Field Guide to the Corals of the Kingdom of Tonga

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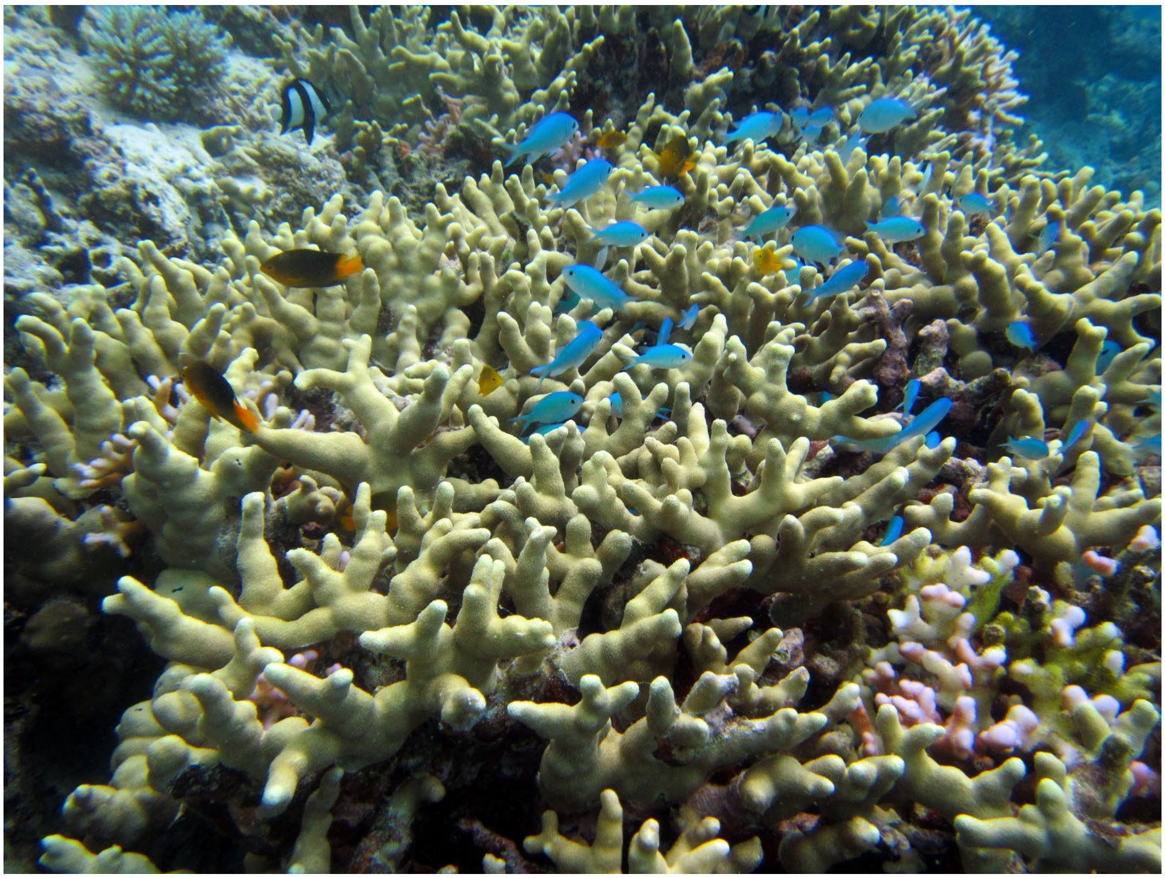
A guide to the underwater identification of 171 species of living stony reef corals in 56 genera in Tonga.



A large colony of *Porites cylindrica*, Vava'u Islands, Tonga.

All photographs in this guide were taken in Tonga, by Douglas Fenner unless indicated otherwise. All species in this guide are in Tonga and look the way the corals look here. This is a first draft ID guide for Tonga. In future years I hope to photograph many more corals and add many more species to this guide. Parts of the introductory text are the same as in other guides by the author.

To J.E.N. “Charlie” Veron, for all you have done to advance the study of corals.

Other field guides by the same author:

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Fenner, D. 2020. Field Guide to the Corals of Wake Atoll. Pdf.
Fenner, D. 2020. Field Guide to the Corals of the Northern Marianas Islands. Pdf.
Fenner, D. 2020. Field Guide to the Corals of New Caledonia. Pdf.

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We stand on the shoulders of giants: this guide would not have been possible without the work of many coral taxonomists who went before me: J.E.N. "Charlie" Veron, Carden Wallace, Bert Hoeksema, Richard Randall, Francisco Nemenzo, John Wells, and Austin Lamberts to name but a few. I thank Lance Smith at NOAA Fisheries' Pacific Islands Regional Office for supporting the development of this guide.

Contents

Corals are presented in the conventional taxonomic order, because it puts corals that are morphologically similar together, which facilitates learning to distinguish them. A few modifications of that order have been introduced to help put similar looking species closer together. The classification based on DNA-sequencing data is presented below this contents listing.

Corals by the New Systematics: DNA-sequencing (PCR) Phylogeny

Here, families are listed alphabetically, genera within each family are listed alphabetically, and species with each genus are listed alphabetically. The species names used are those of the new taxonomy, based on DNA sequencing. There are quite a few changes in which genera species are in and which families genera are in. The old families were based completely on morphology, and morphology had little to base families on. It was impossible to visually identify families. So it is not surprising that DNA sequencing has indicated new groupings of genera into families. What is surprising is that several genera are indicated by the DNA sequencing to be in families that are morphologically very different. So for instance, *Alveopora* which has polyps almost identical to *Goniopora*, is moved from the Poritidae to the Acroporidae to join *Acropora*, *Montipora*, *Astreopora*, *Isopora*, and *Anacropora*, none of which have polyps or skeleton like *Alveopora*. However, under the electron microscope, *Alveopora* is seen to have minute scales on its skeleton like all the other genera in Acroporidae (and a few other species in other genera and families). And, that result has now been replicated using a method that uses much more DNA. Also, the Faviidae in the Pacific and Pectinidae are no more, species in those genera have been moved into the Merulinidae. The faviids, pectinids, and merulinids are all quite different morphologically but all are now in the Merulinidae. The former *Favia* in the Pacific have been renamed *Dipsastrea*, except *Favia stelligera*, which was moved into *Goniastrea*. *Diploastrea* and *Plesiastrea* get their own families. *Montastraea* in the Pacific was divided into *Astrea*, *Phymastrea*, and *Paramontastrea*, which is not surprising, Veron has commented that it seemed to be a collection of different things. The families Mussidae and Echinophyllidae are no more, their species have been moved into a new family, the Lobophyllidae. The morphology of the species in Muissidae and Echinophylliidae are quite different. The genus *Symphyllia* is no more, all the species in *Symphyllia* have been moved into *Lobophyllia*. *Psammocora explanata* and *Coscinaraea wellsi* have been placed in *Cycloseris*, which they don't remotely resemble. *Fungia concinna* and *Fungia repanda* are moved out of *Fungia* which they closely resemble, into the genus *Lithophyllon*, which they don't remotely resemble. Several species in *Fungia* have been moved into *Pleuractis*, and several others into *Danafungia*, and one into *Lobactis*. Only one species remains in *Fungia*, *Fungia fungites*.

Learning to identify corals is less difficult when similar species are compared, and the old taxonomy based on morphology tended to group corals together that had more similar morphology. So the order that corals are presented in this guide is more similar to the old taxonomy than the new systematics. The order of families, genera, and species in the new systematics as shown below is derived from Montgomery et al (2019) which was based on WoRMS (World Register of Marine Species, marinespecies.org). It is said that convergent evolution has produced similar appearances in species that are not closely related, but so far there is no independent evidence for that for most cases with coral taxonomy.

Introduction

This field identification guide was written to help you identify corals in Tonga. All the photos were taken in the Tonga, so the photos look like the corals there. Corals look different from each other on a wide range of scales from near to each other to different reefs to different archipelagoes close together to archipelagos very far apart. No species are included in this guide that are not present in Tonga, so you don't have to pick your way through many species that aren't in Tonga. This is a first version of this and so many corals that are in the Tonga are not yet in this guide, but with additional visits by the author more species will be added. The families of corals are in a period of flux, and this guide follows Veron et al (2020) in omitting families until the families are more certain. The order in which genera are presented is one that has been commonly used in the past (e.g., Veron, 2000). The order of genera and species has been modified slightly here to try to put similar-looking species close together in the order, to assist identification. Veron et al (2020) has been followed in most cases with name changes.

The geology of the islands that reefs are on is important for understanding reefs, because the geology provides the foundations which the reefs are built on. In addition, the structure of the reef itself, that is the calcium carbonate, is also a subject of study by geology. The islands of Tonga are largely in a nearly north-south line. There are three groups of islands, Tongatapu and 'Eua at the south end, Ha'apai in the middle, and Vava'u group at the north end. These islands are on the eastern edge of the Indo-Australian plate. To the east there is a deep trench where the Pacific Plate, which is east of the trench (and in the trench) is located. The Pacific Plate is moving westward at about 7 cm per year. The plate bends downward and as it goes downward to the west the trench is formed by the sea floor, which is where the plate (with sediments on top) bends downward. Where it reaches the Indo-Australia plate at the west side of the trench, the Pacific Plate continues to move down into the earth underneath the Indo-Pacific Plate at 7 cm a year. The whole process of the one plate going under the other is called "subduction." Subducting plates typically go down at an angle of about 45 degrees. It continues down into earth's mantle at that same angle for several hundred kilometers, reaching as deep as 660 km deep. Where the Indo-Pacific Plate rests on top of it, there is a great deal of friction as the Pacific Plate slides under the Indo-Pacific Plate. The two huge slabs of rock stick and don't slide freely past each other. The Pacific Plate keeps moving westward, and force builds up between the two plates. At some point the plates that are stuck against each other with the huge pressure of the weight of the overlying rock, gives way and the Pacific plate slides centimeters to a few meters past the overlying Indo-Pacific plate in a few seconds. This produces an earthquake. The plate goes very deep under Tonga, and so Tonga experiences some of the deepest earthquakes in the world. The earthquakes that happen in the east near the trench are relatively shallow, and earthquakes are increasingly deeper towards the west as the plate dives deeper in the west. The depth of the earthquakes can be used to determine how deep the plate is at any one location, as the earthquakes are produced by the release of stress between the plate and the surrounding rock, or by compression of the rock, or other processes. Where the crack between the two plates start to rub against each other at the western edge of the trench is deep in the ocean, and has lots of soft sediments on top of the Pacific Plate. The water is under tremendous pressure from the overlying kilometers of water. Some water gets into the crack between the two plates as well as cracks in the subducting plate, and the pressure of the water may help the water reduce pressure pushing them together, and/or lubricates the crack, reducing the friction. As the Pacific plate goes deeper and deeper into the mantle, the mantle rock surrounding the plate heats the plate up and it becomes softer. Eventually it becomes about as soft as the mantle. The mantle is probably about as hot as yellow-hot lava coming out of a volcano. Yellow hot is even hotter than red hot. The Pacific Plate deep in the earth also is under increasing pressure from the rock above it. The Pacific Plate probably also has water in its cracks, since the plate was underneath the ocean. The water as well as the rock in the plate get heated to way over (about 700-1200°C) the normal boiling point of water (100°C), but the enormous pressure keeps the water from boiling. Under these conditions, some of the water may dissolve in the very hot rock of the plate. The water lowers the temperature at which the plate rock can melt. Some of it melts, and in places, under the great pressure, the liquid rock (called magma down in the earth), rises if there are cracks it can follow. If it reaches the surface, it erupts as lava. Some evidence now indicates that the water itself may be what rises and melts rock in the mantle above the subducting plate. The water itself is much less dense than rock and more buoyant. Tonga has several active volcanoes both on islands and under the ocean. There are several places on the earth were the plates that form the bottom of the deep oceans get subducted, and in many cases there is a row of volcanoes above where the plate is being subducted below the other plate. The volcanoes are about 100 km or more back from the trench where the one plate goes underneath the other plate, back far enough that some of the plate has melted or the water rising from it is hot enough to melt overlying rock. In addition to the Tongan Trench and the Tongan islands and volcanoes, other such “island arcs” include Vanuatu, the Marianas, the Aleutian Islands of Alaska, and the Windward Antillies in the eastern Caribbean. The three groups of islands in Tonga that people live on are on top of old, extinct volcanoes. The southern and middle island groups are made of old coral reef rock which is on top of the volcano. In the Vava’u Group, the whole group is on top of one large old volcano. Some of the Vava’u Group islands have layers of ancient reef limestone lifted out into the air. From a distance they look like layer cakes. This indicates that the Vava’u Group mountain has been lifted higher by some process deep in the earth, perhaps involving the Pacific Plate. The southern Marianas Islands similarly have layers of ancient reef limestone that have been lifted out of the water, as does Vanuatu. The limestone on land is slowly dissolved by rainwater, which is slightly acid from carbon dioxide in the air that dissolves in it, and becomes honeycombed with holes. Surface water sinks into the porous limestone and there is no surface running water. The limestone filters out most of the sediment in the water, so reefs adjacent to land with limestone usually have much less sediment settling on them than reefs adjacent to areas that do not have limestone. Which is beneficial to the reefs. At the same time, corals are building new reefs in the shallow waters around the islands. In Tonga, the active volcanoes are west of the old extinct volcanoes that have ancient coral reef limestone on top of them. The lava that erupts from volcanoes in island arcs produced by plate subduction are a type of volcanic rock called Andesite, named after the Andes Mountains in South America, which have volcanoes that are produced by the subduction of the Nazca Plate under South America by the movement of South America westward and southeastern Pacific eastward. Subduction of oceanic plate under continents producing volcanoes occurs not only in the Andes mountains, but also the Cascade Mountains of the U.S. Northwest, in Japan, the Phlippines, and Indonesia. Andesite is a fairly stiff lava due to fairly high silicate content. The result is steep sided volcanoes and sometimes explosive eruptions such as those of Mt. Pinatubo in the Philippines, Karakatoa in Indonesia, Mt. St. Helens in the U.S.A., and the recent eruption in Tonga. Oceanic plate is subducted under continents at the Andes, the Cascade Mountains of the U.S. Pacific Northwest, Japan, the Philippines, and Indonesia and produces volcanoes on the continental land in each of these areas. Volcanoes within an oceanic plate are usually produced by stationary “hotspots” of magma down in the earth, and they erupt a type of volcanic rock called “basalt.” Basalt has a lower silica content and so it is more fluid and can flow far, and produces very wide volcanoes with more gradual slopes, called “shield volcanoes.” Such hotspots produce strings of increasingly old islands made of basalt, as in Hawaii and the Samoan chains of islands. In island arcs, however, the islands in the arc are not ordered by age. There are no trenches or subduction at hotspot volcanoes. The volcanoes under the islands people live on in Tonga are likely 10’s of millions of years old. Eruptions of undersea volcanoes in Tonga in recent years have produced huge rafts of floating pumice. There is so much gas and water in the rocks that when the lava erupts and the pressure is released, the gas and water comes out of the rock quickly in the form of bubbles, in a sort of very hot froth. The bubbles make the pumice float, and the raft can drift with the wind and water currents for long distances. Andesite volcanoes tend to be steep sided stratovolcanoes, with alternating layers of lava and softer layers like pumice.

More broadly, the ocean floor around the world is composed of plates made of basalt. Basalt erupts at ocean ridges and hardens there. One such ridge is in the southern and eastern Pacific and another is the Mid-Atlantic Ridge. These ridges as well as the subduction zones, are the junctions between different plates. Plates move in different directions and at different speeds. At the ridge, the plate is relatively thin and hot since it recently erupted as lava. As the plate slowly moves away from the ridge, it cools, shrinks, the hard layer becomes thicker as melt under the plate cools and becomes hard, and the plate becomes denser. The plate essentially floats on top of the mantle, which is hot and over long time periods behaves under heavy pressure like a very viscous fluid. As the plate becomes cooler and denser over 10’s of millions of years, it floats lower in the mantle. As a result, the ocean becomes deeper towards the northwestern Pacific. Any volcanoes on the Pacific plate, like Hawaii and the Samoan archipelago, subside or sink with the plate that they are built on. But volcanoes on the plate above a subducting plate are not in that situation, and don’t subside. The ocean floor is relatively young all over the planet, typically less than about 150 million years old, with the youngest (brand new) parts near ridges and the oldest on the other side of the plate in trenches about to be subducted. The trenches are the deepest part of the oceans. Parts of continents are much older, up to about 3.5 billion years old in small spots, while tiny zircons in continents can be up to around 4 billion years old (earth is about 4.5 billion years old). The continents are made of rocks that are slightly less dense than the mantle and the seafloor plates. They float in the mantle much like icebergs, with most of their volume down in the mantle, their deep roots, and only a small part extending up above the seafloor and even farther into the air. Mountain ranges have the deepest continental roots under them. The seafloor plates and the hotspot chains of volcanoes (like Hawaii) may be some of the least complicated geology on the planet, and continents are the most complicated. Continents have many more mineral types, layers, and provinces and time to form complexities than hotspot island chains, and more geological processes than hotspot chains. All geology is complicated, but oceanic islands are a bit less complicated than continents.

There are three major types of coral reefs, fringing reefs, barrier reefs, and atolls. Fringing reefs are right along shorelines, barrier reefs have a lagoon between the reef and land, and atolls are a ring of coral reef with no land in sight. The puzzle was to figure out how atolls were formed. Darwin knew that coral reefs only grow in shallow water. He hypothesized that coral reefs growing on the shores of a volcanic island would be in the shallow water near shore, and thus would be a fringing reefs. If the volcano subsided, then the reef could grow up where it was as the island sank, and soon there would be a lagoon between the reef and the island and it would be a barrier reef. As the island sank further, it would sink out of sight in the center, leaving a ring of coral reef that would be in the shape of the original shoreline. Eventually, an atoll was drilled and Darwin proved right. However, this model only applies to hotspot volcanoes in mid-plate positions. It does not apply to volcanoes in subduction island arcs. Volcanoes in that situation do not subside, in fact at times they may be uplifted, perhaps by a bump on the plate going underneath it. Coral reef formations out of the water as they are in places in Tonga, must have been formed in the water and then the island must have been uplifted out of the water. Also, there are fringing reefs along continental shores, and barrier reefs on continental shelves such as the Great Barrier Reef and the barrier reef of New Caledonia. There are even a few atolls in the Caribbean, three in Belize and one in Mexico, that are built on continental blocks, not volcanoes. Although the vast majority of the world's thousands of atolls are in the Indo-Pacific and were built on volcanoes, there are those four in the Caribbean that weren't.

Fringing reefs typically have two major types of habitats for coral reefs and barrier reefs and atolls typically have four. All three have fore reef slopes, which are on the outside of the fringing reef, barrier reef or atoll and slopes steeply at about a 45-degree angle down into the abyss. Another habitat that all three types of reef have is the reef flat: a flat, shallow reef area between the reef crest where the waves break and either the lagoon or the island. A habitat that only barrier reefs and atolls have is the inside slope from the island or reef flat down into the lagoon. And the fourth that barrier reefs and atolls have consists of patch reefs some of which are in the shape of pinnacles, in the lagoon. Lagoons are typically sandy bottomed and are usually between about 30 m and 100 m deep. There are often patch reefs or pinnacles in lagoons. The fore reef slope typically has wave surge that decreases with depth and may have currents at times. The reef flat has waves coming across it after they break at the crest, and anything extending above the flat may be exposed to air at extreme low tides. The reef flat on the lagoon side of islands is much more protected than the outer reef flat and thus may have different communities. The slope and patch reefs in the lagoon are protected from open ocean waves and typically have no current. The ring of reefs may have passes where the ring of coral is deeper than elsewhere. Such passes usually have strong currents as water levels outside the lagoon rise or fall with the tides. On rising tides, water rushes through passes into the lagoon, and on falling tides water rushes out. Water on the outer fore reef slope is usually very clear, while that in the lagoon may not be as clear. Each of these zones typically hosts different species of coral, and species that live on one often don't live on the others or are less common on the others. In addition, coral communities are affected by how much wave action they are exposed to. If one side of an atoll has continual heavy wave action and the other side is always calm, there may be quite different coral communities on those two sides. Depth also affects corals, probably from both decreasing light with depth, and decreasing wave surge with depth. Many coral species show some depth zonation, being most abundant at one depth and less abundant deeper or shallower than that. Some may even not be present at some depths. A few species have very wide depth ranges.

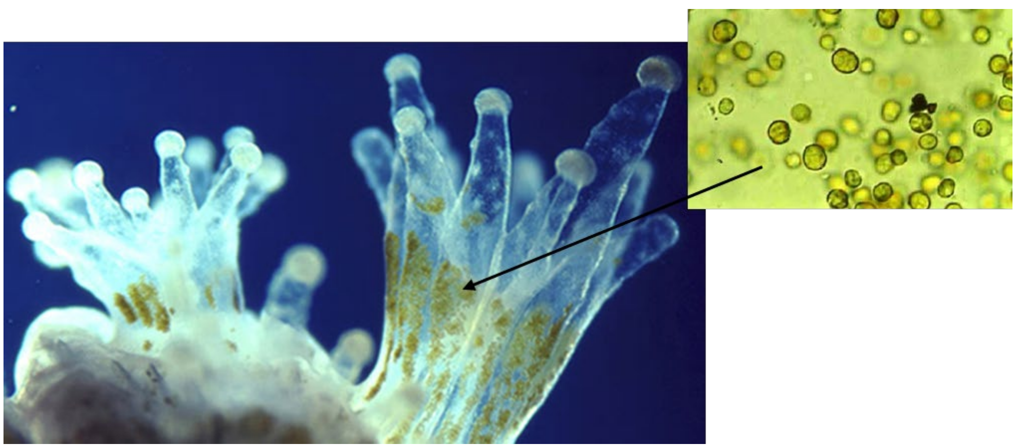
For more background information on marine environments in Tonga and on coral reef ecosystems and habitats in Tonga, see Wells (1978), Fenner (2018), and Stone et al (2019). For more information on coral reefs and corals in general, see Veron (1995; 2000), Wallace (1999), Goldberg (2013), Sheppard et al (2018), Sheppard (2021) and Fenner (2022).

Coral Anatomy and Biology: what are corals? Corals 101.

Corals are animals made up of units or modules called "polyps." A polyp is a bag full of seawater, with a thin wall made of 3 layers, an outer layer of cells called the "epidermis," a middle layer of connective tissue called the "mesoglea." and an inner layer of cells called the "gastroderm." The opening of the bag is the mouth, and it is actually turned inside the opening of the bag. There is a ring of tentacles around the mouth. Each tentacle is a hollow tube much like the finger on a glove, filled with water that is continuous with the water inside of the polyp. The water-filled space inside the polyp is called the "gastrovascular cavity" because it serves the function of both a digestive cavity and a circulatory system. Polyps are very simple and lack organs like a heart, blood vessels, and a brain. The gastrovascular cavity has only one opening, the mouth, unlike the tube digestive systems of higher animals, which have two openings and can digest things in a sequence like an assembly line. Anything that is indigestible has to be spat out the mouth. The inner two layers of the body wall project in a series of curtains called "mesenteries" that extend into the gastrovasuclar cavity. Hard corals have ether six mesenteries or multiples of six, and they have as many tentacles as mesenteries. Usually they have multiples of six. Coral polyps vary in size between species, ranging from less than 1mm diameter up to as much as 30 cm diameter.

Corals and their relatives are carnivores, sit and wait predators. They have a remarkable and unique type of stinger in their tentacles, called a "nematocyst." Nematocysts are actually sub-cellular structures inside cells, secreted by the cell, and not alive. They are oval capsules, with a coiled thin tube inside them. The opening of the tube connects to the end of the capsule which touches the cell surface that is exposed to the water. When an animal touches the trigger on the surface of the cell, it provides a chemical that is only found in animals, a short polypeptide. In addition, the movement of the animal provides a mechanical stimulus. Both chemical and movement are necessary to trigger the nematocysts off. Corals and their relatives eat animals. When the nematocyst is triggered, water from the cell moves into the capsule, but the capsule is rigid and does not stretch. So the pressure goes up very high, about that of a scuba tank, the highest in any organism. There are 3 spines inside the tube which are attached to the tube and their sharp points are against the capsule where the capsule touches the cell surface that is exposed to the outside water. The pressure pushes the spines through the capsule wall, releasing the pressure, which then pushes the tube inside out, and outside the capsule and pushes the spines into the prey. The tube has many tiny spines attached inside it, initially pointing inward. As the tube turns inside out like a sock, the tiny spines are thrust out the end where the tube is being turned inside out, and stick into the prey. As the tube turns inside out, then they stick into the prey backwards, holding the tube in the prey. The spines poke into the prey and anchor the tube in the prey, and pull the tube into the prey. The tiny tube is very long, vastly longer than the capsule in which it was tightly wound up. Thus it can go well into the prey. The capsule is filled with a wide variety of nasty venoms, which attack nerve cells, blood and body cells. The end of the tube is open, so it serves as a hypodermic needle, invented by evolution probably over 500 million years ago. The prey is then pushed into the mouth and on into the gastrovasucular cavity by the tentacles. The layers of cells in the body wall have muscle cells in it which can cause the tentacles or body wall to contract. Once in the gastrovacular cavity, the food item is surrounded by the edges of the mesentery curtains, which have cells on the edge which secrete enzymes that digest the prey. The digested juice of the prey leaks out from between the mesentery edges into the gastrovascular cavity and diffuses through it, sped by body wall contractions that move the water inside it, so the juice reaches cells throughout the body wall and tentacles and feeds them.

The gastrodermis also has single algae cells in it, living inside the coral animal cells. They are called "zooxanthellae" which simply means "colored algae cells that live in animal cells." The zooxanthellae are in a group of single cells called "dinoflagellates" which when they are in water, have two flagella (hairs) that beat, one on the end of the cell, and one in a groove around the equator of the cell. When they beat, the cell swims and spins. The cells have chloroplasts in them that have chlorophyll, and can do photosynthesis in light. They also have other pigments that are red, orange or yellow, and together with green chlorophyll they always look brown. When they build glucose sugar in photosynthesis, some of it leaks out into the coral cell and feeds it. Thus, corals have two sources of food, animals they eat, and sugar from photosynthesis. The sugar is high in energy and low in nutrients, and supplies much of the coral's energy needs. The animals that corals eat are mostly small, and called "zooplankton." They provide the nutrients like nitrogen and phosphorus the coral animal cells need. The algae living inside the animal cell gets the waste products of the animal which are nutrients, fertilizer for plants. Plus, it gets a very well defended, stable spot in the sun. This is a mutualistic symbiosis, two different organisms living together, both benefitting, and it produces tight recycling of nutrients in low-nutrient water. The polyps are all connected by continuous tissue, and the gastrovascular cavities are all connected. The nervous system consists of nerve cells connected together like a net, with no brain or ganglion to control it. All the polyps behave as one connected individual coral organism. In addition, the polyps are all genetically identical and all the same sex. Thus, the colony is the individual, not the polyp. Polyps are modules within an individual.



Coral polyps on the left have tentacles. The white on the end of the tentacles and white bumps on the sides of tentacles are large cells called "nematocyst batteries" because they have many nematocysts. (Image: ocean.si.edu). The brownish green spots are zooxanthellae, seen in a microscope photo on the right. (Image: www.captivereefs.com).

Sexual maturity comes when the colony reaches a certain size, not when polyps reach full size. Eggs and sperm are produced by groups of cells which form gonads on the sides of the mesenteries. In a majority of species, the eggs and sperm are released into the water in what is called "broadcast spawning", where sperm from other colonies of the same species fertilize the eggs. The eggs and sperm are released together in egg-sperm bundles, which float to the surface and then break apart. Once the eggs are fertilized, they begin to divide and it takes about a week for them to divide enough to form a little larva, about the size of the head of a pin, called a "planula' larva. It is then capable of settling if it can find a suitable surface. If not, it can continue to float in the water. Over time, if they don't find a substrate, more and more die, and the last ones may live up to 100 days or so. In some places like the Great Barrier Reef, most coral species all spawn on the same night every year. The floating eggs are so numerous there they can form slicks on the surface so large they can be seen by aircraft. Most larvae probably don't go very far, with fewer and fewer going farther and farther with the currents. In other coral species the eggs are retained in the parent and sperm released, and sperm enter through the mouth to fertilize the eggs inside the parent. Then the egg divides and develops into a larva inside the parent, before being released. These are called "brooded larvae." Brooded larvae are able to settle immediately after being released, or they can float with the currents like other larvae. Some brooders release a few larvae every night, with more during some moon phases and times of the year. In addition, a majority of coral species are hermaphroditic, producing both eggs and sperm in one colony. A minority of species have separate sexes. Broadcast spawning and brooding are types of sexual reproduction.

When a coral planula larva settles, it then metamorphoses into a coral polyp of the same, tiny, size. The polyp then grows until it reaches a mature size. The mature size of polyps differs between species. Once the founding polyp reaches the mature size, it starts to divide. It can divide equally into two new polyps. It divides by the two polyps slowly growing and pulling away from each other. But they don't finish the job of dividing, they continue to stay attached to each other by a thin connection. So all corals start out as one tiny polyp which then grows to a mature size and divides into two. As those two grow, they reach the mature size and then they divide into 4. Then 4 into 8, 8 into 16, and so on until there may be hundreds, thousands, or millions of polyps.

Corals also can reproduce asexually, mainly by fragmentation. If something breaks a coral colony, the pieces can survive and grow if they are stable on a hard surface which they can attach to. In some relatively fragile branching species, this is the primary way they reproduce. In other, sturdier colonies, asexual reproduction by fragmentation is rare. Colonies can also have partial colony mortality which may leave islands of tissue living. In that case, as the islands of living tissue grow, they may reach each other and fuse. Only genetically identical tissue will fuse, when different colonies grow until they touch, they do not fuse. All fragments broken off of one colony are genetically identical and can be called "clone mates." Some species like staghorns form extensive thickets of these clones and are called "clonal." Branching corals like staghorns grow fast at the tip and slow on the sides. At the tip, only thin walls are secreted between corallites so the skeleton is highly porous and weak. Then with time the tissue keeps adding calcium to thicken the walls, until low on the branch not only is the branch thicker but it is nearly solid and very strong. If you think about it, leverage means that pressure near the end of the branch produces much more breaking force low on the branch than near the tip. The fact that the low part of the branch is thicker and more solid and thus much stronger, guards against breakage at the base. Thus, it appears that evolution has actually selected branching corals to resist breakage. That is probably because many fragments do not get stabilized on hard substrate and do not survive. Asexual reproduction by fragmentation can come at a high price. Mushroom corals have a few additional variations on these asexual fragmentation themes. When the larva of a mushroom coral settles, the polyp it forms, grows larger and then taller, and then the top surface with the corallte and septa starts widening beyond the stem-shaped part of the corallite. Then the tissue dissolves a crack in the skeleton under the wide top of the polyp. Then only the tissue holds the top on, and something like wave surge breaks the tissue and it falls off. That top that falls off is the shape of a mushroom coral, and grows much larger without ever attaching to anything. In the two species of "*Diaseris*" mushroom corals, the mature corallite dissolves a crack in its skeleton across the disc, and then the two halves are held together only by tissue. Something breaks the tissue and now there are two, half-disc mushroom corals which proceed to regenerate the other half and then dissolve another crack to do it all over again. As a result, those species can form large numbers of clone mate mushroom corals.

Coral polyps are very similar to sea anemone polyps, but reef building corals are usually colonial with several to many polyps, while anemones are solitary with single polyps that can, in some species, grow quite large. Reef building corals can grow large and have many polyps, and they almost always have zooxanthellae. Other corals are usually small, often solitary, don't have zooxanthellae, and live often in the dark, often in deeper water, and those that live in deep water are in very cold water and a few species live in cold polar waters. Reef building corals live only in warm, shallow water and usually live in clear water. Thus, coral reefs are all in warm, shallow water. All corals build what we call a skeleton, made of calcium carbonate. Calcium and carbonate are abundant in sea water, and actually have a higher concentration than needed to precipitate (but precipitate slowly). Corals take calcium carbonate out of the water and secrete it beneath themselves in a single structure that is external, underneath the living polyps, and not alive. So it is different from our skeleton, which have many separate pieces which are inside and have cells in them and are alive (and our skeletons are made of a complex phosphate compound, "hydroxyapatite"). Calcium carbonate can exist in at least two solid forms, one called "calcite" which forms thick crystals, and another called "aragonite" which forms long thin fiber-like crystals. Corals only build aragonite skeletons. After the larva settles on a surface, it secretes skeleton that is cemented to the substrate. Most coral species are firmly attached to hard substrate, but a few are not. Because the skeleton is not alive, it doesn't matter if other organisms like sponges burrow in the skeleton. As long as it doesn't break, it makes no difference to the living coral which is only on the surface of the skeleton. Each polyp sits in a cup in the skeleton called a "corallite." The inside surface of the cup has walls of skeleton that project into the cup and are called "sclerosepta" with "sclero" meaning hard and "septa" means walls. The corallite shape fits very closely to the polyp and reflects all the fine details of the polyp size and shape. The skeleton is much more permanent than the polyp and can retain its shape indefinitely out of water in a museum, and so is used for identification and taxonomy. All the taxonomy with only one exception is based on the skeleton shape. The irony is that a species is a group of living organisms, but we define coral species based on their skeletons, which are not alive. Both the shapes of colonies and the fine details of the corallites and other details of the skeleton, usually observed under a microscope, are used to separate species. Identification of living corals is not definitive, it requires confirmation by examining skeleton. Living corals in the water have some advantages for studying species, since you can see the whole colonies instead of pieces in a museum, and you can see large numbers of colonies, and it is non-destructive. Skeletons in a museum have the advantage that living tissues are not in the way of you seeing the skeleton details, and you can use a microscope, and you can see the same skeletons other people see.

