DISTRIBUTION AND VARIATION OF *BRANCHIOSTOMA CARIBAEUM* IN MISSISSIPPI SOUND

HERBERT V. BOSCHUNG,[1]
Department of Biology, University of Alabama, Tuscaloosa
and
GORDON GUNTER,
Gulf Coast Research Laboratory, Ocean Springs, Mississippi

The only lancelet known from the Gulf of Mexico is *Branchiostoma caribaeum* Sundevall. The first account of *Branchiostoma* in the Gulf was made by Garman (*in* Kingsley, 1885, p. 64), who mentioned "Specimens at hand from the Gulf of Mexico . . ." but gave no precise location. The first account of a collection from a specific locality in the Gulf was that of Wright (1890), who took lancelets from Tampa Bay, Florida. Adams and Kendall (1891) reported several in dredges at two stations made by the schooner *Grampus* off Cape Romano and Sanibel, Florida. Andrews (1893) recorded additional material from Tampa Bay. Evermann and Kendall (1900) extended the distribution to the Snapper Banks off Pensacola. Large numbers of Gulf lancelets were unknown until Wells (1926) collected some 5,000 on the west coast of Florida. Fowler (1941, 1945) listed a total of 14 specimens in three collections from Sanibel, Florida, and Longley and Hildebrand (1941) reported three near Tortugas. Hutton *et al.* (1956) took 63 specimens in Boca Ciega Bay and Springer and Woodburn (1960) caught 3 in Tampa Bay at salinities ranging from 24.8 to 25.5. Baughman (1950) recorded lancelets from Texas collected by T. E. Pulley, the first known west of Pensacola, Florida. Subsequent small Texas collections were reported by Gunter and Knapp (1951) and by Hoese (1958). Hefley and Shoemaker (1952) took lancelets from Mississippi and Louisiana, and Boschung and Mallory (1956) found them in Alabama. Dawson (1961) also collected lancelets in Louisiana.

Up to the present, amphioxus has been reported in large numbers on the beaches of West Florida, but the literature indicates that its distribution on the northern Gulf is spotty and thin. Statements in the literature also generally indicate that this little animal is most abundant on pure sand bottom. However, it seems to be uncommon along that thousand miles of sand beach between Sabine Pass and Tampico, possibly because of the fine, packed sand.

Distribution and Abundance In Mississippi Waters

Investigations on amphioxus were begun at the Gulf Coast Research Laboratory several years ago (Cf. Hefley and Shoemaker, 1952), but were carried on in a more or less disorganized manner by class and student groups digging for the animals around the shores of the offshore islands, where they are taken every summer. In some cases a thousand and more specimens have been taken by a student group.

In the spring of 1960, the Pan American Petroleum Company sent a research team to Ocean Springs which worked out of the Laboratory and made several hundred corings of Mississippi Sound and adjacent Gulf bottoms. Samples were also taken with a modified Petersen grab. Samples covering one-eighth of a square meter were collected and it was soon noted that *Branchiostoma* was being taken. Figure 1 shows the map of these samplings with the *Branchiostoma* catches distinguished by the large closed circles. The Pan American data give some quantitative information on the numbers and abundance of lancelets which is of considerable interest because such information is lacking in the literature. The figures are minimal because the geologists were not searching for lancelets. They gathered what they could when the Petersen grab was

[1] The first author was enabled to work on this problem through a grant of the National Science Foundation to the Gulf Coast Research Laboratory.

dumped—as a courtesy to this Laboratory. Their data show that there was an average of 72 *B. caribaeum* per square meter in the areas where they were found (see Figure 1), or about 290,000 individuals per acre. Since the area where these animals are taken extends from Mobile Bay to Cat Island, and is about 75 by 5 miles in extent, the lancelets in the area would seem to be numbered in billions.

The greatest depth at which lancelets were taken in the Petersen grab was about 90 feet at a station approximately 20 miles south of Mobile Bay. They are sometimes exposed by low tide. The bottom salinity range at 32 stations where the lancelets were caught was 15.4 to 33.1 *per mille,* and the mean salinity was 24.3. The lancelets are one continuous population and we have noted no differences between low and high salinity populations or any division equivalent to the lagoon and marine forms of *B. nigeriense* which Webb (1956a) reported.

Amphioxus was associated with the infauna commonly found in the bays and shallow Gulf at medium to high salinities. There was often broken shell mixed with the sand and silt, varying in size from fine particles to single valves of *Donax variabilis, Ensis minor, Mulinia, Dosinia, Tagelus* and occasional whole specimens. The lancelets are also associated with various annelid and nemertean worms and at times with *Saccoglossus* sp. Small specimens of the echinoid, *Mellita quinquiesperforata,* were also commonly found on the bottom. The invertebrate crawlers and creepers and bottom swimming fishes, of much greater abundance than the infauna, are too numerous to mention and they need further description and characterization.

Where amphioxus was dug for in shallow water it was noted that they were not abundant on clean sand, but on sand with dark streaks of silt and bottom debris consisting of plant materials (bits of wood) and shell.

Dr. Charles Upshaw, of the Pan American Petroleum Corporation supplied us with a very fine colored map showing the relative entropy isopleths of the sediments, by the usual triangular approximation of sediment grain size, ranging from silt and clay at less than 62 microns diameter up to sand at greater than 250 microns. This map and Figure 1 showed that about nine out of ten times amphioxus was found on coarse sand or mixtures of coarse sand and silt. It was rarely found on fine sand and not at all on clay.

Miscellaneous Observations

In laboratory aquaria *B. caribaeum* swims about vigorously at times, and it is not surprising that both immature specimens and adults have been taken several times in the upper layers of water and at the surface. Rice (1880) reported collecting 20 young from surface tows near the Chesapeake Biological Station at Fort Wool. Wright (1890) reported many lancelets taken in dipnets, "far offshore," at Tampa, and Andrews (1893) reported "small miniature" specimens at the surface of Kingston Harbor, Jamaica. Four specimens from the Aransas Pass ship channel of Texas (Gunter and Knapp, 1951) were taken in plankton tows. We believe they were swimming naturally and were not stirred up by a ship as suggested by Dawson (1961), who also reported a specimen from a plankton tow off Grand Isle, Louisiana.

