

FECONDITY AND REPRODUCTION IN THE LARGESCALE MENHADEN, *BREVOORTIA PATRONUS* GOODE¹

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INTRODUCTION

There are no published accounts of observations on spawning of the largescale menhaden. Suttikus (1956) estimated that spawning occurred between October and February in the Louisiana area. The assumption was based on examination of a number of gonads during different seasons and by extrapolation and interpretation of length-frequency tabulations (Suttikus, 1956). In late fall schools of menhaden move to intermediate depths prior to spawning. This movement in the late fall is common knowledge to menhaden fishermen along the Louisiana coast. Moreover, waters off the mouth of the Mississippi River, where menhaden concentrate, are turbid most of the time, perhaps in part accounting for lack of observations on spawning.

MATERIALS AND METHODS

The 280 specimens used in this study were obtained between 1951 and 1958 along the east Louisiana coast. Most specimens were obtained by otter trawls.

Age Determinations

Total length was measured from the anterior tip of snout to tip of the lower caudal fin lobe. Standard length was measured from tip of snout to posterior margin of hypural; the latter point was determined by flexing the caudal fin.

A scale sample was removed from the lateral area just above the tip of the appressed left pectoral fin of each fish. Each scale was read three times with the aid of a Bausch and Lomb microprojector.

Fecundity

Most specimens were preserved in 10 percent formalin soon after capture and gonads were removed from specimens in the laboratory. Some gonads were removed from the specimens in the fresh condition, the volume was determined, and they were pre-

served in 10 percent formalin. These gonads were remeasured after preservation; thus volumetric statistics are consistent. The maximum volume of the gonads was reached in January (Figures 1 and 2).

Fecundity of the January specimens was determined by the volumetric method (Lagler, 1956) as follows: (1) the total volume in cubic centimeters of each ovary was determined after removal of excess moisture; (2) a small piece was removed from the middle portion of the ovary. The excess moisture was removed and the volume determined; (3) the number of large eggs in this piece was counted under a stereoscopic binocular microscope; and (4) the total number of large eggs in the entire ovary was determined by proportion. To estimate the extent of error in the above method, actual total counts of large eggs were made of ovaries of age groups I and II.

RESULTS

Age

The scale method was used for determination of age after consideration of the findings of June and Roithmayr (1960). Table 1 shows a total-length frequency tabulation by age groups for two samples of menhaden which were collected on January 30 and 31, 1958. These specimens were obtained with a mid-water trawl from the Gulf of Mexico, latitude 29° 21'N, longitude 88° 55'W. We assume the two samples were part of a spawning group. The condition of the gonads (Figures 1, 2, and 3) is substantiating evidence. No age group IV individuals were present in the two January samples; however, 3 of the 280 specimens used in this study were of age group IV.

Fecundity

Fecundity data determined by volumetric method and by actual count are presented in Table 2. The average percent error for two ovaries is 5.5.

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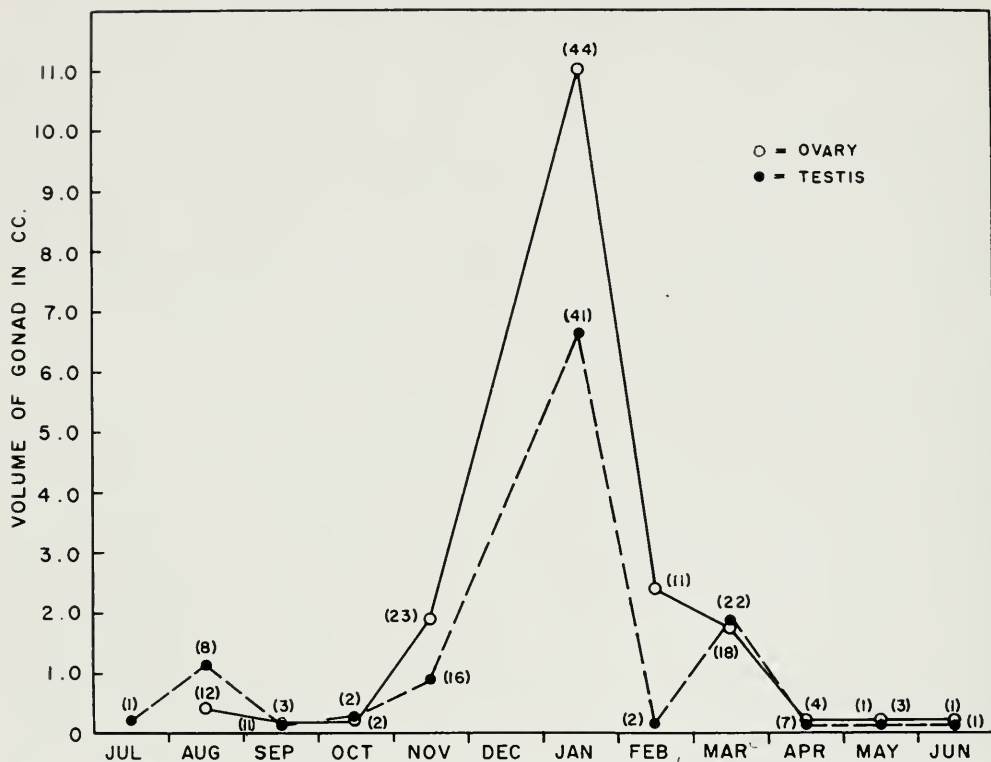


