

SURVEY OF THE SHALLOW-WATER SEA CUCUMBERS OF THE CENTRAL PHILIPPINES



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A Report to the Municipalities of Negros Oriental, Cebu and Bohol, local *Bantay Dagat* groups, Coastal Conservation & Education Foundation, Inc., and Silliman University-Angelo King Center for Research and Environmental Management

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Introduction



Amongst marine ecosystems, coral reefs harbor the greatest biodiversity and yet are the most vulnerable to anthropogenic influences. The order of magnitude of reef biodiversity is poorly known, yet eutrophication, overfishing, and global warming all pose threats to reef ecosystems. Documenting reef biodiversity is thus of the utmost urgency, so that baseline information becomes available about the diversity, distribution, and ecological roles of reef biota, against which future changes can be compared, and management and conservation decisions made.

Holothuroids or sea cucumbers are worm-like echinoderms with a mouth surrounded by feeding tentacles and often a reduced skeleton of microscopic ossicles. Sea cucumbers are among the most poorly known macrobiota on coral reefs, and the systematics of holothurians are in a relatively poor state worldwide. Less than half of reef-associated species have been described, and poorly understood species complexes and non-monophyletic higher taxa are pervasive. In addition most holothuroid systematists are near or past retirement, and modern revisionary and phylogenetic methods entered the field only in the last five years. Aspidochirote holothurians, the dominant group of coral-reef sea cucumbers, are under considerable direct threat, as the multi-million dollar beche-de-mer industry wipes out population after population of these large, slow-growing invertebrates.

This study was conducted through the Aspidochirote Working Group, a global consortium of holothuroid taxonomists. This group is part of a U.S. National Science Foundation-sponsored effort to document and understand the global diversity of coral-reef aspidochirote holothuroids. As part of this effort, a reassessment of the taxonomy of all species in this group is underway.



Many of these species were first described from the islands of the central Philippines. These islands have long played an important part in our understanding of biological diversity, as they are located close to the global epicentre of terrestrial and marine species richness. The islands' rich flora and fauna were first documented in detail by several European scientists, notably Prof. Carl Semper, who came to the islands in 1860. For over a year, Semper studied the butterflies, birds, fishes and marine invertebrates around the islands of Cebu and Bohol. Among his most important contributions to science, was his study of the islands' sea cucumbers (Semper 1868). His exploration of the islands resulted in 41 new species of holothuroids, which he described and illustrated in his publication *Reisen im der Archipel Philippinen*. To make his collections accessible to the scientific community, he placed his collections in various German museums. Unfortunately, these museums suffered destruction during World War II, making many of his specimens unavailable for comparisons today.

Methods

The goal of this survey was to find as many of Semper's species as possible and redescribe them, as well as find previously undescribed species and make those available to the global scientific community. From May 20 to June 18 2006, surveys were conducted at the reefs around the islands of Negros, Cebu, Bohol and neighboring localities. The team was able to find many specimens while snorkeling, but dives were also conducted both during the day and at night. The team took pictures of most of the species they found and examined many pictures of holothuroids from the region taken by previous researchers/photographers. Several museum specimens were also examined to aid in identifications for this study. Table 1 provides a list of all species and the locations at which they were found. Because uncertainties still abound among scientists regarding the diagnoses of many holothuroid species, a few names in this list are still incomplete.

Table 1. Holothuroid species and presence at sites.

