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Maturity and Spawning Periodicity of the Gizzard Shad, *Dorosoma cepedianum*, (La Sueur), in Beaver Reservoir

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INTRODUCTION

There has been no mention in the literature of the spawning period of the gizzard shad in the Southwestern United States. Bodola (1964) mentioned that spawning gizzard shad were captured from the first quarter of June to the first quarter of July inclusive, in Western Lake Erie. The determination of the maturity and spawning period of the gizzard shad in Beaver Reservoir, Arkansas, is based on the gonadal somatic index, or maturity index, and ova diameter measurements along with physical characteristics of the eggs and ovaries.

James (1946) working with bluegills, *Lepomis macrochirus*, and largemouth bass, *Micropterus salmoides*, and Kilpatrick (1959) studying the white bass, *Roccus chrysops*, found that the percentage ratio of ovary weight to body weight was a more reliable indication of the variation in the ovarian cycle than either the sizes or the weights of the ovaries alone. Prabhu (1956) determined the duration of the spawning periods of nine species of fish, by studying the dimensions of eggs in the ovaries of fishes in the penultimate or mature stage of development.

MATERIALS AND METHODS

A total of 348 female gizzard shad from Beaver Reservoir captured by the personnel of the Bureau of Sport Fisheries and Wildlife, South Central Reservoir Investigations, from the period March 1967 to February 1968, was utilized to demonstrate the seasonal trend in the gonadal somatic index, and to measure ova diameters. Collections were made by electroshocker, gill net, trap net, and a mid-water trawl. All fish were taken without any selection as to size. However, most fish in our sample were collected just prior to and during the spawning period. Fish were primarily collected from spawning aggregations. From each fish, the total length was recorded to the nearest millimeter, and total body and ovary weights to the nearest 0.1 of a gram. Scales were taken just posterior to the tip of the left pectoral fin. Six scales from each fish were mounted between two sheets of cellulose acetate and read

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on a scale projecting machine at a magnification of 43X.

Eight mature fish were utilized to determine ova diameter frequencies. Although an unequal number of measurements were taken from the specimens, the modes were similar and data for the eight fish were combined. Only ova larger than 0.20 millimeters in diameter were measured to depict maturation. Three fish which were judged to be in spent condition were selected for measurement. Approximately a 0.5 gram sample was removed from the left ovary of each mature fish and placed in a petri dish, and eggs were randomly measured with an ocular micrometer. Due to the lack of symmetry in the eggs, caused partially by preservation (all ovaries were preserved in 10% formalin), the ocular micrometer was placed in a horizontal position and the diameters were measured parallel to the micrometer. Clark (1934) found this method to be satisfactory. In order to facilitate the measurements of immature transparent ova in the three spent fish, aceto oricine was added to a thin cross sectional slice of the ovary and a cover slip was added.

RESULTS

There was a rapid rise in the gonadal somatic index in February and March (Figure 1). A maximum for the 1963 and 1964 year classes of 8.60 and 8.55 respectively, was attained in April (Figure 1). The increase of the index of the 1965 year class (2-year-old fish) was slower and the maximum value lower than in 3- and 4-year-olds. Kilpatrick (1959) also found that older and larger white bass in Lake Texoma reached higher maturity indexes sooner. However, Bodola (1964) found that 2-year-old gizzard shad in Western Lake Erie had a higher index than older fish. The lower index for the 1965 year class in this study may be due to the fact that all of these fish did not mature. Index values ranged from 5.12 to 11.31. The 1963 and 1964 year classes showed similar gonadal somatic index trends, and all were presumed to have spawned. Bodola (1964) found spawning occurred first in 2-year-olds, but it has been seen that they spawn later here.

Immature ova were transparent and small in size, intermediate ova were white in color, and mature ova had a large amount of yolk present. The mode of 2,374 ova diameter measurements larger than 0.20mm for eight mature fish was 0.65 millimeters (Figure 2). Transparent ova were not measured in this study, but are present throughout the year. Ova from three spent individuals (1390 measurements) were all small and immature (Figure 2). Since there is only one mode of mature eggs present in the mature fish, this would indicate only one spawning period.

A considerable amount of variation in ova diameters was found for fish of the same age and collection date, but the difference between fish of the same age narrowed as the spawning time approached.
The largest ova from 1967 year class fish taken in February 1968 were 0.10mm in diameter, while 1966 year class fish taken at the same time had ova measurements of 0.33mm in diameter. No 1-year-old fish were taken during the spawning season, but it is believed they would not have been mature enough to spawn. Bodola (1964) found that most 1-year-old fish retained partially developed eggs to be spawned the following season.

In mid-April 1967, the largest ova present in 1965 year class fish examined were 0.59mm. The majority of the maturing eggs were 0.50mm in diameter. In mid-May, the largest ova observed were 0.69mm with many 0.53 and 0.66mm ova. In June, the largest were 0.66mm and a considerable amount of resorption was occurring.

The 1964 year class fish showed greatest ova development during the months of February, March, and the beginning of April up to spawning time in mid-April. Largest recorded ova diameters for February were 0.53mm, for March 0.66mm, and for April 0.89mm. In May, average ova diameters were approximately 0.50mm and resorption was observed at the end of May.

The 1963 year class fish seemed to follow the same trend as the 1964 year class, measurements being 0.66mm for February, 0.73mm for March, and 0.95mm for April for the largest ova. Insufficient numbers of older fish were obtained to note any general trends.

CONCLUSIONS

Both the gonadal somatic index and ova diameter measurements indicate that the gizzard shad in Beaver Reservoir had one spawning period which extended from mid-April through May 1967. Some partially spent individuals were taken which indicated that all the eggs were not extruded at one time. By June, only completely spent fish with low indexes and immature eggs, or fish with eggs undergoing rapid resorption were found.

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LITERATURE CITED

Spawning Periodicity of the Gizzard Shad


Figure 1. Average weight of ovaries as percent of body weight, March 1967 to February 1968, for 1963, 1964, and 1965 year classes. Number of fish collected monthly are indicated.
Figure 2. Frequency distribution of ova diameter measurements for 3 spent and 8 mature gizzard shad. Only ova measuring more than 0.20mm in diameter were included for the mature fish.