

BIOLOGICAL RESULTS OF THE UNIVERSITY OF MIAMI DEEP-SEA EXPEDITIONS. 58.  
A NEW SPECIES OF *CLYPEASTER* FROM THE GULF AND  
CARIBBEAN AND A KEY TO THE SPECIES IN THE  
TROPICAL NORTHWESTERN ATLANTIC  
(ECHINODERMATA: ECHINOIDEA)<sup>1</sup>

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ABSTRACT

A new species of *Clypeaster* is described and compared with the closely related congener *C. subdepressus* (Gray). Juvenile characteristics of both species are described and morphologic growth changes are discussed. Size determinations are made for the appearance of genital pores and the acquisition of adult proportions. New ratios are used to supplement those previously established for discerning specific differences in this group. A key to the species of *Clypeaster* in the northwestern Atlantic is included which, where possible, contains adult and juvenile characters.

INTRODUCTION

The genus *Clypeaster* Lamarck, 1801, has a worldwide tropical-subtropical distribution and embraces over 30 Recent and 350 fossil species (Mortensen, 1948). Morphology of the test in this genus of sand dollar is highly variable, most notably in relative height. Mortensen (1948) followed several previous authors and subdivided the genus into several "sections" that were more or less equivalent to subgenera. However, Durham (1955) stated that the various characters used for separation tend to grade into one another without interruption, and that there are no adequate criteria by means of which the genus can be reliably subdivided.

The new species described below constitutes the eleventh Recent species of *Clypeaster* known from the tropical northwestern Atlantic. A key to these species is presented; it uses characters which should be reliable for both juvenile and adult specimens.

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couragement during this study. Appreciation is due Dr. Frederick M. Bayer of the Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, and Dr. H. B. Fell of the Museum of Comparative Zoology, for lending numerous specimens; and to Dr. David L. Pawson and Miss Maureen E. Downey of the United States National Museum, and Robert W. Topp of the Museum of Comparative Zoology, who graciously gave their assistance whenever it was requested. Messrs. Martin A. Moe, Jr., William G. Lyons, and Edwin A. Joyce, Jr., also are acknowledged for critical review of the manuscript. This study was conducted under the auspices of the Florida Board of Conservation Marine Research Laboratory.

#### METHODS AND MATERIALS

Seventeen characters were examined statistically to find those which are of taxonomic significance. Table 1 lists six characters which were most consistent for the new species. Table 2 lists the same characters for the smaller juveniles which do not fall within the ranges established for adults. Terminology follows that of Hyman (1955), Mortensen (1948), and Fell & Moore (1966). Measurements exceeding 130 mm were taken to the nearest 1.0 mm with a standard millimeter scale. Those between 50 and 130 mm were taken with vernier calipers to the nearest 0.5 mm, and those less than 50 mm were taken with vernier calipers to the nearest 0.1 mm.

Ninety-two specimens were obtained from the following institutions: United States National Museum, Washington, D. C. (USNM); Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Florida (UMML); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); Florida Board of Conservation Marine Research Laboratory, St. Petersburg, Florida (FSBC). All specimens are deposited in the above museums.

Family CLYPEASTERIDAE L. Agassiz, 1835

*Clypeaster* Lamarck, 1801

***Clypeaster chesheri***, sp. nov.

Figs. 1-5; 6, C-D; 7

*Material Examined.*—Ninety-two specimens from 32.7 to 225.0 mm in test length (TL), including the following: 2 specimens, 139.0-146.0 mm TL, R/V PILLSBURY sta. P-362, off Colombia, 8°58'N, 76°34'W, 64-55 m, 12 July 1966, MCZ 8607.—2 specimens, 53.5-67.0 mm TL, sta. P-365, off Colombia, 9°31'N, 76°15'W, 56-58 m, 13 July 1966, USNM E10877.—2 specimens, 168.0-184.0 mm TL, sta. P-366, off Colombia, 9°31'N, 76°00'W, 37-33 m, 13 July 1966, USNM E10864, USNM E10868.—3 specimens, 126.0-164.0 mm TL, sta. P-367, off Colombia, 9°31'N, 75°50'W, 37-35 m, 13 July 1966, UMML 42:128, UMML 42:129, UMML 42:130.