There are a few general things about coral morphology that may be of help to you as you go along. The main unit in coral morphology is the polyp, and the corresponding cup in the skeleton which a polyp sits in. The cup in which a polyp sits is called a "corallite" and includes both the inside and the outside surfaces of the cup. The inside of the cup is called a "calice." There are walls that extend from the inside wall of a corallite into the central space of the corallite, which are called "septa." Each corallite has at least six septa. Septa come in sets, the first set having six septa, the second set also having six which are between the first set of six and usually smaller than the first set of six. The third set is 12 and is in between the existing 12 septa, the next set is 24, etc. In the center of the corallite there is a small structure called a “columella” which may be a single solid column or more often many small columns, or curving, twisted columns. The septa commonly extend up over the rim of the corallite and down the outside surface of the corallite, where they are called costae (costa is singular). Septa and costae may have teeth or granules on the edge and granules on their sides. Corallites can come in many different sizes and shapes. They range in size from about 0.5 mm to about 30 cm diameter. Some are circular, others oval, some quite elongated. Each elongated corallite corresponds to an elongated polyp which has several or many mouths but shares a single gastrovascular cavity. The corallite walls in that case are elongated and usually meander, forming a “meandroid” coral, commonly called a “brain coral.” There are many other details.

Coral Identification

Coral species are notoriously difficult to identify. Coral identification and taxonomy are not for the faint hearted. You need all the help you can get. We all do. The purpose of this identification guide is to help you to learn to identify coral species you see in Tonga. This is a preliminary version of the guide, as the author gets more time underwater and finds and photographs more corals, more species will be added. The goal is to present photographs of the corals taken in the Tonga and have clear and helpful text that points out the features of the corals that can help in identification and how each species differs from others. One of the advantages of a pdf is that it can easily be updated as often as desired. Another is that photographs can fill the whole screen. The larger the photographs, the better you can see the corals that you are trying to identify. This guide attempts to show both pictures of the whole colony shape, and of close-ups of the corals, and some of the variation between corals. There are valuable identification clues in both the colony shapes and in the features of the corallites and areas in between corallites. You need to be able to see as many of these features as possible to help you identify the corals you see.

At any one reef, only a portion of Tonga's coral fauna will be present, and an even smaller portion of that fauna will be common enough that you encounter it frequently. The more often you see a coral, the more chance you have to practice your identification skills. The author recommends looking at the guide as often as possible, including before you get in the water. Then it is good to look again after you get out of the water. Going between the guide and looking underwater, back and forth, is one of the best ways to learn coral species. You will see corals in the water that don't fit well with the species in this guide. You will also see things in the guide that you won't initially see in the water, but with more and more time in the water you will see more and more of them. The author is doing the same thing, finding more species with time spent underwater in more places, and using pictures taken to add to the guide. But a local guide has several advantages over a guide that presents all species from all over the world (such as Veron's "Corals of the World"). For one thing, many of the species in a worldwide guide aren't at your location. That means you have to look through many photos of all sorts of things that aren't on your reef. For another, not all coral species look the same everywhere. Some can look quite different in different parts of the world or on different archipelagoes. Some look virtually identical, but others don't. Most or even all of the pictures taken in a worldwide guide weren't taken in Kosrae, and so many of them may look quite different than corals in Kosrae. This guide helps you by only showing you coral species that are in Kosrae, and only showing you photos of corals in Kosrae, so the photos look as much as possible like the corals you see.

Unfortunately, there are only a few common names that have been applied to coral species consistently, and most of those apply to groups of corals. So some corals are called "staghorns" and others "table corals" and others "brain corals." But there are several staghorn species and several table coral species. In this guide, similar looking species are presented together as far as possible. Genera are presented in a traditional order, which tends to put corals that look similar together. In addition, within genera corals that appear similar are put together, so all the "staghorn corals" are together, and all the "table corals" are together, and so on. But the species are all labelled with the scientific (Latinized) names, because only those names correspond (as far as possible) to the actual biological species. Common names in widespread use are also given, but usually there are several species that have the same common name. So there is no easy way around using the scientific names.

There are two major reasons that corals are difficult to identify. The first is a naming problem, and the second is a problem of figuring out what group of organisms is the species you are studying. Names are arbitrary human inventions, while the group of organisms is something that exists in nature whether we give it a name or not. We need species names in order to be able to communicate to each other what we are talking about, but the name itself is arbitrary, any name would do, and everybody has a different idea of what name they would like to call it. The solution is a set of rules invented by Linnaeus. You probably know some of the rules. One of the most important is that the first name correctly applied to a species is the one that is correct. This is called "priority." A second rule is that species names must have two words, the first is the genus and is capitalized, the second is the species and is not capitalized, and both are in italics. Any words can be used, from any language, but the words must be Latinized, making them look like Latin. So the word in English, "bushy", taken from a reef in the Great Barrier Reef where a coral was first discovered, was converted to Latin and became "bushyensis" and the species was named "*Acropora bushyensis*". Another rule is that the name and a description of the species must be published. The rule book does not specify where the name must be published. There are other rules, which are contained in a rulebook, "The International Code of Zoological Nomenclature" (which is available online open-access). This is in effect the rulebook for a game played by taxonomists, that is, naming species. There are a variety of problems with this, but one of the worst come from the publications that commonly are used for new species. Very few people are interested in the original descriptions of new species, mostly just other taxonomists that work on the same group of animals, and usually there are only a few of those in the whole world. No widely read journal that publishes papers that many people think are important will publish original descriptions of new species, because almost no one will be interested and read it. So almost all descriptions of new species are published in obscure little journals that almost no one reads, and almost no libraries subscribe to them, since almost no one uses them. One result is that most coral taxonomists have not read most original descriptions, primarily because they can't find copies of them. So many taxonomists have described as new species, species that were described before, sometimes many times. These are called "synonyms", when two names refer to the same species. Taxonomists occasionally write "revisions" of groups of organisms, in which they give new descriptions, and they list all the names that have been previously applied to what is now all considered one species. This requires considerable taxonomic knowledge and skill, because you have to look at lots of old descriptions to figure out which are all the same species. Yet a single species varies between individuals and locations, so original descriptions from different places are often a little different even though it is the same species, and everyone uses different words and sentences, making this a difficult task.

In addition, the rules do not specify which language must be used in original descriptions. At first, most were written in Latin, because that was the scholarly language of the time in Europe where taxonomy originated. Then they were written mostly in a variety of European modern languages, and now most are written in English. Even in English, the language has changed over time, particularly in coral taxonomy. Older publications in English use terms that they didn't define, and which we don't use now. That makes it harder even in English. I have seen an original description of a coral species that consisted of two sentences in Latin. Your Latin better be very good, the whole definition could hang on the meaning of one word in Latin.

Originally there were no samples of the new species, or photographs (photography had not been invented!) or even drawings of the new species. Then people started including drawings in their new species descriptions. The drawings were often made from a particular piece of the species, and slowly those pieces, in a museum, were taken to be "type specimens" that helped define new species. In time, photographs were added. In 2000, the rules were revised to require the description of a new species to include designating a type specimen (usually in a museum). Type specimens are extremely helpful, because if an original description leaves out something that you now think is important, you can look at the type specimen and find out what that is. Further, it is often difficult to imagine what a species looks like from a description. The saying goes that "a picture is worth a thousand words." Of course, we are handicapped by the fact that for the species that were named long ago, there are no type specimens. Another problem is that some old type specimens are in terrible shape. One that Veron has a picture of on his website (Corals of the World) looks like it was dragged behind a car on beach for a couple miles, all the surface is worn off. You can't even tell what genus it is in. This may not be quite as bad a problem as that, most type specimens are not in bad condition. Another problem is that the type specimen doesn't have to be typical of the species, and the original description doesn't either. That's in part because a wide range of samples of a species are almost never available when a new species is being described, and a large collection of samples is needed to determine the variation within the species and what is typical. At this time, for most coral species, we still don't know the range of variation over the geographical range of the species. No one can go to everywhere there are corals and sample many colonies from every site of every species. But we know they vary from site to site. So some or many type specimens may not be typical, and for most species we don't even know whether they are typical or not.

It has been said that the main job of 20th Century taxonomists was to try to clean up the mess left to them by earlier taxonomists. Much of that comes from the arbitrary naming rules, but some comes from the variability in the organisms themselves.

The second great hurdle for recognizing coral species and doing taxonomy on them, is the question of what group of individual organisms comprise a species. This is an empirical question. With some species, it is easy. For *Homo sapiens*, we have the advantage that no other human species is alive today. Our nearest living relatives, chimpanzees and bonobos, are so different from us no one would ever confuse one with a human, and many people don't believe we're related at all. If Neanderthals were alive, it would be much more difficult.

Almost all species ever named and described were named and described based on their morphology and anatomy alone. Originally, only morphology was known and could be included. Plus, morphology until recently has been the quickest and easiest thing to use to describe species. And it makes it possible to identify species in the field. About 1-2 million species of all types of life on earth have been described, but it is estimated that there are 10-30 million species on earth (and other estimates that run from 3 million to a billion; nobody really knows). After about 250 years, we may have only named and described about 10% of the organisms on earth, and we have little prospect of speeding that up substantially. It is not immediately obvious how large the anatomical differences need to be between individuals for them to be different species. There is lots of variation within some species, so something that is different might be a new species or just a variation within a species. How do you tell? Not easy. One thing is that it is helpful to have at least two different features that are different between two species, and that the two go together. So species 1 has features A and B, and species 2 has features a and b. and individuals that have A and b or a and B are rare or can't be found. Another rule of thumb is that in a single feature that has variation between individuals within a species as well as between species, the distribution of that feature (such as length or body weight) has two modes (one for each species) and at least a small gap in between with no individuals. Of course these things require a lot of knowledge about many individuals within a species. That sort of information is very rarely available when describing a new species, but sometimes is available later on when much more is known about the species. Describing new species remains a fairly intuitive thing.

For corals, the morphology that is used in coral taxonomy is the morphology of the skeleton. Originally, the only thing available to taxonomists was the skeleton. Long sailing voyages of creaky old wooden European sailboats went long distances, sometimes around the world. Along the way the crew would pick up all kinds of curiosities, sometimes including corals. Months or even years later, the ship would return to Europe, and by then the coral had long had all the tissue rot off, and only the skeleton was left. If the taxonomist was lucky, the skeleton had not been broken into many pieces or ground against other pieces as the ship rocked. In time, deliberate collecting voyages were organized, financed, and crewed with people whose purpose was to collect. Corals were usually collected by dredging, pulling a dredge behind a boat which broke many corals and gathered many broken pieces of coral. But only within the lifetime of older people living now, has it become possible to dive into the water with scuba gear and view living corals in their natural state. Pieces of coral in museums are exactly that, they are almost always just pieces, and the overall colony shapes usually can't be seen. Further, it is possible now to see large numbers of living, whole colonies underwater, many more than can be seen in museums. Plus viewing corals is non-destructive. I know one coral taxonomist who has collected over 30,000 coral specimens in his lifetime. That is still tiny compared to the hundreds of millions of colonies destroyed by a single, natural, hurricane. But still it is significant. The colony shape of corals is one of the more useful cues that can be used to identify species, but it is usually only available when they are viewed alive on a reef. So viewing corals alive on a reef has its advantages for identifying coral. One disadvantage is that viewing a living coral is ephemeral and in and of itself you usually can't show it to a variety of colleagues. Now, underwater photography fills that gap, and it is possible to show pictures of whole living colonies and close-ups of smaller features to as many people as you wish. Another disadvantage with living corals is that the skeleton on which the taxonomy and secure identification rests, cannot be seen directly, usually, because it is covered with living tissue. The living tissue obscures many of the features you need to use in identification, such as skeletal septa, spines, etc. Further, underwater you can't use a dissecting microscope, your mask fogs up, waves or currents throw you around, you have to do a lot of other things to stay safe like watch your buddy and check your dive computer and air gauge, all the while you are trying not to break coral and to handle the camera and perhaps collecting tools. So there are advantages to working on a piece of skeleton in a lab or museum as well. But it is good to remember that an identification of a coral in the water is a hypothesis, and firm identification requires examination of skeletal samples under a microscope. The present guide is not yet backed up with examination of skeleton under a microscope by the author, but that is planned for the future. Identification of living corals is guesswork, hopefully well educated guesses, which can be checked against skeleton.

Discovering or studying species requires some idea of what a species is. Darwin wrote that many scientists differ in how they define what a species is, they have an intuitive feel for what it is. By now, about 30 different definitions of species have been offered. What I was describing in the previous paragraph is something like a definition of a species based on morphology, which has been called a "morphospecies." Another famous definition is what is called the "biological species". That defines a species as a group of organisms that interbreed within the group, but not with other groups. Reproductive isolation from other species is the hallmark of a "biological species." Reproductive isolation makes sense of some major problem cases for the morphological definition of species. For instance, dogs have enormous morphological variation. The differences between many dog breeds is far greater than that between many wild species. Yet we are sure all dogs are one species. Why? Because they can interbreed freely. Humans also have lots of variation, yet all modern humans are the same species, we can all interbreed. Another problem with morphospecies is illustrated by parrotfish. There are parrotfish that were described as different species because they are different sizes and have different color patterns. But subsequently, they were seen to be interbreeding, they were different sexes of the same species. Many (but not all) species are dimorphic to some degree, with different morphology in males and females. Sexual dimorphism is an example of polymorphism. There are some species, such as some butterflies, that have multiple morphs that look different, but interbreed freely, they are the same species. So the reproductive isolation definition of species handles these problems well. Intuitively we know that reproductive isolation is a better definition of species than morphology alone. However, one problem with reproductive isolation is that it takes a LOT more time and effort to gather the information needed to define species this way than by morphology alone, and we have millions of species left to describe so we don't have the luxury of testing reproductive isolation with each new species (or most of the old species).

There are at least two other major problems with the reproductive isolation definition of species. One is that a majority of all species are extinct and we know them only through fossils. Yet we can't record in fossils which organisms interbreed with each other and which don't. All we have is morphology. Second, there are some species that don't interbreed at all. Rotifers are entirely unisexual and do not interbreed, and have not been interbreeding for about 200 million years, it is thought. Some microorganisms don't interbreed. Bacteria exchange genetic material, but that's not interbreeding in the sense we mean, and bacteria can easily exchange DNA between different species. So interbreeding isn't much help there. In zooxanthellae, interbreeding has never been observed except in the original description of *Symbiodinium*. So it is in some cases not possible to use the reproductive isolation, and in most or almost all cases it is impractical. There is one study with about 20 species of *Acropora* which spawn all on the same night on the Great Barrier Reef, where reproductive isolation was studied. All possible crosses of these species were made, and whether the crosses would produce fertilized eggs. Several were able to cross, including at least one pair of species that had nearly as high frequency of fertilization success and within species. But most did not cross, and most that did cross had fairly low fertilization success.

The newest challenger is of course genetics. It is possible now to quickly get DNA sequencing data from large numbers of samples. One problem is simply handling the enormous volume of information when more than just single genes or small stretches of DNA are sequenced. Interpretation of the results in some cases is not always clear. For many types of animals, there is a relatively small stretch of DNA that is highly variable between species. The DNA sequence in that locus is unique for each species. This is the technique called "DNA finger printing" or "bar coding." If you define a species by morphology and then sequence this locus in the DNA, then you can sequence that locus in many individuals blindly and the results are "fingerprints" or "bar codes" that can identify the species for you. Thus, for the first time, large volumes of samples and species can be separated into species groups without the laborious task of identifying based on morphology. It is easy to sequence large numbers of individuals and use the fingerprints to divide the samples into species. Then matching to databases of known species sequences, you can identify species. You can only get a species name if a taxonomist has identified a species and it has had its DNA sequence fingerprint taken. Further, you have to sample each individual you want to identify, which would be impractical for some types of ecological surveys or monitoring. For most corals, the problem is that there is not enough variation in these markers to separate species (though it may work for genera), and no one has yet found a new stretch of DNA that works. Markers that do work for species have been found for *Pocillopora* and the Agariciids. So genetic fingerprinting doesn't work with all corals at this time, but it does for some. Note that if you compare a DNA sequence pppfor an individual coral with a database, you have to assume that the specimen for which the sequence appears in the database was correctly identified. That assumption may not be warranted for corals, people without significant training in coral ID may get ID's wrong.

The main problem with morphology for corals, is that corals are so highly variable in morphology within species. There is variation at every possible level. Variation between spines in a single corallite. Variation between neighboring corallites on a single colony. Variation between regions (like top and side) of a single colony. Variations between adjacent colonies (in the same environment). Variation between colonies in different zones of the same reef. Variations between reefs, between islands within the same archipelago, between adjacent archipelagoes and between distant archipelagoes. When you're trying to tell two species apart, they both have variations at all these levels, with all the different morphological features they have, all at the same time and perhaps independently. The variation within species is large, and often the variation between species is small. Some studies have quantitatively measured many features in the same individual coral, on the order of 30 or more features, on several corallites or locations of each coral. Do that on more than a few colonies and the work quickly becomes enormous, do it on all the archipelagoes within a species range and it has never been done and may never be done because the work is way out of proportion to the value of the end product, it is too inefficient.

For more on the results of DNA sequencing of corals, see the section after "Contents" on "Corals by the New Systematics: DNA-sequencing (PCR) Phylogeny' and Kitahara et al (2016). For more on the conflict between DNA sequencing and morphology, see Losos et al (2012). For more on the problems of morphological taxonomy with corals, see Veron (1995; 2000) and Veron et al (2020).

Yet we still very much need to be able to identify corals to species in the field, for studies of ecology, monitoring, and conservation. So we struggle along, doing the best we can. My suggestion is to concentrate on enjoying the feeling of accomplishment each time you learn to identify one more species. Don't dwell on the fact that there are many to go, enjoy learning to identify coral species as you progress.

There are a few general things about coral morphology that may be of help to you as you go along. The main unit in coral morphology is the polyp, and the corresponding cup in the skeleton which a polyp sits in. The cup in which a polyp sits is called a "corallite" and includes both the inside and the outside surfaces of the cup. The inside of the cup is called a "calice." There are walls that extend from the inside wall of a corallite into the central space of the corallite, which are called "septa." Each corallite has at least six septa. Septa come in sets, the first set having six septa, the second set also having six which are between the first set of six and usually smaller than the first set of six. The third set is 12 and is in between the existing 12 septa, the next set is 24, etc. In the center of the corallite there is a small structure called a “columella” which may be a single solid column or more often many small columns, or curving, twisted columns. The septa commonly extend up over the rim of the corallite and down the outside surface of the corallite, where they are called costae (costa is singular). Septa and costae may have teeth or granules on the edge and granules on their sides. Corallites can come in many different sizes and shapes. Some are circular, others oval, some quite elongated. Each elongated corallite corresponds to an elongated polyp which has several or many mouths but shares a single gastrovascular cavity. The corallite walls in that case are elongated and usually meander, forming a “meandroid” coral, commonly called a “brain coral.” There are many other details.

Useful Terms

The descriptions often refer to "corallites." These are the skeleton cups that the polyps sit in. The word "corallite" refers to both the inside of the cup and the outside. "Calice" means the inside (only) of the cup. "Septa" are the inward projecting walls within the cup, and "costae" refers to the ridges on the outside of the cup running down the wall.

The descriptions also commonly refer to several different colony shapes. Here are some of the shapes:

Massive = dome shaped, rounded or hemispherical colonies without deep cracks, but can be any size.

Submassive = appear massive, but there are very deep cracks in it because it is actually branching. The polyps are only on the ends of the branches, and the cracks may not be visible. *Lobophyllia, Caulastrea, Euphyllia*.

Branching = having branches that have side branches and can go in any direction.

Columnar = having near vertical columns that don't branch much.

Encrusting = forming a thin crust over the substrate and attached to it, with no space under the coral. Much like paint though not usually as thin as paint.

Foliose = Plate = a relatively thin, nearly flat structure that is thin and has two sides like a plate. Plates are commonly near horizontal but can be at any angle including vertical.

Mushroom coral = resembles the overturned cap of a mushroom.

Staghorn = branching, with branches that look like staghorn (always in genus *Acropora*)

Table = a flat top surface held up by a pedestal which is usually under the center of the table (always in genus *Acropora*)

Digitate = branches look like fingers, without any side branches, not very long, and usually parallel, extending upward from an encrusting base (always in genus *Acropora*).

Corymbose = similar to digitate, but thinner branches, which are often growing up from larger horizontal branches (always in genus *Acropora*).

Caespitose = bushy, branches going in all directions.

Hispidose = in the shape of a bottlebrush, with short thin branchlets radiating from a central larger branch (always in genus *Acropora*).

The identifications in this guide are primarily based on Veron (2000), Veron et al (2020), Wallace (1999), Wallace et al (2012), Hoeksema (1989), Randall and Cheng (1984) and references therein, and type specimens and original descriptions (mostly for *Acropora*).

The words in **bold red** on the same line as the species name are the categories for endangered species. Some coral species have been listed as "threatened" under the U.S. ESA (Endangered Species Act), and some listed as "vulnerable" under the IUCN (International Union for the Conservation of Nature) Red List, (www.iucnredlist.org), and some both.

The Corals

Phylum Cnidaria

This phylum contains animals that have a very simple sack-like body with three layers of cells and no organs. It has a mouth that leads to the gastrovascular cavity, but the mouth is the only opening to the cavity. It has a ring of hollow tentacles around the mouth, which are extensions of the body wall. The body shape can be a polyp which has an upward facing mouth and the downward end of the body is attached to a surface, or a medusa, which is a jellyfish which is free swimming. In some classes, polyps and jellyfish (medusa) alternate; in one (Anthozoa), only polyps are present.

Subphylum Anthozoa

This class contains animals that have only a polyp stage (no jellyfish = medusa stage). It has two main groups in it, those with exactly 8 tentacles (Octocorals: soft corals, gorgonians, and sea pens), and those with multiples of six tentacles (Hexacorals).

Class Zoantharia or Hexacorals

This subclass contains animals that have six tentacles or multiples thereof: sea anemones, Scleractinia (hard corals), black corals, ceranthid anemones, zoanthids, and corallimorphs.

Order Scleractinia

This order contains animals that build calcium carbonate (aragonite) skeletons underneath themselves. In the corallites ("polyp cups") that polyps sit in, there are "sclerosepta" that are thin walls made of skeleton that project into the calice (the inside of the corallite). This includes almost all of the reef-building hard or stony corals. The reef-building corals have zooxanthellae (single-celled algae inside the coral cells), though there are almost as many scleractinian corals that don't have zooxanthellae and live in deep, dark, and/or cold water or a few that live in shady locations on reefs. Those that have zooxanthellae are called "zooxanthellate" and those that don't are called "azooxanthellate." Most azooxanthellate species are small, and many have only one polyp, but a couple of species that live on reefs are large enough to be reef builders (and have many polyps). Most Scleractinia are attached to a hard surface, but a few like most of the mushroom corals are not attached. Most reef-building Scleractinia have multiple to many polyps and corallites, but a few are solitary, with only one polyp. For those that have many polyps, the colony is the individual, and polyps are modules not individuals. In a sense a polyp could be considered an individual, but the polyps in a colony are all connected together with continuous tissue. Further, all polyps are the same sex in a colony, all are genetically identical, and their digestive systems and nervous systems are connected. They reach sexual maturity when the colony reaches a minimum size, not when polyps reach a minimum size. They function and behave as a single individual with modular units from which a piece can break off and regrow. Polyps vary greatly in size between species from less than 1 mm diameter to as large as 30 cm diameter, and they vary greatly in shape and other details. Colonies also vary greatly in shape, which is helpful in identification.

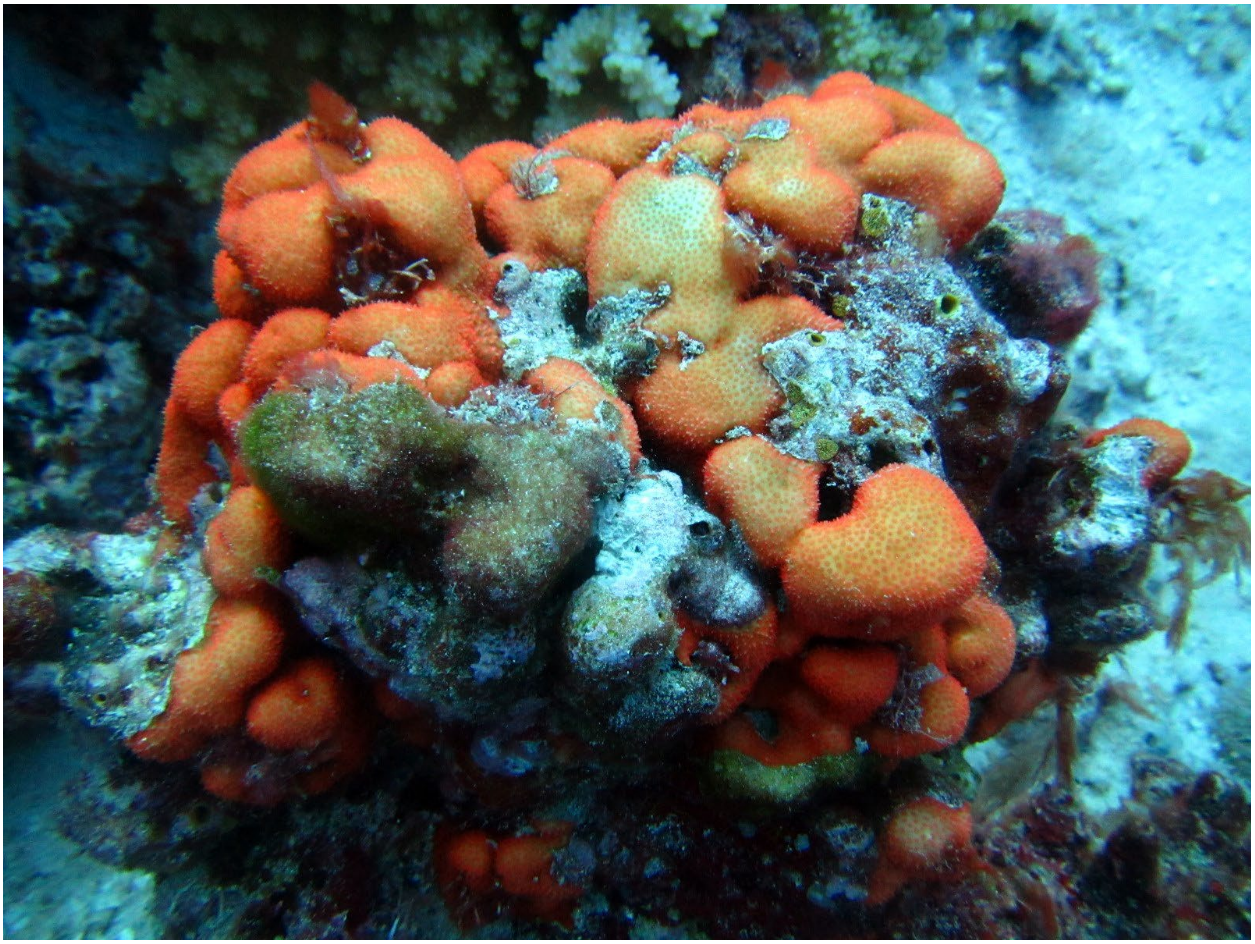
Stylocoeniella

Colonies have small lumps or are encrusting and have tiny corallites less than a millimeter diameter. Each corallite has one tiny spine next to it. The spines are tiny enough to be hard to see underwater; if they can't be seen, they can be felt. *Montipora* has many more spines when it has tiny spines.

Stylocoeniella guentheri

Colonies are up to about 20 cm diameter and usually are on a steep slope. Colonies usually have small rounded knobs on them, about the diameter of a finger-tip. *Styloconiella armata* has much smaller colonies that have no bumps.

A photo of *Stylocoeniella guentheri*.



A colony of *Stylocoeniella guentheri*.

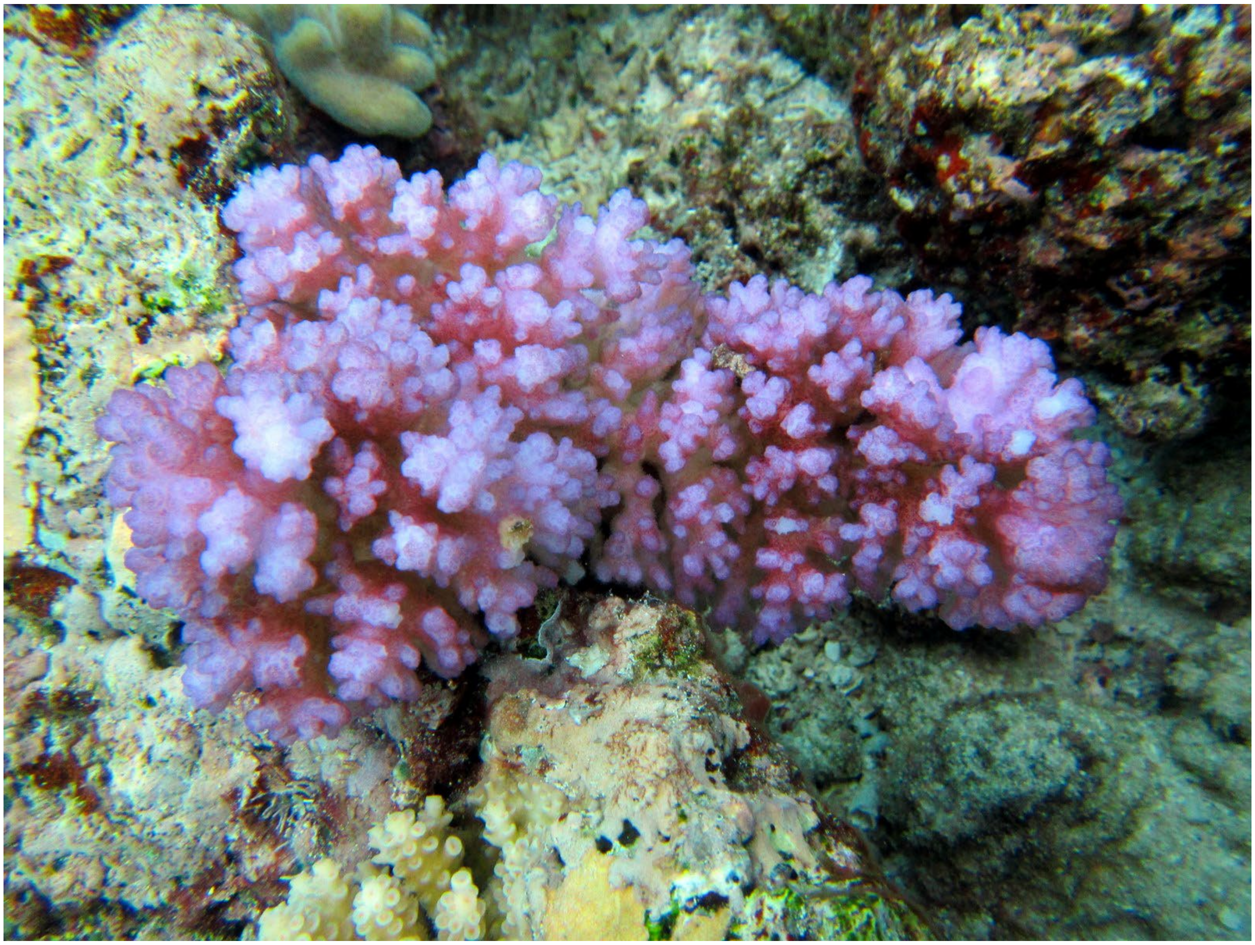
A close-up photo of *Stylocoeniella guentheri*. The polyps are orange and the spines are white on this colony.

Pocillopora

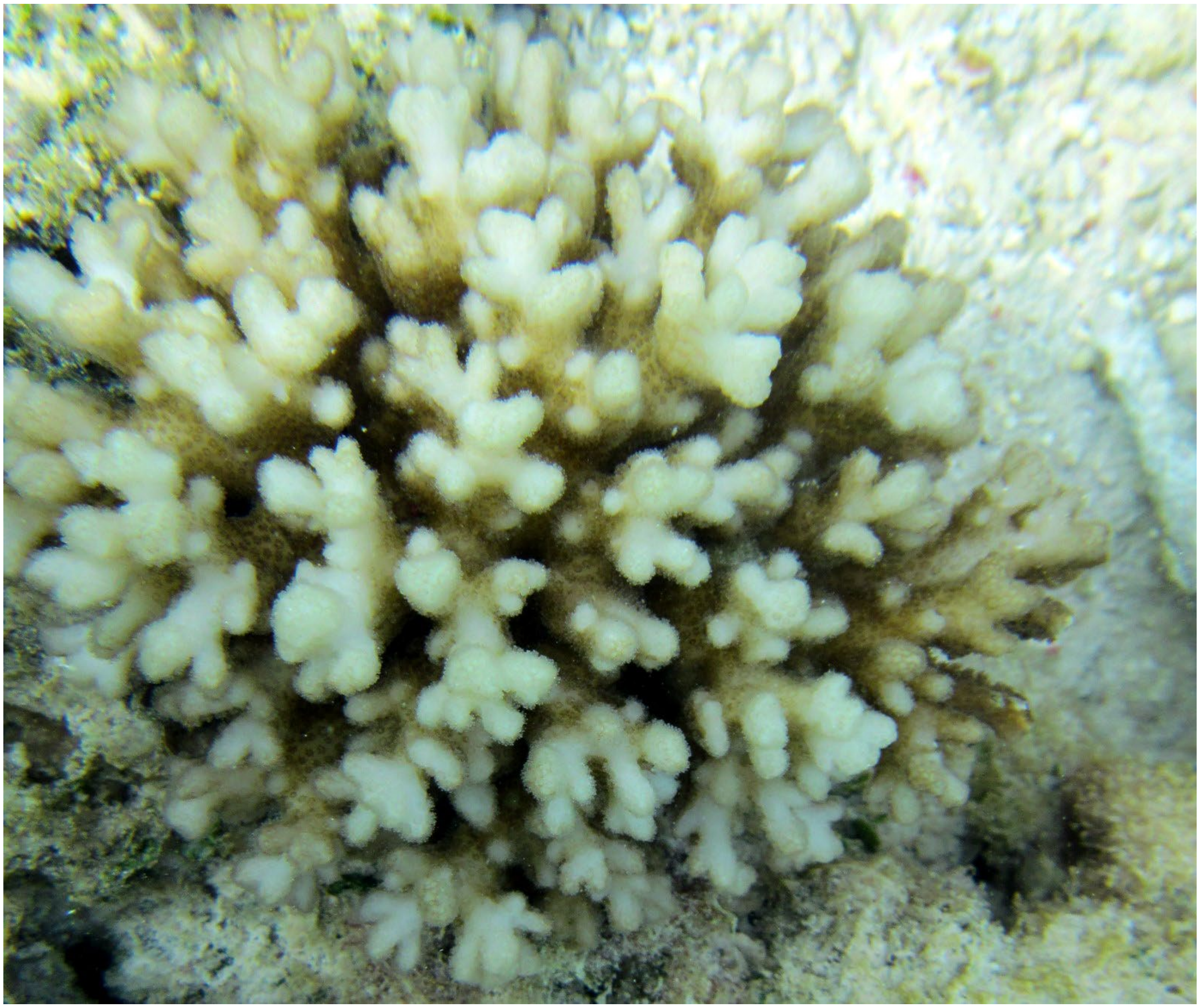
Colonies are always branching, and have little bumps on the branches. The bumps are called “verrucae” and are about 2-3 mm tall and wide. Corallites are tiny, about 1 mm diameter and are all over and between the verrucae. Some *Montipora* species have bumps called “verrucae” on them, but they are usually on encrusting colonies and the bumps are very smooth without any corallites on them.