Figure 1. Mean volume of gonads of the largescale menhaden for various months for age groups I, II, and III. Figures in parentheses indicate number of specimens. (Based on collections of menhaden obtained in 1951 through 1958.)

The mean fecundity, total length, standard length, and volume of ovary, for various groups are shown in Table 3. The results show that fecundity increased with age and length.

Reproduction

Figures 1, 2, and 3 are based on composite samples obtained during the period 1951-58. There probably are slight fluctuations in the time of the spawning peak, from one year to the next as indicated by Suttkus (1956) on the basis of length-frequency tabulations. Moreover, the January peak shown in Figures 1, 2, and 3 is at the time of year during which spawning was estimated to occur. Apparently the enlargement of the gonads in preparation for spawning occurred during late fall, and spawning was finished during February and/or March. The illustrations in Figure 4 show the typical ovaries of age groups I, II and III (bottom to top respectively) during the months of August (left), January (middle), and March (right). The great reduction in volume of the spent

ovaries is obvious by comparison of photos taken in January and March. The firm

TABLE 1.
Total length distribution of age groups of two samples of largescale menhaden collected on January 30 and 31, 1958

Length interval in millimeters	Age group		
	I	II	III
170-174	1	—	—
175-179	2	—	—
180-184	2	—	—
185-189	1	1	—
190-194	1	8	—
195-199	1	12	—
200-204	—	21	1
205-209	—	15	—
210-214	—	13	—
215-219	—	3	—
220-224	—	—	2
225-229	—	—	—
230-234	—	—	1
Number of fish	8	73	4
Percentage of total	9.4	85.9	4.5
Mean total length	182.6	202.7	219.5