Various species of *Branchiostoma* are reported to swim both backward and forward and they are also known to burrow quickly into the sand, entering either by the head or tail with equal ease. We have also observed a third method by which *Branchiostoma* buries itself, which has not been mentioned in any of the accounts we have read. Sometimes the animals will lie flat on the surface of the sand and give convulsive little wiggles much like the swimming pattern and thus settle in the sand. This action is somewhat like that of a flounder settling into its bed.

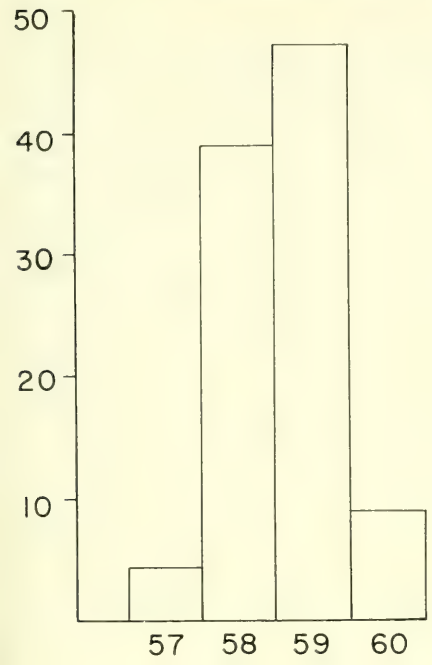
During the months of July and August large individuals were seen with gonads. Smaller individuals had gonads at immature stages of development.

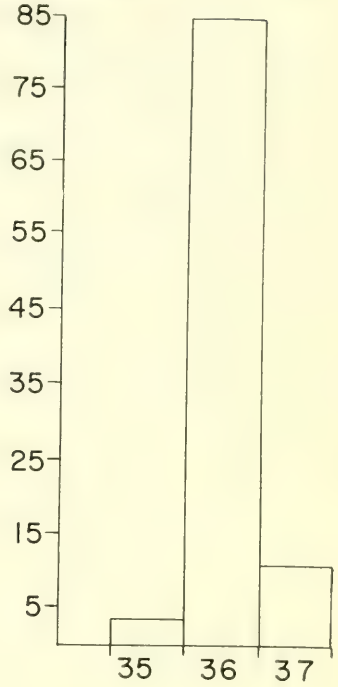
The Mississippi population of amphioxus has associated with it an interesting commensal protozoan, which is a more or less bell-shaped ciliate attached singly along the buccal cirri. Counts in 1960 show that 72 of a hundred specimens were carrying the Protozoa. In August 1961, only two of 50 specimens were found with this commensal.

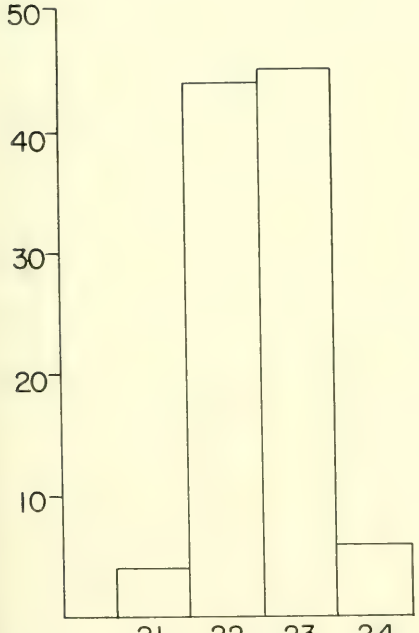
Variation of Taxonomic Characters

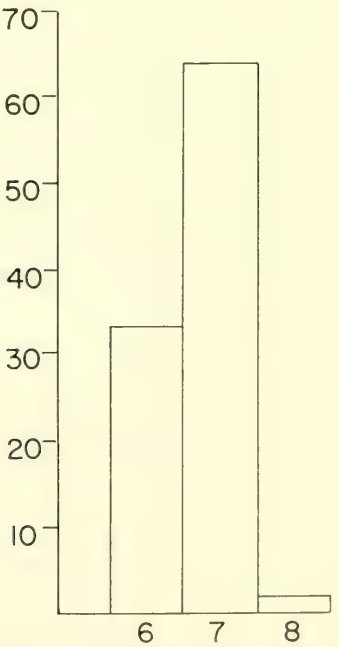
Several meristic characters and measurements have been used by previous authors (Kirkaldy, 1895; Franz, 1922; Hubbs, 1922;

Figure 1. Grab sample stations. Closed circles indicate presence of amphioxus.









Figures 2-5. Mississippi lancelets. **2.** (top left) Frequency distribution of total myotomes. **3.** (top right) Frequency distribution of preatriopore myotomes. **4.** (bottom left) Frequency distribution of postatriopore myotomes. **5.** (bottom right) Frequency distribution of postanal myotomes.

Figure 6. Frequency distribution of myotomes between atriopore and anus of Mississippi lancelets.

Bigelow and Farfante, 1948; Webb, 1956) for the description and identification of lancelets. In addition to the usual characters we have included body depth, caudal fin length, postatriopore length, postanal length expressed as percentage of total length, and the number of oral cirri. Counts and measurements were made on 100 specimens selected at random from the material collected in Mississippi Sound during the spring and summer of 1960. Almost all characters examined showed considerable variation.

Myotomes.—Total myotomes varied from 57 to 60, with 87 per cent of the specimens possessing 58 or 59 (Fig. 2). The number of preatriopore myotomes varied from 35 to 37, with 86 per cent having 36 (Fig. 3). The postatriopore myotome number varied from 21 to 24, with 90 per cent having either 22 or 23 (Fig. 4). The number of postanal myotomes varied from 6 to 8, with 97 per cent of the specimens possessing 6 or 7 (Fig. 5). The number of myotomes between the atriopore and the anus varied from 15 to 17, with the exception of a single specimen whose count was 14 (Fig. 6). The formula for expressing the ranges in myotome counts would seem to be 35 to 37 + 14 to 17 + 6 to 8 = 55 to 62; however, since the minimum and maximum total number of myotomes were 57 to 60, respectively, the theoretical limits of 55 to 62 were not reached. It is evident then that the variation in preanal and postatriopore myotomes were not additive. The variation in the postatriopore numbers was as great as that of the total count, and one of its components, the number of myotomes between the atriopore and anus, showed equal variation. The variation in the number of myotomes of the two components of the postatriopore count was not additive, and where the total myotome counts vary from the mode (59) it is more likely a function of the variation in postatriopore count. The myotome formula for this population is, 35 to 37 + 14 to 17 + 6 to 8 = 57 to 60, or typically 36 + 16 + 7 = 59.