Pocillopora damicornis

Colonies are branching and are almost always less than 30 cm diameter. The branches divide repeatedly until the branch tips are about the size of verrucae. In most other species the branches are larger and easily distinguished from branch tips.



A photo of *Pocillopora damicornis*.

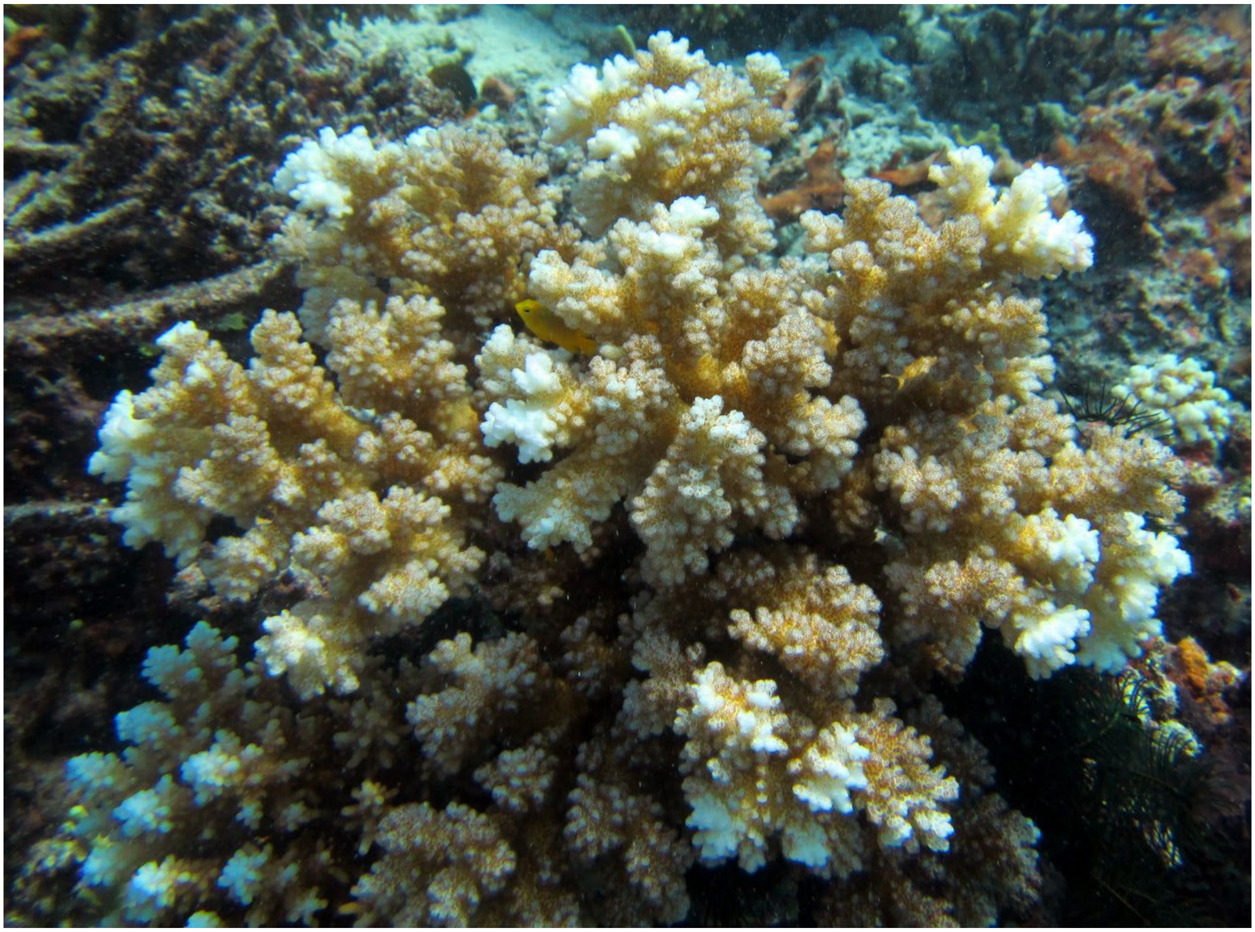


A close-up photo of a colony of *Pocillopora damicornis*.

Pocillopora brevicornis

Colonies have fairly thin, irregular branches which end in clusters of bumps (verrucae). Branches and verrucae can be distinguished. Colonies can reach as much as 1 m diameter though most are closer to 50 cm diameter. Colonies may be clustered together and difficult to distinguish and can even form fields. Branches are thinner than on most species of *Pocillopora*, but branch ends are larger than on *Pocillopora damicornis* and colonies get larger.

A photo of large colony or cluster of colonies, of *Pocillpora brevicornis*.



A photo of *Pocillpora brevicornis*.

A close-up photo of *Pocillopora brevicornis*. The tiny circles are polyps.

Pocillopora setchelli

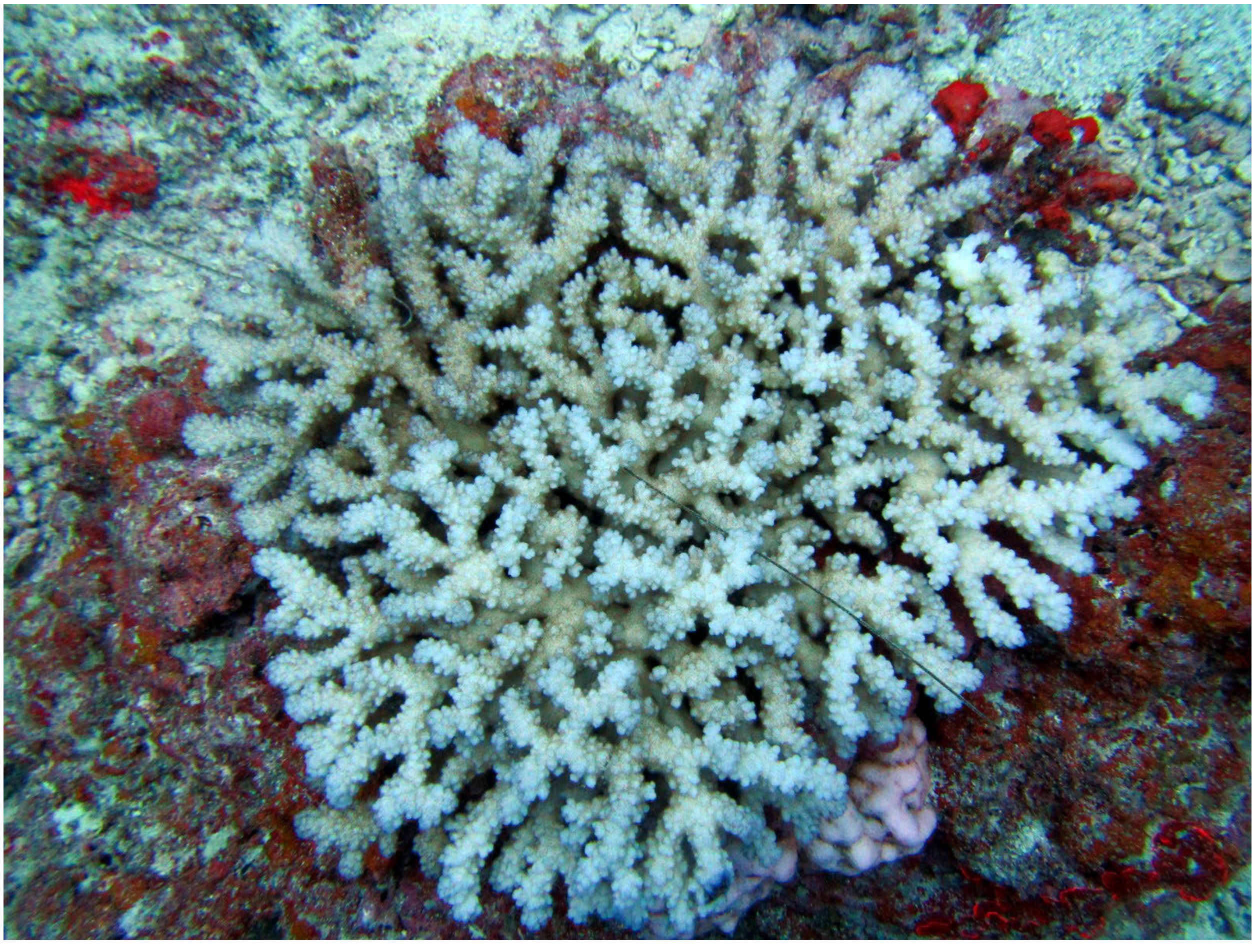
Colonies are usually less than 20 cm diameter and have short branches which are about finger or thumb diameter, some of which may be oval or flattened. The branches are close together. This species is most common in shallow water near the surf zone. Colonies are smaller than on *Pocillopora brevicornis* and branch tips do not have groups of verrucae. Branches are shorter and closer together than on *Pocillopora danae* and *Pocillopora verrucosa*. Verrucae are less irregular than on *Pocillopora danae* and smaller than on *Pocillopora ankeli*.

A photo of *Pocillopora setchelli*.

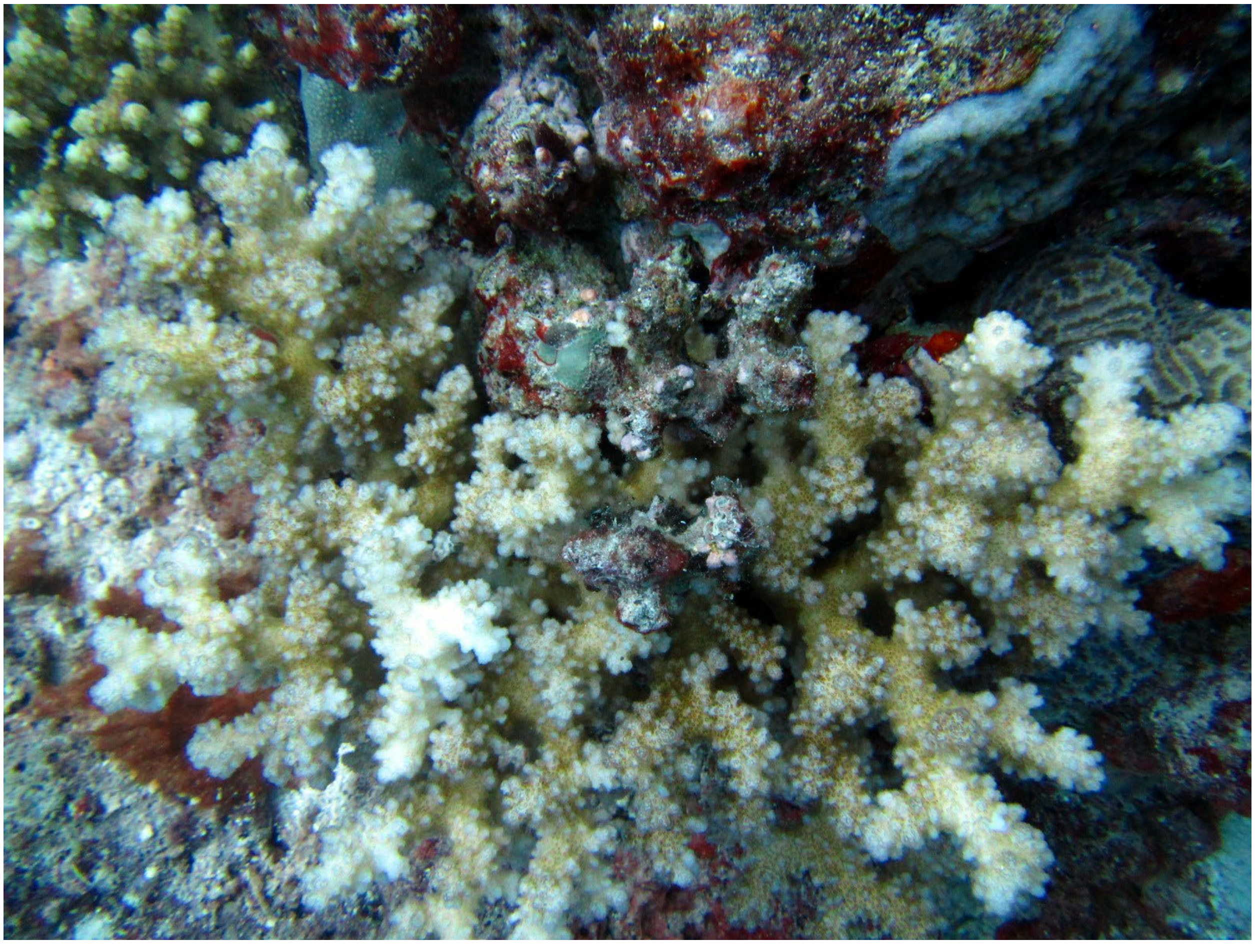
A close-up photo of *Pocillopora setchelli*.

Pocillopora danae

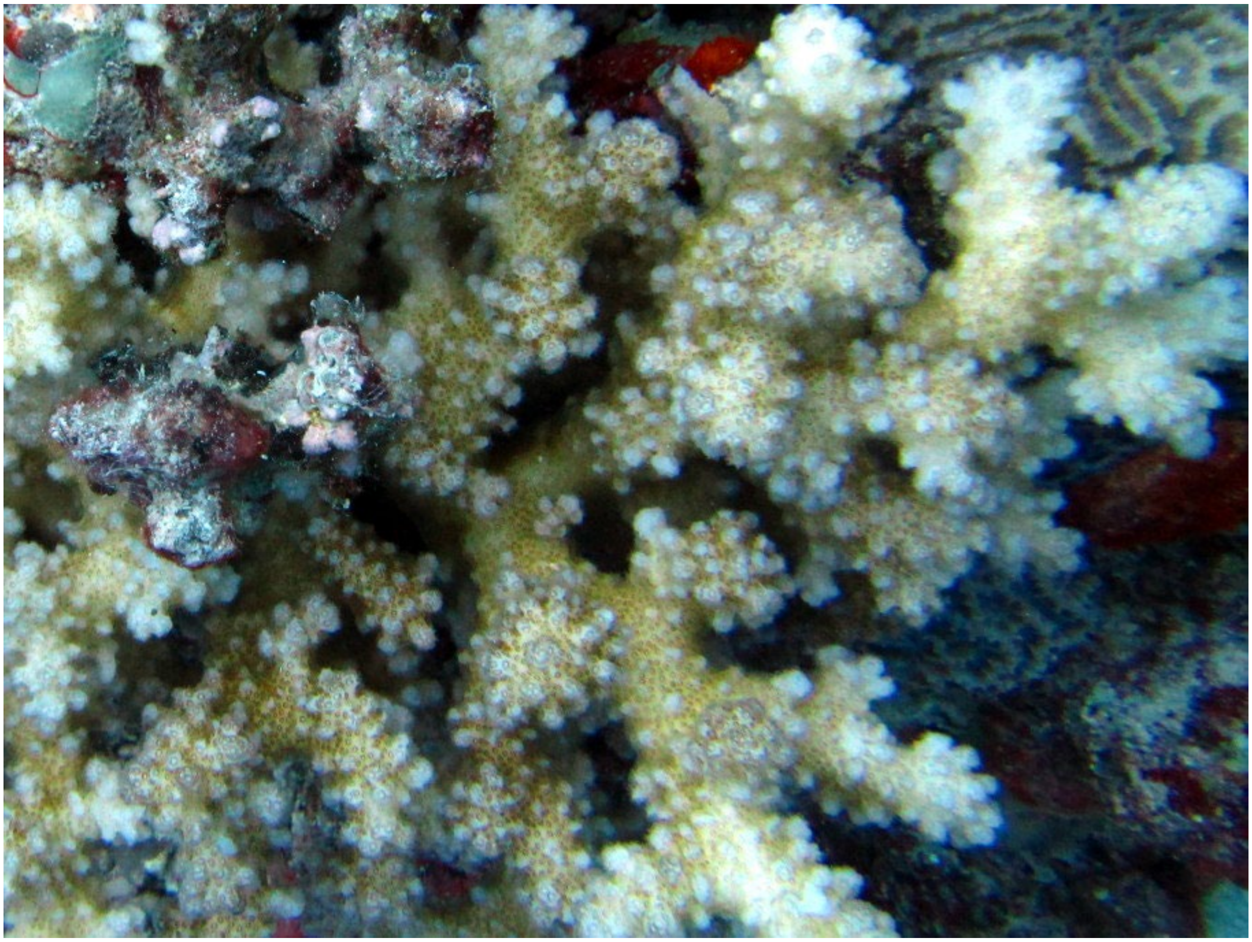
Colonies have cylindrical branches about the diameter of a finger. The branches go many directions, with parts of them going horizontal. The verrucae are irregular in size. The branches are more horizontal that other *Pocillopora* species, the branches more cylindrical and thin than most other *Pocillopora* species, and the verrucae more variable in size than other species.



A photo of *Pocillopora danae*.



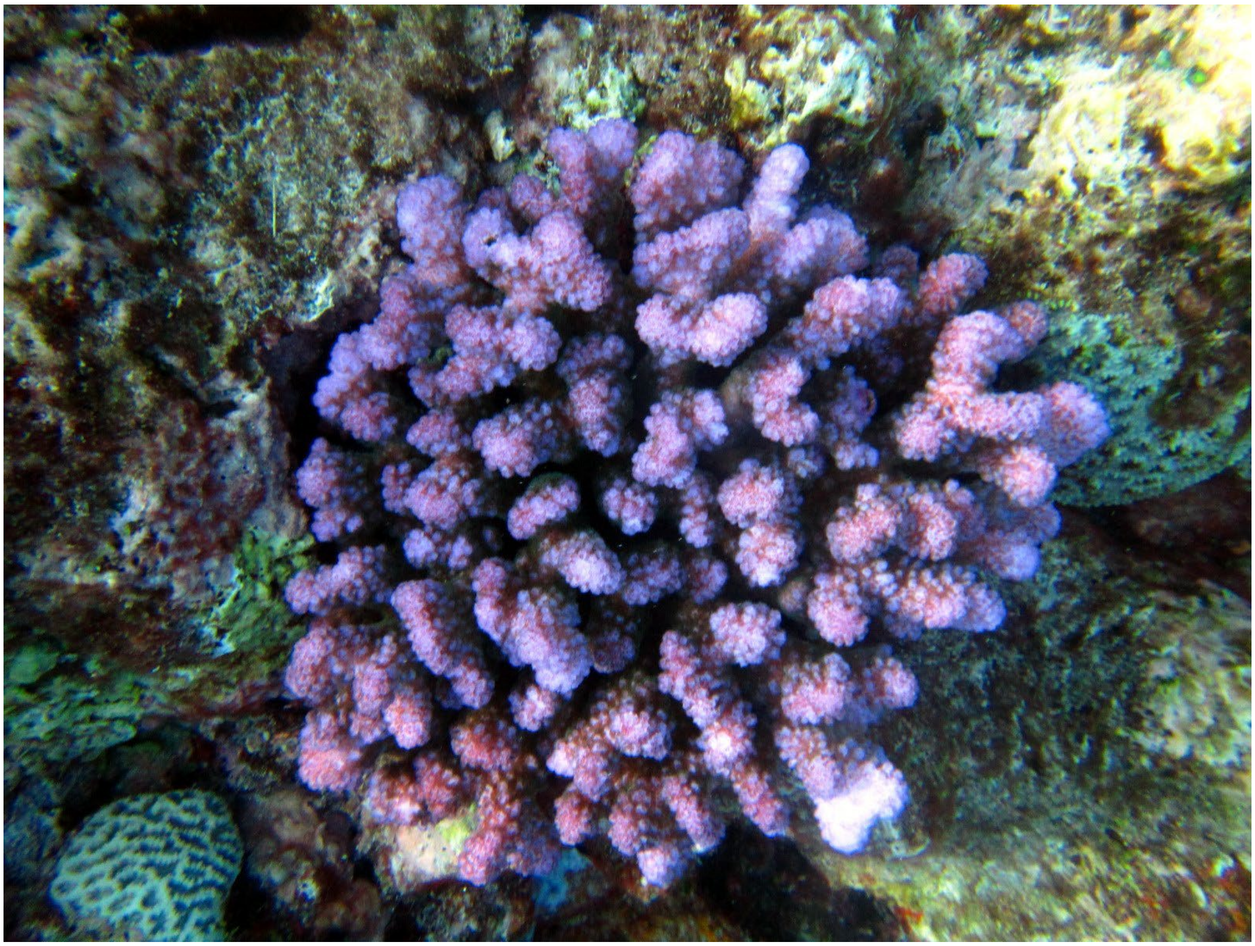
A closer photo of *Pocillopora danae*.



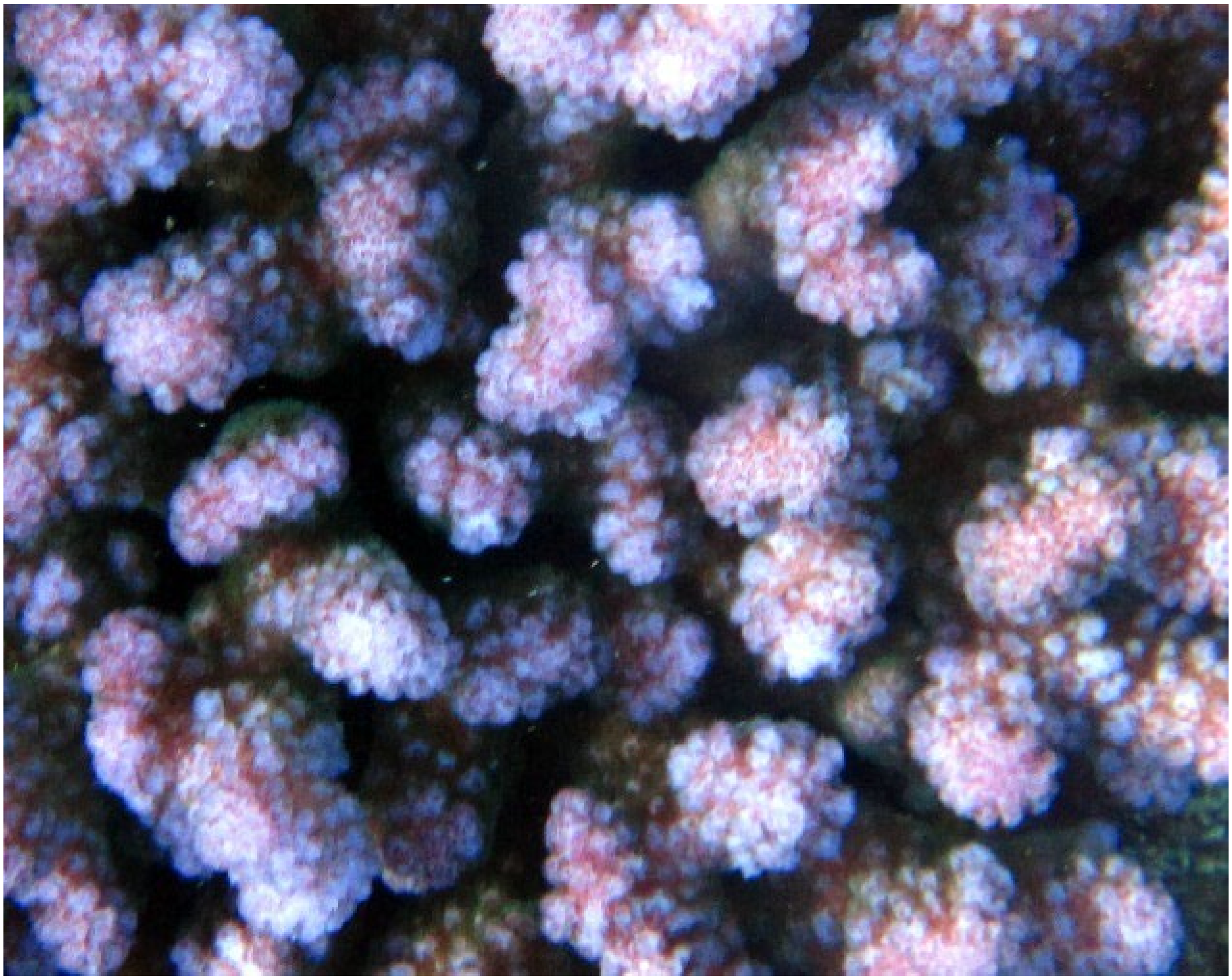
A close-up photo of *Pocillopora danae*.

Pocillopora verrucosa

Colonies have branches that grow upward and radiate, about the diameter of a thumb and are cylindrical or oval, but not flattened. Branches are not very irregular and verrucae are near uniform in size and are not bulbous and crowded. The branches are clearly larger than the verrucae. The branches are larger than on *Pocillopora brevicornis*, grow more vertical and closer together than on *Pocillopora danae*, the verrucae are more uniform than on *Pocillopora danae*, and most of the branches are not flattened and curves like on *Pocillopora meandrina*.



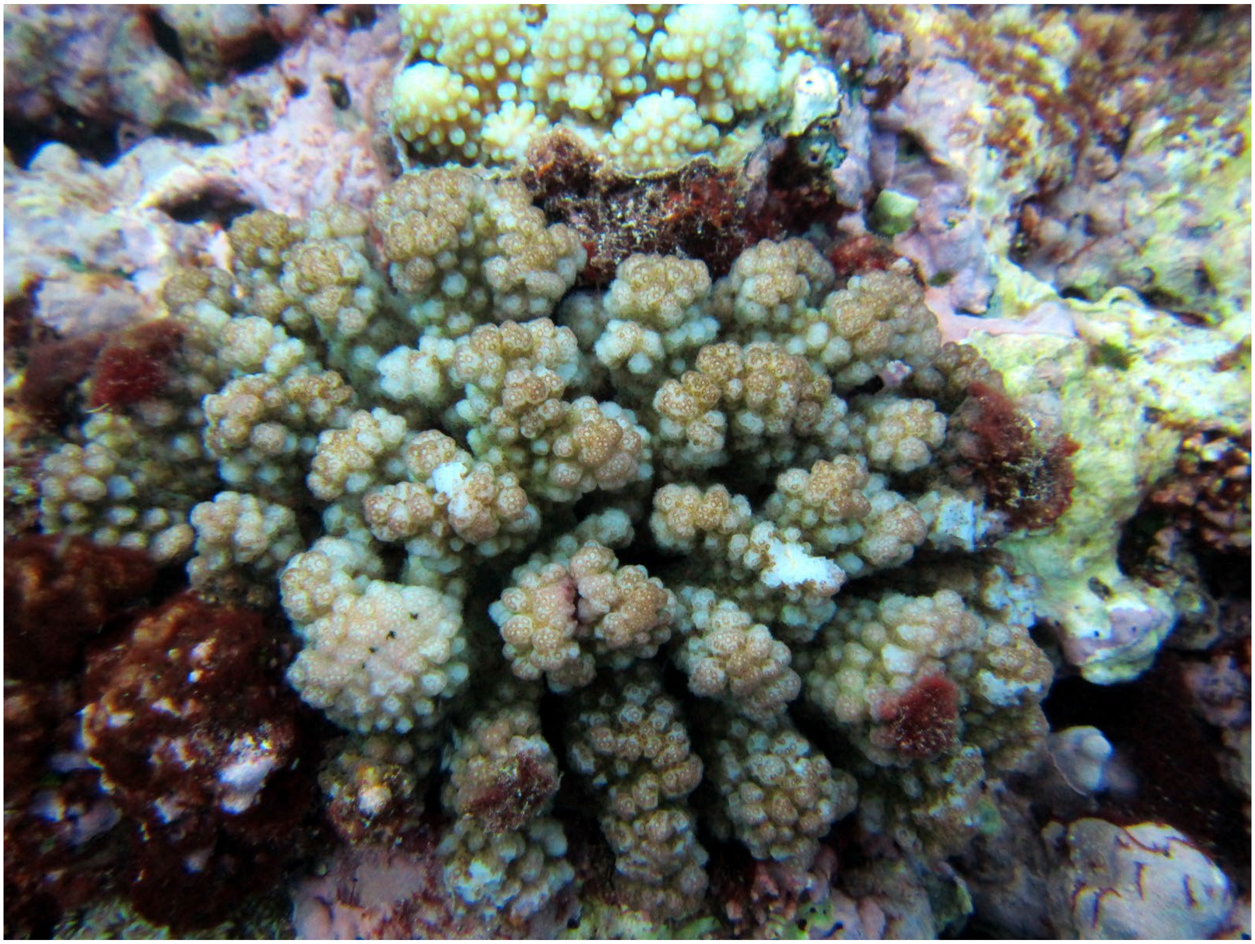
A photo of *Pocillopora verrucosa*.



A close-up photo of *Pocillpora verrucosa*.

Pocillopora ankeli

Colonies are not very large and have branches that may be short and close together. The verrucae are large and may be close together. Branches are shorter and verrucae are larger than on *Pocillopora verrucosa* and are not flattened like on *Pocillpora meandrina*. The branch ends are more rounded than on *Pocillopora setchelli* abd verrucae are larger.



A photo of *Pocillopora ankeli*.

Pocillopora meandrina

Colonies are up to about 40 cm diameter and have radiating branches, most of which are flattened and some are curved (hence the name, from “meander”). Branches are more flattened than on most other *Pocillopora* species except for *Pocillopora elegans* and *Pocillopora eydouxi*. Branches are smaller than *Pocillpora eydouxi* and verrucae are larger than on *Pocillopora elegans*.

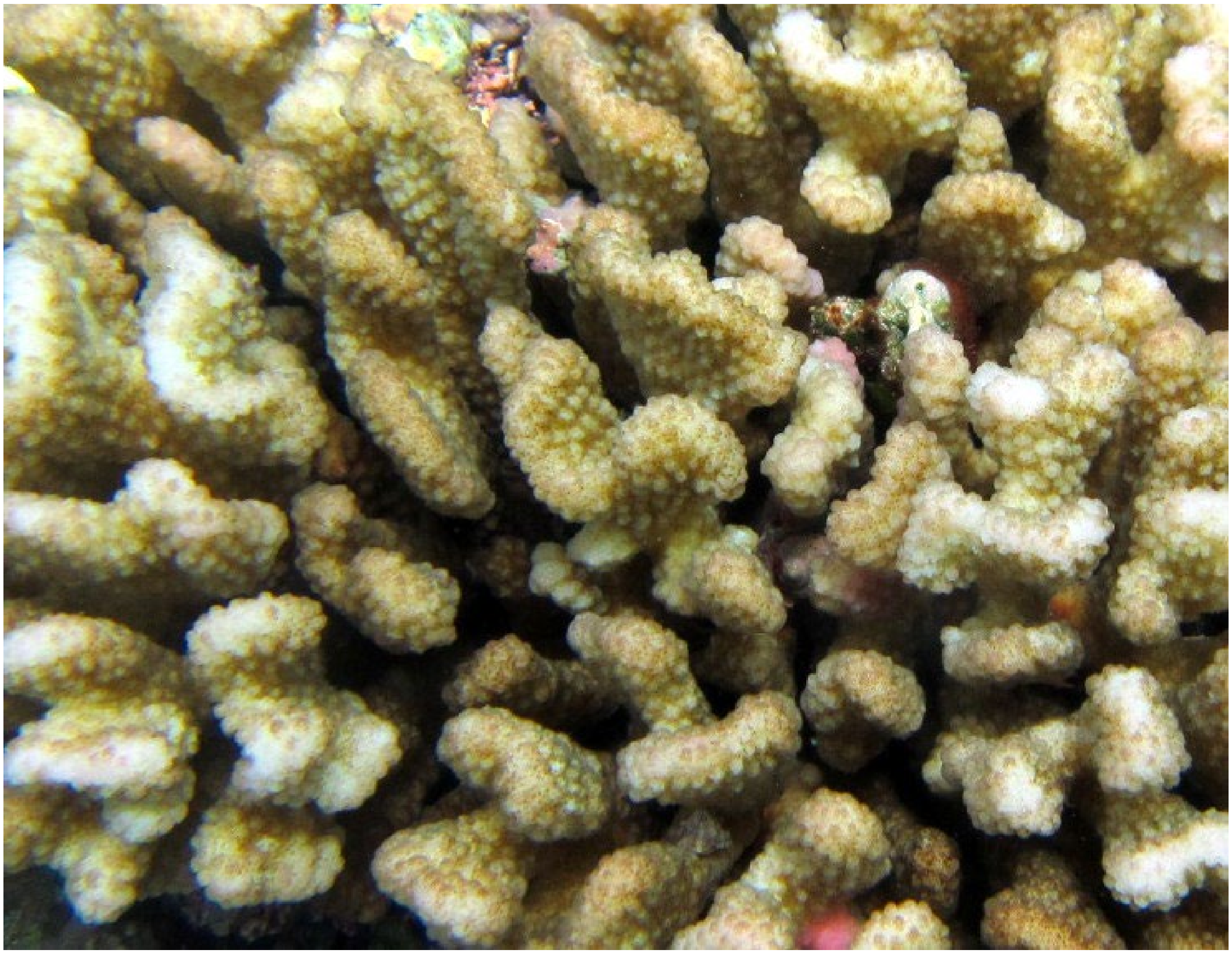
A photo of *Pocillopora meandrina*.

A close-up photo of *Pocillopora meandrina*.

Pocillopora cf. elegans

Colonies have radiating branches, most of which are flattened and some are curved. The verrucae are small. Colonies are similar to *Pocillopora meandrina*, but the verrucae are smaller. Branches are smaller than on *Pocillopora eydouxi*.

