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Shallow water echinoids of Cayos Cochinos, Honduras

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Abstract: The following thirteen species were encountered in a survey of shallow water echinoids at Cayos Cochinos Biological Reserve, Honduras: *Eucidaris tribuloides*, *Diadema antillarum*, *Arbacia punctulata*, *Lytechinus variegatus*, *Tripneustes ventricosus*, *Echinometra lucunter*, *E. viridis*, *Clypeaster rosaceus*, *Paraster doederleini*, *P. floridiensis*, *Brissopsis elongata*, *Brissus unicolor*, and *Meoma ventricosa*. Characters for field identification of these species are given. Most of these species are common in many other areas of the Caribbean, but the presence of *A. punctulata* is noteworthy, because this species is often absent or very rare elsewhere in the tropical west Atlantic. *Lytechinus williamsi*, another echinoid with disjunct geographic distribution, appears to be absent at Cayos Cochinos. *L. variegatus*, normally abundant in *Thalassia* beds everywhere in the Caribbean, was very rare at Cayos Cochinos in 1995. *Diadema antillarum* was also rare; apparently at Cayos Cochinos, as in all other areas where its abundance has been monitored, it has not recovered from mass mortality that it suffered throughout the western Atlantic in 1983-1984.

Keywords: Sea urchins, biogeography, faunal lists, Caribbean, population density.

Echinoids are an integral component of shallow water Caribbean communities, often playing a major role in the maintenance of algal (Hay 1981a, b, Sammarco 1982a, b) and coral diversity (Sammarco 1982a, Hughes *et al.* 1987, Hughes 1994). Approximately seventeen species tend to be common in many areas of the Caribbean, but not always in the same combination (Clark 1910). A few species, such as *Arbacia punctulata* (Lamarck) and *Lytechinus williamsi* Chesher, seem to be patchily distributed, being inexplicably present on some reefs and absent on others. This guide to the echinoids of Cayos Cochinos Biological Reserve has three purposes: (1) To list the echinoids present in this area. (2) To provide characters for easy field identification for the benefit of those with little knowledge of echinoid systematics. (3) To document the densities of some of these species on habitats of Cochino Pequeño Island during 1995 as a reference point for future determinations of fluctuations in species abundance. The mass mortality of *Diadema antillarum* Philippi in 1983-1984 (Lessios *et al.* 1984a, Lessios 1988a) has underscored the need for such baseline determinations of the abundance of marine animals. When such data exist, future investigators can determine whether populations of a species are diminishing or increasing, information that is

becoming more critical as Caribbean reefs continue to degrade.

MATERIALS AND METHODS

Echinoid specimens were collected, and population densities were determined, between 2 and 5 May 1995. Most collections were made while SCUBA diving or snorkeling, but a few specimens were obtained in dredge samples taken from the Smithsonian Tropical Research Institution's research vessel, *R/V Urracá*. Diving was done around the periphery of Cochino Pequeño; a few dives also took place on the North-West side of Cochino Grande and on barely emergent reefs off the South-East side of Cochino Pequeño (Fig. 1). Habitats examined include (numbers in this list are used below to refer to collection sites): (1) Live coral reef, composed mostly of *Montastraea* and *Agaricia*, down to a depth of 30 m. (2) Shallow *Thalassia* habitat on the South and South-West side of Cochino Pequeño. (3) Rocky habitat with sparse coral cover on the East and North sides of Cochino Pequeño. (4) Sandy slope areas on the South-East side of Cochino Pequeño. (5) Hard bottom composed of cobblestones and large pieces of dead *Acropora palmata* (Lamarck) on the East side of Buby Cay. (6) Sandy flat bottom on the North of Buby Cay. (7) Bare patches of sediment with scattered live colonies of *Diploria* and *Montastraea* in the midst of *Thalassia* beds on the West side of Cochino Pequeño. The R.V. *Urracá* extensively sampled soft bottoms around the Cayos Cochinos, but echinoids were only encountered at three stations (see below).