—5 specimens, 32.7-142.0 mm TL, sta. P-370, off Colombia, 9°38'N, 75°50'W, 37 m, 13 July 1966, USNM E10866.—9 specimens, 35.0-102.0 mm TL, sta. P-372, off Colombia, 9°45'N, 76°12'W, 101-82 m, 13-14 July 1966, USNM E10869, USNM E10876.—2 specimens, 90.0-103.0 mm TL, sta. P-380, off Colombia, 10°07'N, 75°48'W, 64-70 m, 14 July 1966, USNM E10871.—3 specimens, 33.0-66.5 mm TL, sta. P-392, off Colombia, 9°45'N, 76°09'W, 79-75 m, 16 July 1966, MCZ 8602.—2 specimens, 85.0-90.0 mm TL, sta. P-397, off Colombia, 9°13'N, 76°27'W, 62-66 m, 17 July 1966, UMML 42:131.—4 specimens, 38.5-58.5 mm TL, sta. P-411, off Panama, 8°41'N, 77°22'W, 29-42 m, 18 July 1966, MCZ 8603.—1 specimen, 88.0 mm TL, sta. P-425, off Panama, 9°39'N, 79°15'W, 70-64 m, 19 July 1966, USNM E10875.—3 specimens, 136.0-169.0 mm TL, sta. P-432, off Panama, 9°18'N, 80°03'W, 24 m, 20 July 1966, MCZ 8608.—3 specimens, 156.0-182.0 mm TL, sta. P-433, off Panama, 9°21'N, 80°14'W, 68-64 m, 20 July 1966, USNM E10867.—2 specimens, 158.0-177.0 mm TL, sta. P-435, off Panama, 9°09'N, 80°30'W, 37-48 m, 20 July 1966, MCZ 8609.—5 specimens, 60.5-118.5 mm TL, sta. P-624, off Honduras, 16°00'N, 86°06'W, 35-48 m, 21 March 1968, MCZ 8604.—12 specimens, 44.7-78.5 mm TL, sta. P-625, off Honduras, 16°00'N, 86°03'W, 27-37 m, 21 March 1968, MCZ 8605.—8 specimens, 63.5-110.0 mm TL, sta. P-626, off Honduras, 15°58'N, 86°09'W, 35-40 m, 21 March 1968, USNM E10873.—1 specimen, 99.0 mm TL, sta. P-627, off Honduras, 15°57'N, 86°14'W, 46 m, 21 March 1968, USNM E10870.—1 specimen, 51.5 mm TL, sta. P-628, off Honduras, 15°57'N, 86°15'W, 46-48 m, 21 March 1968, USNM E10874.—10 specimens, 36.8-99.0 mm TL, R/V GERDA sta. G-566, Dry Tortugas, 24°25'N, 82°56'W, 62 m, 12 April 1965, USNM E10872.—1 specimen, 75.0 mm TL, sta. G-583, Florida Keys, 24°32'N, 81°23'W, 54 m, 14 April 1965, FSBC 6587.—1 specimen, 106.5 mm TL, R/V HERNAN CORTEZ sta. M, off Ft. Myers, Florida, 26°24'N, 83°43'W, 73 m, 16 February 1967, FSBC 4683.—1 specimen, 166.0 mm TL, R/V HERNAN CORTEZ sta. M, off Ft. Myers, Florida, 26°24'N, 83°43'W, 73 m, 9 March 1967, FSBC 4684.—4 specimens, 41.0-45.6 mm TL, R/V ANTON BRUUN sta. 835, off Loggerhead Key, Dry Tortugas, 59 m, 18 October 1966, MCZ 8441.—1 specimen, 66.0 mm TL, R/V HERNAN CORTEZ sta. 108, off St. Petersburg, Florida, 27°25'N, 84°08'W, 64 m, 24 May 1965, FSBC 4682.—2 specimens, 33.1-36.4 mm TL, Johnson-Smithsonian Expedition of 1933, off Puerto Rico, USNM E3908.—2 specimens, 154.0-225.0 mm TL, no data, FSBC 6592, MCZ 8606.

*Diagnosis.*—Paired petals closed distally; oral side nearly flat with only a slight concavity around peristome; areoles of aboral primary tubercles relatively uniform in size; test oval, greatest width divided by width at posterior

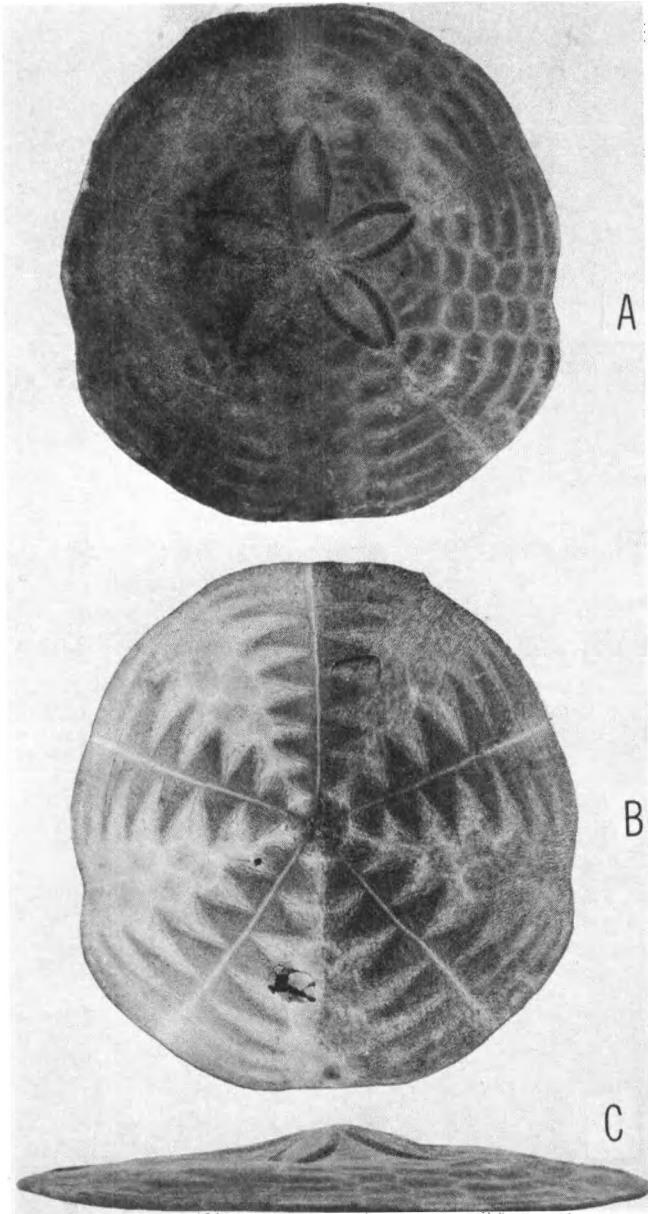


FIGURE 1. *Clypeaster chesheri*, USNM E10868, holotype, 184.0 mm test length: A, aboral view; B, oral view; C, side view.

