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REPRODUCTIVE POTENTIAL OF YOUNG-OF-THE-YEAR THREADFIN SHAD (DOROSOMA PETENENSE) IN SOUTHERN ILLINOIS LAKES[1/]

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ABSTRACT

Young-of-the-year threadfin shad (Dorosoma petenense) spawned in southern Illinois waters. The management potential of this fish is discussed.

INTRODUCTION

Researchers have repeatedly demonstrated that the threadfin shad (Dorosoma petenense) is a valuable forage fish (Myhr, 1971; Range, 1971; Beers and McConnell, 1966; Goodson, 1965; Stevens, 1959). Reservoir investigations throughout the southern half of the United States have resulted in recommendations for stocking the threadfin shad where slow-growing crappie (Pomoxis sp.) populations exist (Goodson, 1966). The establishment of threadfin shad populations has also increased the growth rate of white bass (Morone chrysops) and walleye (Stizostedion vitreum) (Range, 1971). In Illinois waters the threadfin shad occurs naturally in the Ohio and Mississippi River drainages during the summer and fall months. The threadfin shad's inability to overwinter in northern waters has previously discouraged interest in their introduction into Illinois lakes. The development of a significant forage population by annual stocking of 2 to 12 adult fish per ha in the spring is partially dependent upon whether or not the young-of-the-year fish will spawn the year in which they are stocked.

The objective of this study was to determine if young-of-tha-year threadfin shad could spawn in southern Illinois lakes.

1/ In part this paper is based on a master's research report submitted by the junior author to the Graduate Faculty of Southern Illinois University at Carbondale in 1974. The study was supported by the Graduate School, SIU-C, and the Lake of Egypt Property Owners' Association. Permission to work on Little Grassy Lake was granted by the Crab Orchard National Wildlife Refuge.

MATERIALS AND METHODS

In June 1973, young-of-the-year threadfin shad which were spawned in May were stocked into 10 .06-ha hatchery ponds at a rate of 20 fish per pond. At stocking the fish were 2.53 cm total length. The ponds had a minimum depth of 1 m and a maximum depth of 1.5 m. The ponds contained various combinations and numbers of catfish, sunfish, minnows, and largemouth bass (Micropterus salmoides). Success of reproduction of the young-of-the-year threadfin shad that had been stocked was evaluated by seining on 27 September 1973.

In a second experiment the ability of young-of-the-year threadfin to spawn in a large reservoir was evaluated. In March 1973 approximately 1500 yearling threadfin shad were stocked into Little Grassy Lake. Little Grassy Lake is a 405-ha manmade lake on the Crab Orchard National Wildlife Refuge in Williamson County, Illinois. It has 45 km of shoreline, an average depth of 8 m and a maximum depth of 24 m. The lake has a strong white crappie (Pomoxis annularis) and largemouth bass population. During 1970 a 6-month creel census revealed that the white crappie represented 70.4% of the total catch by weight. The largemouth bass ranked second, constituting 15.2% by numbers and 38.0% by weight (Harrison, 1970). Gizzard shad (Dorosoma cepedianum) also occur in Grassy Lake.

Samples of larval and juvenile threadfin shad were periodically collected from June until November 21, 1973 with a meter net having a mesh size of 0.75 cm. Gill nets of 12.65 mm (1/2-inch), and 18.98 (3/4-inch) bar mesh were used to collect young-of-the-year shad that were not vulnerable to the meter net.

In order to determine if these fish were sexually maturing in Little Grassy Lake, diameters of their ova were measured to the nearest 0.01 mm using a compound microscope at 35x fitted with an ocular micrometer. Ova having diameters greater than 0.53 mm were considered mature (Kilambi and Baglin, 1969). The maturity index (Johnson, 1971), which is equivalent to the gonadalsomatic index (Kilambi and Baglin, 1969), was also calculated on young-of-the-year female threadfin shad using the following formula:

$$\text{Gonadalsomatic index} = \text{maturity index} = \frac{\text{ovary wt. (g)} \times 100}{\text{gross body wt. (g)}}$$

RESULTS

When the 10 hatchery ponds that were stocked in June with young-of-the-year threadfin shad were seined 27 September 1973, 6 ponds contained at least 500 threadfin shad. Two ponds contained only 1 and 6 respectively of the originally stocked young-of-the-year threadfin shad, and 2 ponds contained no shad.