A photo of *Pocillopora elegans*.



A close-up photo of *Pocillopora elegans*.

Pocillopora grandis previously known as "Pocillopora eydouxi"

Colonies can be up to a meter tall and wide but commonly are smaller than that. Branches are usually flattened and some curved. In some colonies, branches may be cylindrical. Branches are similar in shape but are larger and farther apart than on *Pocillopora meandrina* and *Pocillopora elegans*.

A photo of *Pocillopora grandis*.

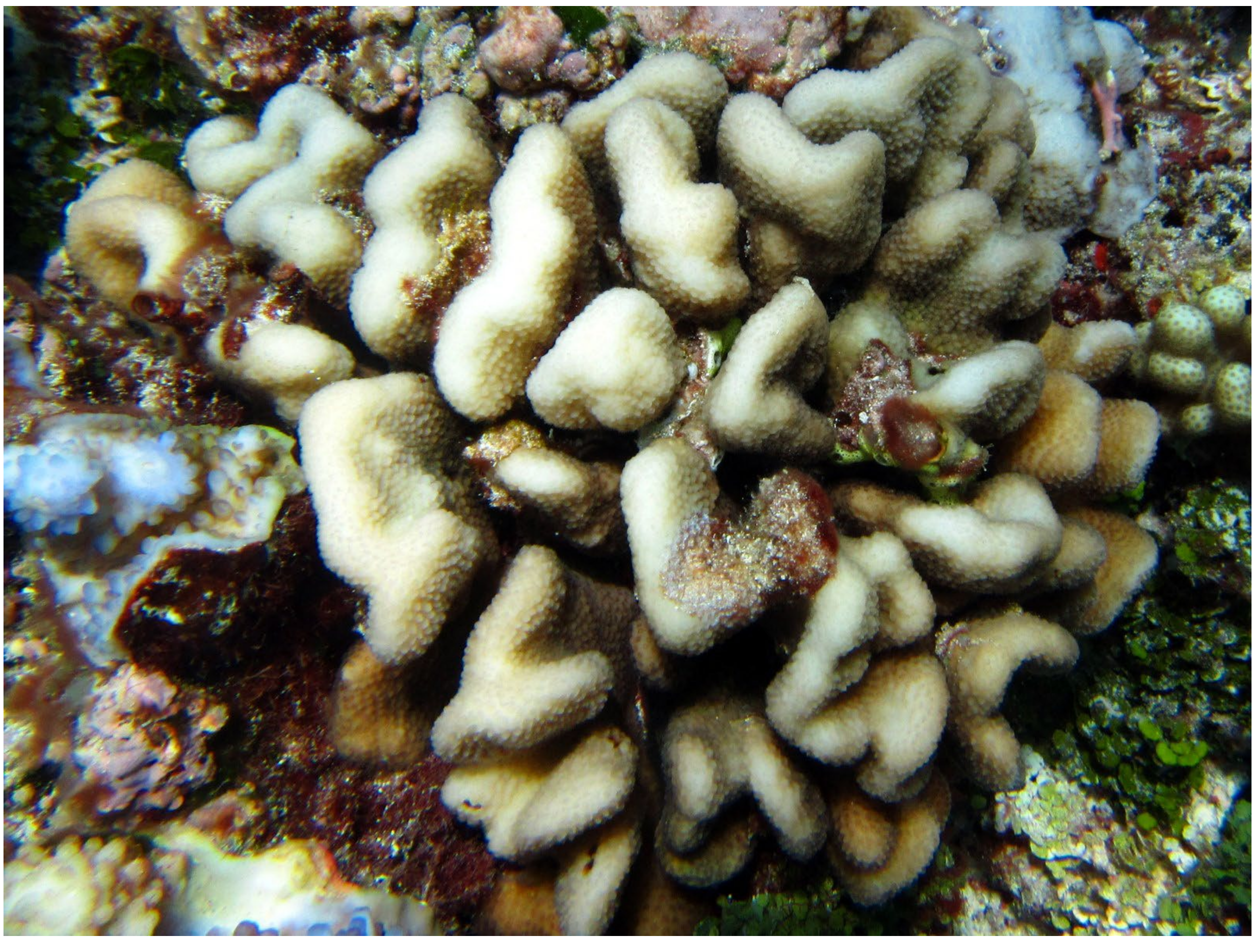
A close-up photo of *Pocillopora grandis*.

Stylophora

Colonies are branching, with smooth, rounded tips. Corallites are tiny, about 1 mm diameter. Each corallite has a tiny hood over it, a bit like a spine. The spines are tiny enough they are hard to see, but can be felt. Some *Pocillopora* species can have very similar branch shapes to some *Stylophora* species, but *Pocillopora* have obvious verrucae (“bumps”) while *Stylophora* has tiny hood-like spines which are so small they are hard to see.

Stylophora pistillata

Colonies have radiating branches that are relatively large and often have flattened tips that may also be curved. Branches are larger than on *Stylophora subseriata* and are often flattened.

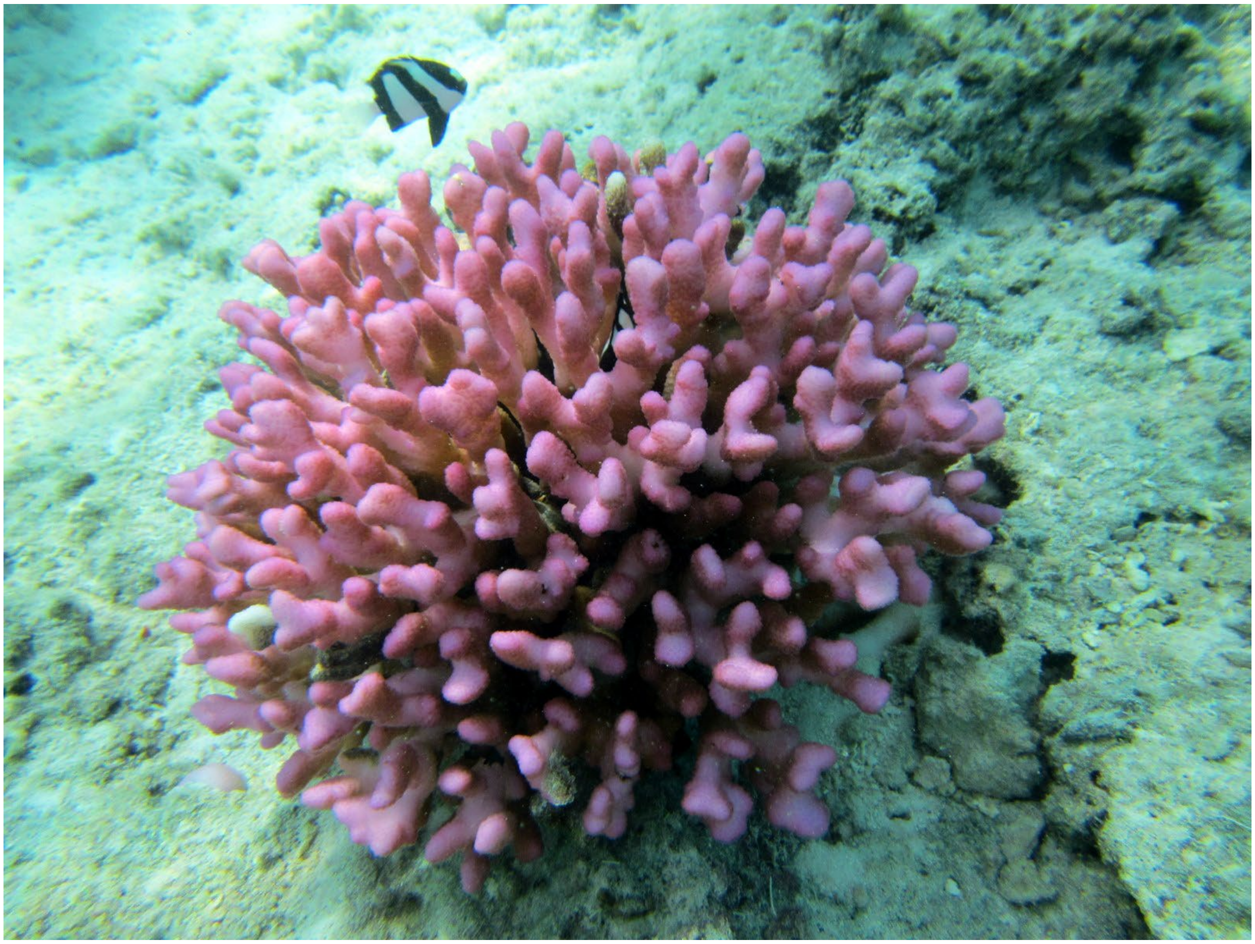


A photo of *Stylophora pistillata*.

A close-up photo of *Stylophora pistillata*.

Stylophora subseriata

Colonies are branching, and branches may radiate. Branches are fairly thin, divide fairly frequently, may be widely spaced, and don't have flattened ends. Branches are thinner, may be more widely spaced, and do not have flattened tips like *Stylophora pistillata*.



A photo of *Stylophora subseriata*.

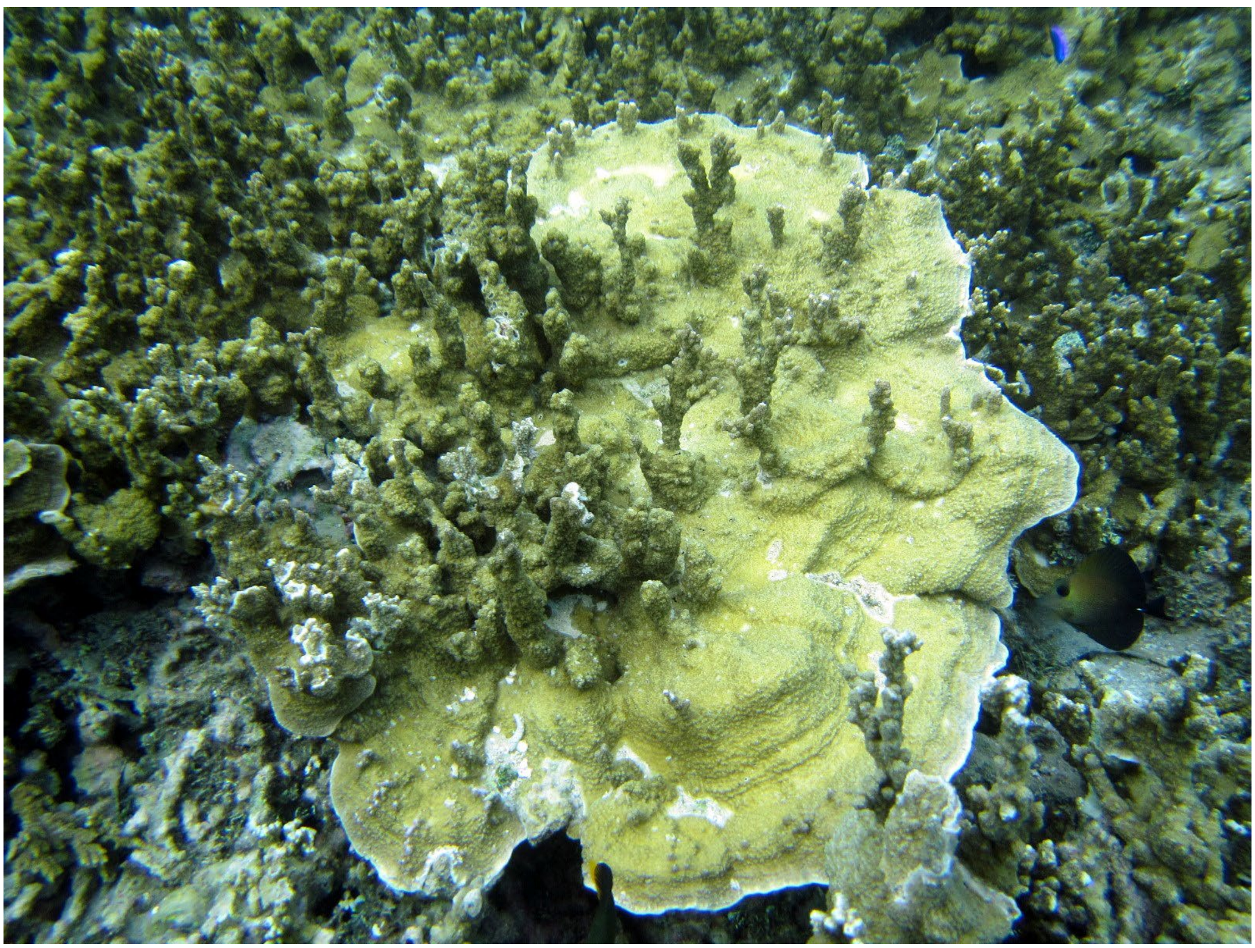
A close-up photo of *Sylophora subseriata*.

Montipora

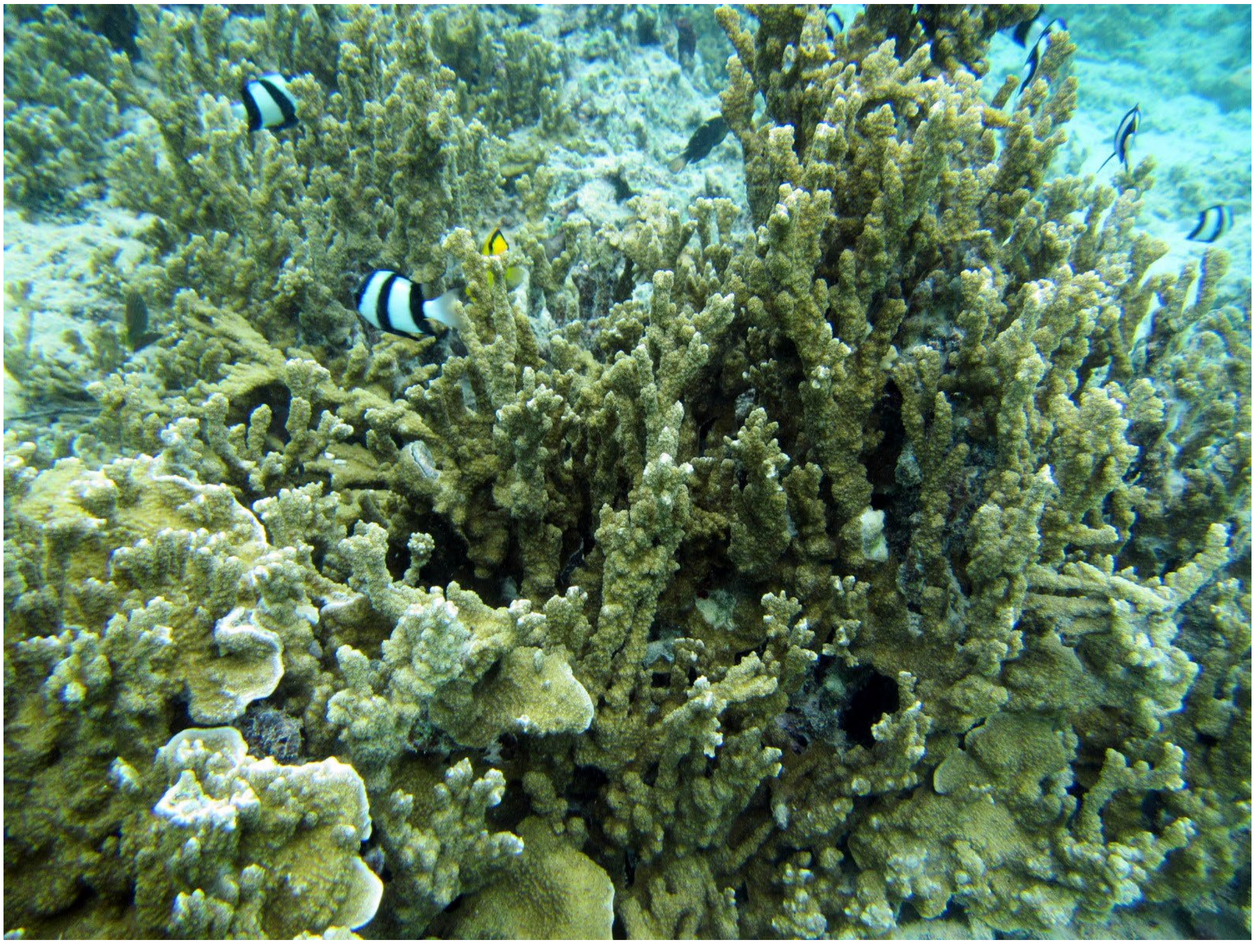
Colonies can be encrusting, massive, branching, or foliose. Colonies have tiny corallites about 1 mm diameter. Colonies can have many tiny spines called "papillae" that are so small they are almost like grains of sand, or have thin ridges between corallites, or little pegs called "tuberculae", or smooth rounded bumps called "verrucae" that don't have any corallites on them, or small to moderate sized lumps that do have corallites on them. *Pocillpora* is always branching and has "verrucae" that have tiny corallites all over them. *Montipora* is the second largest genus of corals, with about 75 known species.

Montipora hispida

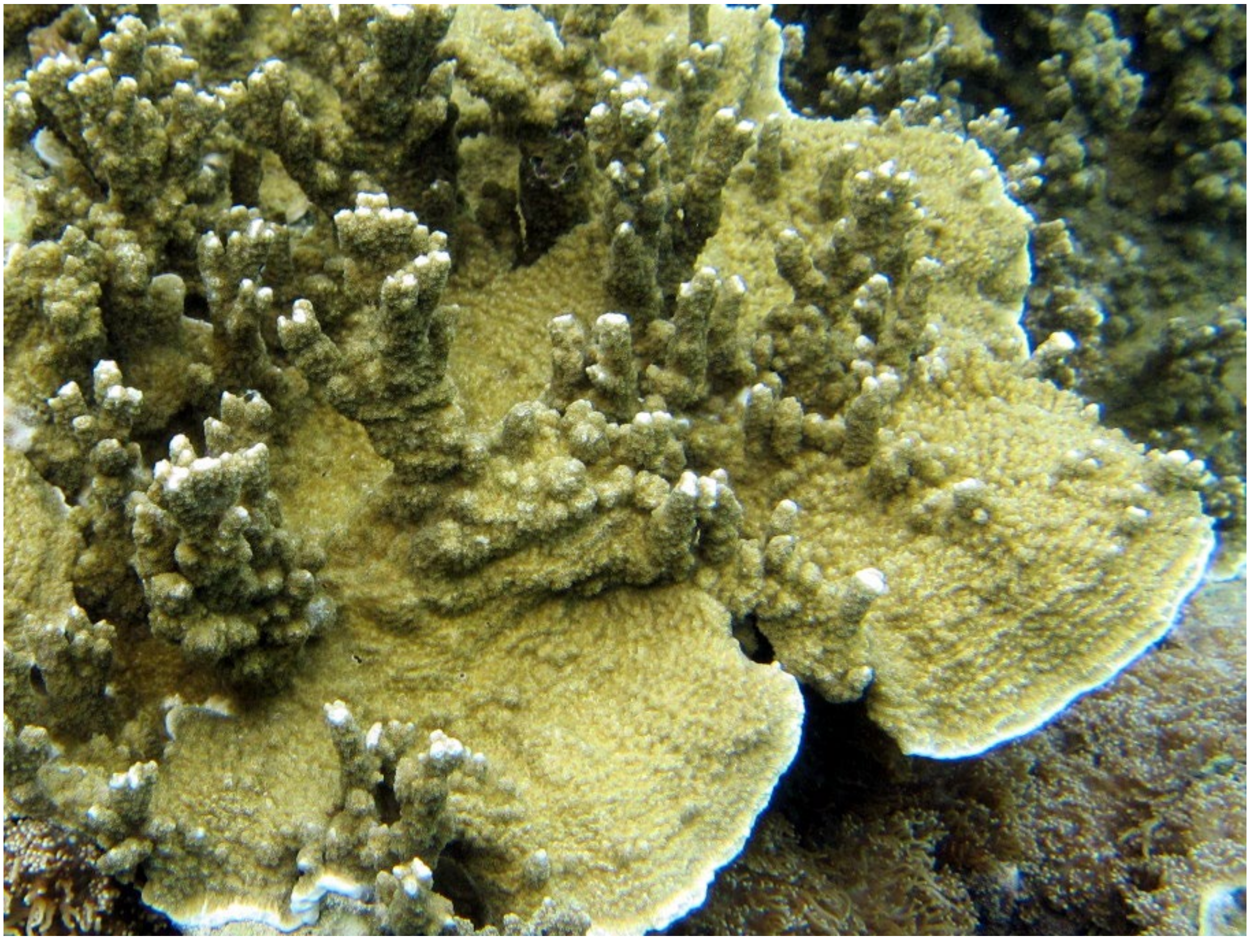
Colonies consist of thin plates that can be whorls or nearly flat, and which almost always have upward growing, thin, bumpy, irregular columns, and some columns may not have visible plate bases. Surfaces have a dense covering of tiny spines called "papillae" that are thinner than the corallites. The papillae often surround the corallites, producing little bumps that are larger than the papillae. Columns and plates are fairly fragile. Colonies usually have both thin plates and thin columns unlike other *Montipora* species.



A photo of a colony of *Montipora hispida* with a large plate and relatively few columns.



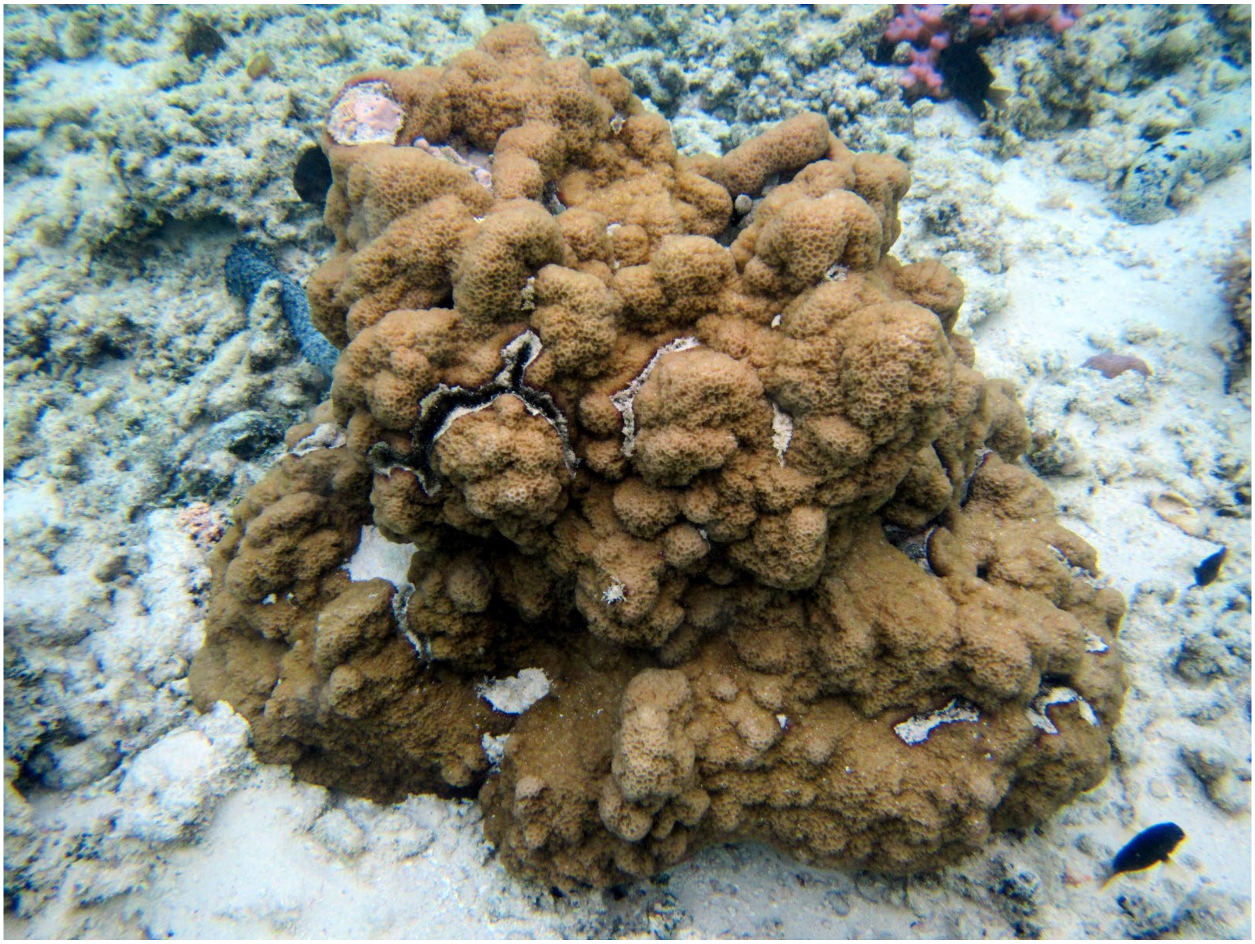
A photo of a colony of *Monitpora hispida* with many columns and relatively little plating.



A closer photo of *Montipora hispida*.

Montipora foveolata

Colonies can be encrusting or massive and lumpy. Surfaces are covered with tiny thin ridges that surround and separate corallites. As a result, the corallites are at the bottom of funnels, where the tiny ridges form the funnels. In *Montipora foveolata* the ridges completely surround the corallites, while in *Montipora caliculata* they vary from surrounding to partly surrounding to broken into papillae on different parts of the colony.

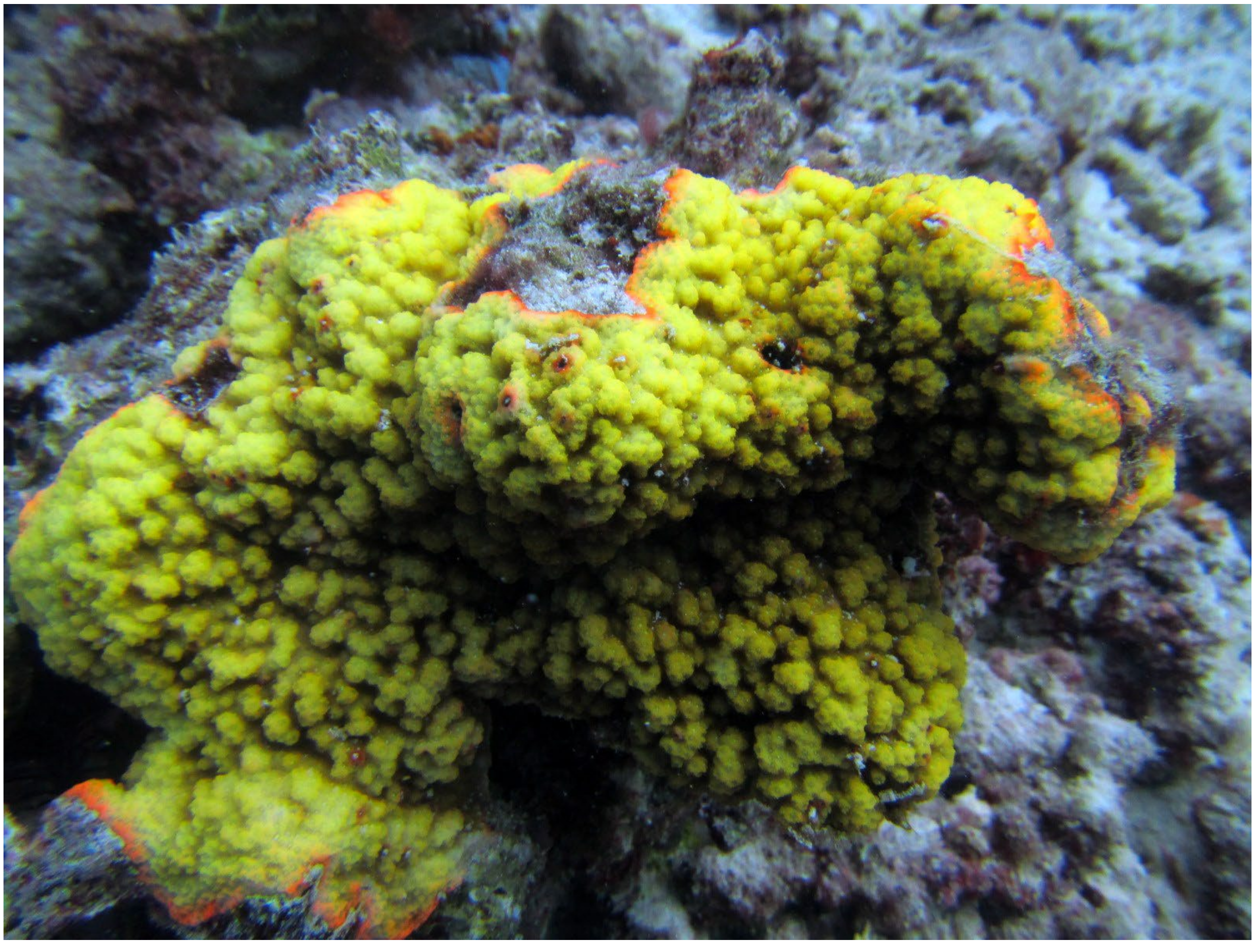


A photo of a massive colony of *Montipora foveolata*.

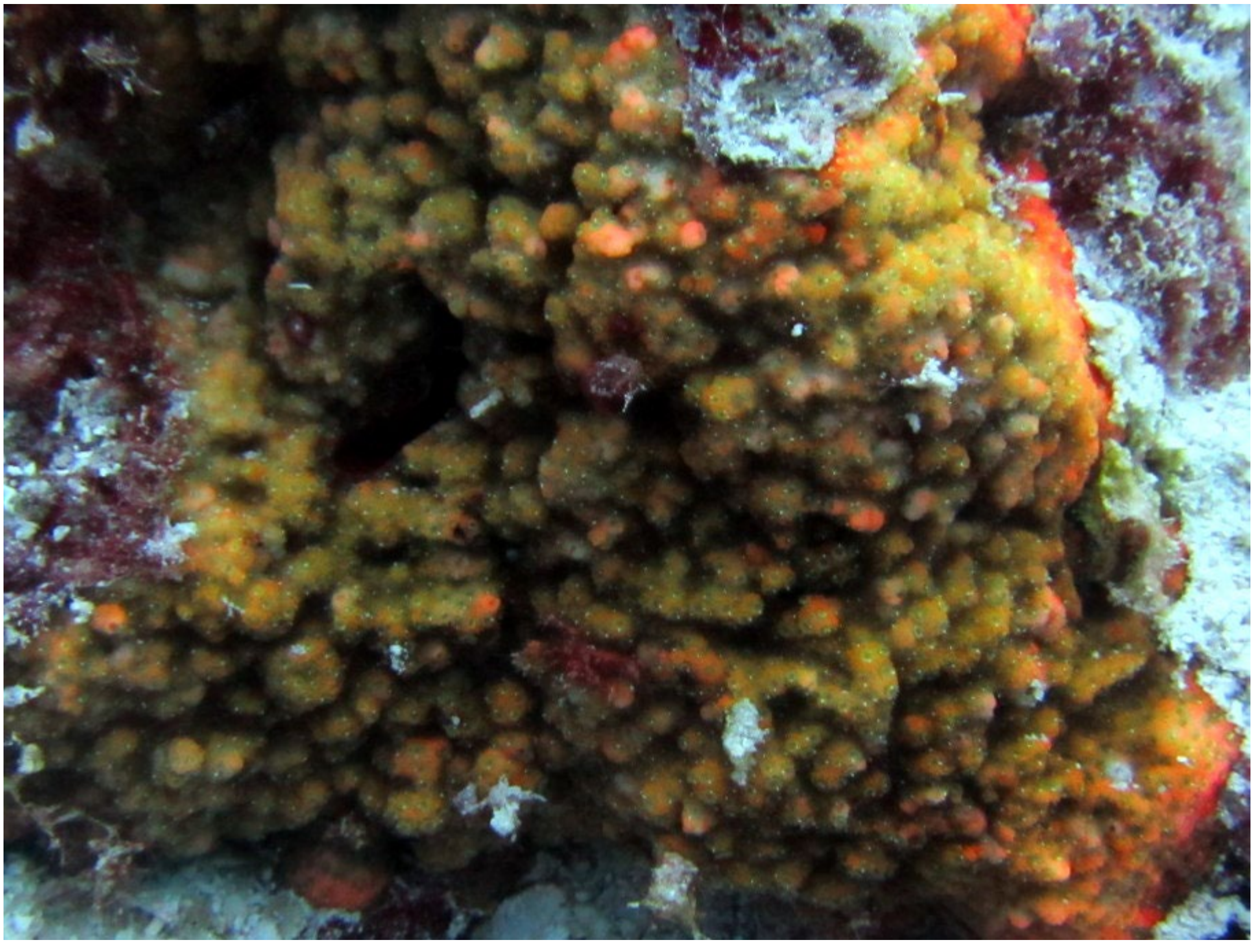
A close-up photo of *Montipora foveolata*.

Montipora florida or hoffmeisteri

Colonies have small, irregular lumps that have a few corallites on them. These two species are so similar they are hard to separate in live colonies. The bumps are irregular and not smooth, and have corallites on them unlike on *Montipora capitata*, *Montipora verrucosa*, and *Montipora palawanensis*.