TABLE 1  
MORPHOMETRIC CHARACTERS FOR THE HOLOTYPE OF *C. chesheri* AND STATISTICAL ANALYSIS OF 75 SPECIMENS LARGER THAN 50 MM IN TEST LENGTH

	Test length (mm)	Ratio, length-to-width	Height (% of TL)	Thickness of test edge (% of TL)	Petal III (%)*	Petal II (%)*	Petal I (%)*
Holotype	184.0	1.03	10	1.4	49	46	44
Mean	95.7	1.06	12	3.1	49	43	42
Standard deviation	41.6	0.03	1.4	0.7	4.3	3.2	3.3
Standard error	4.750	0.004	0.158	0.081	0.486	0.377	0.390
Range	50.5– 225.0	0.97– 1.12	9–15	1.4– 5.0	41–61	38–57	35–56

\* Length of petal in terms of percentage of the distance from the apex to the ambitus at the center of the corresponding ambulacrum.

edge of interambulacra 1 and 4 (Loven's system) less than 1.10; ridge between pore-pairs of petals with nine or more primary tubercles in adults; petaloid region less than 50 per cent of test length; length-to-width ratio less than 1.14.

*Description.*—The test varies from nearly circular to slightly elongate with a length-to-width ratio of 0.97-1.12. The edge is slightly indented at each interambulacrum in full-grown adults. The petaloid area is surrounded by a low ridge that gradually tapers to the ambitus. Test height, expressed as a percentage of length, varies from 10 to 15 per cent in adults. Certain proportions and ratios of juveniles differ from those of adults. Specimens without genital pores were designated as juveniles and were evaluated separately. Juveniles are somewhat higher, ranging from 11 to 19 per cent of the test length. An unusually large, flat juvenile, USNM number E10872, has a height of 9 per cent of the length. The thickness of the anterior edge of the test is 1.4 to 3.9 per cent of the test length in adults and 2.4 to 5.7 per cent in juveniles.

The ambulacral petals are distinctly closed at their distal ends. The anterior unpaired petal (III) is the longest and extends 40 to 56 per cent of the distance from the apex to the ambitus at the center of ambulacrum III. In juveniles, this percentage is generally less, ranging from 41 to 51 per cent. The posterior paired petals (I and V) are the next longest. They extend from 36 to 50 per cent of the distance from the apex to the ambitus at the center of ambulacra I or V. In juveniles, these petals are generally shorter, extending from 35 to 45 per cent of this distance. The anterior paired petals (II and IV) are the shortest. They extend 39 to 49