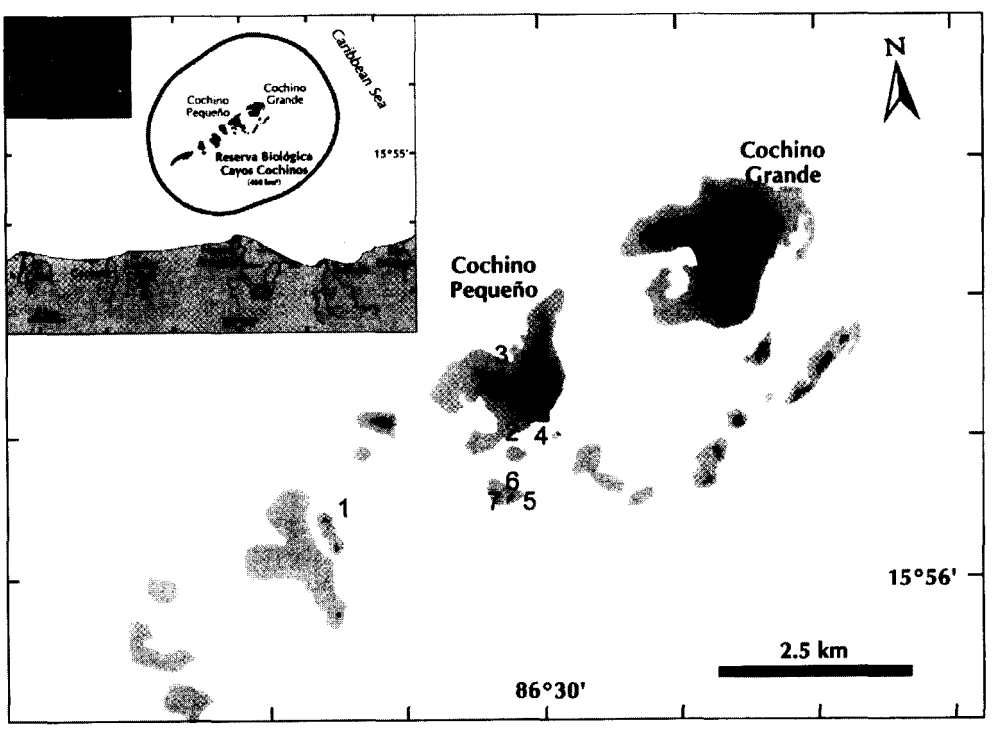

Fig. 1. Location of collection and transect sites for Cayos Cochinos Biological Reserve, Honduras.

Echinoid densities were determined on the West, North and East sides of Buby Cay (Fig. 1). Transects were laid at arbitrary points from the shallowest point at which sea urchins occurred to a length of 15 m, and were oriented perpendicular to the shore. This generally covered a depth range between >1m to 2 m. Each transect was 2 m wide. All echinoids found within the 15 x 2 m corridor were recorded.

RESULTS

Table 1 lists the echinoid species that were seen in Cayos Cochinos in May 1995. The following brief descriptions of characters that can be used for field identification may be of use to non-specialists. A more extensive treatment of each species, along with superb photographs, can be found in Hendler *et al.* (1995).

TABLE 1

List of echinoids encountered in Cayos Cochinos, Honduras; habitat and approximate depth at which they were encountered are also given.