The myotome count is the least variable character of the Mississippi Sound lancelets. Based on works of Andrews (1893), Hubbs (1922) and Bigelow and Farfante (1948) and disregarding Andrews' Jamaican specimen reputed to have had only 48 myotomes,

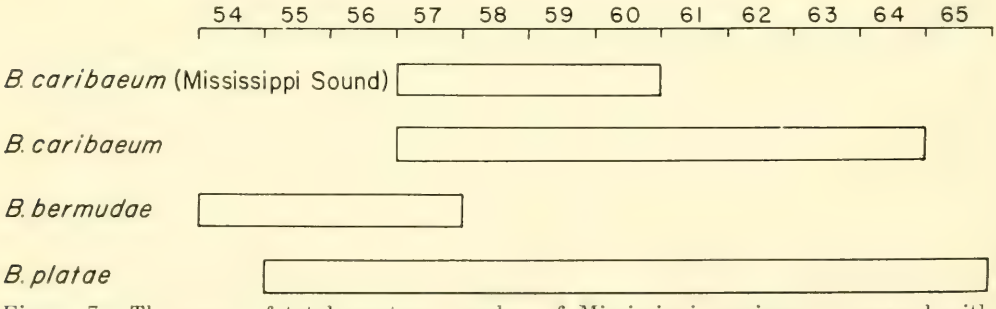


Figure 7. The range of total myotome number of Mississippi specimens compared with other western Atlantic lancelets.

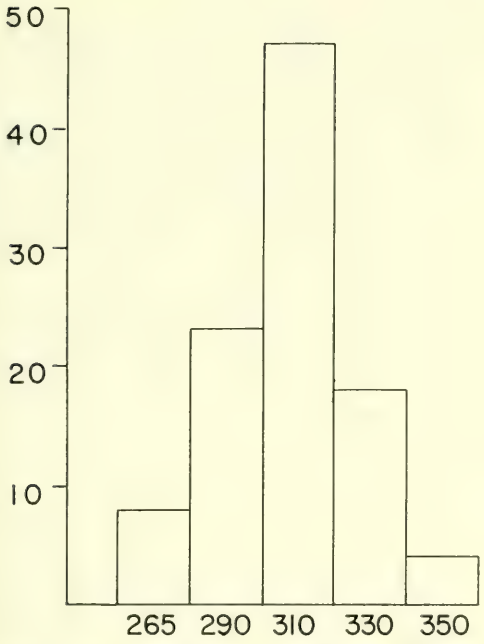


Figure 8. Frequency distribution of dorsal fin-ray chambers of Mississippi lancelets.

the known range of myotomes for *caribaeum* (including *floridae* and *virginiae*) is 57 to 64. The range of total myotomes of *platae* (55 to 65, Samaya and Carvalho, 1950) encompasses the range of *caribaeum* and broadly overlaps that of *bermudae* (Fig. 7). The myotome count of our study material as well as other *caribaeum* reported in the literature overlaps *bermudae* by only one; however, the variation of all *caribaeum* reported in the literature is great enough to encompass the range known for *haekelii* and *minucauda* and overlaps that of *bazarutense* and *belcheri* as well as *bermudae*.

Fins.—The number of dorsal fin-ray chambers varied from 252-359, with 84 per cent of the specimens possessing 281-330 chambers (Fig. 8). Bigelow and Farfante (1948) gave a minimum count of 227 chambers for specimens from Puerto Rico and a maximum count of 330 for specimens from Florida. Thus, the now known range of dorsal fin-ray chambers in *caribaeum* is 227 to 359, giving a variation of 133 chambers for the species. However, the variation of 108 chambers in the Mississippi Sound lancelets is unparalleled by any known population of *Branchiostoma*. The dorsal fin-ray chamber variation of *caribaeum* narrowly overlaps that of *bermudae* and encompasses that of *platae* (Fig. 9).

The preanal (ventral) fin-ray chambers varied from 35 to 61, with 81 per cent of the specimens possessing 41 to 55 (Fig. 10). Previously reported low and high counts for *caribaeum* were 15 and 18 for specimens from Puerto Rico and Florida respectively to 42 for those from Virginia and North Carolina (Bigelow and Farfante, 1948). The number of preanal fin-ray chambers in *caribaeum* is now known to vary from 15 to 61, giving a variation of 47 chambers for the species. The preanal fin-ray chamber variation of *caribaeum* overlaps well that known of *bermudae* and encompasses that of *platae* (Fig. 11). The ventral fin-ray chambers become progressively smaller towards the anus and are difficult to see in opaque specimens.

The caudal fin varied in shape, and several selected from the study material are shown in Figure 12. No attempt to categorize shapes was made since there is no sharp line of demarcation between the types studied. Caudal fin A shows the upper lobe

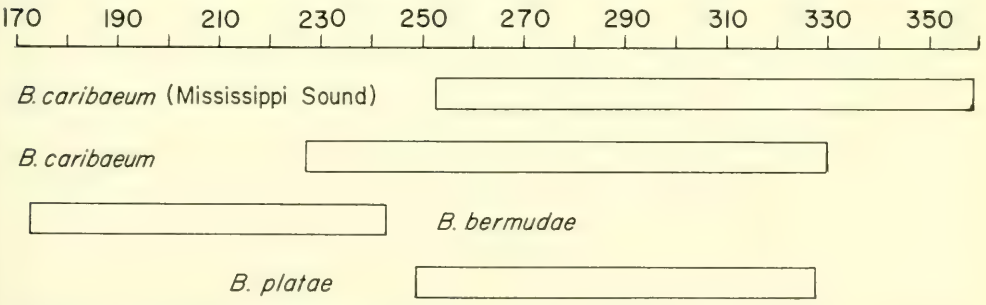


Figure 9. The range of numbers of dorsal fin-ray chambers of Mississippi specimens compared with other western Atlantic lancelets.