	Alona Reef	Gakang Island	Balicasag	Nalusu-an	Hilitungan	Zaragosa	Moalboal	Saavedra	Apo Island	Poblacion	Bais	Sumilon	Dumaguete	Cang-alwang
<i>Actinopyga caerulea</i>									X					
<i>Actinopyga caroliniana</i>					X									
<i>Actinopyga echinites</i>					X									
<i>Actinopyga lecanora</i>					X			X	X					
<i>Actinopyga miliaris</i>		X												
<i>Actinopyga palauensis</i>									X					
<i>Bohadschia</i> sp.				X										
<i>Bohadschia</i> aff. <i>marmorata</i>	X				X				X					
<i>Bohadschia argus</i>	X		X					X	X					
<i>Bohadschia bivittata</i>					X									
<i>Bohadschia koellikeri</i>									X					
<i>Bohadschia marmorata</i>		X			X				X					
<i>Bohadschia vitiensis</i>				X	X					X			X	
<i>Euapta geoffroyi</i>							X							
<i>Holothuria</i> aff. <i>atra</i>			X						X					
<i>Holothuria</i> aff. <i>edulis</i>						X			X	X				
<i>Holothuria</i> aff. <i>pervicax</i>		X												
<i>Holothuria arenicola</i>					X									
<i>Holothuria atra</i>			X					X		X				
<i>Holothuria canaliculata</i> *														
<i>Holothuria coluber</i>					X									
<i>Holothuria edulis</i>											X			
<i>Holothuria excellens</i>							X							
<i>Holothuria fuscocinerea</i>		X			X									
<i>Holothuria fuscogilva</i>										X				
<i>Holothuria fuscopunctata</i>	X			X								X		
<i>Holothuria hilla</i>		X			X							X		
<i>Holothuria impatiens</i>		X			X							X		X
<i>Holothuria leucospilota</i>		X			X		X				X			
<i>Holothuria pervicax</i>	X				X									
<i>Holothuria rigida</i>		X												
<i>Holothuria hilla</i>	X													
<i>Holothuria</i> sp. aff. <i>hilla</i>	X													

	Alona Reef	Gakang Island	Balicasag	Nalusuan	Hikutungan	Zaragosa	Moalboal	Saavedra	Apo Island	Poblacion	Bais	Sumilon	Dumaguete	Cang-alwang
<i>?Holothuria sp.</i>	X													
<i>Holothuria turriscelsa</i>	X				X		X							
<i>Opheodesoma grisea</i>			X											
<i>Opheodesoma sp. 1 aff. grisea</i>	X					X								
<i>Opheodesoma sp. 2 aff. grisea</i>											X			
<i>Pearsonothuria graeffeii</i>	X	X		X	X	X		X	X		X			X
<i>Polyplectana sp.</i>					X							X		X
<i>Stichopus aff. noctivagus</i>	X													
<i>Stichopus chloronotus</i>			X					X	X					
<i>Stichopus hermannii</i>					X									
<i>Stichopus horrens</i>	X				X									
<i>Stichopus noctivagus</i>	X				X									
<i>Stichopus variegates</i>					X									
<i>Synapta maculata</i>				X	X									
<i>Synaptula spp.</i>	X		X			X		X			X	X		X
<i>Thelenota anax</i>				X										
<i>Thelenota rubralineata</i>						X								

*single museum specimen examined; not found during field surveys.