Species	Depth range (m)	Habitat(s)
Eucidaris tribuloides	0-19	Coral, live and dead
Diadema antillarum	<1	Around coral outcrops
Arbacia punctulata	0.5-2	Under dead pieces of *Acropora palmata*
Lytechinus variegatus	1-2	Cobblestones
Tripneustes ventricosus	1-3	*Thalassia* beds, juveniles on dead coral rubble
Echinometra lucunter	<1	Dead coral, rocks
Echinometra viridis	1-15	Live coral
Clypeaster rosaceus	1.5-3	Rubble and sand
Paraster doederleini	44	Sandy bottom
Paraster floridiensis	44	Sandy bottom
Brissopsis elongata	44	Sandy bottom
Brissus unicolor	50	Sandy bottom
Meoma ventricosa	1.5-19	Sandy bottom

Eucidaris tribuloides (Lamarck): It is the only shallow-water cidaroid in the Caribbean. Its test is grayish to brown. It can be distinguished from all other sea urchins by its thick, blunt primary spines, not covered by ectoderm, and, therefore, often encrusted with epizoic organisms. The secondary spines are flat and line the ambulacra in ten rows, extending from the top to the bottom of the test. It rarely exceeds 3 cm in test diameter, though the maximum recorded size is 130 mm (Hendler *et al.* 1995). It is always wedged in coral crevices or hidden under coral heads and rocks. At Cayos Cochinos, this species was present wherever there were coral crevices; many specimens were collected at site 5. It was also taken by the R/V *Urracá* by dredge at 15° 32.15' N, 86° 29.85' W in 19 m of water.

Diadema antillarum: This is a large (adult size 3-10 cm in test diameter), black sea urchin with long, sharp spines, capable of inflicting a painful sting. Juveniles usually have spines banded with white. Cave-dwelling individuals can retain this coloration to adulthood, or they can be completely white. Spines in live animals are almost perpetually in motion. A prominent anal cone is seen on the dorsal side of the animals while they are in the water, but collapses when they are brought into the air. The sharp, highly motile spines and the anal cone are characteristics that it shares with another Caribbean diadematid, *Astropyga magnifica* A.H. Clark. However, *A. magnifica* is as a rule extremely rare, has a light coloration (usually baize, or yellow) with five prominent V- shaped marks on the anal side, and rows of iridescent blue spots running down the test. The test itself is much flatter than that of *Diadema. Diadema antillarum* was very common in all habitats before it suffered mass mortality all over the Caribbean in 1983-1984 (Lessios *et al.* 1984a, Lessios 1988a). In 1995 I only found it at Cayos Cochinos at low densities (Table 2) around shallow coral patches on all sides of Buby Cay and at site 3, near Cochino Pequeño.

TABLE 2

Average densities of echinoids in 7 transects, each 2 m wide and 15 m long, laid down on the North, East and West side of Buby Cay, Cayos Cochinos, Honduras (sites 5 to 7).

Species	Mean density (N/m2)
Eucidaris tribuloides	0.467
Diadema antillarum	0.190
Arbacia punctulata	0.010
Lytechinus variegatus	0.005
Echinometra lucunter	3.805
Echinometra viridis	0.238

Arbacia punctulata: This is the only Caribbean sea urchin with valves covering the anal

opening. Its color is dark brown or purple to black. Another distinguishing characteristic is its five areas naked of spines, one in each interambulacrum. At first glance it can be confused with *Echinometra lucunter* (Linnaeus), but unlike the latter, the test is always circular in outline. Individuals of this species can attain 5.6 cm in test diameter (Harvey 1956), but all specimens found in Cayos Cochinos were much smaller, less than 2 cm. This species is found along the American coast, from Cape Cod to the French Guayana, but has a very patchy distribution in the Caribbean (Clark 1910). It is noteworthy that it exists at Cayos Cochinos in sufficient numbers to be located with rather limited sampling effort. It was found only on the East side of Buby Cay under pieces of dead *Acropora palmata* (site 5).