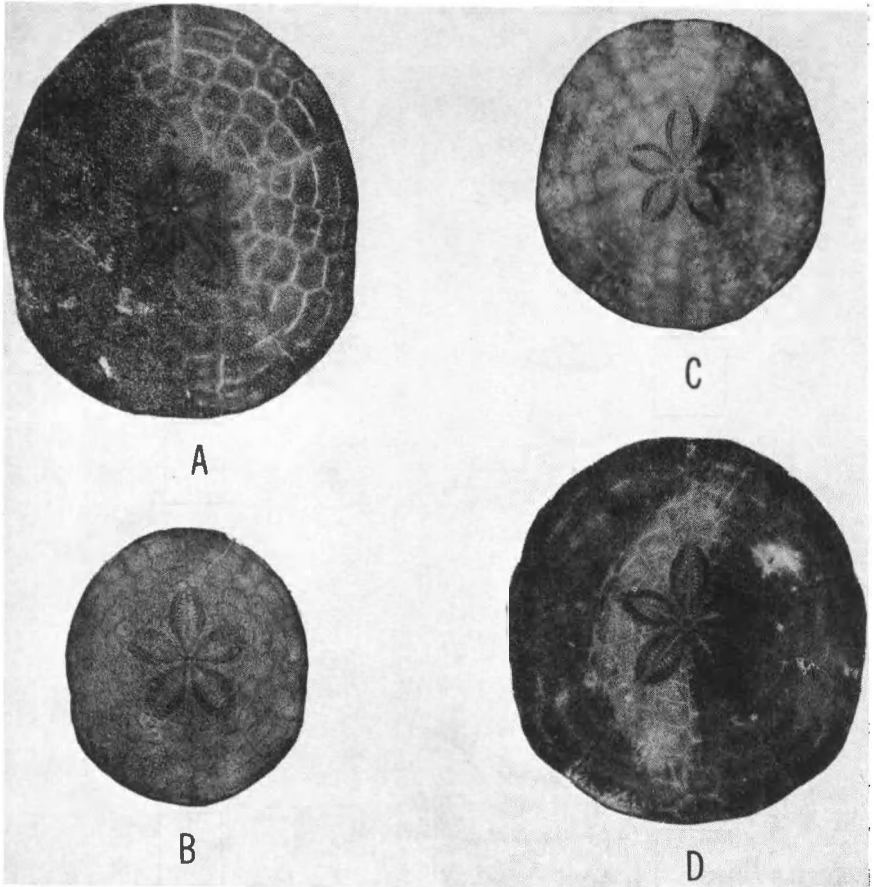


FIGURE 2. Juveniles: A, *Clypeaster subdepressus*, FSBC I 5863, 43.6 mm test length; B, *C. subdepressus*, FSBC I 1430, 29.3 mm test length; C, *C. chesheri*, USNM E10866, 32.7 mm test length; D, *C. chesheri*, USNM E10866, 40.0 mm test length.

per cent of the distance from the apex to the ambitus at the center of ambulacra II or IV. In juveniles, this percentage is slightly less, ranging from 37 to 46 per cent. In some specimens, this percentage is greater for the anterior paired petals than for the longer posterior paired petals; the apical system is slightly anterior in these.

The primary tubercles on the ridge between the pore-pairs increase in number as the size of the animal increases. The number of tubercles varies considerably from one area of the petal to another, due to differences in the length of the ridge separating the pore-pairs. This frequently used

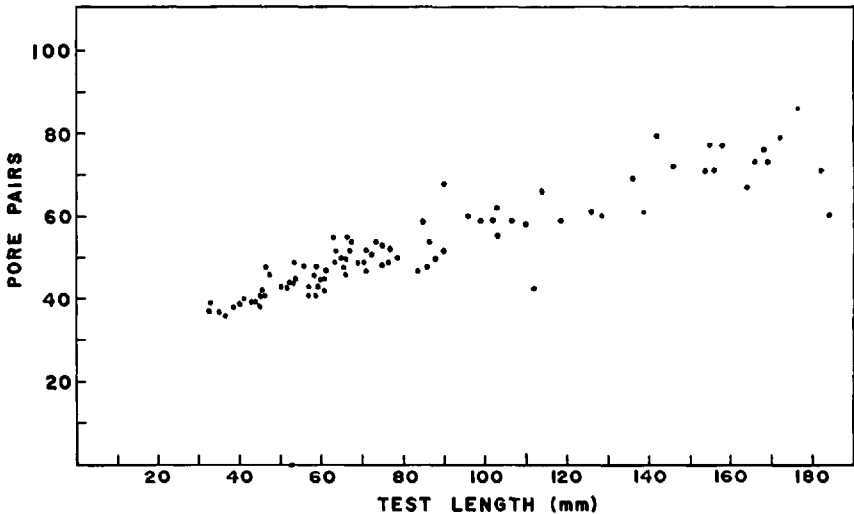


FIGURE 3. The number of pore-pairs in petal III as a function of test length for *Clypeaster chesheri*.

character has doubtful taxonomic significance in immature specimens. Adults display some consistency in the maximum number of tubercles on a ridge at the widest part of a petal, and this count can be used as a differentiating character. The number for the present species is 9-14 per ridge. Pore-pairs are added distally with growth. There is a high positive linear relationship between the number of pore-pairs in a petal and the length of the test (Fig. 3) in the specimens examined.

In the interambulacra, primary tubercles are evenly distributed on the aboral side. The concentration of tubercles varies with the size of the test. The density of tubercles ranges from 400-500 per  $\text{cm}^2$  on a specimen 166 mm long. The diameter of the aboral areoles is uniform on any one specimen but varies in adult specimens from 0.27 to 0.41 mm. Conversely, the concentration of tubercles on the oral side varies considerably from one area of the test to another. They are least concentrated around the peristome and gradually increase in concentration toward the ambitus. The density on a specimen 166 mm long ranges from 200 per  $\text{cm}^2$  near the mouth to 300 per  $\text{cm}^2$  near the ambitus. The diameters of the oral areoles range from 0.41-0.54 mm in adults, and are approximately 1.5 times greater than the diameters of the aboral areoles.

The apical system is located centrally. The distance from the anterior ambitus to the center of the apex ranges from 47 to 53 per cent of the test length. Adults have five genital pores. In some specimens, genital

TABLE 2  
MORPHOMETRIC CHARACTERS FOR JUVENILE SPECIMENS OF *C. chesheri* LESS  
THAN 50 MM IN TEST LENGTH

Catalog number	Test length (mm)	Ratio, length-to-width	Height (% of TL)	Thickness of test edge (% of TL)	Petal III (%)*	Petal II (%)*	Petal I (%)*
USNM E10869	47.5	1.07	14	5.3	49	43	41
USNM E10876	46.5	1.07	15	5.4	51	44	41
USNM E10872	46.0	1.06	12	4.3	43	40	36
MCZ 8441	45.6	1.05	16	5.3	51	45	44
MCZ 8441	45.3	1.08	16	4.4	46	41	41
MCZ 8605	44.7	1.07	15	4.7	44	41	42
MCZ 8441	44.1	1.10	15	3.8	44	39	37
MCZ 8603	44.0	1.05	15	3.4	46	40	36
MCZ 8441	41.0	1.11	16	4.6	47	45	45
USNM E10866	40.0	1.05	14	3.8	43	42	38
MCZ 8603	38.5	1.04	18	3.9	46	40	37
USNM E10872	36.8	1.06	12	5.4	48	41	39
USNM E3908	36.4	1.08	—	5.8	49	43	43
USNM E10869	35.0	1.03	19	5.7	43	39	40
USNM E3908	33.1	1.06	15	5.7	51	46	45
MCZ 8602	33.0	1.03	17	4.5	47	44	44
USNM E10866	32.7	1.06	14	4.3	43	41	39