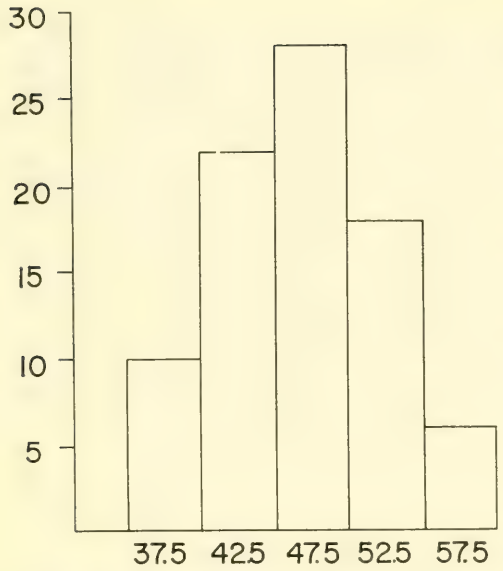


Figure 10. Frequency distribution of preanal fin-ray chambers of Mississippi lancelets.

of the caudal fin considerably posterior to the lower lobe. This shape when compared with the figures of Bigelow and Farfante (1948, Fig. 2, A and F) is seen to be similar to that of *bermudae,* and to some extent *platae*. Fins B and C are most typical of our study material, C being more characteristic of the larger specimens. In fin D the upper lobe extends as far anteriorly as does the lower.

The caudal fin length, measured from the anterior-most part of the lower lobe to the tip, varied from 11.6 to 17.5 per cent of the total body length (Fig. 13). There is a direct correlation between caudal length and body length.

Body proportions.—The study material varied in total length from 9.9 to 52.3 mm. Seventy per cent of the specimens fell into the 35 to 45 mm. class. The mean size was 38 mm. The body depth varied from 7.3 to 11.7 per cent of the total length, with 78 per cent being in the 7.5 to 8.5 per cent class

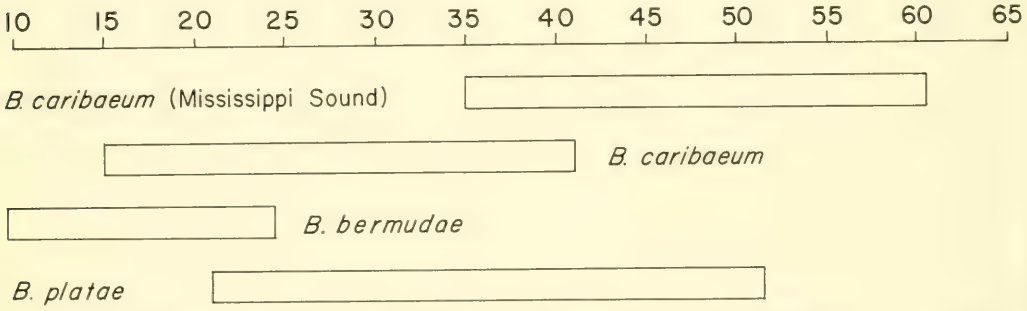


Figure 11. The range of number of preanal fin-ray chambers of Mississippi specimens compared with other western Atlantic lancelets.

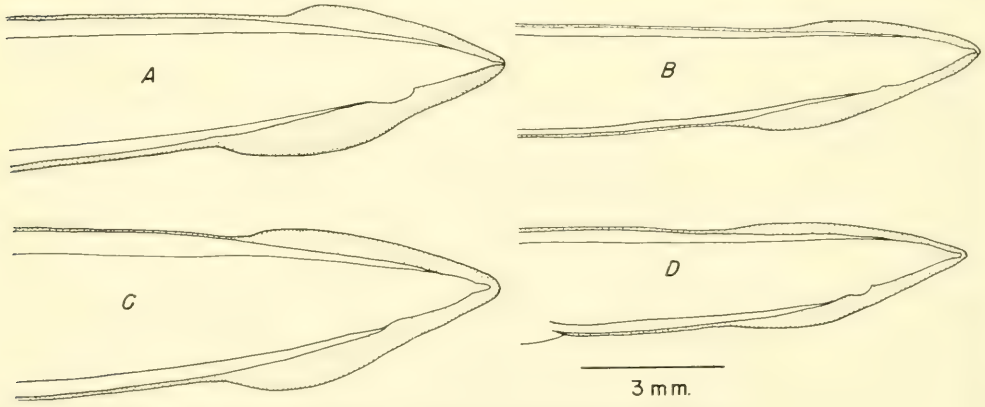
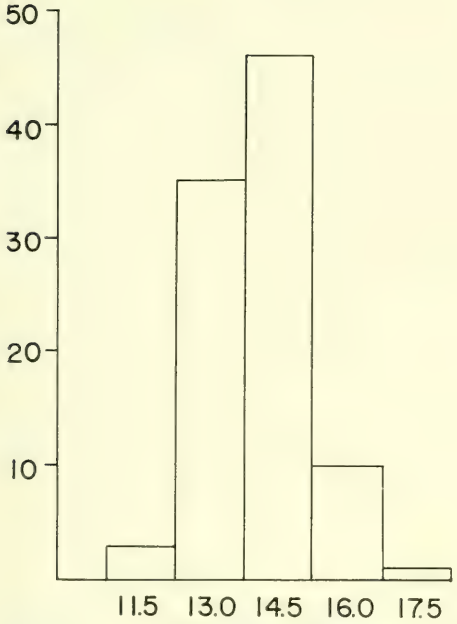
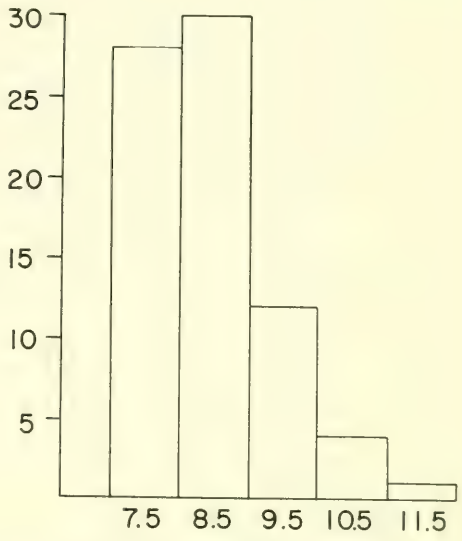


Figure 12. Variations in caudal fin shapes of Mississippi lancelets.