Lytechinus variegatus (Lamarck): Distinguished by a relatively large (up to 11 cm test diameter), slightly conical test, with spines much shorter than those of *Diadema*, but longer than those of *Tripneustes*. It can be completely white, though it is usually green. Sometimes the spines are pink. There are two shallow water species of *Lytechinus* in the Caribbean, though only *L. variegatus* was found in Cayos Cochinos. *L. variegatus* is the larger of the two (any specimen larger than 3 cm in diameter belongs to this species) lives primarily in *Thalassia* beds, and has a test raised on the anal side. *L. williamsi* prefers live coral reef, has a test more flattened on the anal side, and very prominent pedicellariae. Though Chesher (1968) states in the species description that pedicellariae of *L. williamsi* are always purple, I have found in Panama a fair number of specimens, undoubtedly belonging to *L. williamsi*, in which the pedicellariae are white, as they are in *L. variegatus*. However, the heads of the pedicellariae are always larger, relative to the test size, than those of *L. variegatus*. One juvenile *L. variegatus* was found at site 5. Tests of adults (but no live specimens) were located at site 2.

Tripneustes ventricosus (Lamarck): This is a very large (often > 10 cm in test diameter) sea urchin with spherical, brown test and short, white spines. It is usually found in *Thalassia* beds, but occasionally ranges onto reefs. It often covers itself with objects it picks up from the bottom, a characteristic it shares with *Lytechinus variegatus*. However, it is easily distinguished from the latter by its color, the shape of its test, and its relatively shorter spines. It was found at all sites where *Thalassia* was present.

Echinometra lucunter: The genus *Echinometra* is easily distinguished from all other Caribbean regular echinoids, because the test is oval in outline. The oval shape is easier to discern if the sea urchin is viewed from the oral side. *E. lucunter* displays a high degree of color polymorphism; it can be black, gray, green, red, or even bluish. The best field character for telling *E. lucunter* apart from its congener, *E. viridis* A. agassiz, is the number of spines on the apical system (the ten plates surrounding the anal opening). *E. lucunter* has numerous thin spines, so it is often difficult to see the anus when one is looking directly down at the test. *E. viridis* has one primary spine per plate and no more than 3 smaller spines, so the apical system appears relatively bare (Mortensen 1943). Dead tests of adult *E. lucunter* can be identified by a large "tag" that is attached to the symphysis of the auricles on the inside edge of the mouth (Mortensen 1943). This tag is always absent in *E. viridis*, but it is also absent in juveniles of *E. lucunter*. Both *E. lucunter* and *E. viridis* are usually less than 5 cm in largest test diameter. Though Hendler *et al.* (1995), following Serafy (1979), list E. *lucunter* as found down to 45 m, it is almost exclusively a shallow water species, restricted to less than 1 m of depth. At Cayos Cochinos, it was present at all shallow habitats with hard cover, but it was particularly abundant on the North side of Buby Cay and the North side of Cochino Grande.

Echinometra viridis: Similar to *E. lucunter*, except in characters already described. The spines of this species have a prominent white ring at their base. Such a ring can sometimes also be seen in *E. lucunter*, but it is not nearly as conspicuous. Though this is not obvious from the density measurements in Table 2 (because of the habitats sampled), *E. viridis* is probably the most abundant sea urchin in Cayos Cochinos. It is the echinoid most often associated with live coral reefs, and it can reach high densities around *Agaricia*, *Montastraea* and *Diploria*. All shallow sites that had live coral also had *E. viridis*, particularly site 1.

Clypeaster rosaceus (Linnaeus): This is a thick-shelled sand dollar with rounded margins and a prominent depression around the oral opening. The apical system is also prominently raised. It can be distinguished from its congener, *C. subdepressus* (Gray), by its thicker shell and coarser spines. Its adult size is large, approximately 10-15 cm in length. Its color is invariably dark brown. It is found on sand and rubble zones. Unlike *C. subdepressus*, it rarely buries itself under the sediment, but it is often covered by mounts of coral rubble. At Cayos Cochinos, I found it at site 7.