\* Length of petal in terms of percentage of the distance from the apex to the ambitus at the center of the corresponding ambulacrum.

pores were present in an early stage of development corresponding to stage 2 of Tahara & Okada (1968). These were designated "subadults." The genital pores begin to develop when individuals are between 58 and 90 mm in test length.

The peristome varies from circular to laterally elongate. It is located directly opposite the center of the apical system and is slightly depressed.

The periproct varies in shape from round to somewhat irregular. Periproct plates are covered with miliary tubercles. On a periproct 5.0 mm wide, these tubercles number about 100. The distance from the edge of the periproct to the ambitus is generally less than the width of the periproct.

Primary spines on the oral side are hollow, curved, and tapered distally (Fig. 4,A). They are slightly flattened throughout their length and possess serrations on the distal half. The serrations are located only on the spokes of the outer side of the curvature. The large primaries around the peristome are also hollow, curved, flattened, and tapered distally, but are without serrations (Fig. 4,B). The primaries of the aboral side are straight, club-shaped spines with serrations on all spokes of the distal end (Fig. 4,E). These are 25 to 35 per cent as long as the oral primaries. The miliary spines on the oral side are straight and blunt, without serrations



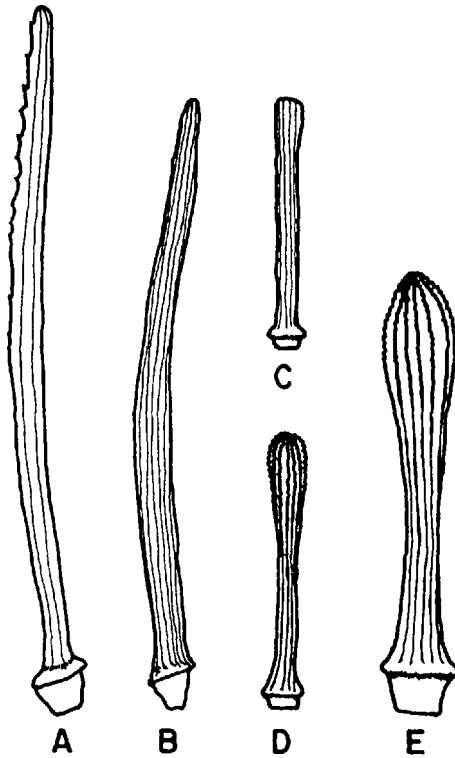


FIGURE 4. Spines of *Clypeaster chesheri*: A, primary from oral side, 2.23 mm long; B, primary from depressed area around mouth, 3.65 mm long; C, miliary from oral side, 0.36 mm long; D, miliary from aboral side, 0.40 mm long; E, primary from aboral side, 0.65 mm long. All spines were taken from a specimen 154 mm in test length.

on the spokes (Fig. 4,C). The miliaries on the aboral side (Fig. 4,D) are straight, club-shaped, and serrated, similar to the aboral primaries.

Four types of pedicellariae were found: quadridentate, tridentate, triphyllous, and ophicephalous. The quadridentate type, often referred to as the four-valved tridentate, is found in only a few groups of echinoids. In this species, they occur over the entire test, but are more concentrated and slightly larger on the oral side. Quadridentate pedicellariae (Fig. 5,A) located around the mouth are considerably larger than those in other areas of the test. Tridentate pedicellariae (Fig. 5,B) are found over the entire test in greater numbers than the quadridentate pedicellariae, and are similarly larger and more numerous on the oral side. Ophicephalous pedicellariae (Fig. 5,D) are found on both sides of the test, concentrated near