Figures 13-14 Mississippi lancelets. 13. (left side) Frequency distribution of per cent caudal fin length of total body length. 14. (right side) Frequency distribution of per cent body depth of total length.

(Fig. 14). The postatriopore length varied from 27.4 to 32.4 per cent of the total length, 61 per cent falling into the 29 to 30 per cent class (Fig. 15). Both the depth and postatriopore length are more or less directly proportional to total length (Figs. 16 and 17).

The dorsal fin-ray chamber height-breadth ratio is quite variable, the height being from 3 to 5 times the breadth. These limits are equal to those of *bermudae* and overlap those of *platae*. The height of the dorsal fin is contained in the body depth (at deepest point) from 6 to 10 times. There is no correlation of number of dorsal fin-ray chambers and total length. In fact, two relatively small specimens measuring 19.4 and 20.8 mm. in total length possessed 252 and 359 dorsal chambers, respectively. Although the fin-ray chamber measurements were made with an ocular micrometer, we consider the measurements not too reliable since such measurements are affected by the opaqueness of the specimen. Other workers have used this characteristic but we feel that it is not of much value.

The position of the anus varies within the genus *Branchiostoma* from in advance of the center of the caudal lobe to far behind the center. Previous writers have stated that in *caribaeum* the anus is near the center

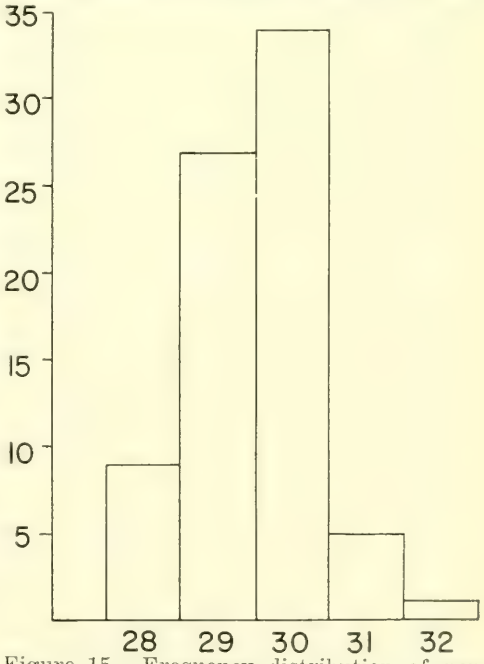


Figure 15. Frequency distribution of per cent postatriopore length of total length of Mississippi lancelets.

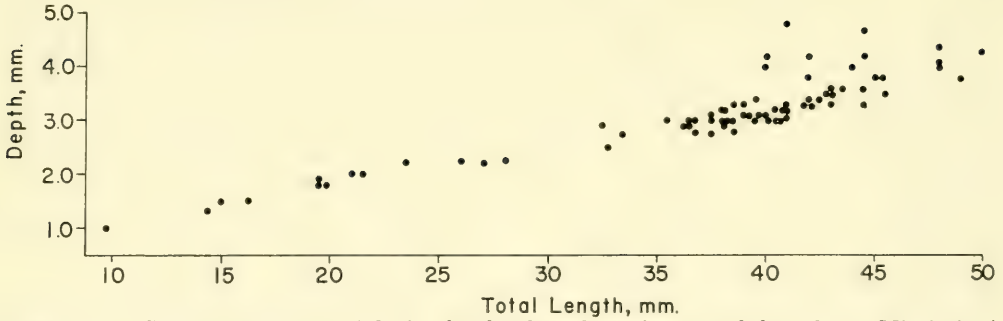


Figure 16. Scatter diagram of body depth plotted against total length of Mississippi lancelets.

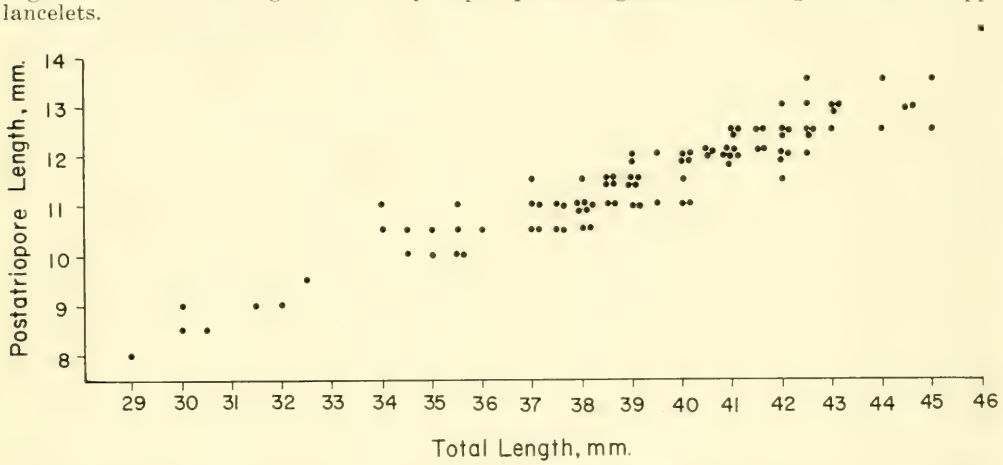
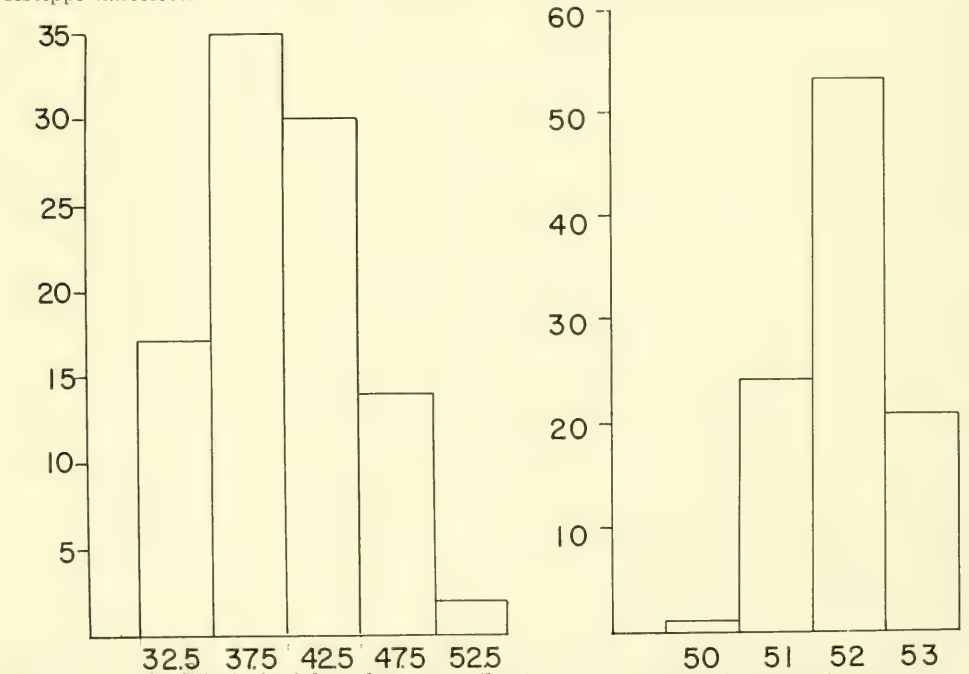