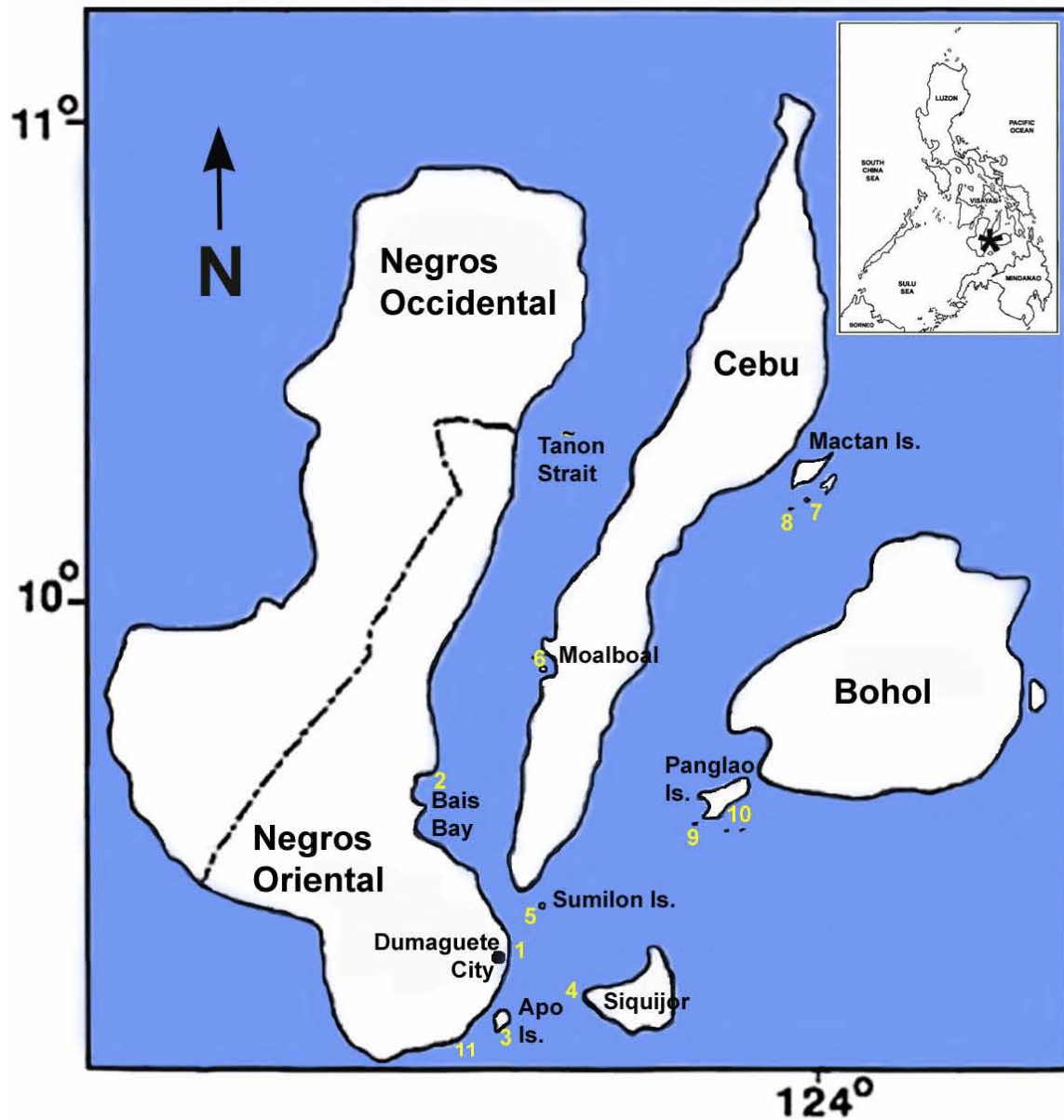


Figure 1. Map of Central Visayas and survey sites: 1: Dumaguete (Bantayan Reef) 2: Bais 3: Apo Island 4: Cang-alwang, Siquijor 5: Simulon 6: Saavedra, Moalboal and Zaragosa 7: Hilutungan 8: Nalusu-an 9: Balicasag and Gakang 10: Alona Reef 11: Poblacion

Results and Discussion

One of the most notable aspects of the reef ecology of the surveyed islands was the almost complete absence outside of marine protected areas (MPAs) of large marine invertebrates, particularly holothuroids. Species otherwise common in the Indo-Pacific, e.g., *Holothuria atra* and *Stichopus chloronotus* could be found at densities rivaling those seen elsewhere in the Pacific within MPAs, sometimes up to the boundary of the reserve marked by a line of buoys. Yet, not several metres away, outside the preserve, they were nowhere to be found. This pattern was seen at all sites surveyed with the exception of Panglao Island, Bohol, where holothuroids were still diverse in the unprotected areas of the western reef flats and the southern forereef slopes. This pattern is undoubtedly due to commercially driven fishing for these animals that appears to be some of the most intense in the world. The remaining fauna at Bohol is likely in immediate danger of extirpation should these levels of fishing continue into the near future.