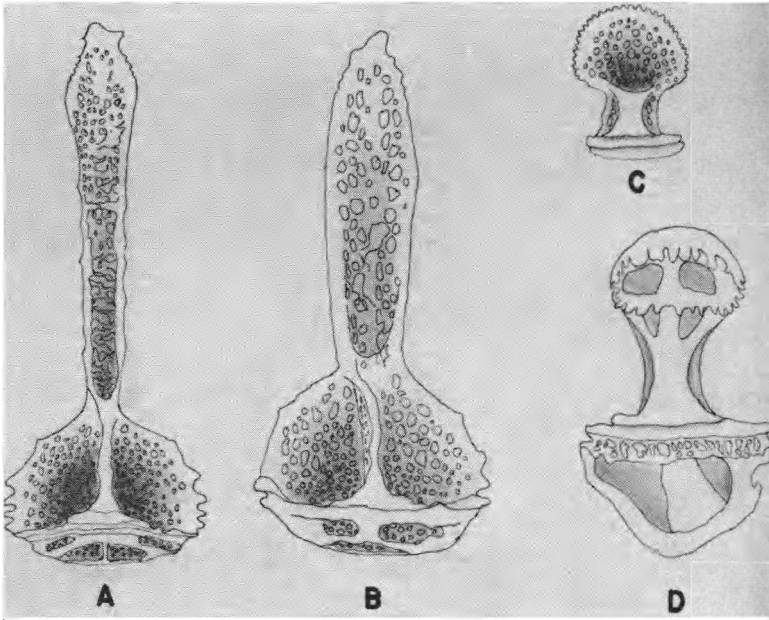


FIGURE 5. Pedicellariae of *Clypeaster chesheri*: A, quadridentate from around mouth, 0.72 mm long; B, tridentate from aboral side, 0.49 mm long; C, triphyllous from oral side, 0.05 mm long; D, ophicephalous from oral side, 0.22 mm long. A, taken from a specimen 177 mm in test length; B-D, taken from a specimen 154 mm in test length.

the ambitus. Extremely small triphyllous pedicellariae (Fig. 5,C) are the most numerous type and are evenly distributed over the entire test.

No live specimens were observed. Dried specimens fixed in 10 per cent formaldehyde are tan to brown. Specimens preserved in 70 per cent ethyl alcohol are brown or brownish green. The test is white when cleaned with a commercial bleach.

*Holotype*.—The holotype is deposited in the United States National Museum as number E10864. It is 184 mm long, 179 mm wide, and 18.5 mm high.

*Type-Locality*.—Off Colombia, South America, R/V PILLSBURY station P-366.

*Distribution*.—This species has been collected from the west coast of Florida, southwest along the Caribbean coasts of Honduras, Panama, and Colombia, and southeast to Puerto Rico. It has been collected in depths from 29-101 m. The extremes of the range of depths were determined

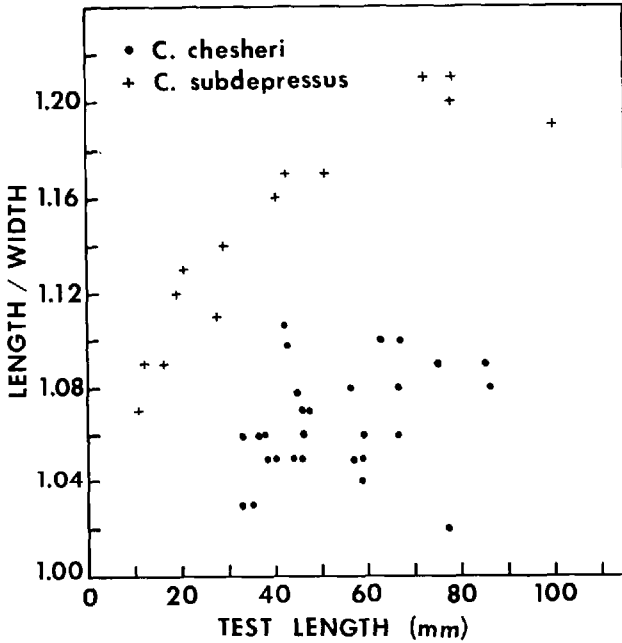


FIGURE 6. Length-to-width ratio as a function of test length in juvenile specimens of *Clypeaster subdepressus* and *C. chesheri*.

from specimens collected off the Central and South American coasts during random sampling cruises. Monthly samples from approximately 6-73 m were collected off the west coast of Florida by the Florida Board of Conservation Marine Research Laboratory during its 28-month systematic sampling program, Project Hourglass. Specimens of *Clypeaster chesheri* were collected only from our station M (73 m). An additional specimen was taken west of Tampa Bay in 62 m during an earlier sampling program. The occurrence of the species in deeper waters off the west coast of Florida is unknown.

*Discussion.*—Morphologically, *C. chesheri* appears most closely related to the widely distributed Caribbean species *C. subdepressus* (Gray, 1825). Proportionately, the petaloid area is smaller, the edge of the test is thinner, and the test is lower and less elongate in *C. chesheri* than in *C. subdepressus*.

The 17 measurements and counts taken for the new species were also taken for comparative purposes on 49 adult and 14 juvenile specimens of *C. subdepressus*. These specimens were obtained from the west coast

of Florida, the Caribbean coasts of Panama and Colombia, and from off Jamaica and St. Lucia.

The specimen Mortensen illustrated as *C. subdepressus* (1948, pl. 23, fig. 1) appears to be a small specimen of *C. chesheri*. *C. subdepressus* is considerably more elongate than the new species. The adults of *C. subdepressus* have a length-to-width ratio of 1.15-1.31. Juveniles examined, ranging from 11.8-100.0 mm in length, display a positive linear relationship between the length and the degree of elongation of the test (Fig. 6). The length-to-width ratio increases from 1.07 to 1.17 with an increase in test length from 11.8 to 50.9 mm. Juveniles longer than 50.9 mm are within the range of variation in the length-to-width ratio of adults. This relationship is also linear for juvenile individuals of *C. chesheri*, but is of low correlation (Fig. 6). Variation in the length-to-width ratio found in juveniles of *C. chesheri* is within the range of variation displayed by adults.