Figure 17. Scatter diagram of postatriopore length plotted against total length of Mississippi lancelets.



Figures 18-19. Mississippi lancelets. **18.** (left) Frequency distribution of per cent postanal length of lower caudal fin lobe. **19.** (right) Frequency distribution of position of anus by myotome number.

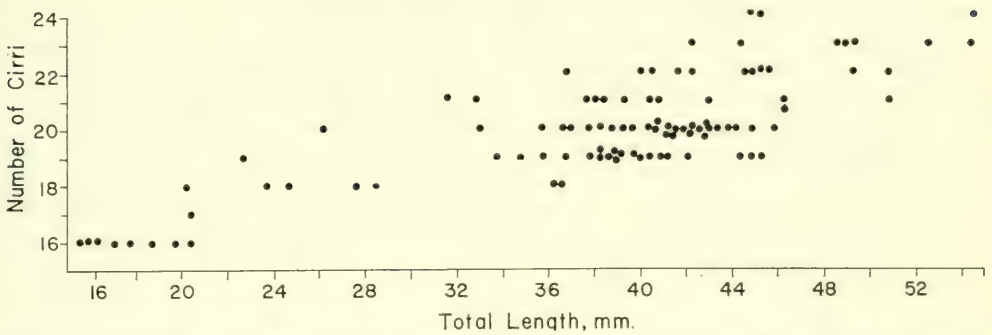


Figure 20. Scatter diagram of number of cirri on left side of oral hood plotted against total body length of Mississippi lancelets.

but have not placed it by actual measurements. We have found in the Mississippi Sound specimens that the anus is almost always behind the center of the lower caudal lobe, the postanal length varying from 30 to 53 per cent of the lower caudal lobe. The mean postanal length is 40 per cent of the lower caudal lobe (Fig. 18). The position of the anus by myotome number varies from myotome 50 to 53, with the mode 52 (Fig. 19).

Cirri.—Oral cirri were counted on the left side only. They varied from 16 to 24, the number increasing proportionally with body length (Fig. 20). The diameter of the cirri varied from 0.04 to 0.09 mm., this too having some correlation with total length of the lancelet. The cirri of the Mississippi Sound lancelets all have lateral knob-like projections, varying in number and position. They are best developed on larger specimens and are most dense on the longer, lateral cirri.

Gonads.—The position of the gonads relative to myotomes may have some taxonomic significance. The modal formula for this character is 9—25—1, where 9 is the number of myotomes anterior to the first gonad; 25, the number of myotomes within the gonadal region, and 1, the number of myotomes between the last gonad and the atriopore. Counts on 50 specimens, without regard to sex, varied as follows: 6 to 11 — 20 to 28 — 0 to 3. These figures were established from counts made on the left side of the animal.

Gonad counts were made on 100 mature specimens ranging in size from 32 to 52 mm. The total number of gonads varied from 46 to 57, with a mean of 51.4 and mode of 52. There was a slight difference between right and left sides. The left side

TABLE 1.
Statistical table of 12 characters in Branchiostoma caribaeum *

Character	Number	Range	Mean	Standard Deviation	Standard Error	Coefficient of Variation	Rank
1	100	57–60	58.6	0.76	0.07	1.3	2
2	100	35–37	36.1	0.14	0.01	0.39	1
3	100	21–24	22.5	0.45	0.04	2.0	4
4	100	14–17	15.8	0.69	0.07	4.4	6
5	100	6–8	6.7	0.50	0.05	7.5	9
6	100	252–359	306.9	18.84	1.88	6.2	7
7	84	35–61	47.2	5.75	0.63	12.2	12
8	95	11.6–17.5	14.1	0.99	0.10	7.1	8
9	100	30.2–53.2	39.8	4.62	0.46	11.7	11
10	74	7.3–11.7	8.4	0.85	0.99	10.1	10
11	100	50–53	51.95	0.70	0.07	1.4	3
12	100	27.4–32.4	29.4	1.0	0.1	3.4	5

*(1) Total myotomes; (2) Preatriopore myotomes; (3) Postatriopore myotomes; (4) myotomes between atriopore and anus; (5) Postanal myotomes; (6) Dorsal fin-ray chambers; (7) Preanal (ventral) fin-ray chambers; (8) Per cent caudal fin length of total body length; (9) Per cent postanal length of caudal fin length; (10) Per cent body depth of body length; (11) Position of anus, myotome number; (12) Per cent atriopore length of total length.

varied from 23 to 29, with a mean of 25.1 and mode of 27, whereas the right side varied from 22 to 30, with a mean of 26.3 and a mode of 26. There was no correlation between number of gonads and size of the animal.