A total of 49 holothuroid species were found during this survey. Many of these are well known, widely dispersed Indo-west Pacific species. The most commonly encountered species was *Pearsonothuria graeffei*. This species was found feeding almost exclusively on the forereef slope from a few to at least 30 m in depth during the day and night on coral and coralline rock. Other commonly encountered species included the diurnally exposed *Holothuria aff. atra*, *H. aff. edulis* and *Stichopus chloronotus*. Common nocturnal species included , *H. hilla*, *H. perrucax*, *H. turriscelsa*, *S. horrens* and *S. noctivagus*. Several species of widely dispersed Indo-west Pacific species common in other parts of their range were not seen, though we expect that further surveys may well have turned them up. These species include *H. whitmaei*, a large black species valuable in the beche de mer trade, and *Thelenota ananas*, another large, commercially valuable species. Only one specimen of *S. hermanni* was seen, at Hilutungan, though this species is reported to be reasonably abundant elsewhere in the Visayas (B. Hayes, Silliman Univ., *pers. comm.*). Another species, an unidentified Chiridota (Chiridotidae: Apodida) is also recently reported (C. Raabe, *pers. comm.*). This species was probably common at

some of the surveyed sites buried deeply in well aerated sand, but this habitat was unfortunately overlooked.

Eleven of the species found were not positively identified to an already established species. Thus, there is a strong possibility a few may need to be described as completely new species. *Holothuria* sp. *aff. hilla* is the most unusual form, found on the reef flat of Alona Reef, Panglao Island, Bohol. While its ossicles have not yet been examined for a definitive identification, its colour and gross morphology – of large white and yellow dorsal papillae – strongly suggest that this is an undescribed species. *Stichopus variegatus* has previously been considered a name covering several species. The species was therefore slated to be broken up and the name *variegatus* sunk (F. Rowe, *pers. comm.*). However, the discovery of a specimen at Hilutungan matching the colour plate in Semper's (1868) original description suggests that this is a valid species. ?*Holothuria* sp. is apparently a soon-to-be described new species of *Actinopyga* (F. Rowe and C. Massin, *pers. comm.*). This species was uncommon and found along the reef crest in strands of macroalgae. Another source of new species is likely the several species of *Opheodesoma*. This tropical genus is poorly studied; forms of distinctly different colors have sometimes previously been ascribed to a few known species, *O. grisea* and *O. glabra*.

The site with the highest number of species found was Hilutungan, a site in the smaller eastern islands of Cebu. It had 22 total species, eight of those not found at any other site during this study and two of them possibly new. Surveys at Hilutungan took place both inside and outside of a designated Marine Protected Area. This area and nearby reefs, including those on Mactan Island, were surveyed in the early 1980's by Tan Tiu (1981). He described three new species from the area. We were only able to locate one of these species in the field, *Actinopyga carolineana*. This species appears to be invalid and actually comprised of juveniles of *A. echinites*, also found in abundance at Hilutungan. Genetic work and examination of ossicles will clarify the disposition of his species. We also visited the putative repository of his type specimens, the museum at San Carlos University, Cebu City, in an effort to further clarify his species. We were

only able to locate two of his specimens, neither identified as types: a specimen of *A. carolineana* labeled as “*Holothuria* sp.” and a specimen of *H. canaliculata* identified as “*Holothuria (Mertensiothuria) canaliculata*.” His other material appears, therefore, to be lost, though, it is possible that his type material was deposited at the National Museum of the Philippines.

Summary and proposed work

In one month of collecting, at least 40 species of sea cucumbers were found by the research team. The team also examined photographs of sea cucumbers taken by several biologists and divers who reside in the Philippines or have made extensive trips to the region. A few of their species were not found during this survey. Several of these appear to be new species or of uncertain taxonomic status. Thus, it would be useful to continue the surveys in the Visayan Islands in hopes of collecting these important missing species. Future efforts would probably be concentrated on the extensive reef flat, seagrass beds and adjacent forereef slopes of Panglao Island in southern Bohol where the greatest number of interesting finds was encountered.