Paraster doederleini Chesher: This is a medium sized (up to 7.5 cm in length) heart urchin, slightly raised on the posterior end, with two long anterior petals and two short posterior ones. Distinguishing characters are the bright red tube feet in the anterior grove, and a prominent fasciole (grove bare of spines) around the petals. A single specimen was taken by the R/V *Urracá* by dredge at 15° 58.68' N, 86° 30.00' W in 44 m of water.

Paraster floridiensis (Kier and Grant): This is a very small (ca 1 cm in length) heart urchin with a fragile test. The anterior petals are long, the posterior ones very short. Until now, this species was only known from Florida, the Bahamas, Dominica and Panama (Hendler *et al.* 1995). Several specimens were taken at Cayos Cochinos by the R/V *Urracá* at the same station as *Paraster doederleini.*

Brissopsis elongata Mortensen: A medium-sized heart urchin, reaching 10 cm along its long axis. It is elongate, like *Brissus unicolor* (Leske), with which it can be confused. However, unlike the latter species, the anterior two petals of *B. elongata* are pointing forward at an angle of roughly 120° to each other, and the posterior petals are parallel for much of their length. Two specimens were collected by the R/V *Urracá* at the same station as *Paraster doederleini.*

Brissus unicolor: An elongate heart-urchin, normally burrowed deeply in sand. Its color is white, the spines are short and fine, and there is no anterior notch. The anterior petals are in a straight line, perpendicular to the major axis of the test. The posterior petals are longer than the anterior ones, and form a 45° angle to each other. It can reach 12 cm in length, but most animals are usually less than 5 cm. Several specimens were in dredge samples collected at 15° 59.30'N, 86° 30'W in water 50 m deep.

Meoma ventricosa (Lamarck): The most common spatangoid (heart urchin) in the Cayos Cochinos and in many other areas of the Caribbean. It can be distinguished from other spatangoids by the golden-brown color of its short spines, its large size (up to 15 cm in length), and a shallow anterior notch. It lives under the sand, but it usually burrows so shallowly, that a trace of its movements can be seen as a furrow on the sand surface. If one follows the furrows to their end and removes the top 1 cm of sand, one usually finds the animal. It was found to be abundant during SCUBA dives in site 4. Two specimens were also taken by dredge at the same *Urracá* station as *Eucidaris tribuloides.*

Densities: The transects performed to determine density (Table 2) give a representative picture for the habitats sampled, but not necessarily of the overall abundances of echinoids at Cayos Cochinos. Because the transects include a great deal of shallow water habitat, *E. lucunter* is the species that shows in the data the highest numbers per square meter, whereas *E. viridis* appears to be rare by comparison. In fact, the abundance of live coral reef in the Cayos Cochinos, habitat preferred by *E. viridis*, virtually guarantees that the latter reaches higher absolute numbers at this locality. The densities of species of the other genera agree with my subjective opinions, formed while collecting in all habitats. *Eucidaris tribuloides* is moderately abundant, while *Arbacia punctulata*, *Diadema antillarum* and (surprisingly) *Lytechinus variegatus* are rare.

DISCUSSION

The shallow water echinoid fauna of Cayos Cochinos Biological Reserve appears to be typical of that of many other areas in the Caribbean in that it includes many of the species common elsewhere, such as *Echinometra lucunter*, *E. viridis*, *Eucidaris tribuloides*, *Tripneustes ventricosus*, *Clypeaster rosaceus* and *Meoma ventricosa*. Some infaunal species that are abundant elsewhere, such as *Clypeaster*