Discussion of Taxonomic Characters

A statistical analysis of 12 meristic counts and measurements is shown in Table 1. The coefficient of variation was calculated to give an index to the reliability of each character. The characters are accordingly ranked in order of increasing variation or decreasing taxomonic significance. Myotomes, especially preatriopore myotomes, are the least variable among the characters, but as we have seen, they alone cannot be used to separate *B. caribaeum* from the other western Atlantic species, or indeed, several other species of the world. In fact, a statistical analysis of populations of lance-

Table 2.

Comparison of seven taxonomic characters of six species of Branchiostoma

Species	N	Total Myotomes				Preatriopore Myotomes			
		Range	Mean	S.D.	C.V.	Range	Mean	S.D.	C.V.
B. caribaeum (Mississippi Sound)	100	57–60	58.6	0.76	1.3	35–37	36.1	0.14	0.39
B. platae [1]	64	55–65	59	0.65	1.1	34–42	37	0.53	1.4
B. nigeriense [2]	100	65–71	67.8	1.4	2.6	39–44	41.8	1.29	3.1
B. senegalense [2]	40	67–71	68.6	0.86	1.3	39–41	40.2	0.6	1.5
B. leonense [3]	25	66–73	69.2	1.92	2.8	40–45	43.2	1.33	3.1
B. lanceolatum [4]	27	61–65	62.6	1.04	1.67	35–37	36	0.71	1.42

Species	N	Myotomes between Atriopore and Anus				Postanal Myotomes			
		Range	Mean	S.D.	C.V.	Range	Mean	S.D.	C.V.
B. caribaeum (Mississippi Sound)	100	14–17	15.8	0.69	4.4	6–8	6.7	0.5	7.5
B. platae [1]	64	9–17	15	0.47	3.1	5–9	6.8	0.23	3.3
B. nigeriense [2]	100	14–16	15.2	0.35	2.3	10–12	10.9	0.3	2.8
B. senegalense [2]	40	16–18	17	0.63	3.7	10–12	11.4	0.57	5.0
B. leonense [3]	25	14–16	15.5	0.59	3.8	10–12	10.4	0.65	6.2
B. lanceolatum [4]	27	13–16	14.3	0.71	5.0	11–14	12.4	0.75	6.0

Species	N	Dorsal Fin-Ray Chambers				Preanal Fin-Ray Chambers			
		Range	Mean	S.D.	C.V.	Range	Mean	S.D.	C.V.
B. caribaeum (Mississippi Sound)	100	252–359	307	18.8	6.2	35–61	47	5.8	12.2
B. platae [1]	64	249–310	278	14.7	5.2	22–53	35	11.4	32.5
B. nigeriense [2]	100	330–376	346	9.7	2.8	50–58	55	2.0	3.7
B. senegalense [2]	40	267–325	292	13.4	4.6	45–59	52	3.2	6.2
B. leonense [3]	25	355–418	382	15.2	4.0	51–64	58	3.2	5.4
B. lanceolatum [4]	27	210–270	238	15.0	6.3	30–48	39	4.1	10.5

Species	N	Per cent postatriopore length of preatriopore length			
		Range	Mean	S.D.	C.V.
B. caribaeum (Mississippi Sound)	100	38–48	42	2.1	5.0
B. platae [1]	64	–	–	–	–
B. nigeriense [2]	100	40–45	42.4	1.5	3.5
B. senegalense [2]	40	44–54	50	2.3	4.6
B. leonense [3]	25	33–41	38	2.1	5.5
B. lanceolatum [4]	27	43–51	47	1.9	4.1

[1] Sawaya and Carvalho, 1950
[2] Webb, 1955
[3] Webb, 1956a
[4] Webb, 1956c

TABLE 3.

Comparison of the Mississippi Sound lancelets with the other species of the western Atlantic *

Species	Taxonomic Characters										
	1	2	3	4	5	6	7	8	9	10	11
B. caribaeum (Mississippi Sound)	57–60	35–37	14–17	6–8	252–359	35–61	6–10x	3–5x	.38–.48	22–30	Behind midpoint of lower caudal lobe
*B. caribaeum*** (Previously reported)	57–64	35–38	13–17	6–9	227–320	15–42	8x	5–8x	–	22–29	In advance of midpoint of lower caudal lobe
*B. platae***	55–65	34–42	9–17	5–9	249–327	19–53	4–8x	4x	.28–.32	26–31	Near midpoint of lower caudal lobe
*B. bermudae***	54–57	35–36	12–14	5–7	172–242	9–24	6–7x	3–4x	.31–.43	22–28	Little behind midpoint of lower caudal lobe

* The characters are numbered 1-11: (1) Total myotomes; (2) Preatriopore myotomes; (3) Myotomes between atriopore and anus; (4) Postanal myotomes; (5) Dorsal fin-ray chambers; (6) Preanal (ventral) fin-ray chambers; (7) Number of times height of dorsal fin is contained in depth of body; (8) Height of dorsal fin-ray chamber times its breadth; (9) Postatriopore region as a proportion of the length of the preatriopore region; (10) Gonads, one side; (11) Position of anus.

** Data based on works cited in text.

lets would be necessary in order to separate them unequivocally. Too, a character that varies widely in one species does not necessarily do so in another. Webb (1955) assessed the value of various taxonomic characters in *B. senegalense* and *nigeriense* and found that although both species were equally variable as a whole, the degree of variation for a given character was not necessarily the same in both species. Comparison of present data on *B. caribaeum* (Table 2) with that of several other species of lancelets of the world gives further weight to Webb's conclusion.

Table 3 compares the Mississippi Sound lancelets to others of the western Atlantic. In some ways *B. caribaeum* is more similar to *platae* than to *bermudae,* and vice versa, but in general it seems to be a bit more similar to *B. platae.*

References Cited

Adams, A. C. and William C. Kendall 1891. Report upon an investigation of the fishing grounds off the west coast of Florida. *Bull. U. S. Fish Comm.* 9(1889): 289-312.