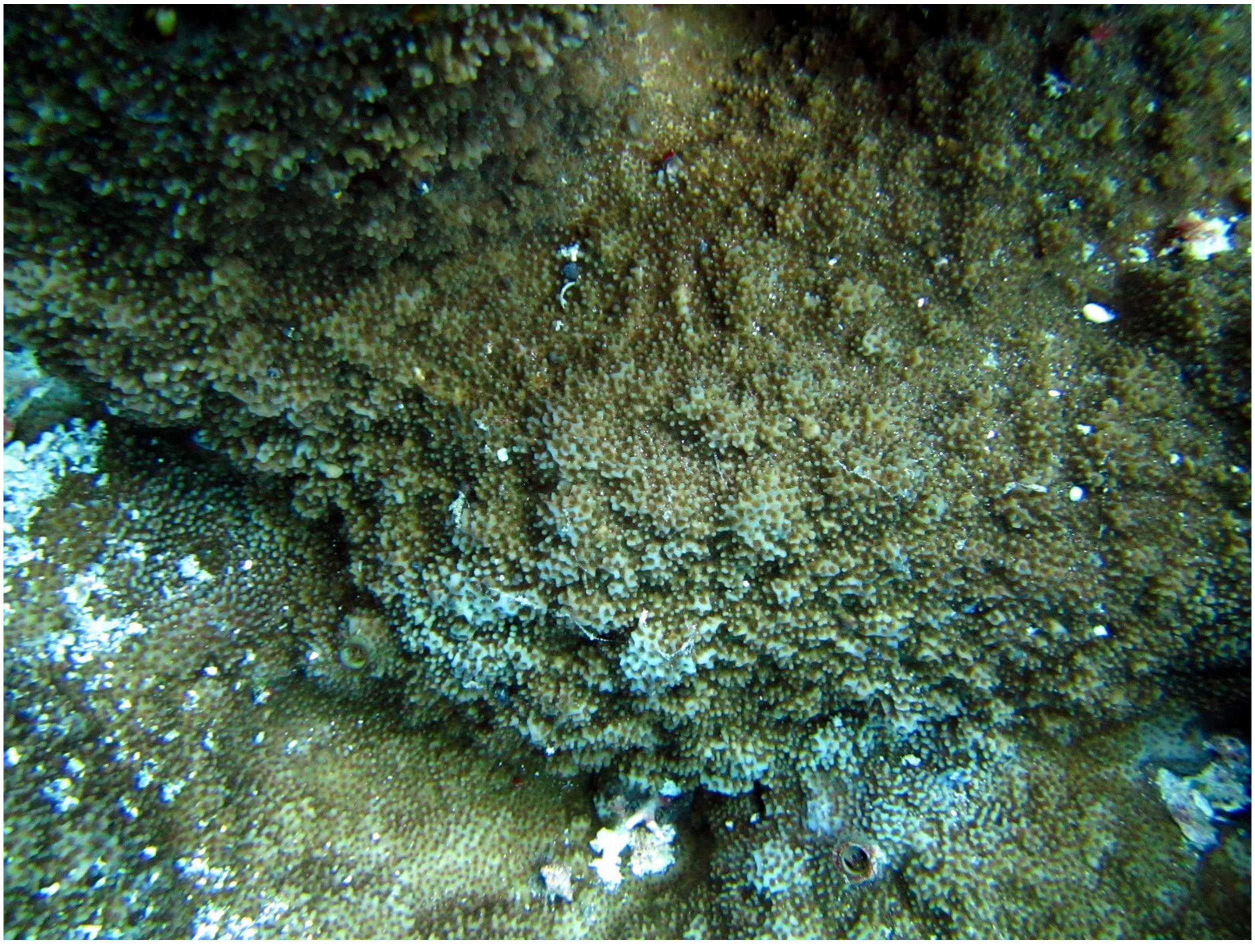
A colony of *Montipora florida* or *M. hoffmeisteri*.



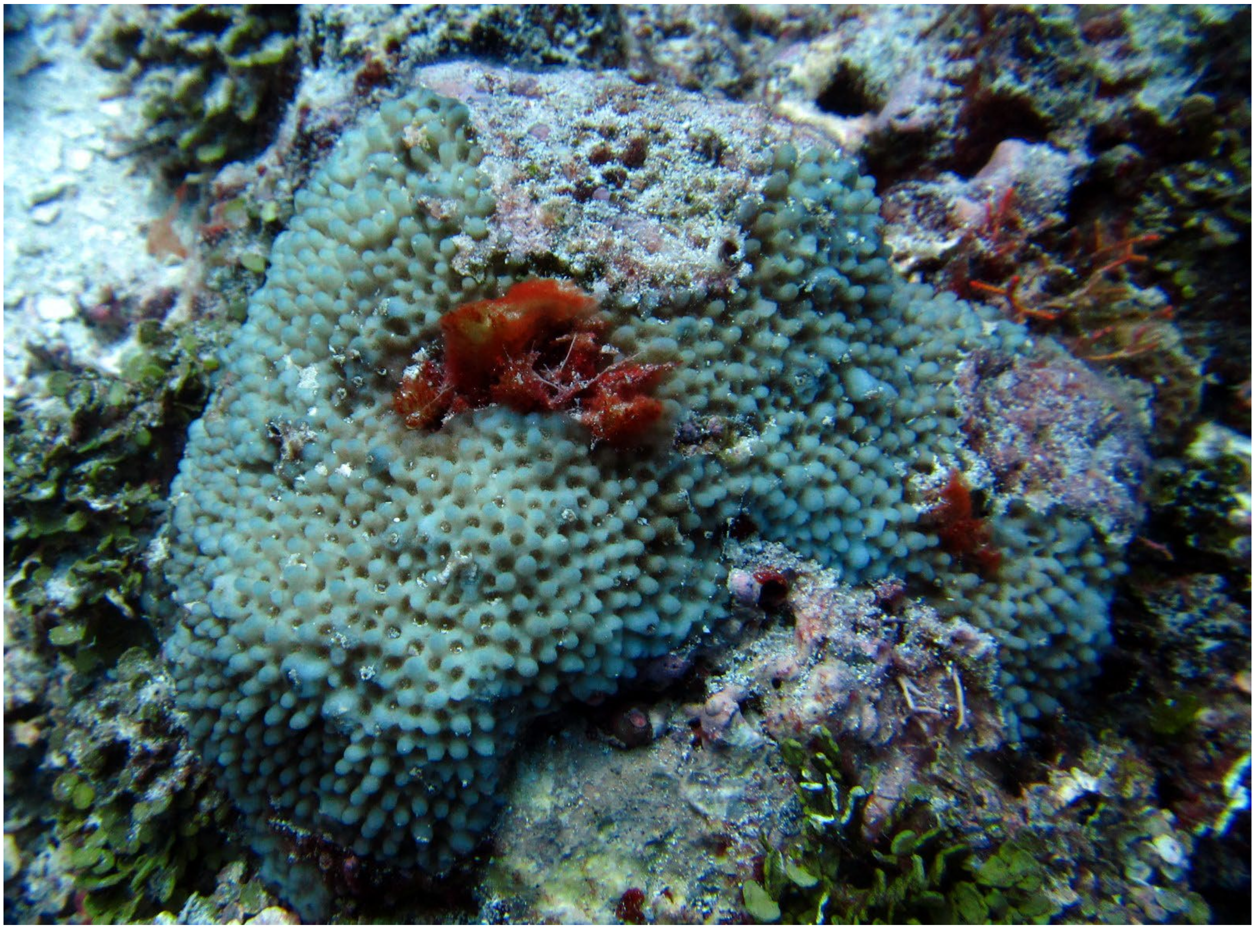
A close-up photo of *Montipora floweri* or *Montipora hoffmeisteri*. The polyp centers are tiny white dots.

Montipora tuberculosa

Colonies are usually encrusting. Surfaces have tiny pegs called “tubercules” between the corallites. The tubercules are about the diameter of the corallites, about 1 mm. *Montipora hispida* has tinier spines called “papillae”, and *Montipora capitata* has larger bumps called “verrucae.”



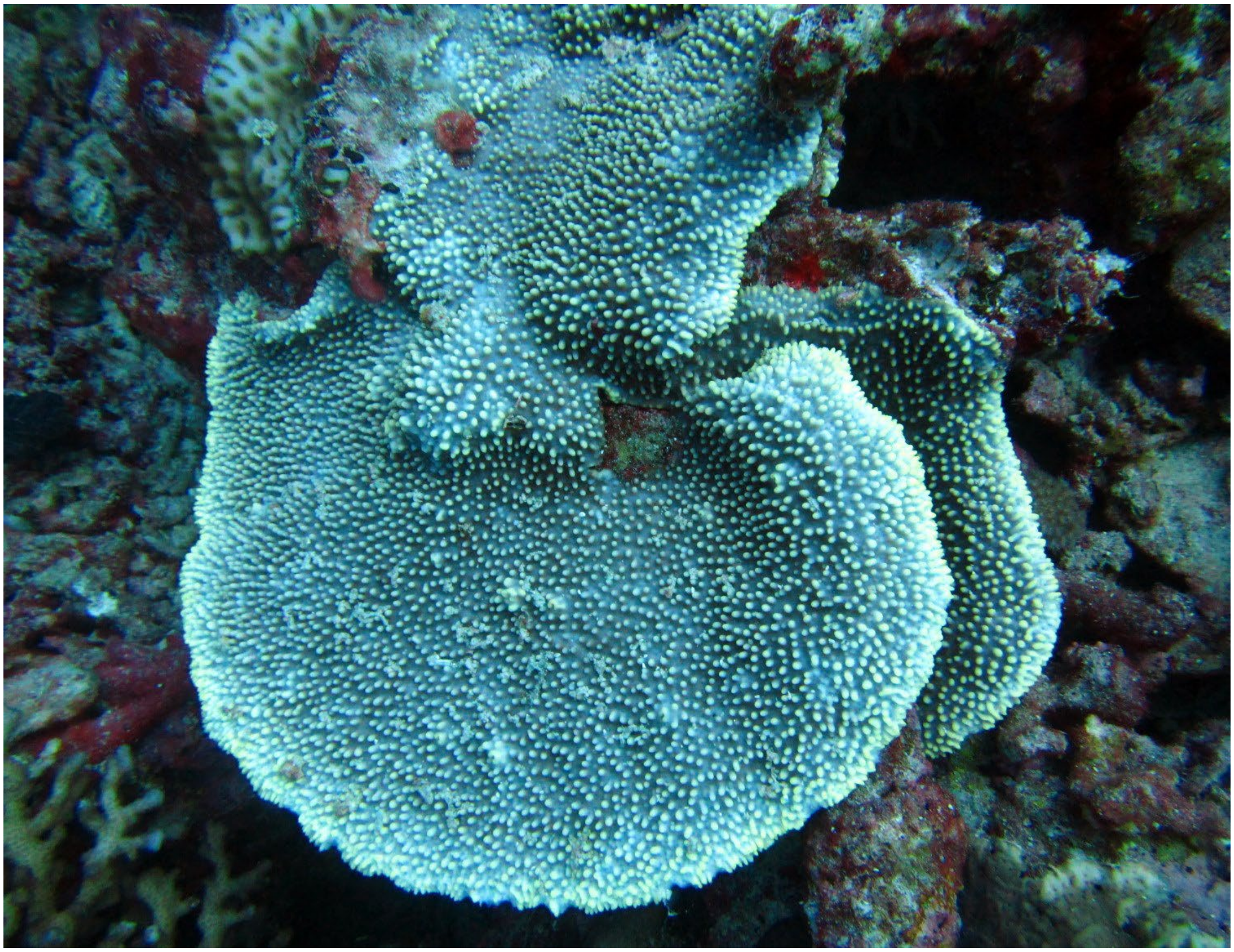
A colony of *Montipora tuberculosa*.



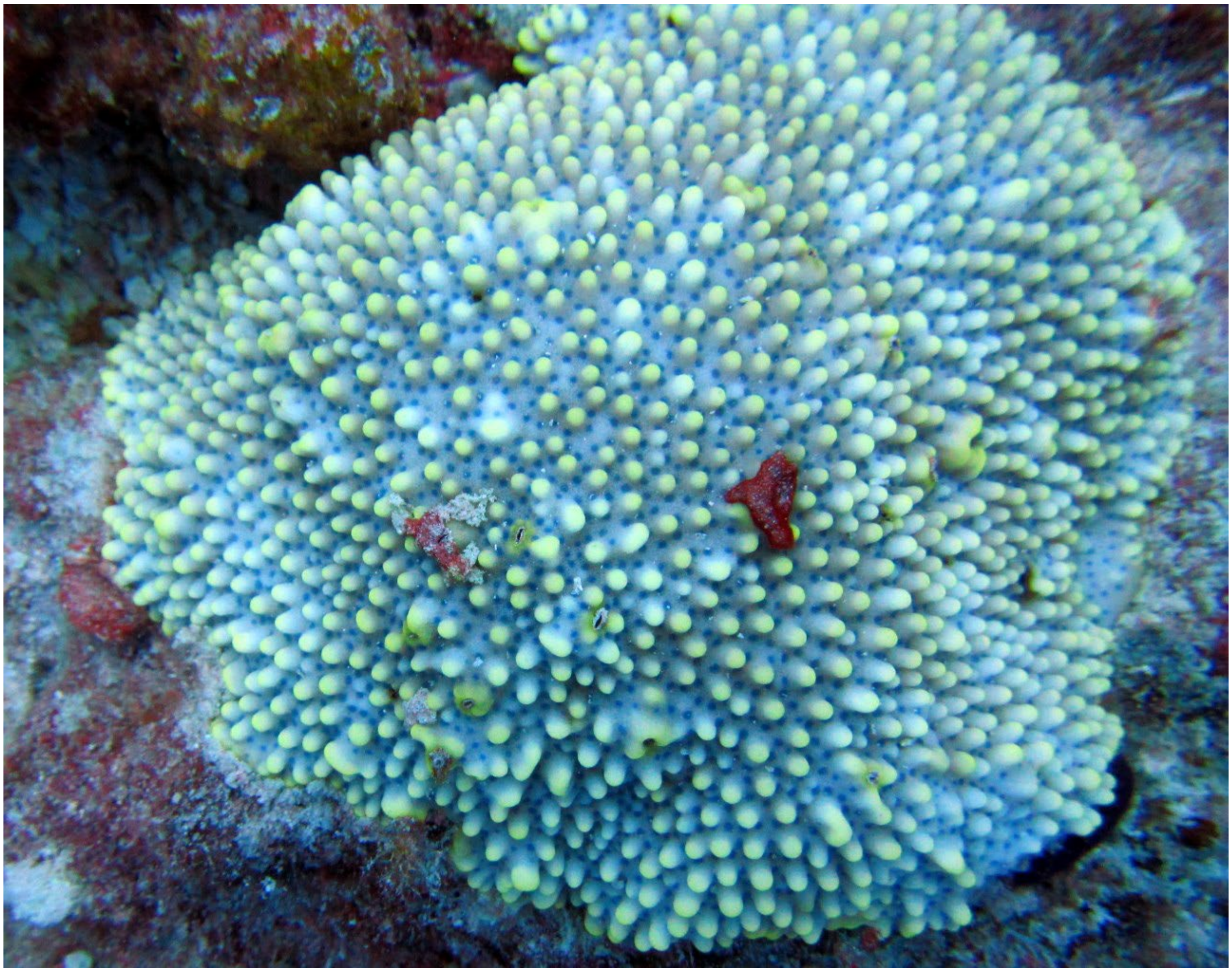
A close-up photo of *Montipora tuburculosa*.

Montipora capitata

Colonies can be encrusting, plates, branching, or a combination of these. The surfaces have small verrucae (bumps) on them, which are rounded and smooth, do not have any corallites on them, and are larger than corallites. The verrucae are typically about as wide as tall or perhaps slightly taller than wide. The corallites are between the verrucae and there may be more than one corallite between verrucae as there is usually plenty of space. The verrucae are larger than the tuberculae on *Montipora tuberculosa* and smaller than on *Montipora verrucosa* and *Montipora palawanensis* where they are wider.



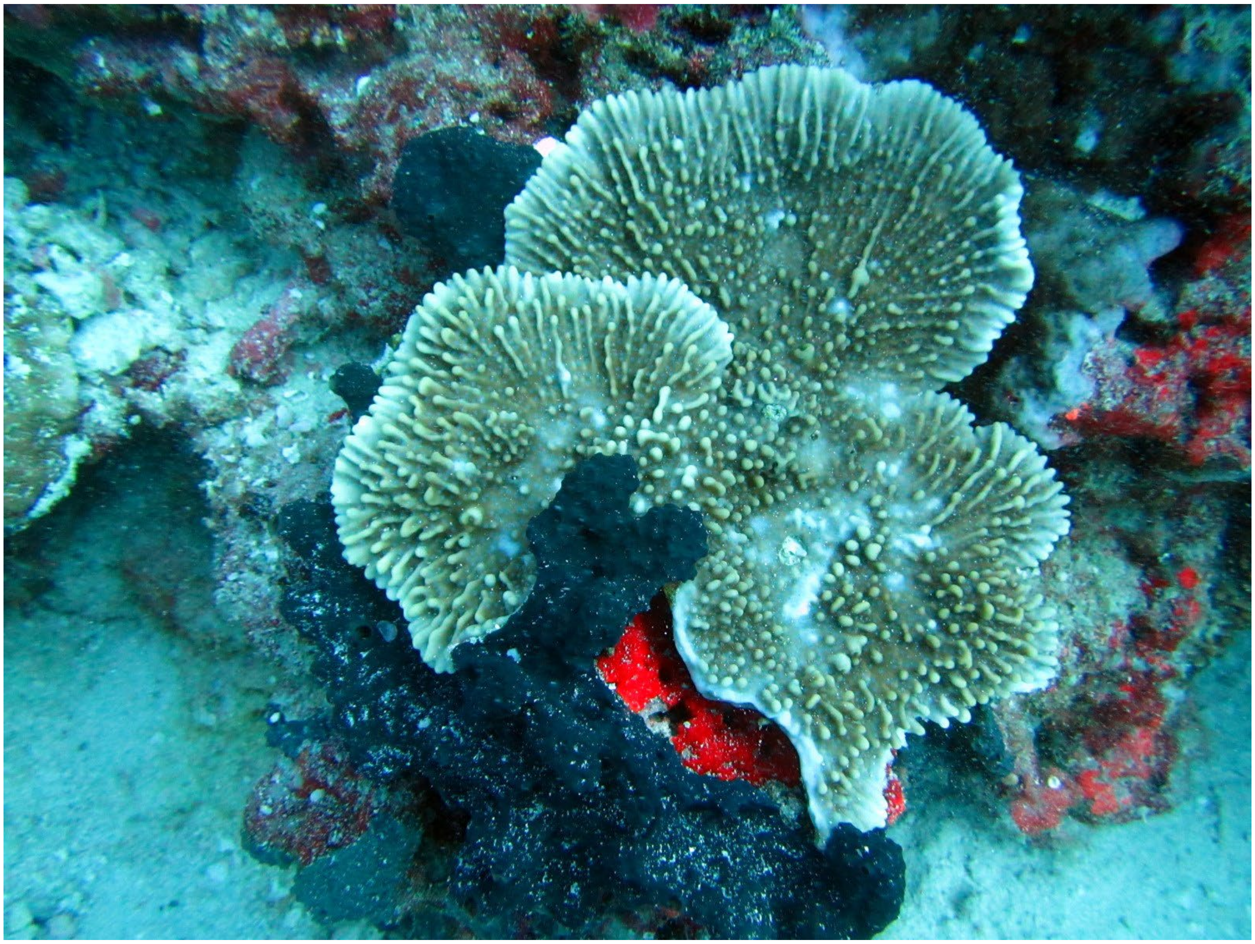
A photo of *Montipora capitata*.



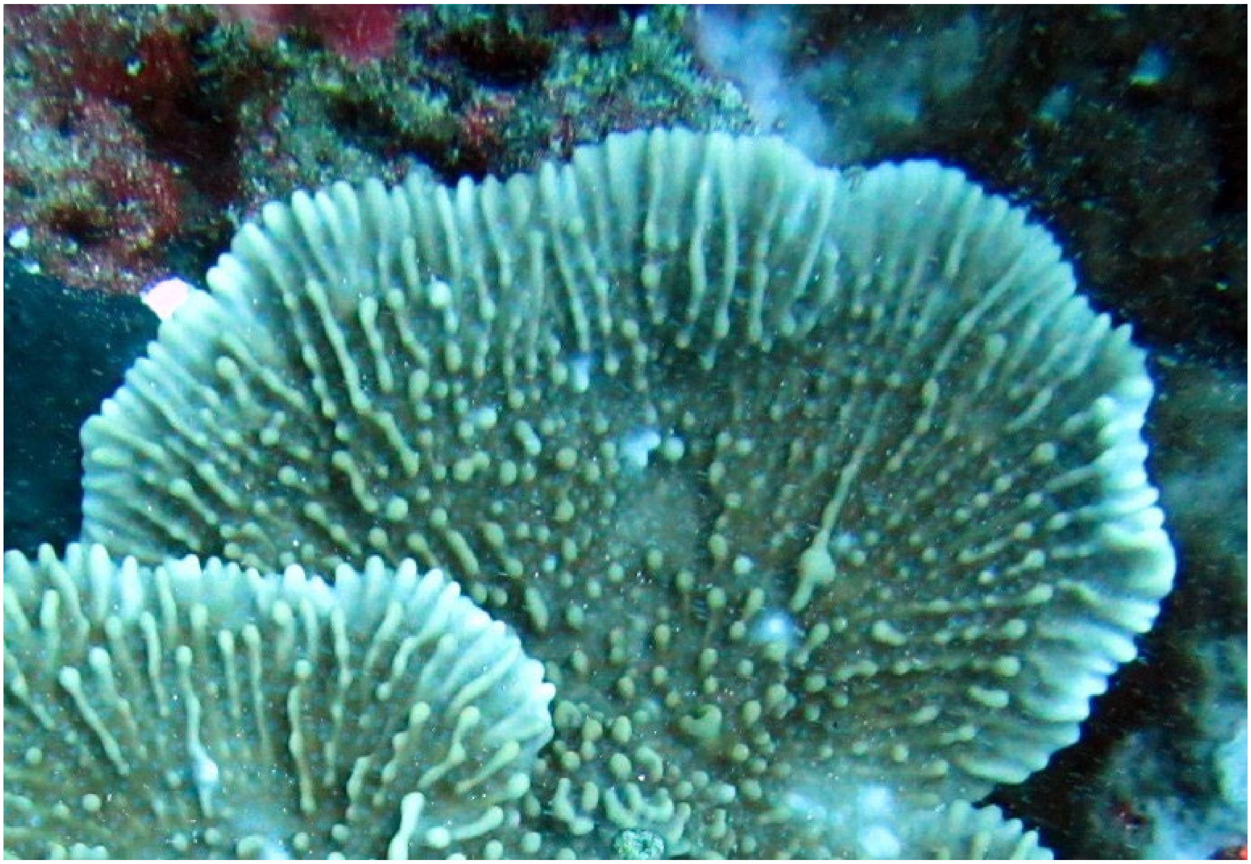
A close-up photo of *Montipora capitata*. The blue dots are the polyps.

Montipora cebuensis

Colonies are usually plates. Surfaces have verrucae which are about as tall as wide, except near the edges of the plates, where they are partly or completely fused into radiating ridges. The verrucae are about the same size as on *Montipora capitata*, larger than the tuberculae on *Montipora tuberculosa*, and smaller than the verrucase on *Montipora verrucosa*. Colonies have radiating ridges near their edges unlike *Montipora capitata*.



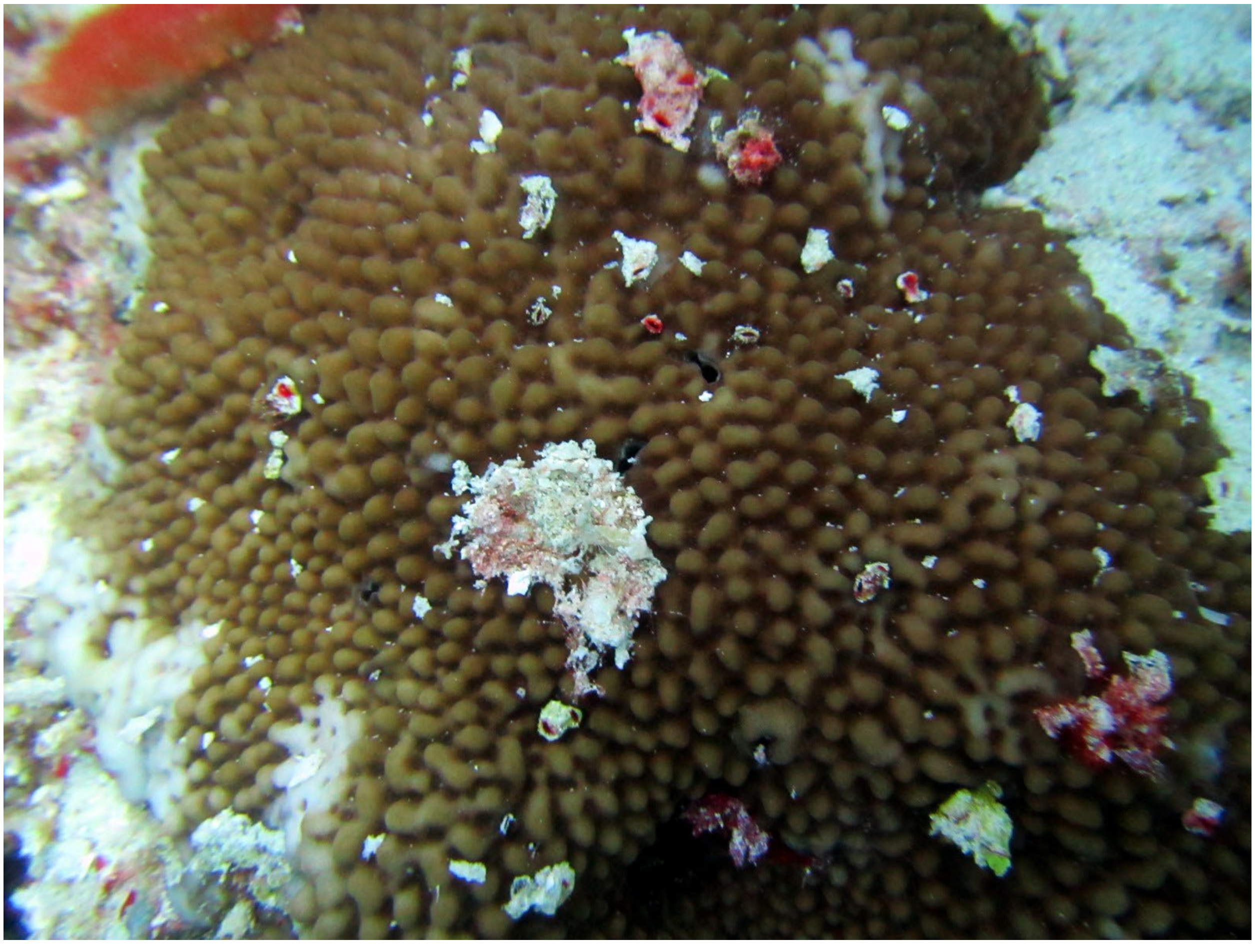
A photo of a colony of *Montipora cebuensis*.



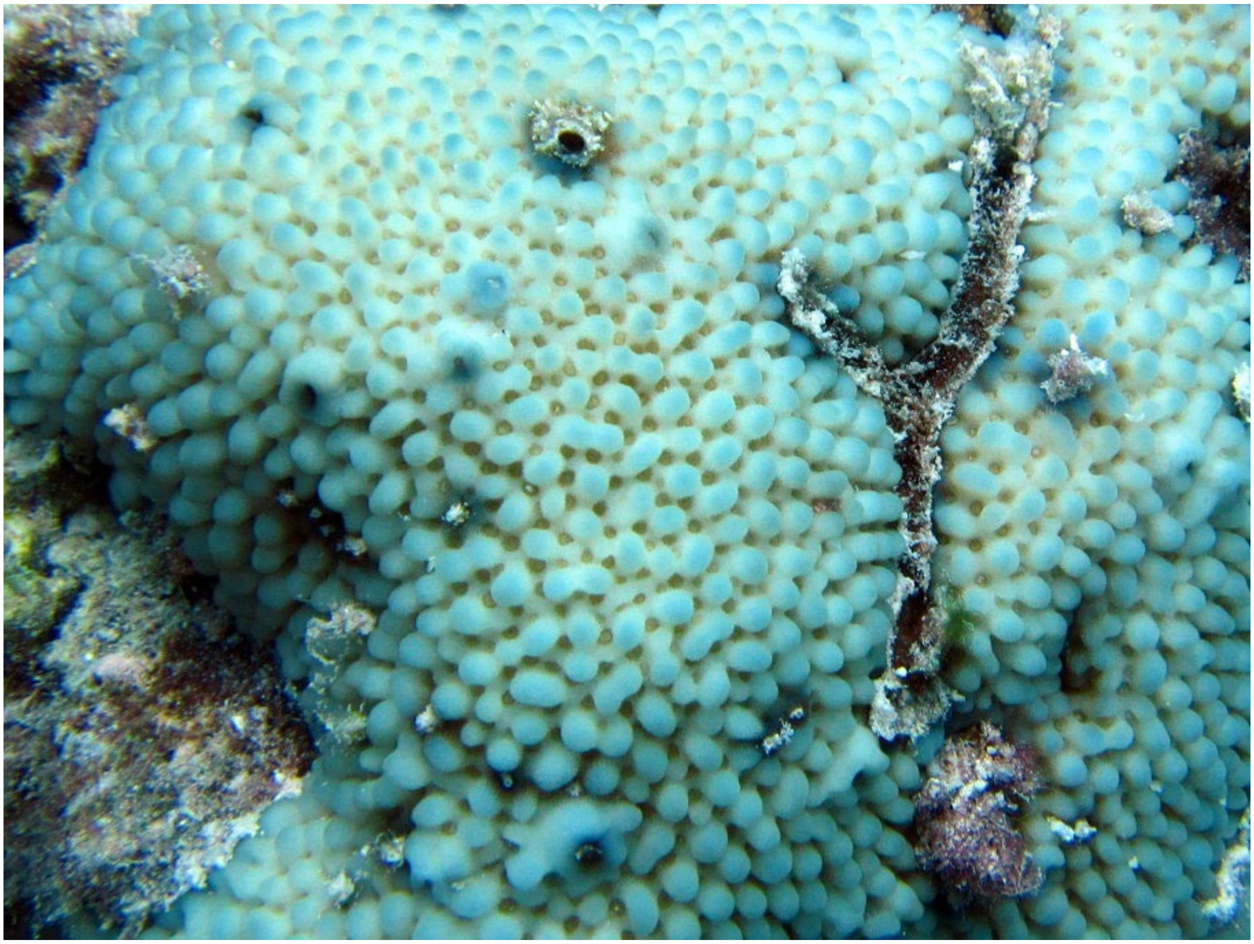
A close-up photo of a colony of *Montipora cebuensis*.

Montipora verrucosa

Colonies are usually encrusting and are often small. Surfaces have verrucae that are wider than tall and usually close together with only one corallite squeezed between verrucae. Most verrucae are circular or slightly oval. Verrucae are wider than on *Montipora capitata* but smaller and more circular than on *Montipora palawanensis*.



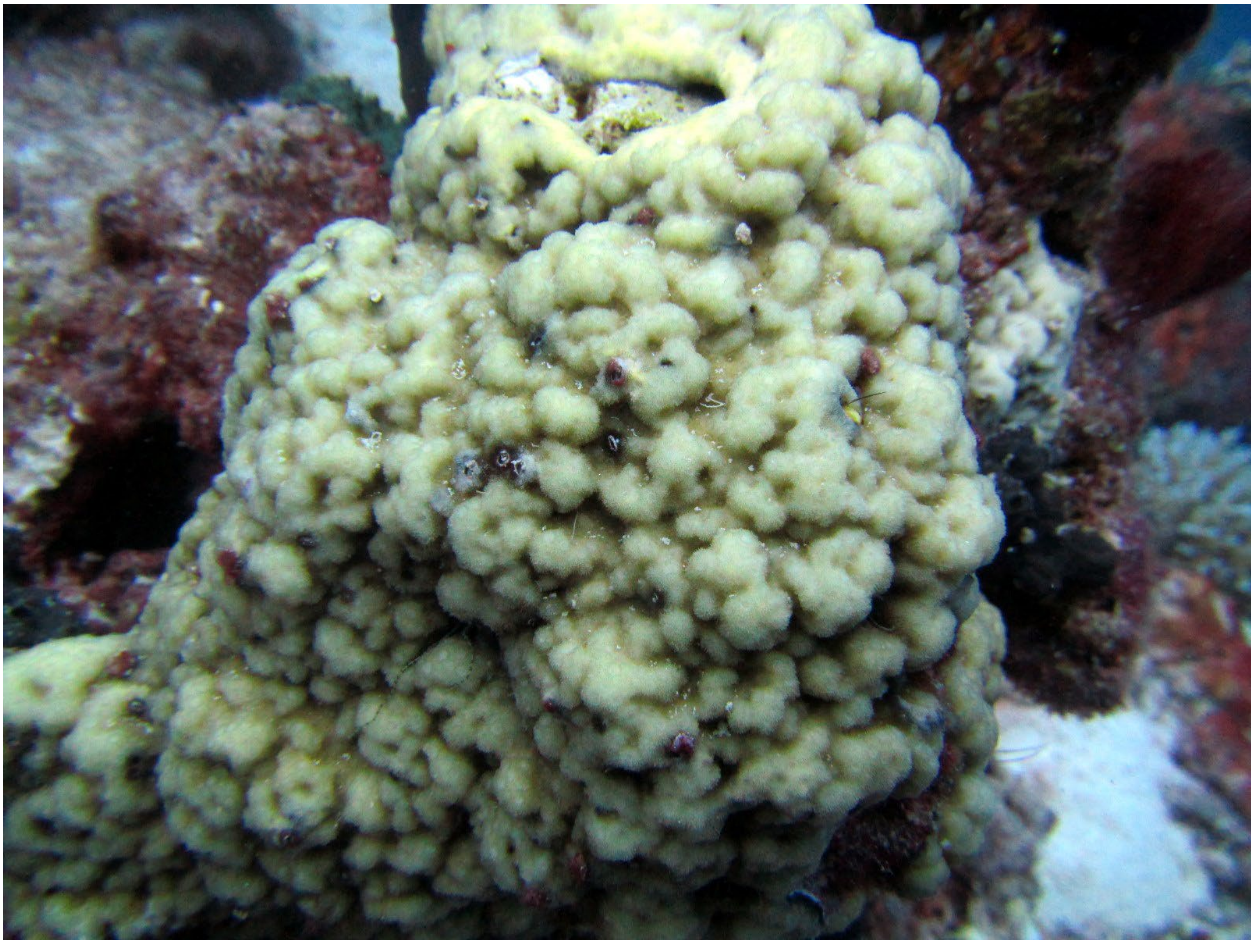
A colony of *Montipora verrucosa*.