Test height of *C. subdepressus* is proportionately greater than that of the new species. Test height, expressed as a percentage of the length, varies from 11 to 22 per cent in adults and from 17 to 26 per cent in juveniles. Similarly, the edge of the test is proportionately thicker in *C. subdepressus* than in *C. chesheri*. The edge of the test at ambulacrum III varies from 4.7 to 9.4 per cent of the length in adults and from 5.5 to 13.6 per cent in juveniles.

The petaloid area is proportionately larger in *C. subdepressus* than in *C. chesheri*. The anterior unpaired petal (III) of *C. subdepressus* is the longest and extends from 56 to 75 per cent of the distance from the apical system to the ambitus at ambulacrum III. In juveniles, this percentage is generally less, ranging from 52 to 65 per cent. The anterior paired petals (II and IV) are the shortest and extend from 54 to 66 per cent of the distance from the apex to the ambitus at ambulacra II and IV, respectively. This proportion in juveniles is again somewhat less, ranging from 49 to 64 per cent. The posterior paired petals (I and V) extend 47 to 65 per cent of the distance from the apex to the ambitus at ambulacra I and V, respectively. In juveniles this proportion is generally less, ranging from 46 to 61 per cent.

Sexual maturity is reached in *C. subdepressus* at approximately 100 mm in test length and in *C. chesheri* at approximately 60 to 90 mm in test length. The juveniles of these species appear to acquire adult proportions at approximately 70 and 50 mm in length, respectively. In general, smaller juveniles of both species have proportionately higher tests, thicker edges, and smaller petals than the adults. Smaller juveniles of *C. subdepressus* have less elongate tests than adults.

In both species, measurements of the large juveniles (those already exhibiting adult proportions) were included in the juvenile range-groups. Therefore, the measurements of the large juveniles establish the upper

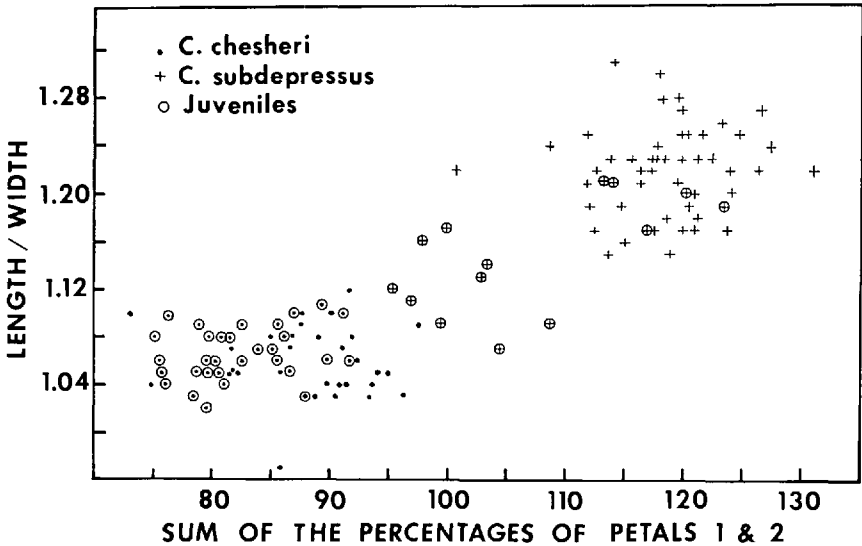


FIGURE 7. Length-to-width ratio as a function of the sum of the percentages of petals I and II for *Clypeaster chesheri* and *C. subdepressus*. Large juveniles of the latter species fall within the range displayed by the adults, while smaller juveniles that have not assumed adult proportions fall between the cluster for *C. subdepressus* and that for *C. chesheri*.

limit of juvenile variation in length of petals as well as the lower limits of the proportional height of the test and the proportional thickness at the edge of the test.

*Taxonomic Affinities.*—Three species of *Clypeaster* superficially resemble the new species. *C. latissimus* (Lamarck, 1816), from the Java Sea, can be distinguished from *C. chesheri* in that the periproct is located considerably more than its own width from the ambitus, and that the test is nearly flat aborally, with a gradual rise from the ambitus to the apical system. The Australian species, *C. telurus* H. L. Clark, 1914, differs from the new species in that the periproct is located considerably more than its own width from the ambitus, the tridentate pedicellariae are very wide distally (Mortensen, 1948, pl. 66, figs. 21-22), and there are 6-8 primary tubercles on the ridges between the pore-pairs of the petals in adults. The Philippine species, *C. pateriformis* Mortensen, 1948, differs in that the oral side is slightly concave, the tridentate pedicellariae have distinct spines on the distal end (Mortensen, 1948, pl. 66, figs. 5-7), and there are 4-7 primary tubercles on the ridges between the pore-pairs of the petals in adults.