Andrews, E. A. 1893. An undescribed acraniate: *Asymmetron lucayanum. Stud. Biol. Lab. Johns Hopkins Univ.* 5(4): 213-247.

Bigelow, Henry B. and Isabel Pérez Farfante 1948. Lancelets (in *Fishes of the Western North Atlantic,* No. 1) pp. 1-28. Sears Found. Mar. Res., New Haven.

Boschung, Herbert T. and Jack C. Mallory 1956. A record of the lancelet, *Branchiostoma caribaeum,* from the stomach of a sturgeon from the Gulf Coast of Alabama. *Copeia* 1956 (2): 116.

Baughman, J. L. 1950. Random notes on Texas fishes. Part 1. *Texas J. Sci.* 2(1): 117-138.

Dawson, C. E. 1961. Notes on a second record of *Branchiostoma* from Louisiana. *Copeia* 1961 (2): 242.

Everman, B. W. and W. C. Kendall 1900. Check-list of the fishes of Florida. *Rept. U. S. Comm. Fish.* (1899): 37-103.

Fowler, Henry W. 1945. A study of the fishes of the southern Piedmont and coastal plain. *Monogr. Acad. Nat. Sci. Philadelphia* 7: 1-408.

Franz, Victor 1922. Systematische Revision der Akranier. (Fauna et Anatomia ceylanica, nr. 10). *Jena. Zeitschr. Naturw.* 58: 369-452.

Gunter, Gordon and Frank T. Knapp 1951. Fishes, new rare or seldom recorded from the Texas coast. *Texas J. Sci.* 3(1): 134-138.

Hefley, Harold M. and Hurst Shoemaker 1952. The occurrence of *Branchiostoma* (Amphioxus) in Mississippi and Louisiana. *Science* 115(2976): 48.

Hoese, Hinton D. 1958. A partially annotated checklist of the marine fishes of Texas. *Publ. Inst. Mar. Sci., (U. Texas)* 5: 312-352.

Hubbs, C. L. 1922. A list of the lancelets of the world with diagnoses of five new species of *Branchiostoma. Occ. Paps. Mus. Zool. Univ. Michigan,* No. 105: 1-16.

Hutton, R. F., B. Eldred, K. D. Woodburn, and R. M. Ingle. 1956. The ecology of Boca Ciega Bay with special reference to dredging and filling operations. *Fla. State Board Conserv., Tech. Ser.* 17(1): 1-86.

Kingsley, J. S. (Ed.) 1885. Lower vertebrates. *Standard Natural History,* Vol. III, 302 pp. S. E. Cassino Co., Boston.

Longley, William H. and Samuel F. Hildebrand 1941. Systematic catalogue of the fishes of Tortugas, Florida. *Paps. Tortugas Lab.* 34: 1-331.

Rice, Henry J. 1880. Observations upon the habits, structure and development of *Amphioxus lanceolatus. Amer. Nat.* 14 (1): 1-19.

Sawaya, Paulo and Joao De Paiva Carvalho 1950. On the *Branchiostoma* (Amphioxus) of the coast of Sao Paulo. *Bol. Fac. Filos. Cien. e Letras (Univ. Sao Paulo), Zool.* 15: 235-237.

Springer, V. G. and K. D. Woodburn 1960. An ecological study of the fishes of the Tampa Bay area. *Fla. State Board Conserv., Prof. Paps. Ser.* No. 1: v + 104 pp.

Webb, J. E. 1955. On the lancelets of West Africa. *Proc. Zool. Soc. London* 125: 421-443, 3 pls.

---------- 1956a. Cephalochordata of the coast of tropical West Africa. *Atlantide Report* 4: 167-182.

---------- 1956b. A note on the lancelets of Singapore, with a description of a new species of *Branchiostoma. Proc. Zool. Soc. London* 127: 119-123.

---------- ---------- 1956c. On the populations of *Branchiostoma lanceolatum* and their relations with the West African lancelets. *Ibid.* 127: 125-140.

Wells, Morris Miller 1926. Collecting amphioxus. *Science,* n.s. 64: 187-188.

Wright, A. A. 1890. Amphioxus in Tampa Bay. *Amer. Nat.* 24: 1085.

Abstract

The known distribution of *Branchiostoma caribaeum* Sundevall in the Gulf of Mexico is from Cape Romano, Florida to Port Aransas, Texas. The literature indicates that this lancelet is abundant on parts of the western Florida coast, but it has not been recorded in abundance along the northern Gulf coast. Quantitative collections by the use of a modified Petersen grab showed that this species is present in numbers up to 73 per square meter in Missis-

sippi Sound and a little way outside the barrier islands from Mobile Bay to Louisiana, an area of about 350 square miles. The total numbers in this region must be in the order of several billions. The lancelet is sometimes exposed by low tides, and the greatest depth at which it was taken was 15 fathoms, 20 miles south of Mobile Bay. In shallow water *B. caribaeum* was taken in greatest numbers where shell and plant debris was common on the bottom. Hundreds of sediment samples collected in Mississippi Sound and the adjacent Gulf show that about nine times out of ten amphioxus was taken in coarse or medium coarse sand, or coarse sand mixed with silt, and was taken rarely on fine sand and not at all on clay. The salinity at 32 stations where amphioxus was taken ranged from 15.4 to 33.1 *per mille* and the mean salinity was 24.3. (This does not include the outside stations, where the salinity was certainly up to 36.0). Lancelets were taken with *Saccoglossus*, the echinoid *Mellita*, and various nemertean and annelid worms, as well as several pelecypods. It was observed that lancelets lying on the bottom would wriggle their way into the sand, a manner of burial which has not been recorded before. Analysis of meristic characters confirms Webb's dictum that a character which varies widely in one species does not necessarily do so in another. Some meristic characters overlap those of the other species of the western Atlantic to a considerable extent, and even other species of lancelets of the world. In meristic characters *B. caribaeum* is more similar to *B. platae* than to *B. bermudae* but this generalization does not hold for all characters. Statistical analyses of populations of lancelets are necessary for their unequivocal separation as species.