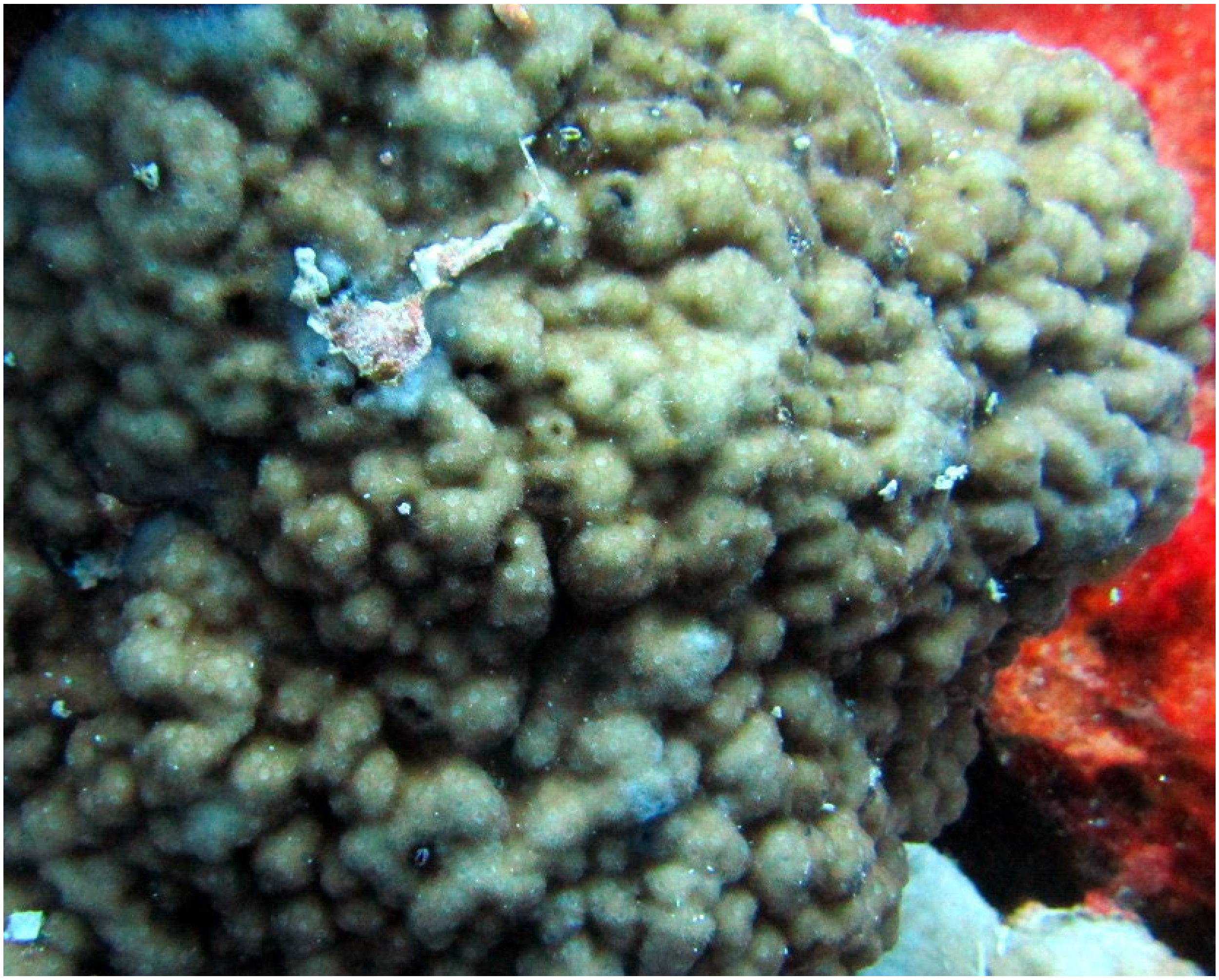
A photo of *Montipora verrucosa*.

Montipora turgescens

Colonies are massive or encrusting and have irregular, rounded lumps many of which are larger than verrucae and have corallites on them. There are no papillae or other smaller projections. Th lumps are larger than on *Montipora floweri* and *Montipora hoffmeisteri*.



A photo of a colony of *Montipora turgescens*.



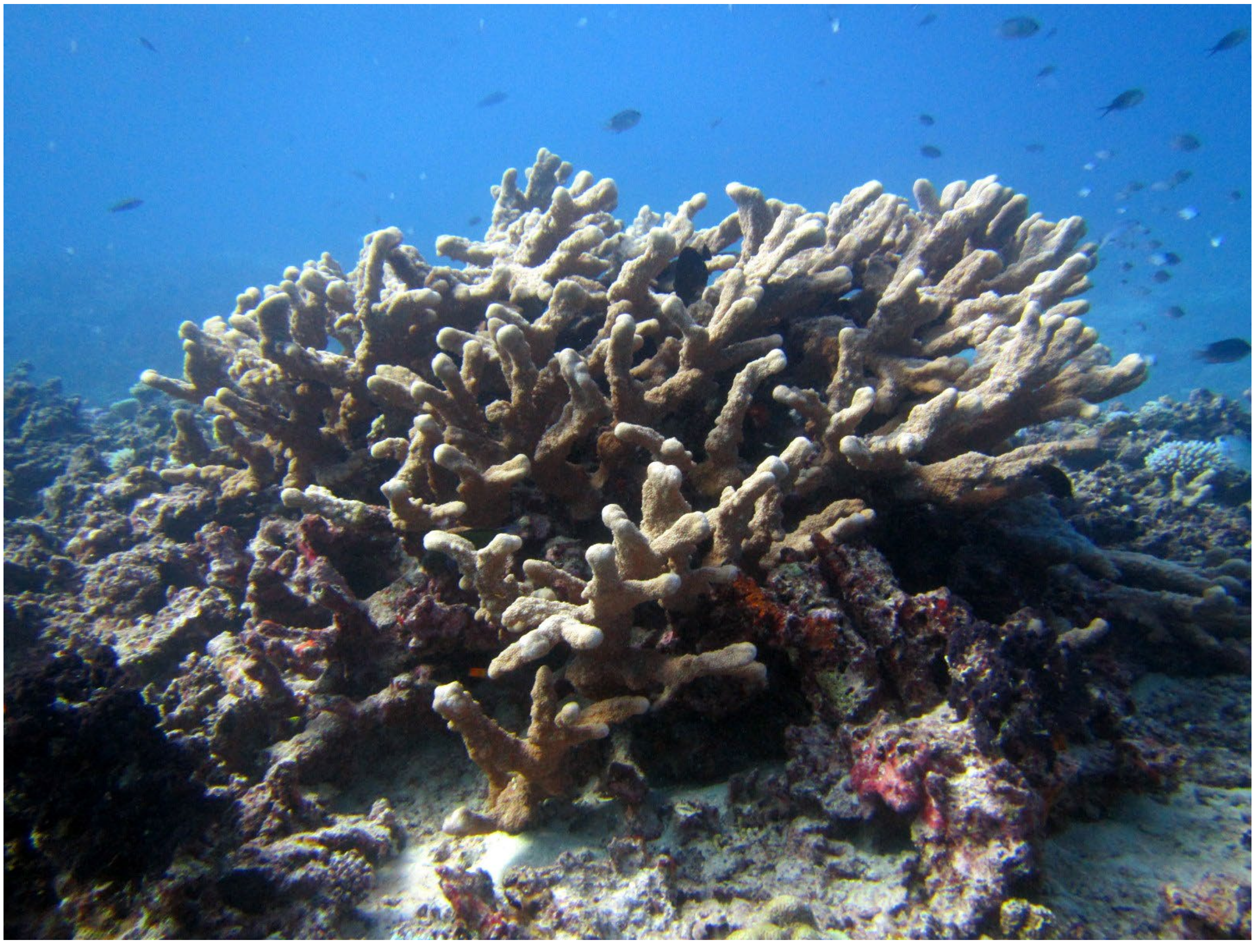
A closer photo of *Montipora turgescens*. The white circles are polyps.

Isopora

Colonies are most often branching but can form wall-like colonies or be encrusting. When there are branches they are usually sturdy and roughly wrist-diameter. The branch ends are usually rounded and always have multiple or many equal corallites. The genus name means equal pores (corallites), referring to the branch ends. This used to be a sub-genus of *Acropora*, but *Acropora* always has just one corallite on branch ends. Also, *Isopora* always broods larvae while *Acropora* always broadcast spawns.

Isopora palifera

Colonies are branching. Branches may grow vertically or horizontally, or in between. Branches are usually relatively smooth. The corallites are slightly larger than on Isopora cuneata. *Isopora palifera* does not form wall-like colonies like *Isopora cuneata* forms.



A photo of a large colony of *Isopora palifera*. Colonies are not usually this large.

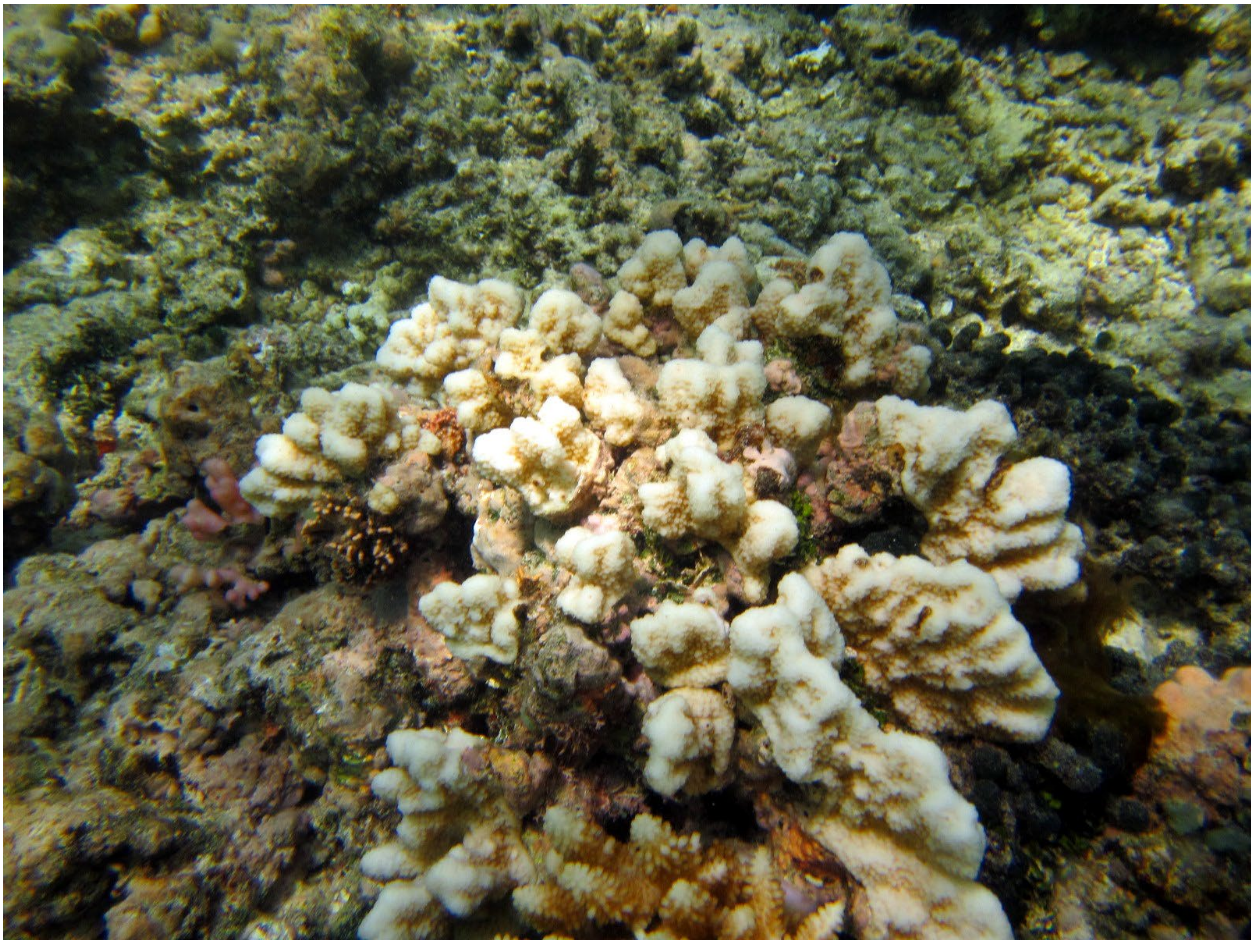
A closer photo of *Isopora palifera*.

A close-up photo of *Isopora palifera*.

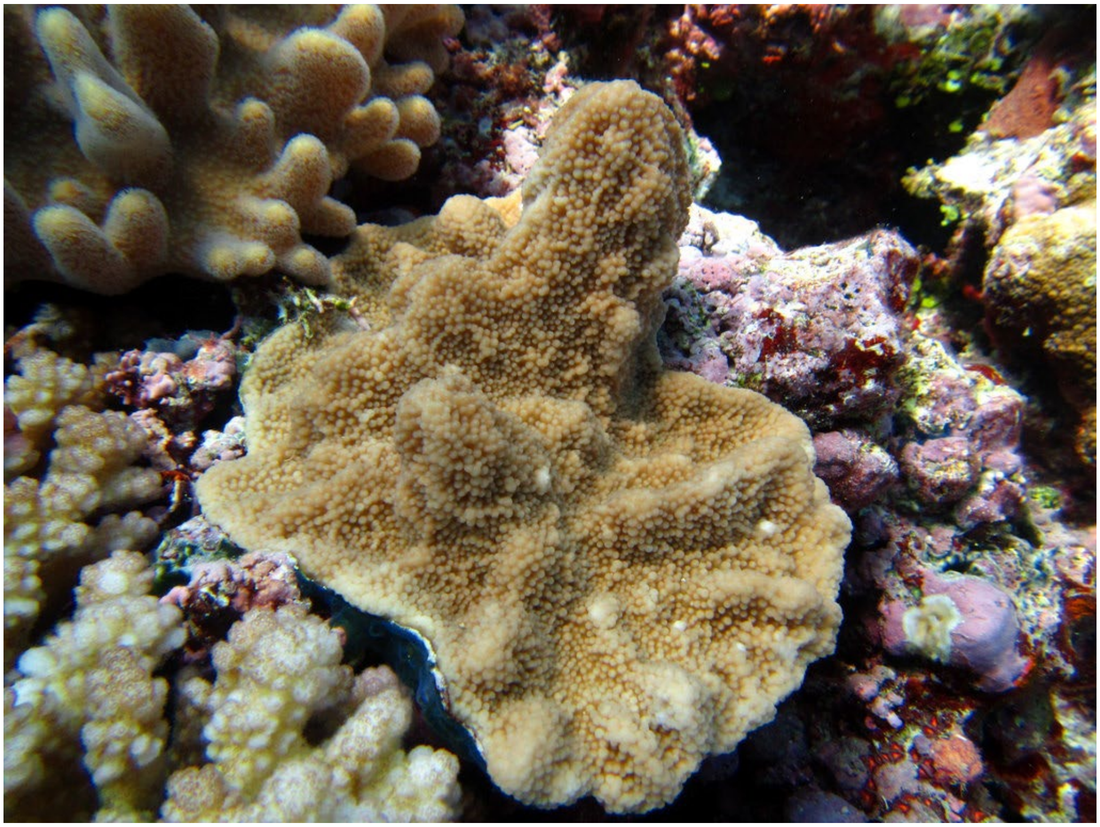
Isopora cuneata

Colonies can be branching or form vertical walls. Branching colonies may have more flattened or irregular branches than *Isopora palifera*. Colonies have slightly smaller corallites than *Isopora palifera*, but corallites are identical to those on *Isopora crateriformis*. The difference in corallite size between *Isopora palifera* and *Isopora cuneata* may only be clear if the two species are side by side. *Isopora crateriformis* forms encrusting colonies which may have lifted plate edges. These three species can be quite difficult to distinguish, and in Tonga there are colonies that are partly encrusting and have short branches, making them intermediate between *Isopora cuneata* and *Isopora crateriformis*. Wallace (1999) writes that these two may not be separate species.

A photo of a brancning colony of *Isopora cuneata*.



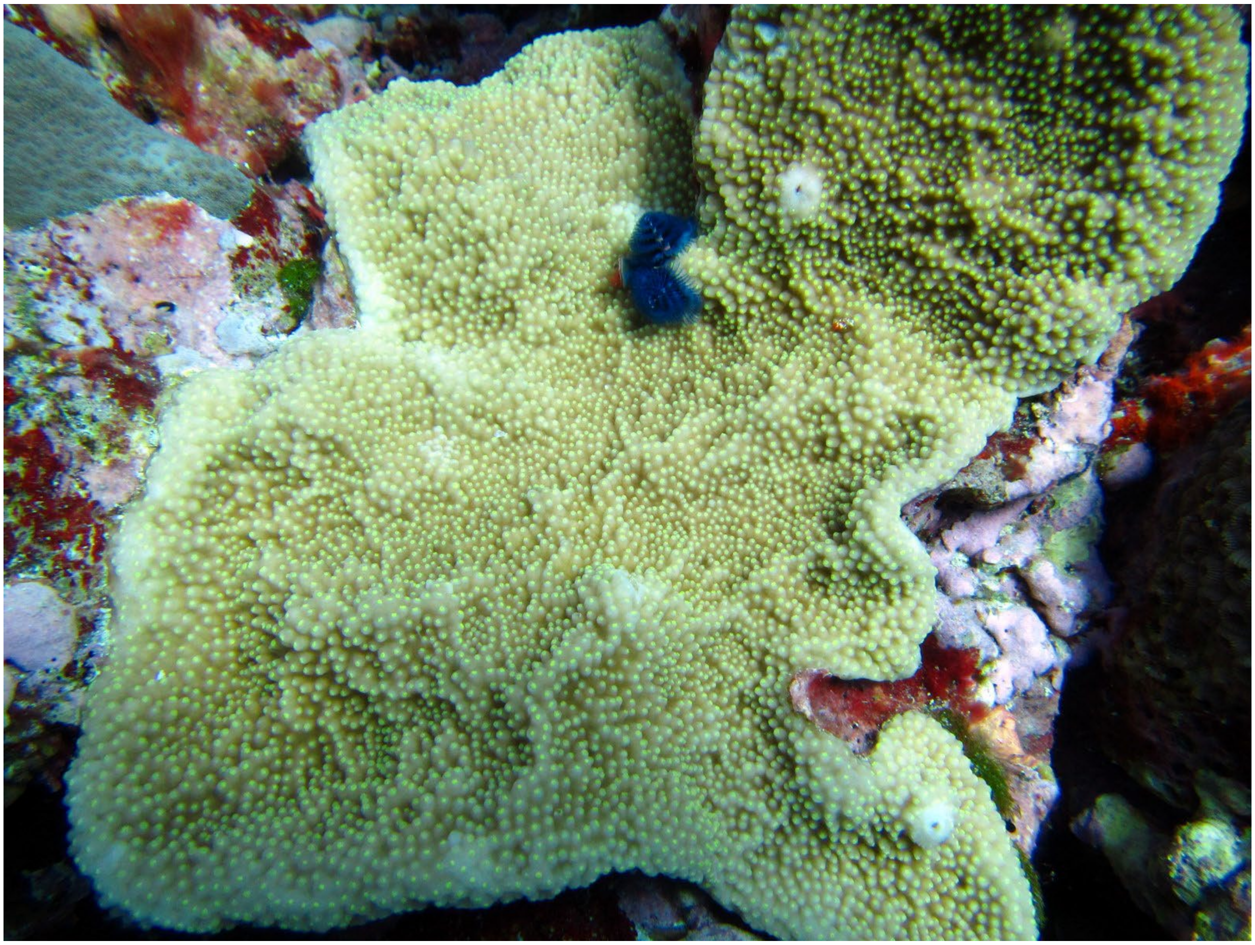
A photo of a colony of *Isopora cuneata* with some wall-like formations.



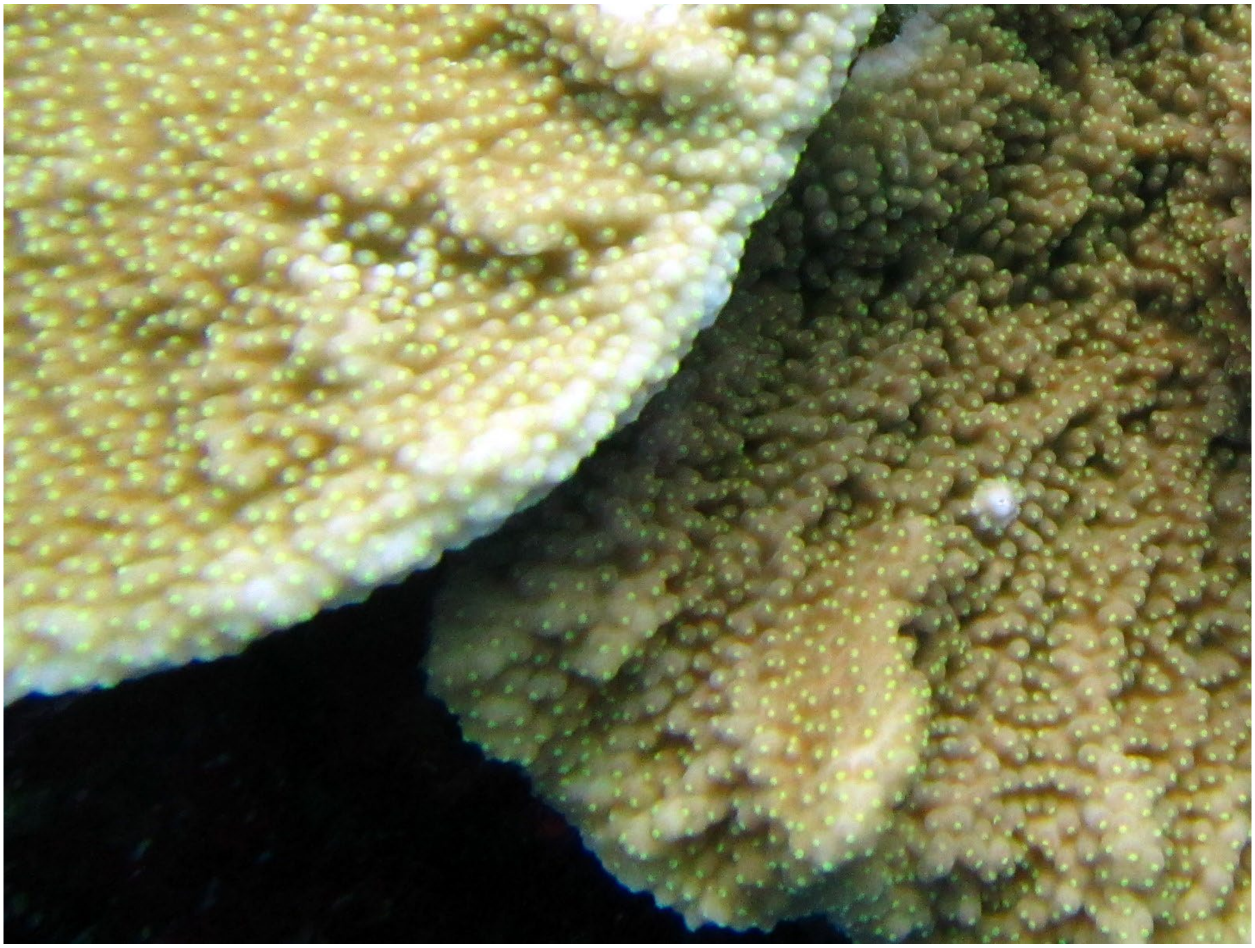
A colony that has both an encrusting-plate portion and a stubby branch, combining features of *Isopora cuneata* and *Isopora crateriformis*. Intermediate colonies like this are common in Tonga.

Isopora crateriformis

Colonies are encrusting and may have raised plate edges. The surface usually has ripples which are formed of larger, taller, corallites. *Isopora palifera* and *Isopora cuneata* are branching.



A photo of a colony of *Isopora crateriformis*.



A close-up photo of *Isopora crateriformis*.

Acropora

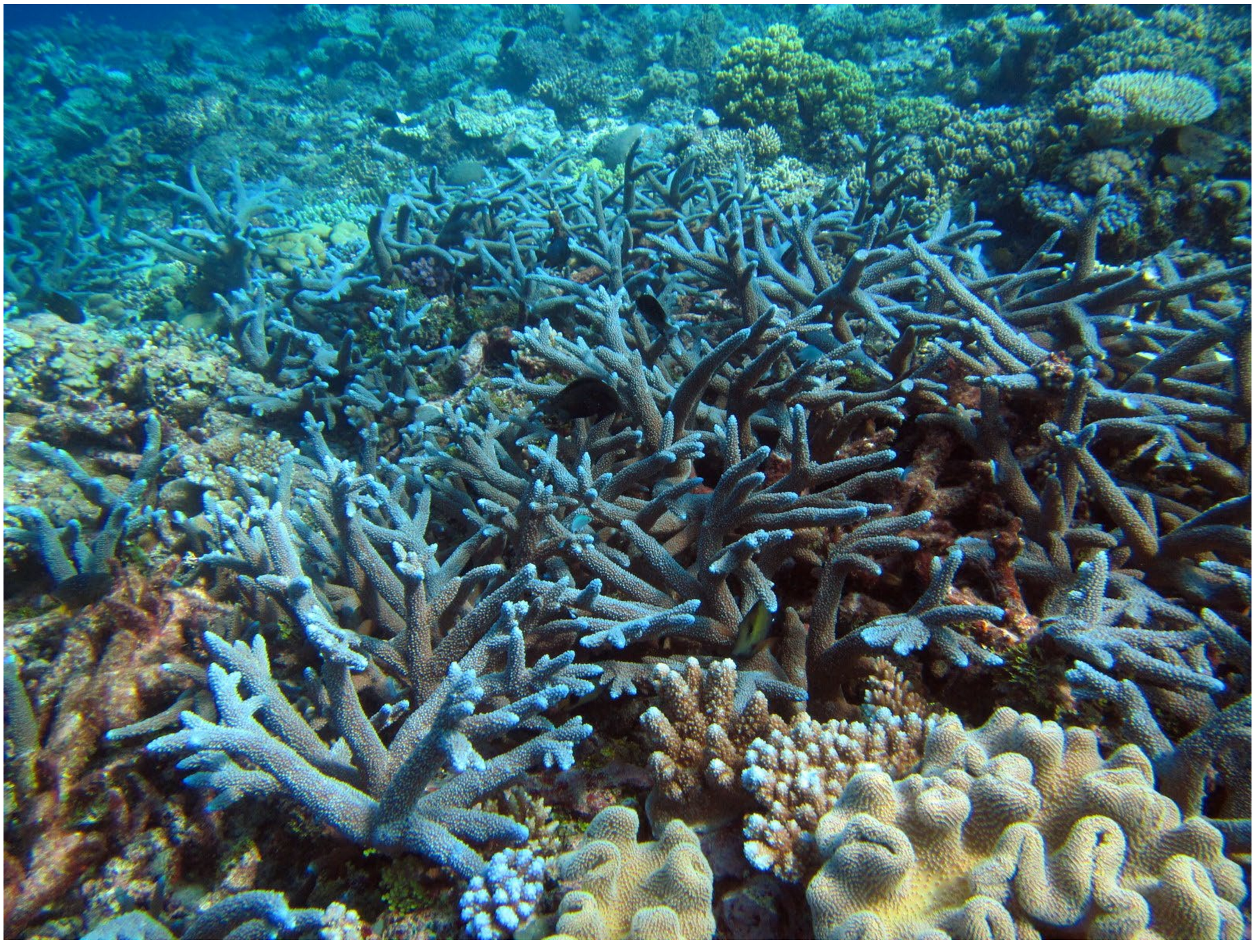
Colonies are always branching, and have exactly one corallite on branch tips. The corallite on the branch tip is called the “axial” corallite, much like an axel on a car, while corallites on branch sides are called “radial” corallites, much like a radial tire. There are a wide variety of colony shapes. Species can have arborescent colonies with long cylindrical branches that taper to a sharp point, and called “staghorn” because they are similar in shape to deer antlers. Other species have short branches that are usually parallel and finger-sized and shaped and so called “digitate”. Other species have thinner branches that are also parallel that usually grow up from spreading branches, and are called “corymbose.” Other species form table-shaped colonies, with a central column that holds a flat table-top up. The upper surface of tables have many little branchlets on them. Other colonies have branches of various sizes with many sub-branches going in many directions and are bushy, and are called “caespitose.” Other colonies have may short, thin branchlets or long corallites radiating from branches and are called “hispidose” or bottle-brush. *Acropora* is the largest genus with about 165 species currently recognized, and more left to discover and name. No other genus always has branches and has just one corallite on the end of each branch.

Staghorns

Staghorn corals have cylindrical branches that are long and have a limited number of side branches that have a similar shap. Typically, they taper slightly over their length or more near the branch tip, which is fairly sharp. They are shaped somewhat like a deer’s horns, which is what th name comes from. They can produce thickets of indefinite size.

Acropora intermedia

Colonies are sturdy staghorns; basal branches can be quite thick. Colonies can form extensive thickets of indefinite size. Branches taper to points. The axial corallite is a short tube that is much larger than the radial corallites. Radial corallites are in two sizes. They are relatively short and wide, and the opening is cut into the side towards the branch tip. Branches are thicker than on *Acropora muricata*, and the radial corallites are thicker and the openings point towards the branch tip, and the radial corallites may be shorter.



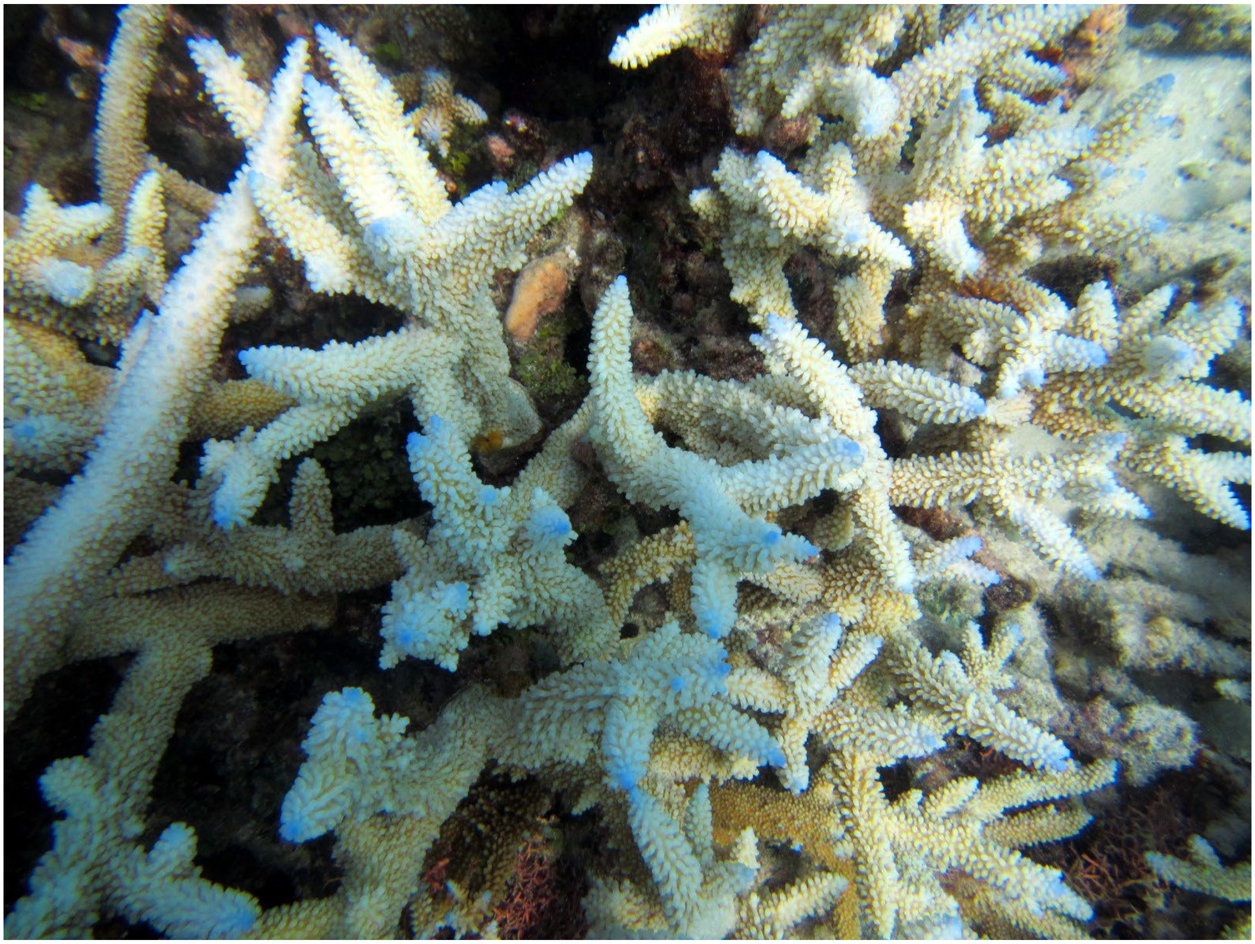
A photo of a thicket of *Acropora intermedia*.

A close photo of *Acropora intermedia* showing the two sizes of radial corallites.

A close-up photo of *Acropora intermedia.*

Acropora muricata

Colonies are staghorns with fairly slender branches. Colonies can form extensive thickets of indefinite size. Radial corallites are relatively thin tubes. Branch bases are thinner than on *Acropora intermedia* and radial corallites are longer, thinner and their openings are less cut at an angle.