Acknowledgements

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Appendix: The Sea Cucumbers of the Central Philippines

What follows is a gallery of the species found with brief descriptions on appearance, behavior and habitat. Names are arranged alphabetically by genus while ignoring family arrangements. The English names are for the most part simply glosses of the Latin binomials. Note that these identifications are provisional, made in the field from gross appearance and ecology, rather than from detailed examination of ossicles. Several large and common species previously reported from the Philippines were not seen during this survey, notably, *Thelenota ananas* and *Holothuria whitmaei*. Others were seen, but not photographed, notably *Holothuria coluber* and *H. hilla*. Photographs and descriptions of most of these species can be found in published field guides on Indo-west Pacific marine invertebrates, such as Colin and Arneson (1995), White (2001) and Allen and Steene (1995)



Blue Sea Cucumber

Actinopyga caerulea

This sea cucumber is fairly new to science, having been formally described in 2005. It is also known from Indonesia. This species is usually found during the day and night on sand or sand and rubble of the forereef slope to at least 30 m depth. It grows to about 30 cm in length and is mottled variably in grayish blue on a white background. Like other members of *Actinopyga*, it has an anus encircled by five calcareous “teeth.”



Caroline's Sea Cucumber

Actinopyga caroliniana

This sea cucumber grows to 15 cm in length, light brown with stout, conical cream-coloured papillae laterally. This species has only been found on Mactan and neighboring islands. It may turn out to be a variant of the darker, but otherwise nearly identical *A. echinites*. It is active and exposed day and night, usually found in shallow water of the reef flat, particularly in seagrass beds. It was described in 1986.



Spiny Sea Cucumber

Actinopyga echinites

This sea cucumber grows to 30 cm in length, dark brown, occasionally with irregular back transverse bands dorsally. The figured specimen shows the papillae typical of small animals and absent in larger individuals. It is active and exposed day and night, usually found in shallow water of the reef flat, particularly in seagrass beds.



White-bottomed Sea Cucumber

Actinopyga lecanora

This sea cucumber with a thick, muscular body wall, grows to 25 cm in length, mottled in chestnut with numerous whitish blotches to uniformly chestnut or olive. It possesses a characteristic white posterior. The only nocturnal species of Actinopyga, it is usually found on the forereef slope to at least 20 m.



Grainy Sea Cucumber

Actinopyga miliaris

This species grows to at least 25 cm in length and is completely brown-black to black and is often covered with a fine layer of sand. It is found exposed day and night on sand or rubble usually near seagrass beds. The figured specimen may be *A. palauensis*, but the latter species is usually longer and slightly flat on top. Black to nearly black, *Actinopyga* probably comprise several species that are difficult to distinguish.



Palauan Sea Cucumber

Actinopyga palauensis

This uncommon species is usually found on the forereef slope below 10 m depth on sand. It grows to about 30 cm in length and is dark brown to black, often with a fine layer of sediment on its back. Like other members of *Actinopyga*, it has an anus encircled by five calcareous “teeth.” This species is a member of a complex of dark brown to black *Actinopyga* whose relationships and species’ status are uncertain.



Ocellated Sea Cucumber

Bohadschia argus

This relatively common species grows to at least 50 cm in length. It usually has a grey cast with numerous ocelli of brown and white encircling the papillae dorsally and is whitish to yellowish ventrally. It is found on sand and rubble on the reef flat and forereef slope to at least 25 m in depth during both day and night.



Two-ribbed Sea Cucumber

Bohadschia bivittata

This sea cucumber, which grows to 25 cm in length, is usually called *B. marmorata*, a name associated with a group of species. This species is characterised by two transverse brown bands over the dorsum. Like others of the “marmorata” group, it is nocturnally active, lying buried in well-aerated sand during the day. It is usually found in shallow water of the reef flat, particularly in seagrass beds. Ejects numerous Cuvierian tubules when disturbed.



Speckled Sea Cucumber

Bohadschia vitiensis

This sea cucumber grows to 50 cm in length and is usually called *B. marmorata*, a name applied to several species. This form may be a variant of *B. bivittata*, which has two transverse brown bands over the dorsum. Like others of the “marmorata” group, it is nocturnally active, lying buried in well-aerated sand during the day. It is usually found in shallow water of the reef flat, particularly in seagrass beds.