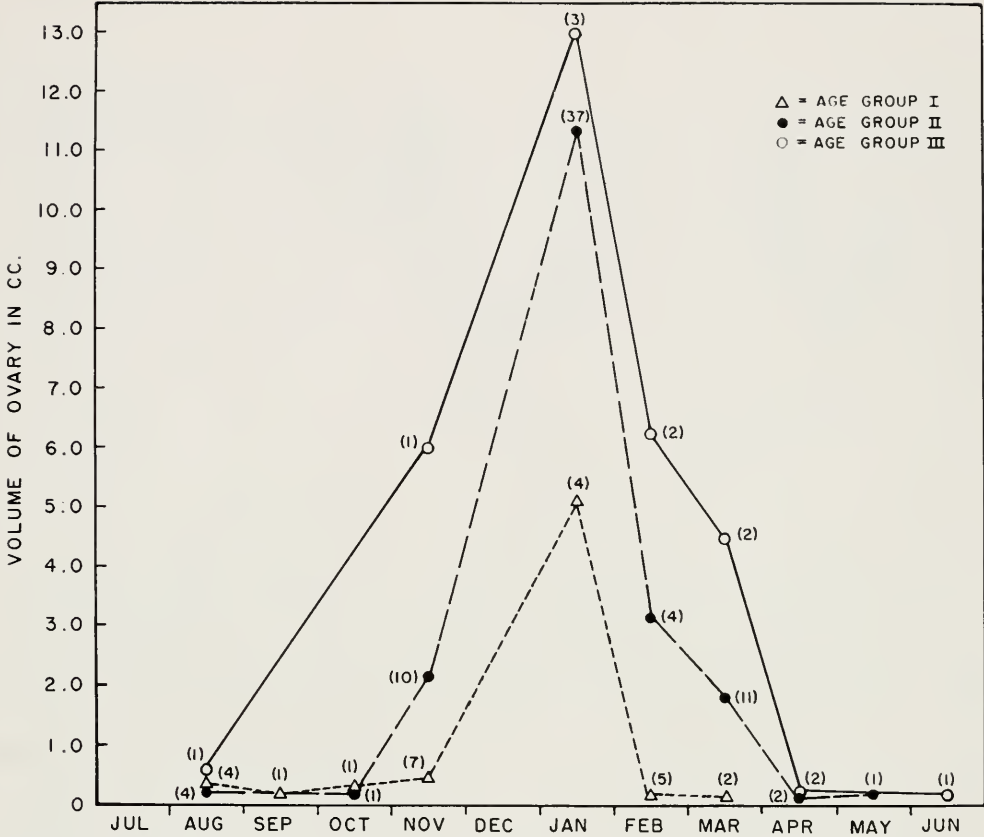


Figure 2. Mean volume of ovaries of largescale menhaden for various months for age groups I, II, and III. Figures in parentheses indicate the number of specimens. (Based on collections of menhaden obtained in 1951 through 1958.)

TABLE 2.
Comparisons of estimated and actual fecundities in the largescale menhaden

Date collected	Age group	Total length in millimeters	Volume of gonad in cc.	Estimated number of eggs	Actual number of eggs	Percent error
January 31 1958	I	176	4.0	21,960	20,827	—5.4
January 30 1958	II	208	10.0	36,000	34,059	—5.6

TABLE 3.
Mean fecundity of 18 largescale menhaden collected in January, 1958

Age group	Number of specimens	Mean total length in millimeters	Mean volume of ovary in cc.	Mean number of eggs per female
I	2	176	4.0	21,960
II	14	209	12.7	68,655
III	2	228	17.2	122,062

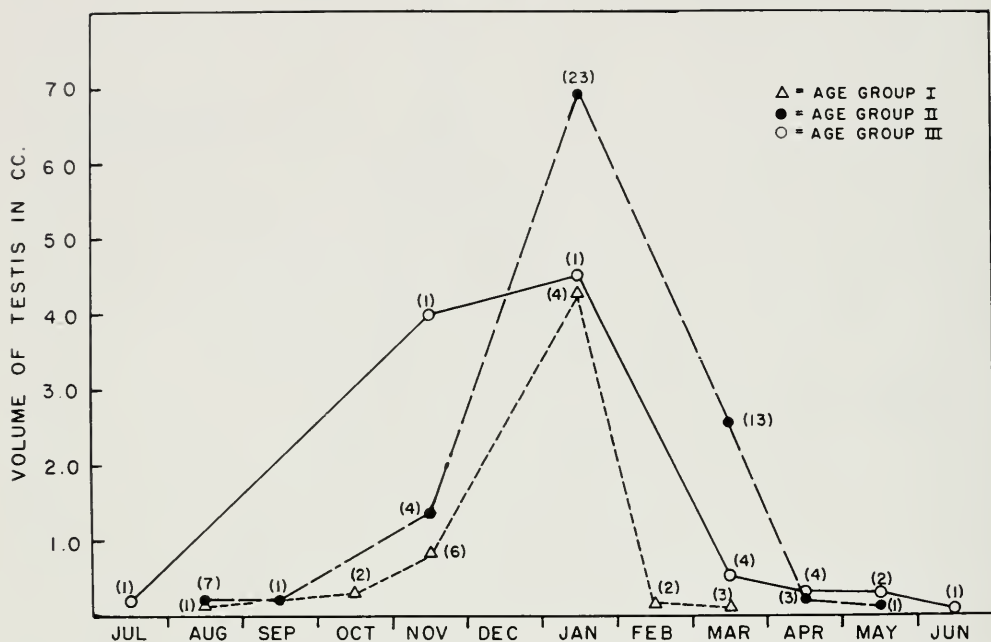


Figure 3. Mean volume of testes of the largescale menhaden for various months for age groups I, II, and III. Figures in parentheses indicate the number of specimens. (Based on collections of menhaden obtained in 1951 through 1958.)

texture and highly vascularized condition of the ovaries of those taken in January are also indicative of an ovary that is close to being spawned. The ovaries of the March samples were flaccid and the vascularization was degenerate. Age group II females of the January sample had an average gonad volume of slightly over 11 cubic centimeters whereas age group II males of the same sample averaged about 7 cubic centimeters. Part of the difference in volume is due to actual difference in volume of gonads of the same size individuals, though part is also due to the larger average size of the age group II females (Figure 5).