subdepressus, *Leodia sexiesperforata* (Leske), and *Moira atropos* (Lamarck) (Clark 1910), were probably not located not because they are absent, but because little effort was expended in digging under the sand. Two species are notable, one by its presence, the other by its virtual absence. *Arbacia punctulata* has a patchy distribution in the Caribbean, being present in some areas, such as Florida, then being absent from many intervening localities, then reappearing in Tobago (Clark 1910). Though it is listed from Galeta Point at the mouth of the Panama Canal (Cubit & Williams 1983), it is so rare in Panama, that in 16 years of continuous fieldwork at the San Blas Archipelago I have only seen one individual, and even this had settled on an artificial substrate. It is by no means abundant at Cayos Cochinos, and all individuals I was able to locate were juveniles, but its presence in this area is still noteworthy. *Lytechinus variegatus* is a species normally abundant in *Thalassia* beds everywhere in the Caribbean. Moore *et al.* (1963) reported maximum densities of 250 individuals m^{-2} and Camp *et al.* (1973) densities of 5.6-636 individuals m^{-2} in Florida. In the San Blas Archipelago, Panama it has average densities of 0.83 individuals m^{-2}, which fluctuate from year to year (Lessios *et al.* 1984b, 1988b). Yet in Cayos Cochinos it was very rare in 1995. One juvenile was seen in the transects at Buby Cay; no other live individuals could be found, even after extensive searching in *Thalassia* beds at the South and West side of Cochino Pequeño. The search, however, located approximately 10 dead tests. It is possible that this species died off shortly before May 1995, because it is known to suffer occasional localized mass mortalities in the Gulf of Mexico (Moore *et al.* 1963; Beddingfield & McClintock 1994). Though these high mortalities have been linked to low temperatures -which are unlikely to have occurred in Honduras-, it is possible that storms also take a toll, because in the San Blas Archipelago, island shores are often littered with freshly dead *L. variegatus* after periods of high winds (Lessios, unpublished observations). Such storms are frequent at Cayos Cochinos from December to March (Guzmán, pers. com.).

Another species with patchy distribution around the Caribbean is *Lytechinus williamsi*. It is abundant in Panama, its type locality (Lessios 1984b, 1988b), and also in Jamaica (Hughes *et al.* 1987), and it is also found in Florida, Belize and Colombia (Hendler *et al.* 1995) but appears to be absent from many other localities, including the Cayos Cochinos. As with *Arbacia punctulata*, there is no obvious reason for its spotty distribution.

Diadema antillarum is present at low densities at Cayos Cochinos, densities typical of the ones encountered elsewhere after the 1983-84 Caribbean-wide mass mortality (Lessios 1988a). Though the abundance of this species before 1983 at Cayos Cochinos is unknown, it seems probable that, as in Panama (Lessios 1988b, 1995) and in Jamaica (Hughes 1994) its populations have not recovered from the sharp reduction in numbers that it suffered 13 years ago. It will be interesting to compare the densities I determined in 1995 with those determined in subsequent years to see whether a recovery is ever attained.

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RESUMEN

En un inventario realizado en la Reserva Biológica Cayos Cochinos, Honduras en aguas someras se encontraron las siguientes trece especies de la clase Echinoidea: *Eucidaris tribuloides*, *Diadema antillarum*, *Arbacia punctulata*, *Lytechinus variegatus*, *Tripneustes ventricosus*, *Echinometra lucunter*, *E. viridis*, *Clypeaster rosaceus*, *Paraster doederleini*, *P. floridiensis*, *Brissopsis elongata*, *Brissus unicolor*, y *Meoma ventricosa*. La mayoría de éstas especies son comunes en muchas otras áreas del Caribe, pero amerita resaltar la presencia de *A. punctulata*, porque esta especie es muy rara o ausente en otras áreas del Atlántico occidental. *Lytechinus williamsi* es otro echinodeo con distribución geográfica discontinúa que aparentemente no está presente en los Cayos Cochinos. *L. variegatus*, que normalmente resulta abundante dentro de las praderas de *Thalassia* en todo el Caribe, fue raramente

encontrado en los Cayos Cochinos durante 1995. *Diadema antillarum* también resultó rara. Aparentemente, ésta especie no se ha recuperado, ni en los Cayos Cochinos ni en las otras áreas donde se ha monitoreado su abundancia, de la mortalidad masiva que sufrió a lo largo del Atlántico occidental en 1983-1984.

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