Mottled Sea Cucumber

Bohadschia koellikeri

This species is often identified as *B. marmorata*, a species likely comprised of over half a dozen good species. Another possibility is that *B. koellikeri* is a hybrid between the spotted *B. argus* and one of the “marmorata” group. It grows to about 40 cm in length and is usually found buried during the day in aerated sediment on reef flats and the forereef slope to at least 30 m. Like other *Bohadschia*, it readily releases copious, milky white, pointed Cuvierian tubules.



Blotched Sea Cucumber

Bohadschia aff. marmorata

This form pictured is often identified as *B. marmorata*, a species likely comprised of over half a dozen good species. It grows to about 35 cm in length and is usually found buried during the day in aerated sediment on reef flats and the forereef slope to at least 30 m. Like other *Bohadschia*, it readily releases copious, milky white, pointed Cuvierian tubules.



Marbled Sea Cucumber

Bohadschia marmorata

This sea cucumber grows to 20 cm in length with well defined marbled patches dorsally. This appears to be the “real” *B. marmorata*, a name that is now used for several good species. Like others of the “marmorata” group, it is nocturnally active, lying buried in well-aerated sand during the day. It is usually found in shallow water of the reef flat, particularly in seagrass beds. However, unlike its close relatives, it seldom ejects Cuvierian tubules when disturbed.



Eye-spot Sea Cucumber

Bohadschia sp.

This species grows to at least 25 cm in length and is characterised by numerous large brown circles ringed in white. Stays buried during the day in aerated sand near seagrass beds. May be a new species.



Black Sea Cucumber

Holothuria atra

This is the most common sea cucumber throughout much of its range. It grows to about 20 cm in length and is usually found exposed day and night in shallow water, on reef flats and in seagrass, on bare sediment. It is often covered by a thin layer of sand with patches of exposed dorsum arranged in two rows. It is the only sea cucumber that when vigorously rubbed releases a wine-coloured exudate. Another morph, possibly another species, is found in deeper water.



Black Forereef Sea Cucumber

Holothuria aff. atra

This species is usually identified as *H. atra*, a smaller species and one of the most common sea cucumbers throughout much of its range in the Indo-west Pacific. It grows to about 40 cm in length and is usually found exposed day and night on bare sediment of the forereef slope to at least 30 m. Unlike the shallow-water *H. atra*, it is never covered by a thin, even layer of sand with patches of exposed dorsum. Instead it may be covered in a thin, possibly mucus sheath. It also does not release a wine-coloured exudate when rubbed. This may therefore be a different, possibly new species.



Impatient Sea Cucumber

Holothuria impatiens

This relatively common sea cucumber grows to about 30 cm in length. It is grayish yellow with dark purplish transverse stripes on its dorsum. It can usually be found during the day under coralline rubble on the reef flat and in crevices on the forereef slope. At night it extends its anterior end from its hole to feed on nearby sediment. The specimen pictured is the most common form seen in the central Philippines. Several other forms usually identified as *H. impatiens* were also seen and are shown on the following pages. These forms appear to be separate and distinct species.



Ashen Sea Cucumber

Holothuria fuscocinerea

The ashen sea cucumber, which grows to 25 cm in length, is distinguished by its grayish brown colour and indistinct spots on its dorsum. Additionally, it possesses a dark brown ring around its anus and similarly circumscribed ventral tubefeet. It is usually found under rubble on the reef flat during the day, venturing out only at night, though the figured specimen occurred on the forereef slope. It readily ejects large translucent Cuvierian tubules when disturbed. A possible variety of this species is uniformly ashen brown and is found in the same habitat.



White Teatfish

Holothuria fuscogilva

This large, loaf-shaped sea cucumber is seen during the day and night on the deeper forereef slope, usually below 10 m depth. It grows to about 50 cm in length and is mottled brown and white. Large specimens evince five yellowish anal teeth. This is among the most commercially valuable species in the beche-de-mer trade and has likely been fished out of much of its former range in the central Philippines.