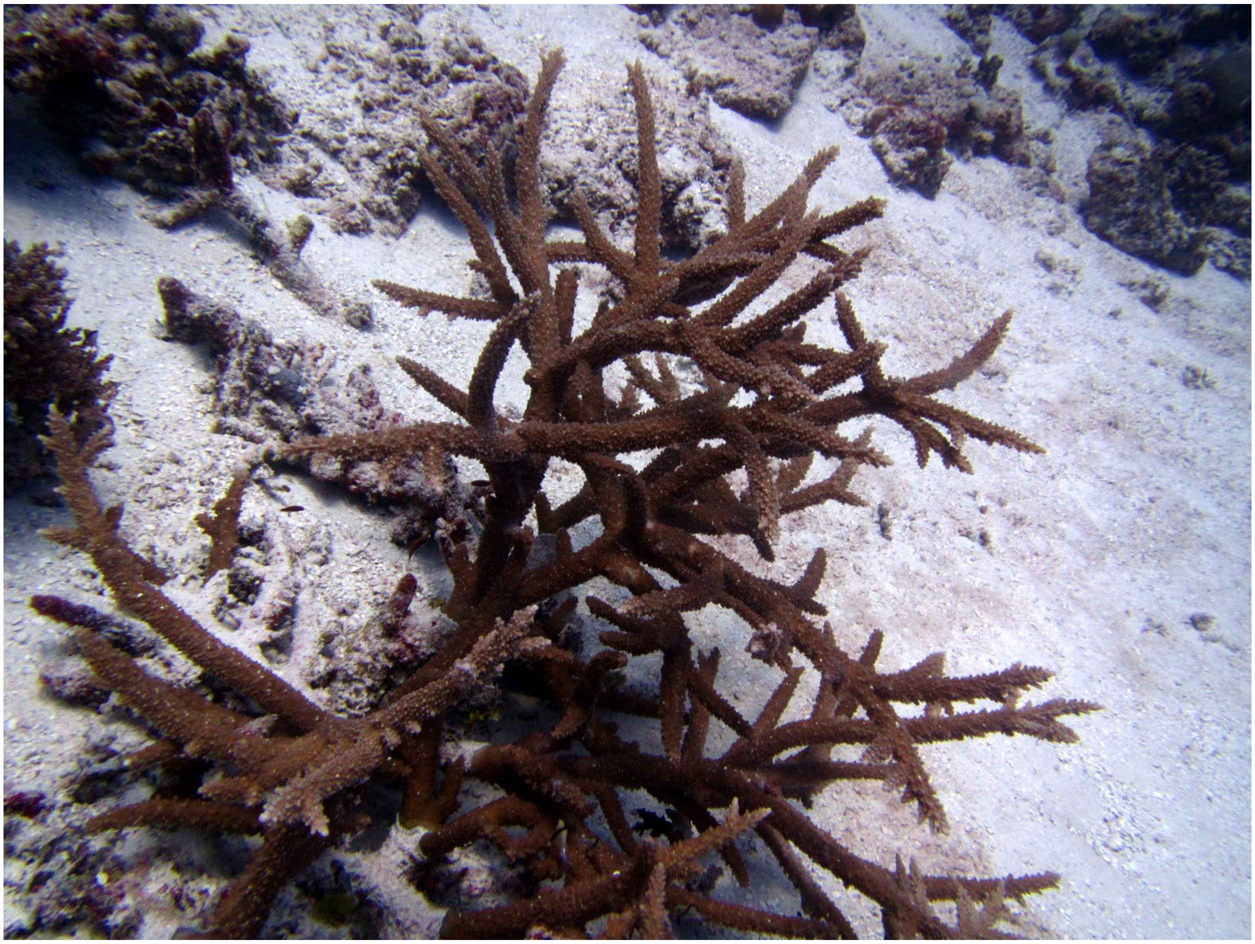


A photo of a thicket of *Acropora muricata*.

A close photo of *Acropora muricata*.

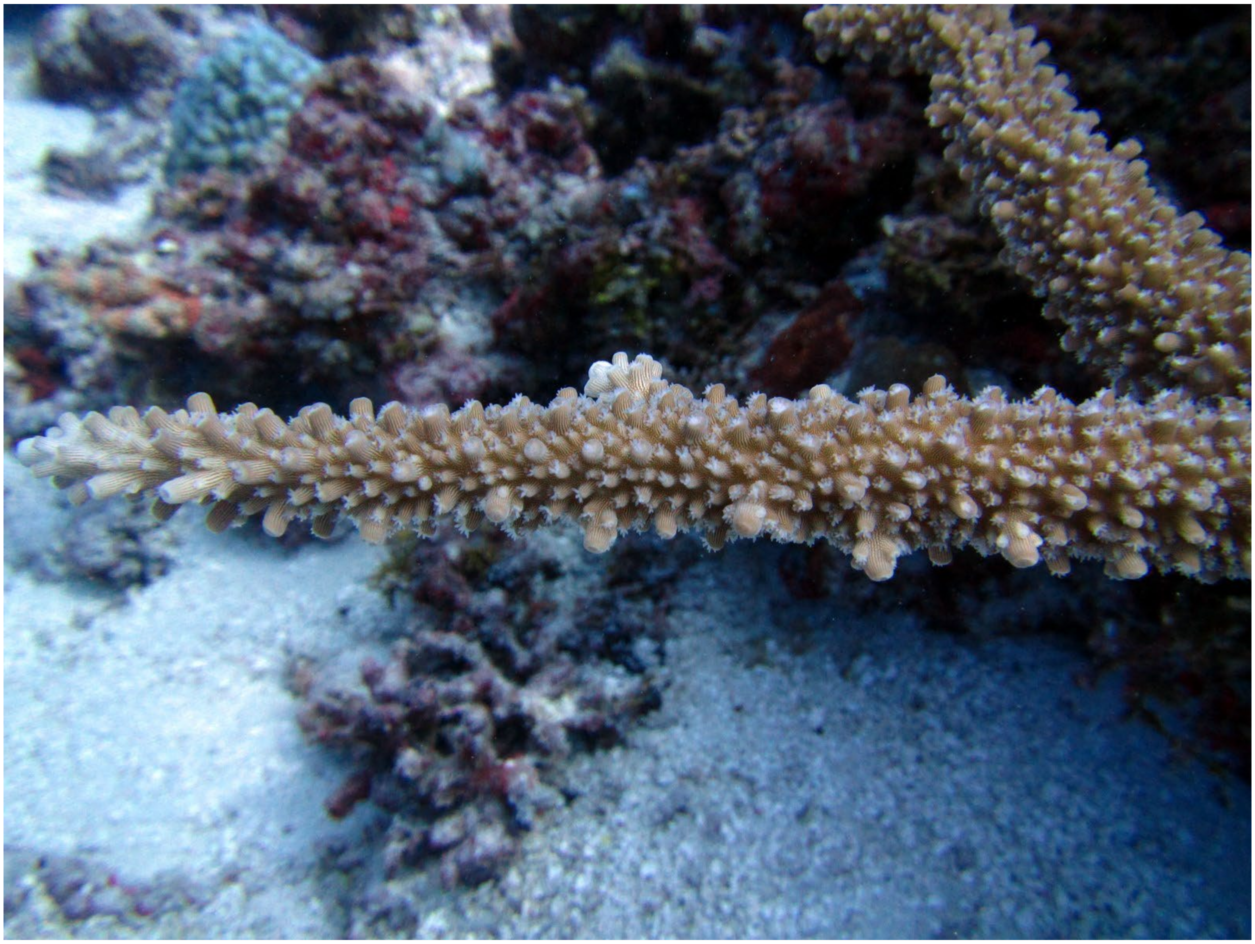
Acropora grandis

Colonies have staghorn branches that can be longer than other staghorn species. Colonies can form thickets of indeterminate size. Most radial corallites are tubular, and point towards the branch tip (a few are longer). Near the branch tip they project from the branch and can appear long. Their skeleton is relatively delicate and easily crushed in your fingers. Corallites are more appressed on branches except at branch tips than on other staghorns and more easily crushed near branch tips. Branches may be longer than on *Acropora muricata* and *Acropora intermedia*, and radial corallites are usually longer near the end of branch tips.



A photo of *Acropora grandis*.

A closer photo of *Acropora grandis*.

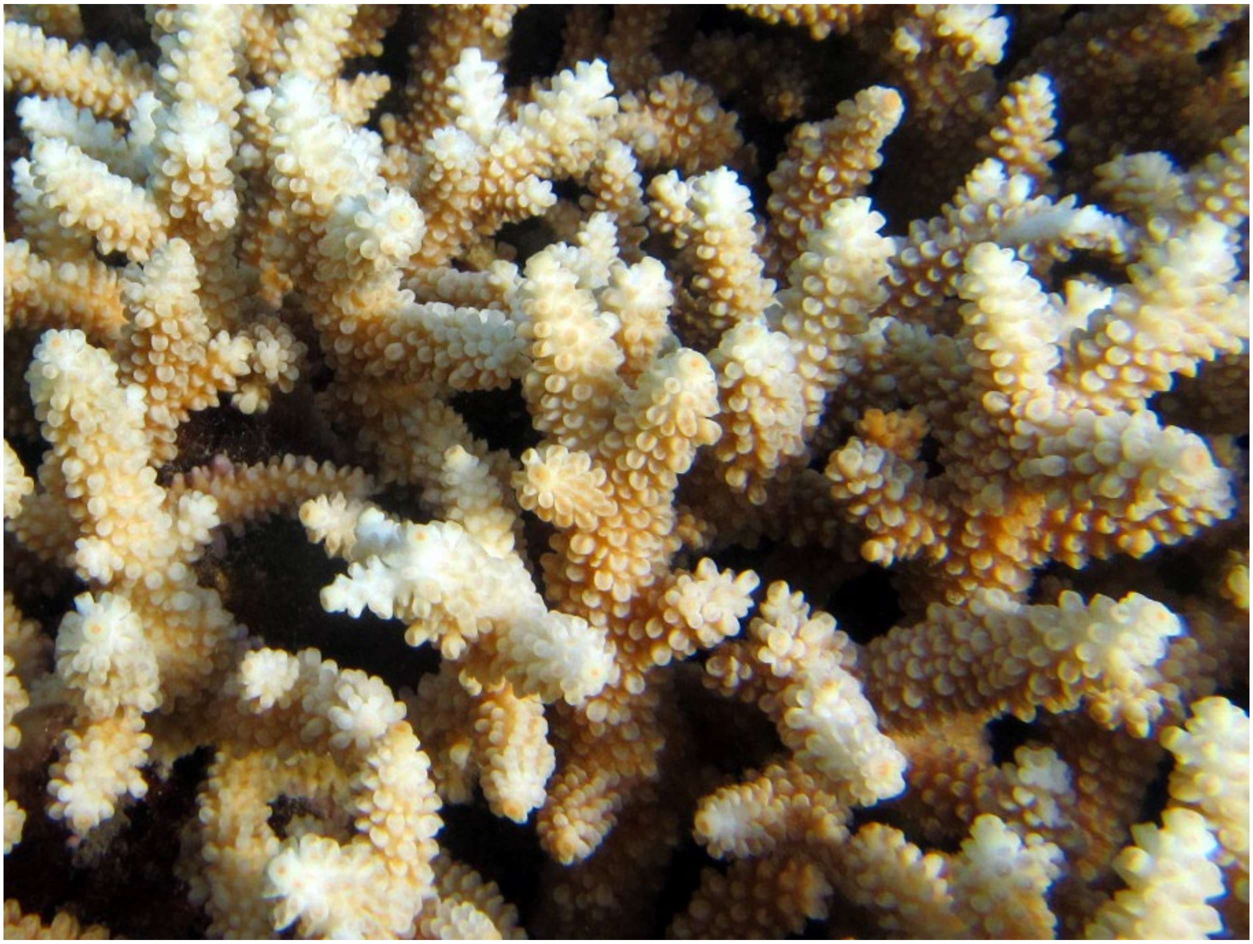


A close-up photo of *Acropora grandis*.

Acropora yongei

Colonies have short staghorn-shaped branches and could be thought of as either staghorn or bushy. Colonies can form thickets of indeterminate size. Radial corallites have expanded lower lips and no upper wall, and look like troughs. Branches are shorter than other staghorns and radial corallites only have lower lips.

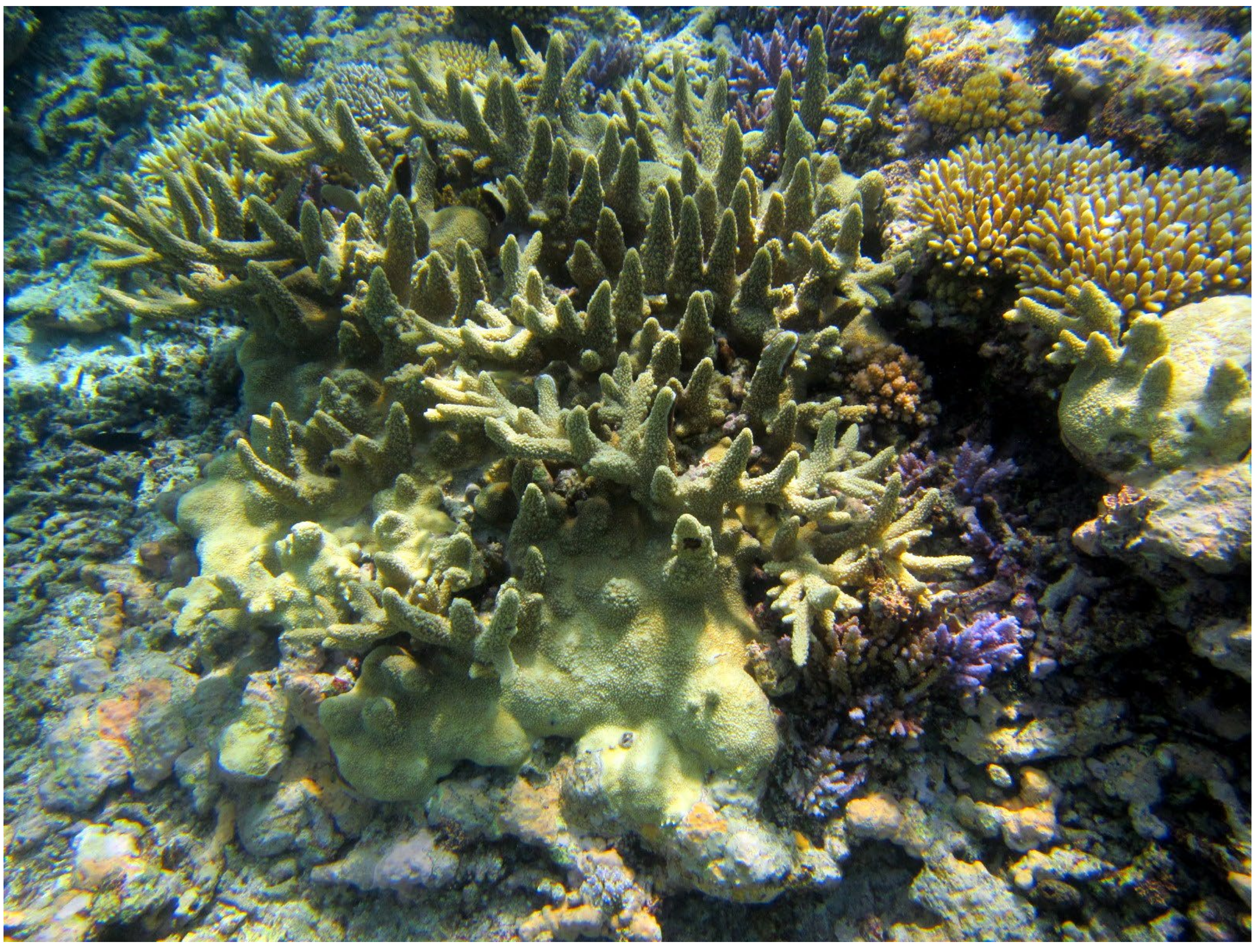
A photo of a thicket of *Acropora yongei*.



A close photo of *Acropora yongei*.

Acropora robusta

Colonies have staghorn-like branches which usually radiate from a central attachment point. Colonies are discrete but can be large. Branches on the edges of colonies are horizontal and curve upward near the branch tip, while branches in the center are usually vertical. Branches are cylindrical, thick near the attachment point, and taper, particularly near the branch tip, which is relatively sharp. Sometimes some of the central vertical branches are short, thick and have rounded ends. Axial corallites are tubes that are larger than the radial corallites. Radial corallites are thin walled and the openings are cut at an angle so the opening faces the branch tip. Radial corallites are relatively uniform in shape and size and do not get long near branch tips like on *Acropora abrotanoides*. *Acropora robusta* is most common in shallow water and may be near the reef crest. *Acropora palmerae* is similar but is all or almost encrusting base, with little if any branching. *Acropora valenciennessi* has thinner branches and is more up off the substrate.



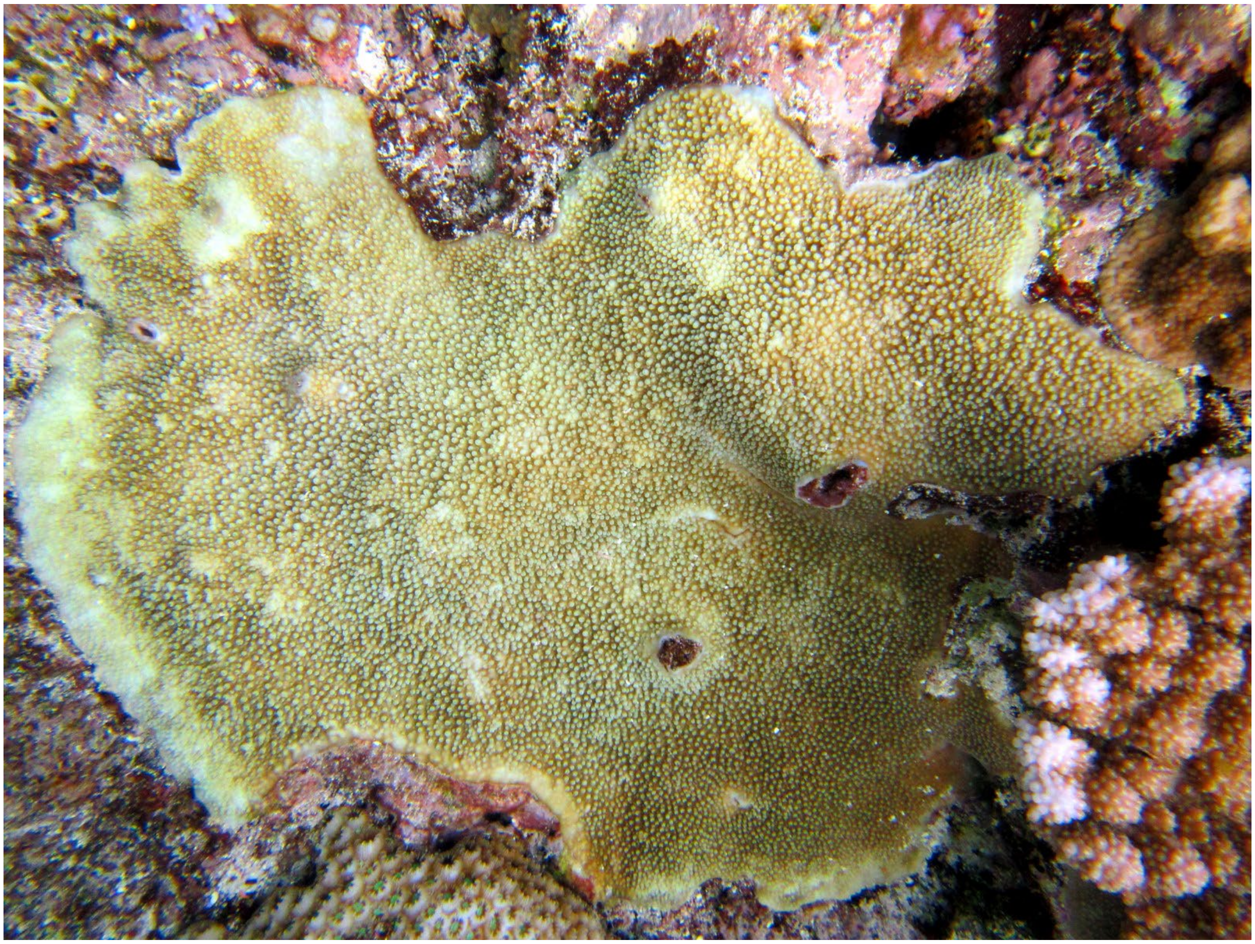
A photo of a colony of *Acropora robusta* that has more encrusting base visible than most colonies have.

A closer photo of *Acropora robusta*.

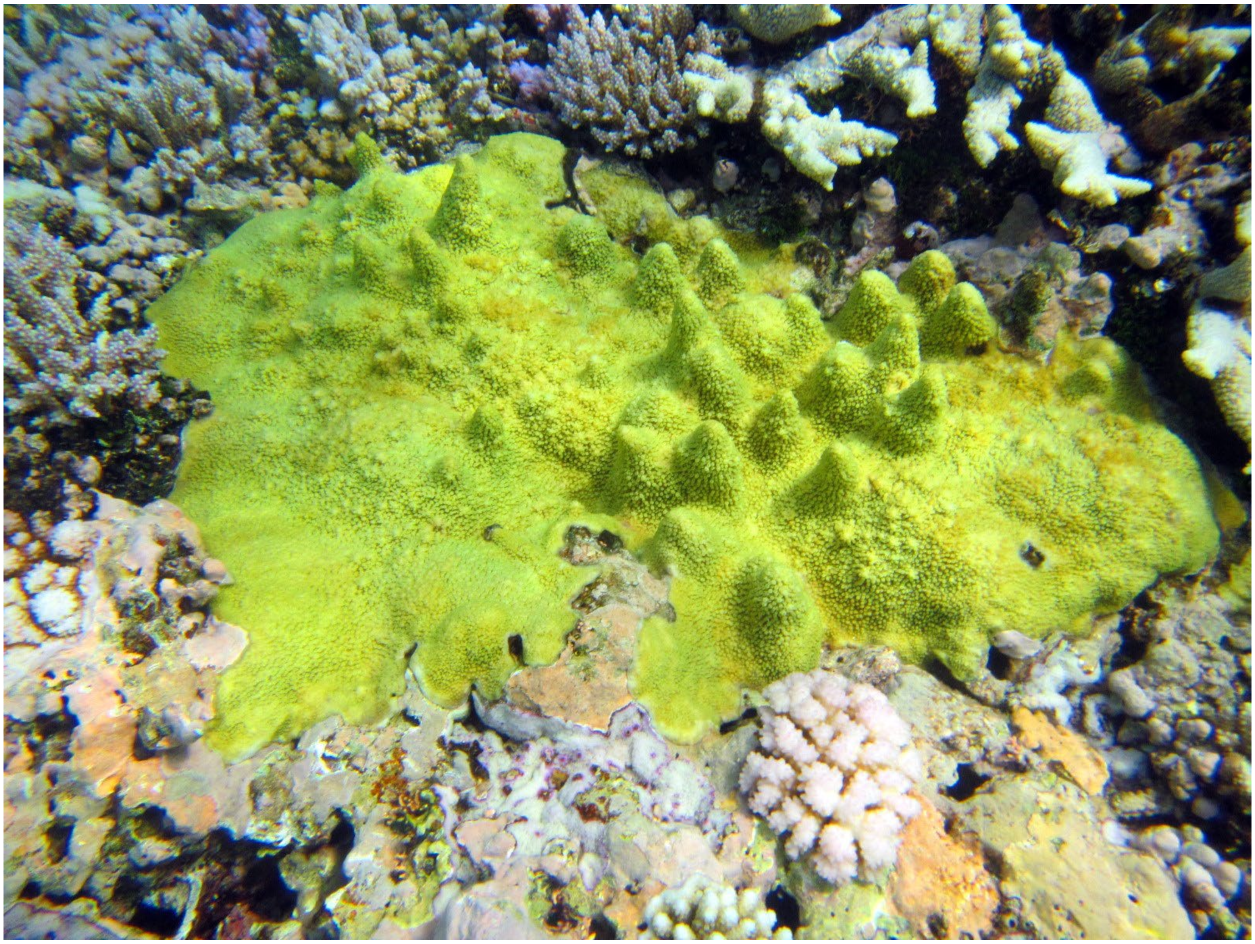
A close-up photo of *Acropora robusta*.

Acropora palmerae

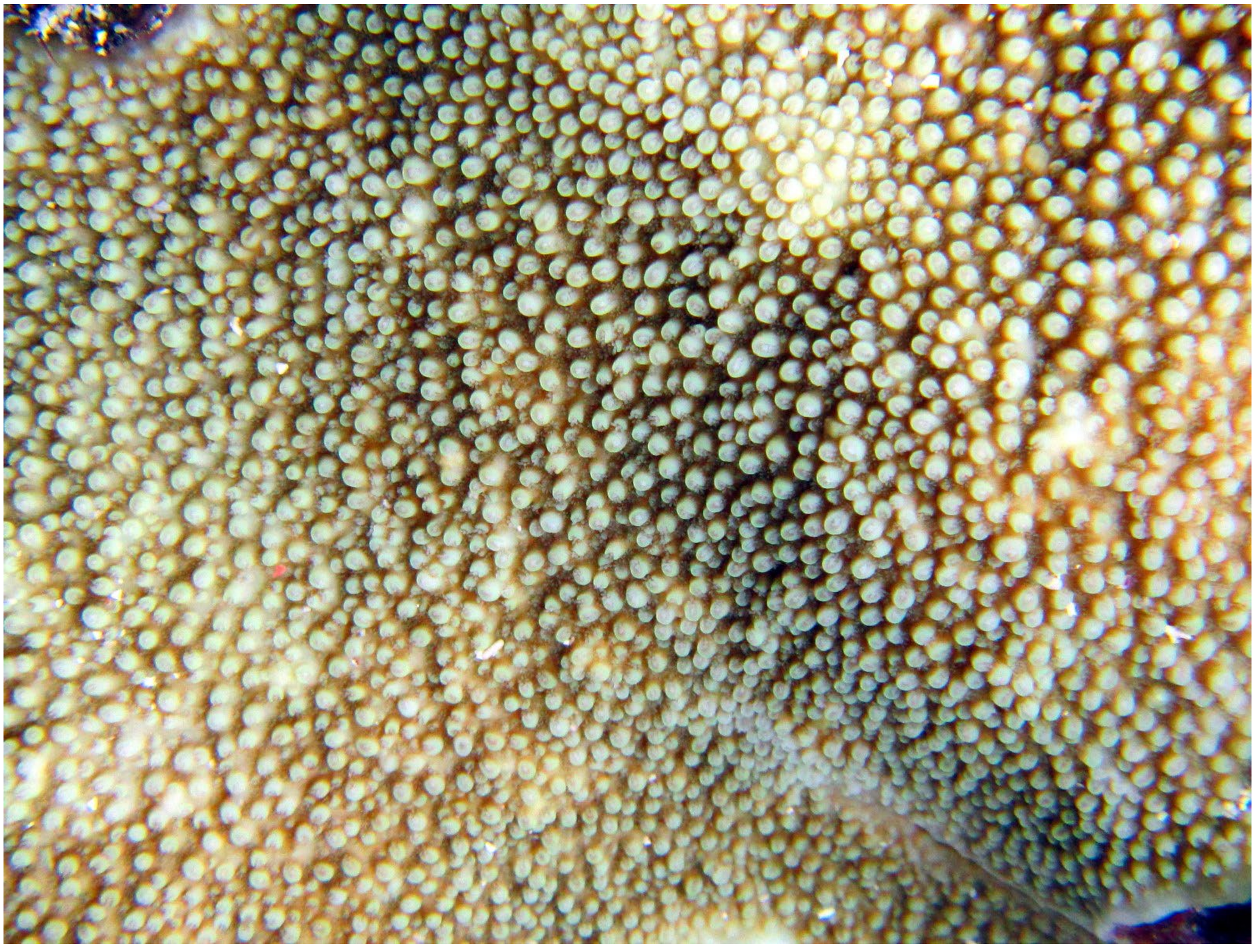
Colonies are encrusting, and may have a few short branches. Corallites are thin walled and the openings are cut at a slant. Branches and corallites are just like on *Acropora robusta*, but the colonies are entirely encrusting or have just a little branch development. In some places colonies are most common about 2-3 m deep. Wallace (1999) cautions that there is no difference between this species and *Acropora robusta* other than the amount of encrusting base vs branching.



An encrusting colony of *Acropora palmerae*.

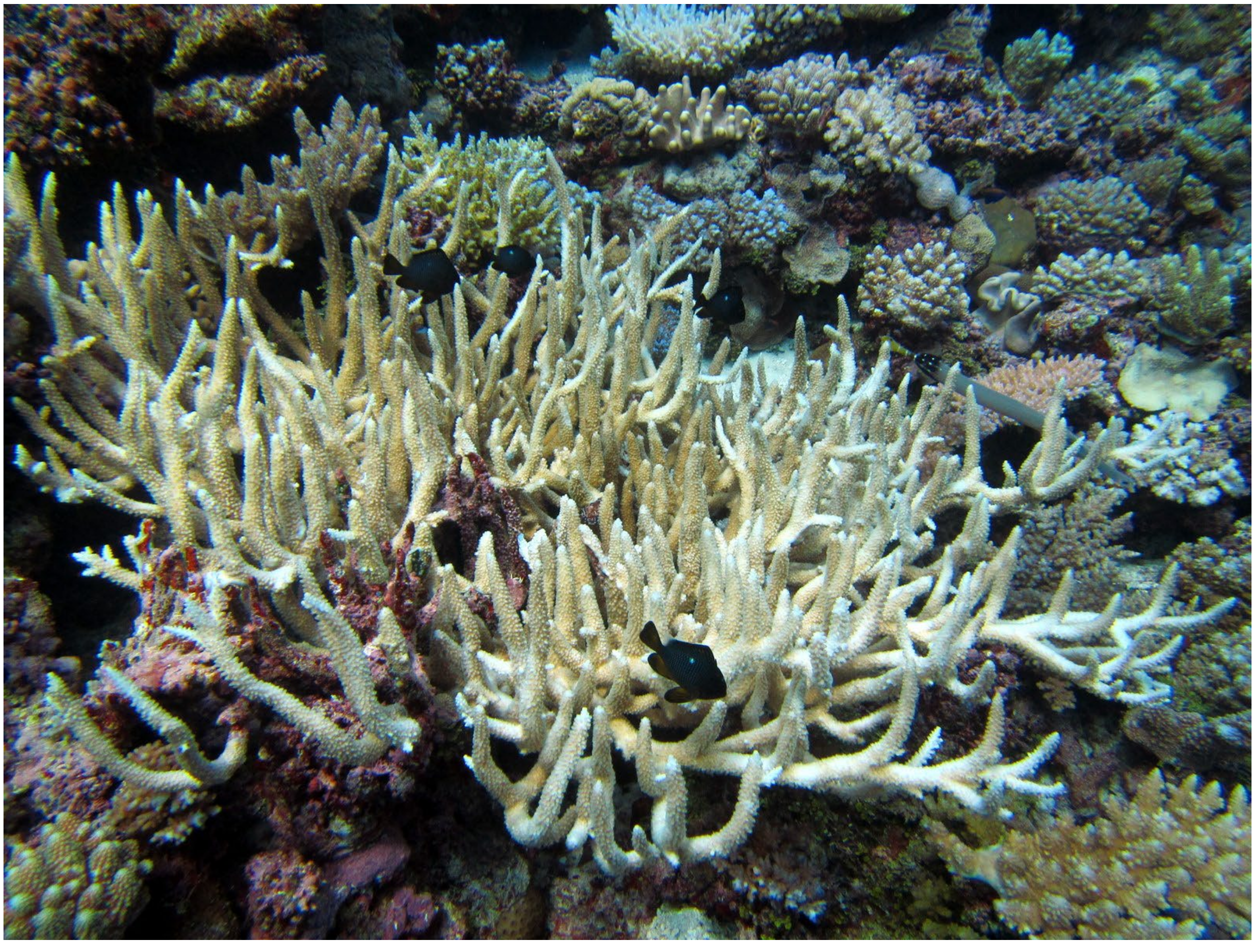


A photo of a colony of *Acropora palmerae* with some short branches.

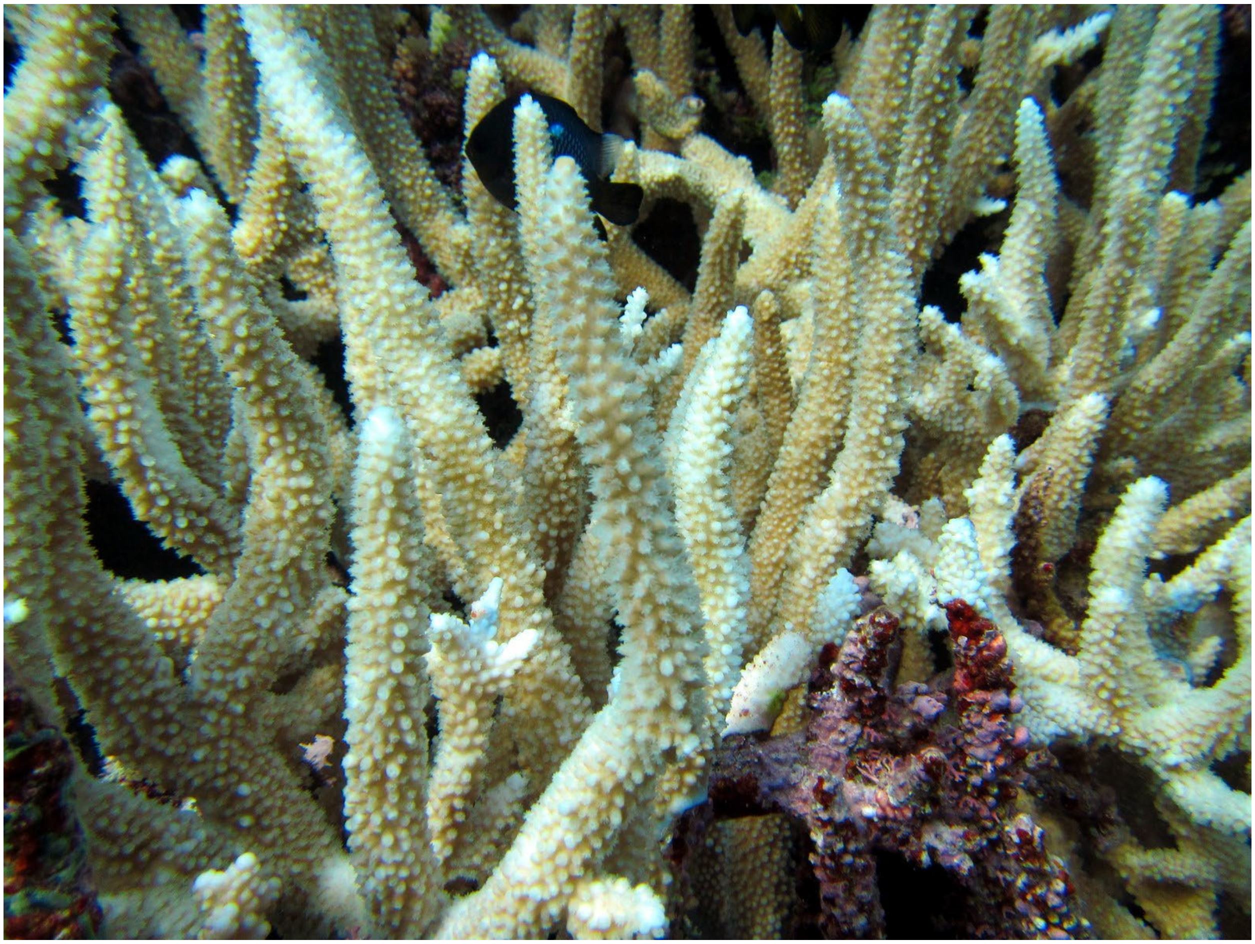

A close-up photo of *Acropora palmerae*.