The January 30 and 31, 1958, combined sample was the only one that was of sufficient size to warrant analysis of age composition. In this sample age group II individuals made up 85 percent of the spawning population, age group I made up approximately 9 percent, and age group III about 4 percent (Table 1). Perhaps the most significant fact is that the largescale menhaden is a rapidly renewable resource.

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ABSTRACT

Fecundity of the largescale menhaden, *Brevoortia patronus*, from Louisiana coastal waters was estimated by volu-

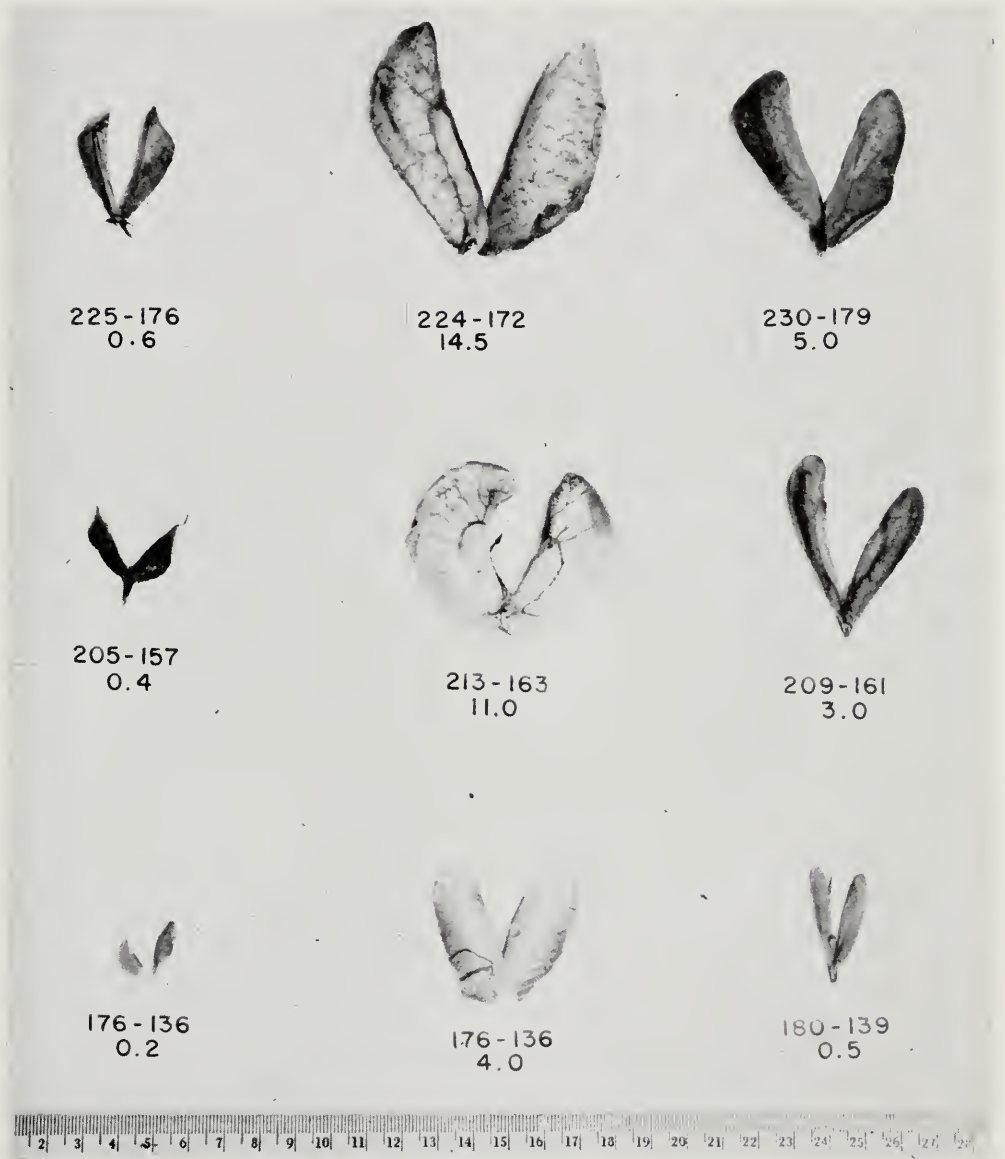


Figure 4. Ovaries of the largescale menhaden from age groups I, II, and III collected during August, January and March. Age group I (bottom row); age group II (middle row); and age group III (upper row). August sample (left column); January sample (middle column); and March sample (right column). The numbers separated by a hyphen are the total and standard lengths of the specimens and that below is the volume in cubic centimeters for the particular ovary illustrated.