Pink Sea Cucumber

Holothuria aff. edulis

This sea cucumber is usually found during the day and night on the shallow forereef slope to at least 30 m depth. It grows to about 30 cm in length and is entirely pink, though may appear grey at depth or when covered in a fine layer of sediment. It is usually identified as *H. edulis*, a smaller form from shallow water that is only pink ventrally. Hence, this may well be a different species, perhaps new.



Stubborn Sea Cucumber

Holothuria pervicax

This small common species, growing to 15 cm in length, is usually found on the reef flat under rubble during the day, being active and exposed only at night. It is mottled in grey and cream with variably sized papillae on its dorsum, often with a pinkish cast. It readily ejects copious amounts of Cuvierian tubules.



Yellow-bellied Sea Cucumber

Holothuria gracilis

This small common species, grows to 25 cm in length, and can be found on the forereef slope to at least 25 m depth during the night, but hides in crevices during the day. It is grayish dorsally with numerous papillae of equal height. The ventrum is lighter, yellowish with numerous small dark flecks. It readily ejects copious amounts of Cuvierian tubules of a type seen in *H. pervicax*.



Warty Sea Cucumber

Holothuria turriscelsa

This sea cucumber, which grows to 30 cm in length is nocturnally active, usually found on the forereef slope to at least 30 m depth. It is uniformly grey, though a few specimens are lighter, almost cream, ventrally. It readily ejects numerous large Cuvierian tubules at the slightest provocation. This species was only first described in 1980.



Shy Black Sea Cucumber

Holothuria leucospilota

This common sea cucumber, which grows to 30 cm in length active day and night, usually feeding by extending its anterior end from the safety of a crevice. It is uniformly black with black tentacles, though often appears dusky or grey from a covering of fine sediment or what appears to be a mucus sheath



Channelled Sea Cucumber

Holothuria canaliculata

This sea cucumber grows to 15 cm in length, is grayish cream and speckled with numerous dark blotches dorsally. The species was described from specimens found at a single site near Mactan Island. The figured specimen is the only known specimen and is curated at San Carlos University.



Sand Sea Cucumber

Holothuria arenicola

This species grows to 30 cm in length, is creamy white with to longitudinal rows of brown spots on its dorsum. It is always buried in sand, though can be encountered by turning over rubble resting on sand; often associated with seagrass beds. Specimens from the Caribbean ascribed to this species eject Cuvierian tubules when handled roughly.



Kris's Sea Cucumber

?Holothuria sp.

This species grows to 20 cm in length. Dorsally is dark brown with numerous fine papillae, and ventrally is mottled chestnut and white. Usually found in seagrass or large algae, such as *Sargassum*. This may be a new species.



Brown-spotted Sea Cucumber

Holothuria fuscopunctata

This large species grows to about 70 cm in length, is loaf shaped, speckled in small brown spots on a whitish to yellowish dorsum having numerous transverse wrinkles lined in black. White ventrally. Always exposed, usually on sand with rubble at the base of the forereef slope, below 10 m in depth. Often found in the same habitat as *Thelenota anax*.



Rigid Sea Cucumber

Holothuria rigida

This species grows to about 15 cm in length and is uniformly white to grayish white. It feels hard and rough to touch. Possesses two longitudinal rows of slightly enlarged brown papillae dorsally. A burrowing species, it is rarely seen in the open, usually being found under rubble on sand.



Epi's Sea Cucumber

Holothuria sp.aff. hilla

This species grows to at least 20 cm in length. It is black with numerous large yellow to whitish papillae dorsally and rather rough to the touch. Probably nocturnal, hiding in crevices and under rubble during the day. Possesses two longitudinal rows of slightly enlarged brown papillae dorsally. A burrowing species, it is rarely seen in the open, usually being found under rubble on sand.



Brown Medusan Sea Cucumber

Opheodesoma aff. grisea

This species probably is comprised of several good species, such as the one pictured above. It is reddish brown dorsally and ventrally with similarly coloured tentacles and grows to about 70 cm in length. The specimens figured were spawning as were numerous other specimens of identical colour and form, suggesting this is a verifiable species.