A KEY TO THE SPECIES OF *Clypeaster* IN THE TROPICAL NORTHWESTERN ATLANTIC

1. Paired petals markedly open distally, the distance between the two inner pore-pairs at the end of the petal greater than 60 per cent of the distance between the inner pore-pairs at the widest part of the petal ..... 2
1. Paired petals closed distally, the above distance less than 60 per cent ..... 4
2. Edge of test thickened, forming a marginal ridge .....  
..... *C. ravenelii* (A. Agassiz)
2. Edge of test not thickened ..... 3
3. The distance between the two inner pore-pairs at the distal end of the petal slightly less than the distance between the two inner pore-pairs at the widest part of the petal; test circular, ridge between the pore-pairs with 0-3 primary tubercles in adults .....  
..... *C. cyclophilus* H. L. Clark
3. The distance between the two inner pore-pairs at the end of the petal equal to, or greater than, the distance between any other pore-pairs of the petal; test pentagonal with the sides indented in adults, test nearly circular in juveniles; ridge between the pore-pairs with 3-7 primary tubercles in adults ... *C. euclastus* H. L. Clark
4. Oral side markedly concave in adults, less so in juveniles ..... 5
4. Oral side nearly flat in adults, with only a slight concavity around the mouth; oral side slightly concave in juveniles ..... 7
5. Test low with a distinct flattened margin; height less than 25 per cent of the length; genital pores fully developed at 18 mm .....  
..... *C. luetkeni* Mortensen
5. Test high without a distinct flattened margin; the upper surface rising uniformly from the ambitus to the apex; height more than 25 per cent of the length; genital pores not developed until about 40 mm ..... 6
6. Petals distinctly elevated; pore-pairs of petals numerous (more than 45 in an anterior unpaired petal 22 mm long) .....  
..... *C. rosaceus* (Linnaeus)
6. Petals not distinctly elevated; pore-pairs in petals less numerous (39 in an anterior unpaired petal 37 mm long) .....  
..... *C. pallidus* H. L. Clark
7. Areoles of the aboral primary tubercles within a circle described by the distal ends of the petals, 2-4 times larger than those out-

- side this area; ridge between pore-pairs of petals with 0-3 primary tubercles in adults ..... *C. lamprus* H. L. Clark
7. Areoles of the aboral primary tubercles uniform in size; ridge between pore-pairs of petals with 6 or more primary tubercles in adults ..... 8
8. Test pentagonal; the greatest width of the test divided by the width at the posterior edge of interambulacra 1 and 4 (Loven's system) greater than 1.10; ridge between pore-pairs of petals with less than 9 primary tubercles in adults (unusually large specimens, greater than 120 mm TL, may have as many as 13 primary tubercles) ..... 9
8. Test oval; above ratio less than 1.10; ridge between pore-pairs of petals with 9 or more primary tubercles in adults ..... 10
9. Edge of test thickened, forming a marginal ridge; ridge between pore-pairs of petals with 3-4 primary tubercles .....  
..... *C. durandi* Cherbonnier
9. Edge of test not forming a marginal ridge; 6-8 primary tubercles in adults (unusually large specimens, greater than 120 mm TL, may have as many as 13 primary tubercles) .... *C. prostratus* Ravenel
10. Petaloid area longer than 50 per cent of the length in adults; test elongate, with a length-to-width ratio greater than 1.14 in specimens greater than 50 mm in length (Fig. 6) .... *C. subdepressus* (Gray)
10. Petaloid area less than 50 per cent of the length in adults; test oval with a length-to-width ratio less than 1.14 (Fig. 6) .....  
..... *C. chesheri*, sp. nov.

## SUMMARY

*Clypeaster chesheri*, sp. nov., constitutes the eleventh Recent species of this genus known from the tropical northwestern Atlantic. Morphologically, it appears most closely related to the widely distributed Caribbean species *C. subdepressus* (Gray). The petaloid area of *C. chesheri* is smaller, the test is lower, thinner at the edge, and less elongate than in the related species. Juveniles of *C. chesheri* and *C. subdepressus* display a positive linear relationship between the length and the degree of elongation of the test. This relationship is of higher correlation in the latter species.

Sexual maturity is reached in *C. chesheri* at approximately 58.5-90.0 mm in length and in *C. subdepressus* at approximately 100 mm in length. The juveniles of these species appear to acquire adult proportions at approximately 50 and 70 mm in length, respectively. Juveniles of both species generally have proportionately higher tests, thicker edges, and smaller petals than the adults.

## SUMARIO

UNA NUEVA ESPECIE DE *Clypeaster* DEL GOLFO Y EL CARIBE Y CLAVE PARA LA IDENTIFICACIÓN DE LAS ESPECIES DEL NOROESTE DEL ATLÁNTICO TROPICAL (ECHINODERMATA: ECHINOIDEA)

*Clypeaster chesheri* sp. nov. constituye la undécima especie reciente de este género que se ha conocido procedente del noroeste del Atlántico Tropical. Morfológicamente parece estar más relacionada con la ampliamente distribuida especie del Caribe *C. subdepressus* (Gray). El área petaloidea de *C. chesheri* es más pequeña, la testa es más baja, el borde más fino y es menos alargada que la especie con ella relacionada. Juveniles de *C. chesheri* y *C. subdepressus* muestran una relación linear positiva entre la longitud y el grado de alargamiento de la testa. Esta relación es de mayor correlación en la última especie.

La madurez sexual es alcanzada por *C. chesheri* aproximadamente de 58.5-90.0 mm de longitud y en *C. subdepressus* aproximadamente a los 100 mm. Los juveniles de estas especies parecen adquirir proporciones de adultos aproximadamente a los 50 y 70 mm de longitud, respectivamente. Los juveniles de ambas especies tienen en general testas proporcionalmente más altas, bordes más gruesos y pétalos más pequeños que los adultos.

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