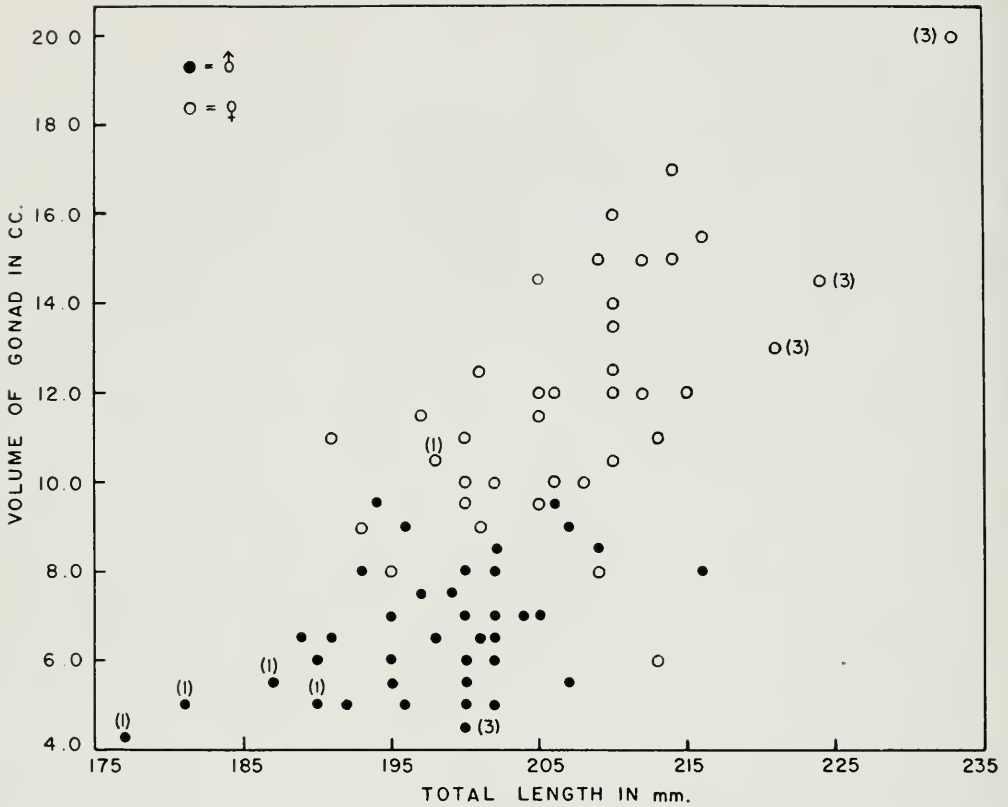


Figure 5. Relationship between total length and volume of gonad, based on part of two samples of the largescale menhaden collected on January 30 and 31, 1958. All menhaden except where otherwise noted on figure were age group II.

metric method. By actual count, we found 20,827 and 34,059 large eggs in the ovaries of one each of age groups I and II. Ovaries of age group II individuals averaged about four cubic centimeters more than the testes of the age group II males from the same spawning mass. Part of the difference in gonad volume was due to the larger average size of the age group II fe-

males. The period of the maximum volume of testes and ovaries in addition to texture indicate a spawning peak in January. Age group II individuals make up the major part (about 85 percent) of the spawning population, age group I about 9 percent, and age group III about 4 percent. The short life and early maturity make the largescale menhaden a rapidly renewable resource.