Red-striped Medusan Sea Cucumber

Opheodesoma aff. grisea

This “species” is probably comprised of several actual species, such as the one pictured above. It is grayish dorsally with indistinct red longitudinal stripes and whitish ventrally with similarly coloured tentacles. It appears to grow longer than the other forms of *O. grisea*, to perhaps a metre in length.



Grey Medusan Sea Cucumber

Opheodesoma aff. grisea

This species is probably comprised of several good species, such as the one pictured above. It is reddish above, grey below with whitish tentacles and grows to about a meter in length. This specimen was found on the forereef slope at night. Like other medusan sea cucumbers, its prickly or sticky body is caused by small pointed ossicles protruding from the skin.



Black-spotted Medusan Sea Cucumber

Opheodesoma aff. grisea

As mentioned previously, *O. grisea* is probably comprised of several actual species, such as the one pictured above. It has numerous large dark greenish-black blotches dorsally and ventrally with grayish green tentacles. It grows to about 70 cm in length and appears to be nocturnal, is found on the reef flat usually in seagrass beds and on the forereef slope.



Graeffe's Sea Cucumber

Pearsonothuria graeffei

This common sea cucumber is usually found during the day and night on the shallow forereef slope to at least 30 m depth. It grows to about 30 cm in length and is mottled brown, black and white. Its large, flat tentacles are distinctive, jet black and edged in white. From juvenile size until it is a few cm in length, it is strikingly coloured in black and white with bright yellow conical papillae, resembling a toxic phyllidiid nudibranch. This species has Cuvierian tubules, but ejects them only after considerable irritation.



Night-wandering Sea Cucumber

Stichopus noctivagus

This species is mottled orange-red and white, with occasional dark blotches and with small erect white papillae scattered over the dorsum. It grows to about 20 cm in length. This is a nocturnal species usually found in deeper water on the forereef slope to at least 30 m depth on sand and sandy rubble near live coral. This species was only first described in 1980.



Dark Night-wandering Sea Cucumber

Stichopus aff. noctivagus

This may turn out to be a very dark colour variant of *S. noctivagus*. It differs in being uniformly rust coloured with whitish papillae laterally. This was the only specimen seen, about 15 cm in length, exposed at night on rubble of the forereef slope at about 20 m depth.



Horrible Sea Cucumber

Stichopus horrens

This species is comprised of several different color morphs which may turn out to be different species. Some forms are grey, green, orange, pink or mottled as in the figure above. All are nocturnally active and found under rubble during the day on the reef flat. The largest specimens are usually found in deeper water.



Many-coloured Sea Cucumber

Stichopus variegatus

This species grows to 40 cm in length with numerous papillae of different sizes giving it a bumpy appearance, with a mottled coloration of pink, grey, brown and cream. Found on sand or sand with rubble at night on the forereef slope to at least 30 m in depth. Hides in crevices during the day.



Sponge Sea Cucumbers

Synaptula spp.

These sea cucumbers are invariably small, growing to 10 cm in length. They are whitish and live on the outer surface of sponges of the forereef slope below a few metres in depth. Their aggregations can be so dense that even large vase sponges can appear completely white. The figure above shows a white form, as well as one mottled with tan and pink. These may turn out to be separate species. There are undoubtedly several other species of *Synaptula* on sponges, but there has been very little work done to sort out the different types.



Chiefly Sea Cucumber

Thelenota anax

This species grows to over one metre in length, almost square in cross-section, light brown with darker brown blotches, sometimes frosted in pink or red dorsally. Always exposed, usually on sand with rubble at the base of the forereef slope below 10 m in depth. One of the biggest sea cucumbers, it can weigh over 5 kg.



Candy Cane Sea Cucumber

Thelenota rubralineata

This uncommon sea cucumber grows to 50 cm in length and is active day and night. It is covered in large, spiky papillae and painted in a herringbone pattern of crimson on white. The tips of the papillae are yellow. This species lives at the base of the forereef slope on rubble and sand from 10 m to at least 35 m depth in the Philippines.