	44	43-45						
12	37	51	50-52	9	51	50-52				25	44	41-46						
13	25	51	49-54	4	51	50-53				25	44	43-45						
14	25	51	50-53	15	51	49-52				25	44	43-46						
15	25	51	50-52	16	51	49-53				25	44	40-46	2	40	38-42			
16	25	51	50-52	5	50	50-51	2	48	47-49	26	44	41-46	7	42	40-44			
17	25	51	50-52	1	52	52	2	48	48	25	44	41-45	13	41	39-43			
18	25	51	50-52							25	44	42-46	8	41	39-42			
19	25	51	50-52							25	44	42-45	1	41	41			
20-22	25	51	50-52				11	49	47-52	24	44	42-45						
All lengths	374	51	46-54	112	51	48-53	15	49	47-52	326	44	40-46	31	41	39-44	27	42	38-45

Table 2. Summary of characteristics which differentiate gizzard shad and threadfin shad larvae from Rend Lake, Illinois.

Characteristic	Total length(mm)	Gizzard shad	Threadfin shad
Eye pigmented[a]	3-5	No	Yes
Total myomeres	6-7	46-52	43-45
	8-15	47-54	40-45
	16-22	50-52	41-46
Anal fin rays[b]	>22	29-35	17-27

[a]From Shelton (1972)
[b]From Lippson and Moran (1974)