Meter net samples from Little Grassy Lake during June yielded threadfin shad with maximum total length of 38 mm. Gizzard shad were more abundant in the samples throughout June. By mid-July the threadfin shad were predominant over the gizzard shad in numbers collected. On 31 July, gizzard shad disappeared from the meter net samples, whereas threadfin shad on this date were abundant and ranged in total length from 16 mm to 36 mm (Table 1). On the same date, 12.65 bar mesh gill net samples contained threadfin shad that ranged in total length from 81 mm to 93 mm. Thus by 31 July 1973, young-of-the-year threadfin shad, ranging from at least 16 mm to 93 mm in total length, were present in Little Grassy Lake.

Mature ova were present in young-of-the-year threadfin shad by late summer (Table 2), the gonadalsomatic index of young-of-the-year females was at a maximum in July and August and dropped to an insignificant percentage by September. The disappearance of mature ova coincided with the decrease in gonadalsomatic index. Male young-of-the-year threadfin shad were "running ripe" in August.

TABLE 1. Occurrence of threadfin shad and gizzard shad captured in meter net samples from Little Grassy Lake during the summer of 1973.

Month	Total length (mm)		
	0-19	21-29	30-39
June	GT	GT	GT
July	GT	GT	GT
August	T	T	T
September	T	T	--

G = gizzard shad, T = threadfin shad

TABLE 2. Spawning condition of young-of-the-year female threadfin shad in Little Grassy Lake during 1973.

Date	Number of fish	Total length (mm)	Weight (g)	Gonadal-somatic index	Mature ova >0.53 mm
July 31	16	88	7.5	9.6	present
Aug 24	1	92	8.0	8.8	present
Aug 24	3	88	7.0	<1.0	absent
Sept 10	4	98	9.7	<1.0	absent
Nov 21	5	132	21.0	<1.0	absent

DISCUSSION.

A population of young-of-the-year threadfin shad was established in Little Grassy Lake. Based on the length of the threadfin shad in the June samples and assuming that the young-of-the-year threadfin grew at a rate of 20 mm to 24 mm per month (Kersch 1970), the brood fish commenced spawning in early May. Spawning also took place in May in the small hatchery ponds. The presence of larval and juvenile threadfin shad throughout June and July suggests a prolonged, or a multiple spawning season by the brood stock.

Based on ova diameter, young-of-the-year female threadfin shad were capable of producing mature ova in less than 4 months after hatching in Little Grassy Lake. However, Johnson (1971) stated that female threadfin shad with a maturity index of less than 19% were incapable of releasing eggs, even though mature ova may be present in fish with a lower maturity index. He measured fish 2 years of age and older. Kilambi and Baglin (1969) considered females with a gonadalsomatic index of 14% to be mature. They, too, considered only fish 2 years or older.

The gonadalsomatic index of young-of-the-year threadfin shad collected from Little Grassy Lake was lower than the gonadal somatic index considered as mature by the above authors. There are at least three plausible explanations for this difference. The gonadalsomatic index could have exceeded 14% during the 3 weeks between collections. Size selectivity of the 12.65 mm gill net may have accounted for the scarcity of the more robust females. Finally, fish in this study were young-of-the-year, and the gonadalsomatic index of threadfin shad probably increases with age and size.

It is possible that the larval threadfin shad collected with the meter net from Little Grassy Lake in August and September could have resulted from a second spawn of the adult brood stock. Regardless, based upon the facts that young-of-the-year fish spawned in the hatchery ponds; mature ova were present in young-of-the-year females before and during August, but not afterwards; and young-of-the-year males were running ripe in August, it appears that young-of-the-year threadfin shad spawned in Little Grassy Lake.

Since the young-of-the-year threadfin shad spawn in southern Illinois waters, an arithmetic increase in the density of the brood stock can result in a geometric increase in the forage produced. Consequently, there is a considerable potentia for this management technique in midwestern lakes.

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