Acropora valenciennesi

Colonies are discrete, with staghorn-looking branches. Branches grow outward horizontally from the center of the colony and curve upward near the edge of the colony. Branches are about the thickness of a finger. Radial corallites are tubular and uniform and neatly arranged. Colony and branch shapes are similar to *Acropora robusta* but branches are much thinner, and radial corallites do not have openings cut at a slant.



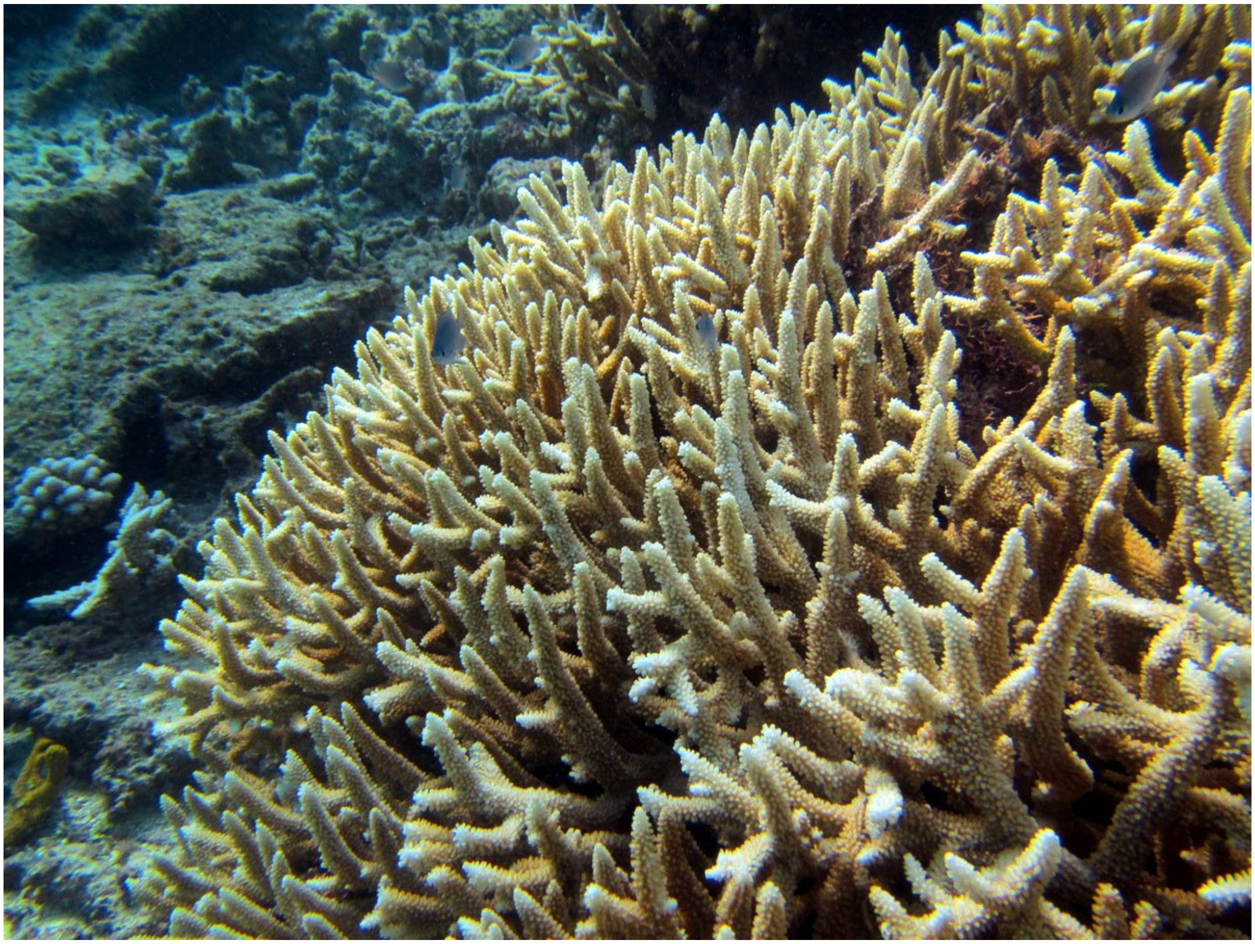
A photo of a colony of *Acropora valenciennesi*.



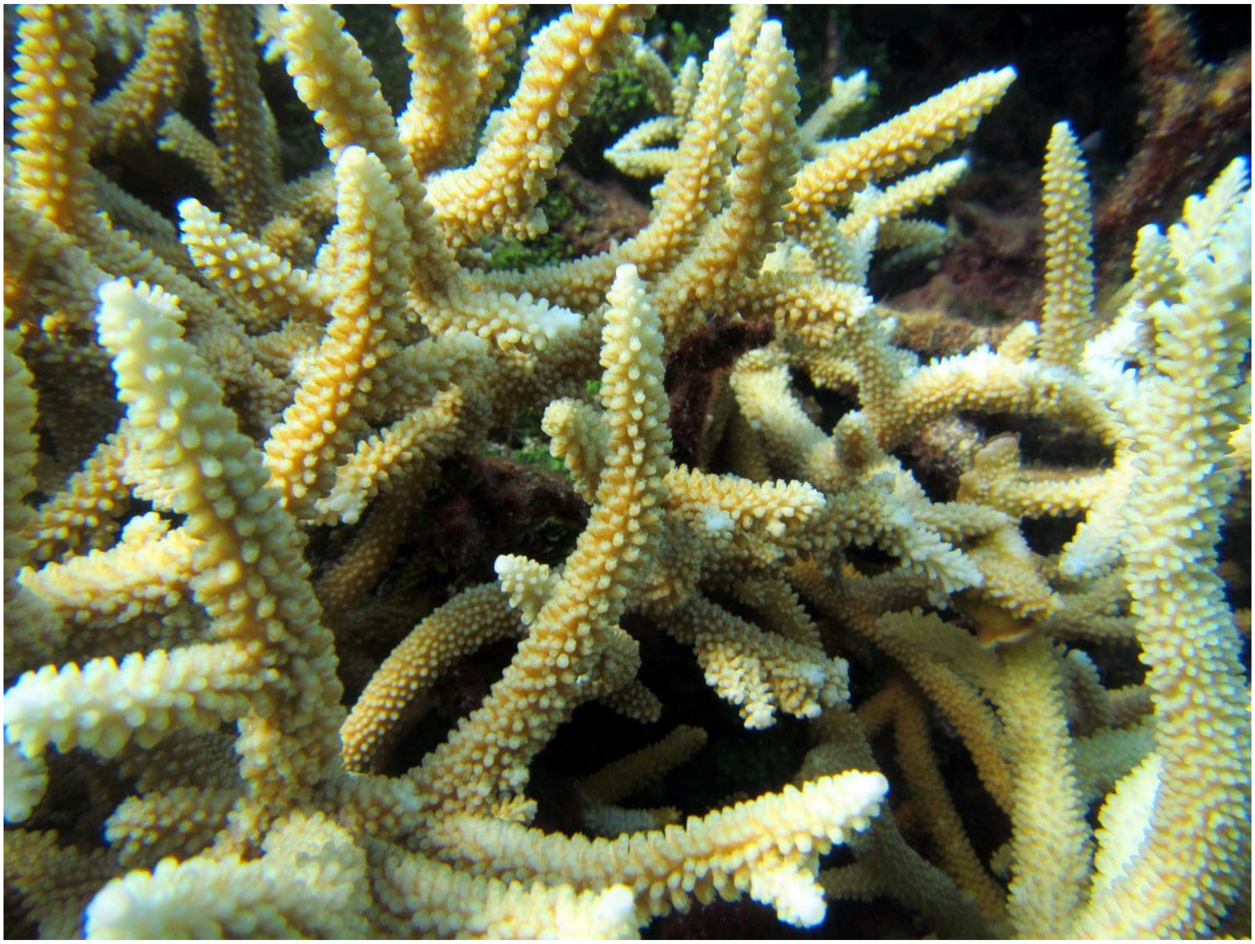
A closer photo of *Acropora valenciennesi*.

Acropora acuminata

Colonies have thin staghorn-like branches and form discrete colonies. Basal branches extend horizontally, and at the edge of the colony curve upward. Branches are relatively close together and taper top points. Radial corallites can be in two sizes, the longer of which have sharp edges. Colonies have branches closer together than *Acropora valenciennesi*, and much smaller than *Acropora robusta*.



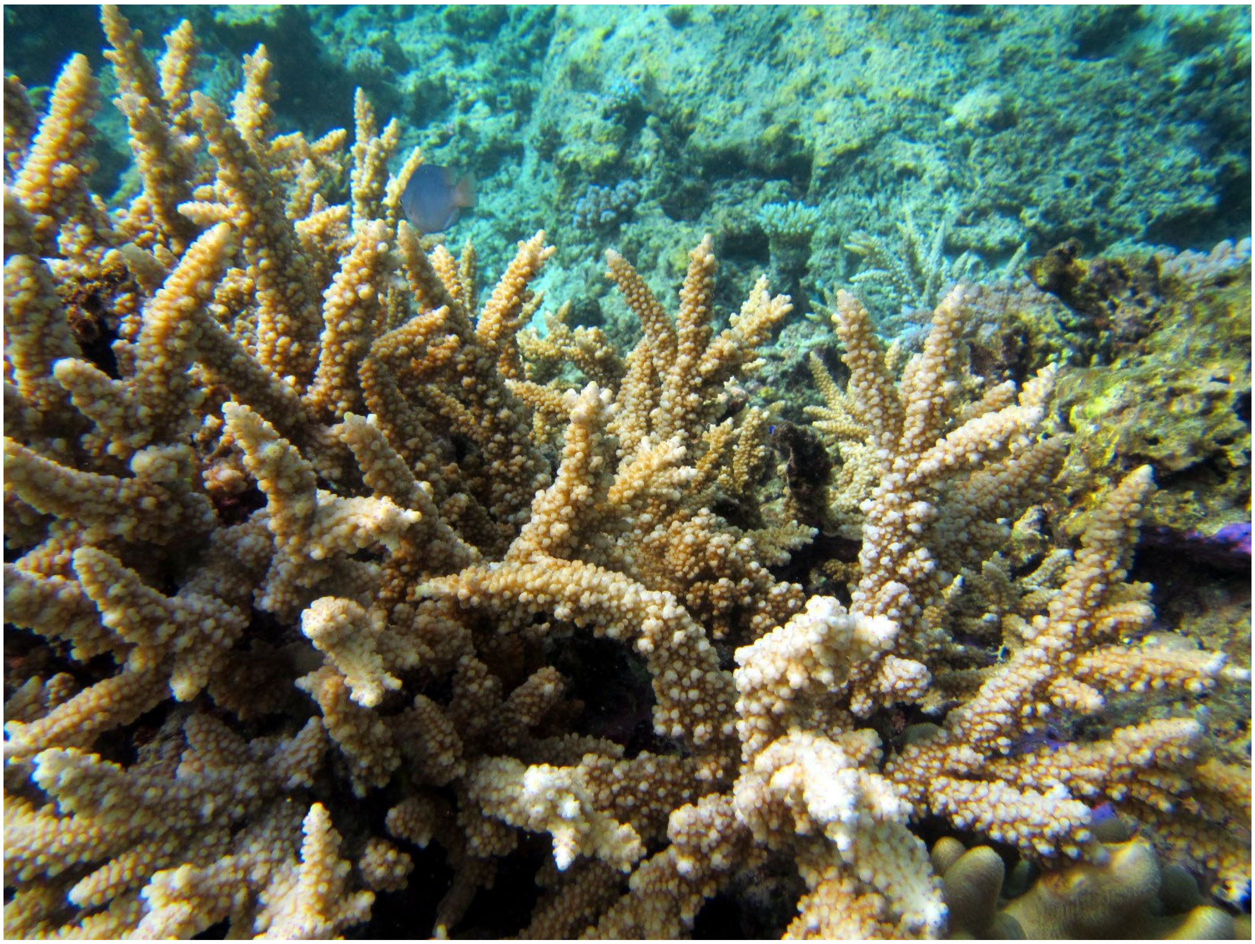
A photo of a colony that may be *Acropora acuminata*.



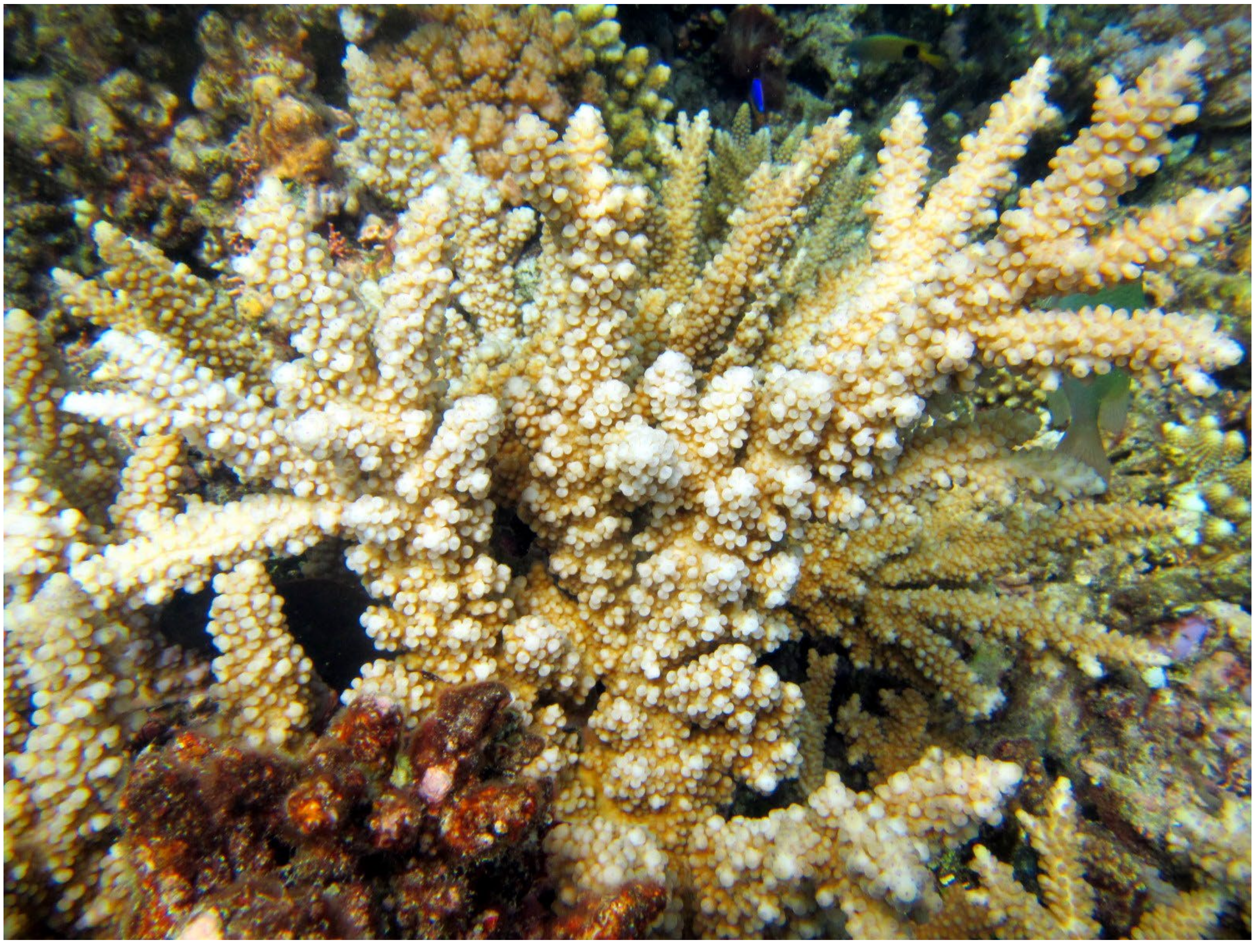
A close photo of what may be *Acropora acuminata*.

Acropora austera

Colonies are branching, with somewhat staghorn-like branches that are more or less cylindrical and tapering, but which are irregular, with some fusion, curving, diverging, and lumps on some branches or colonies. Radial corallites are wide and thick walled. Branches are more irregular than on staghorn species and corallites are larger than on most species. Branches are more irregular and radial corallites are less uniform than on *Acropora verweyi*.



A photo of *Acropora austera*.



A photo of *Acropora austera*.

A close-up photo of *Acropora austera*.

Digitate

Coloniies are encrusting, with vertical branches that reach a fixed height and then stop growing. Branches are generally thicker than on corymbose colonies. Colonies grow on their edges.

Acropora globiceps Vulnerable Threatened

Colonies are digitate, with finger shaped- and sized- branches growing up from an encrusting base. The branches are typically uniform size and shape, usually with rounded branch ends but sometimes with some tapering. The branches are usually pretty close together and if you look down from above you may see uniform width spaces between branches on the lower parts of branches. The branches have few sub-branches and they are usually stubby and small. The axial corallite is a very short ring that is not large. Radial corallites are small and fairly short, and some may be in vertical rows. Most colonies are 30 cm or less in diameter, but they can reach at least 50 cm and maybe 1 m diameter rarely. *Acropora humilis* has thinner, diverging branches that vary in length, and also have more side branches and have an axial corallite that is usually just a bit larger than on *Acropora globiceps* but sometimes is huge.

A photo of *Acropora globiceps*.

A close-up photo of *Acropora globiceps* showing the small axial corallite and the radial corallites.

A photo of *Acropora globiceps* with shorter branches.

A close-up photo of a colony that may be *Acropora globiceps* with slightly thinner branches and slightly larger axial corallites. The white on the surface between branches is a disease called a “growth anomaly”.

Acropora humilis

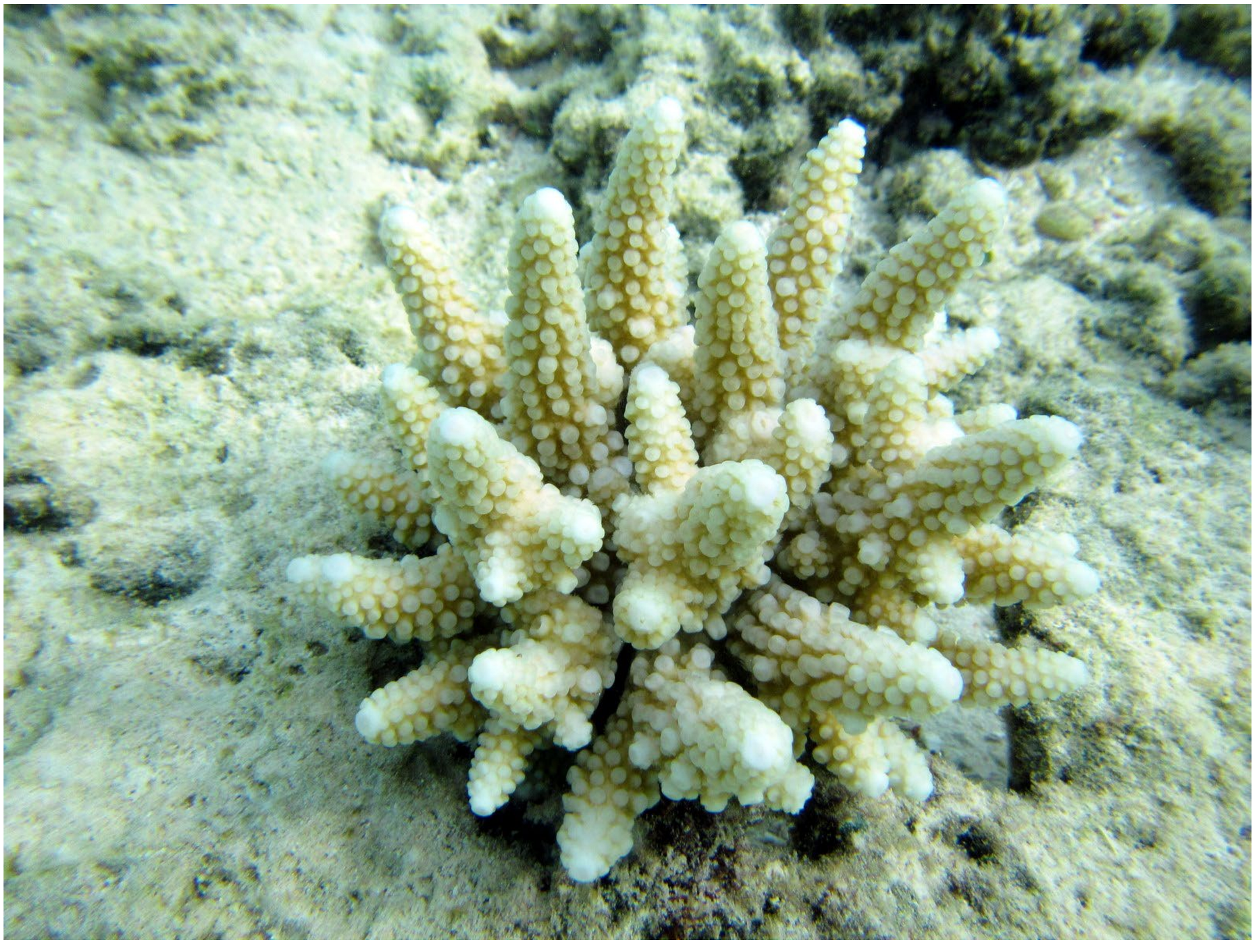
Colonies are digitate with branches that are about finger size and shape, growing up from an encrusting base. Branches have rounded ends. Branches often diverge or are far apart, vary in length, and have side branches. The axial corallites are most often moderate size but in some places like Australia can be huge. The branches are a bit thinner than on *Acropora globiceps*, diverge more, are farther apart, vary more in length, have more side branches, and have larger axial corallites.

A photo of a young colony of *Acropora humilis*.

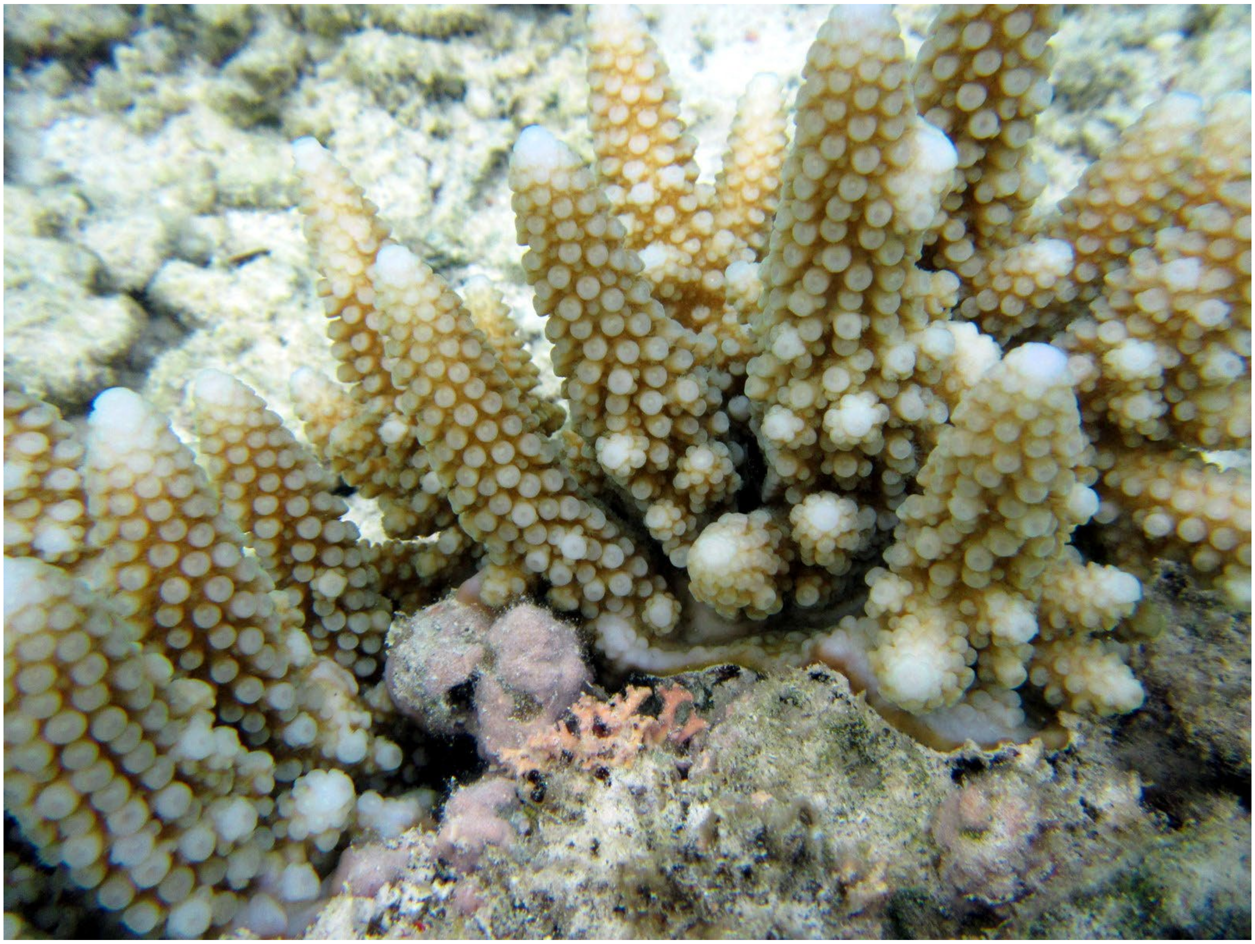
A photo of *Acropora humilis*.

Acropora gemmifera

Colonies are digitate. Branches may be parallel or diverge, sometimes in the same colony. Branches may taper. Radial corallites are large but short, with thick walls, and may increase in size down branches. Corallites are larger than on *Acropora globiceps* and *Acropora humilis*, and branches may diverge more than on *Acropora globiceps*.



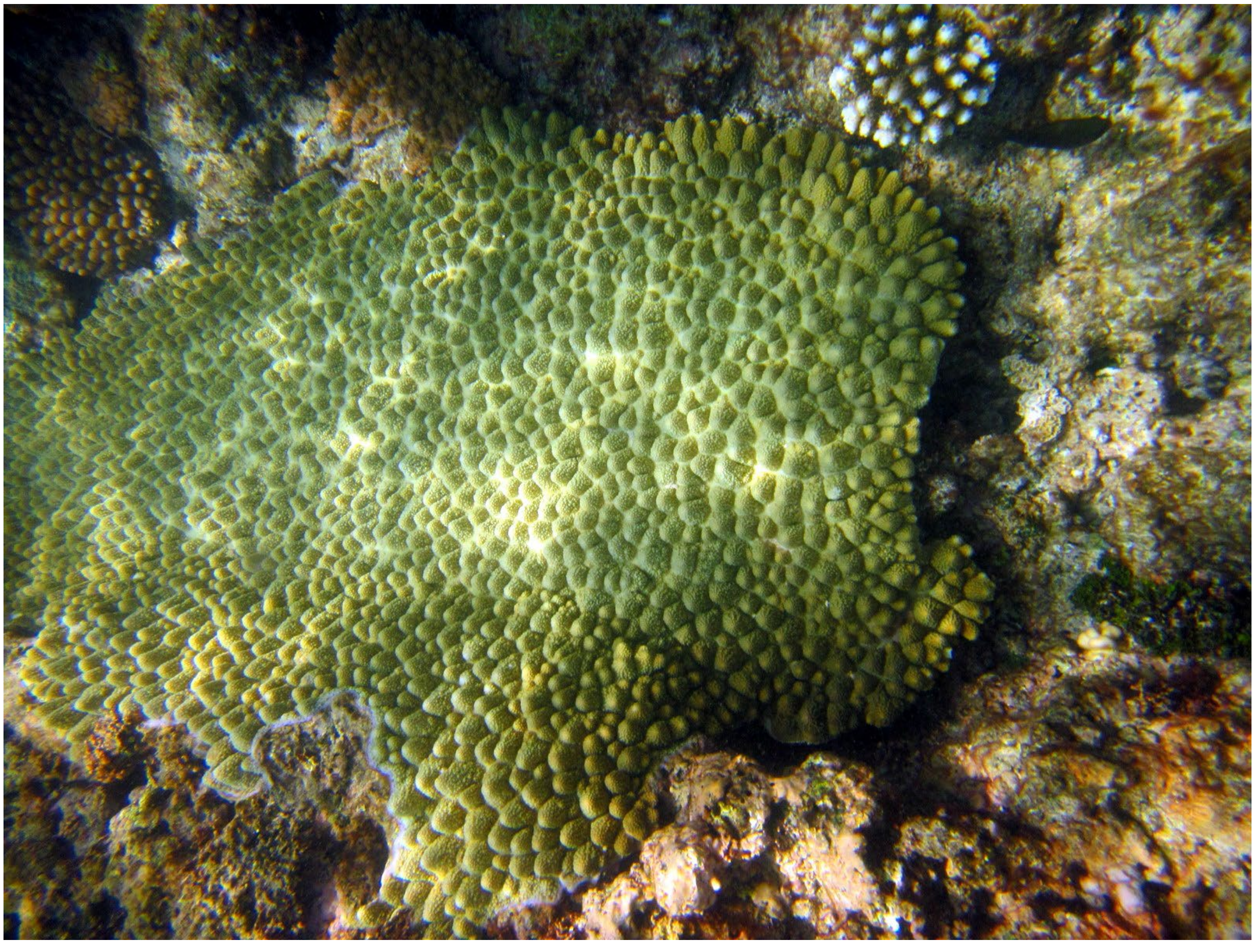
A photo of a colony that is probably *Acropora gemmifera*.



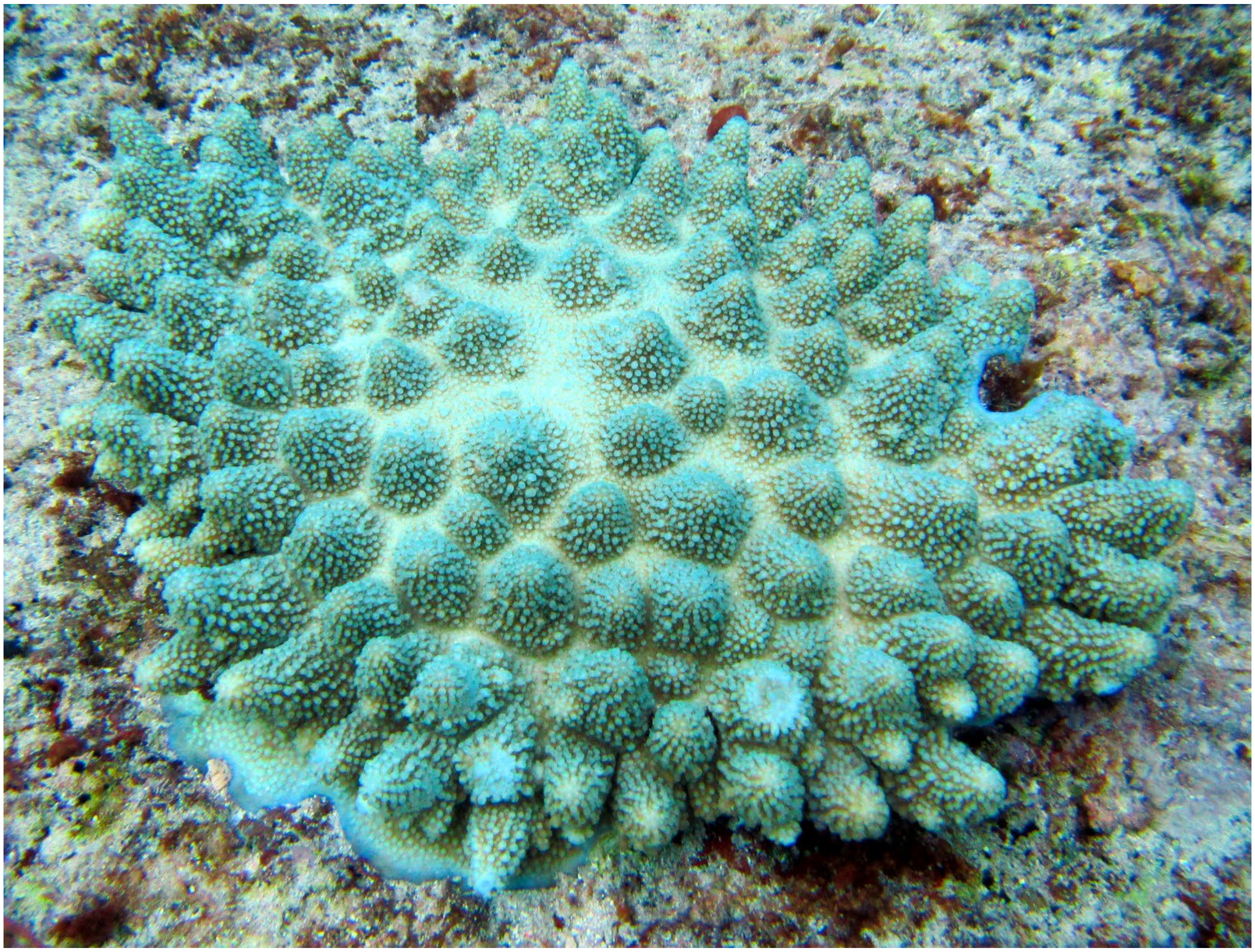
A close-up photo of *Acropora gemmifera* showing the large radial corallites.

Acropora monticulosa

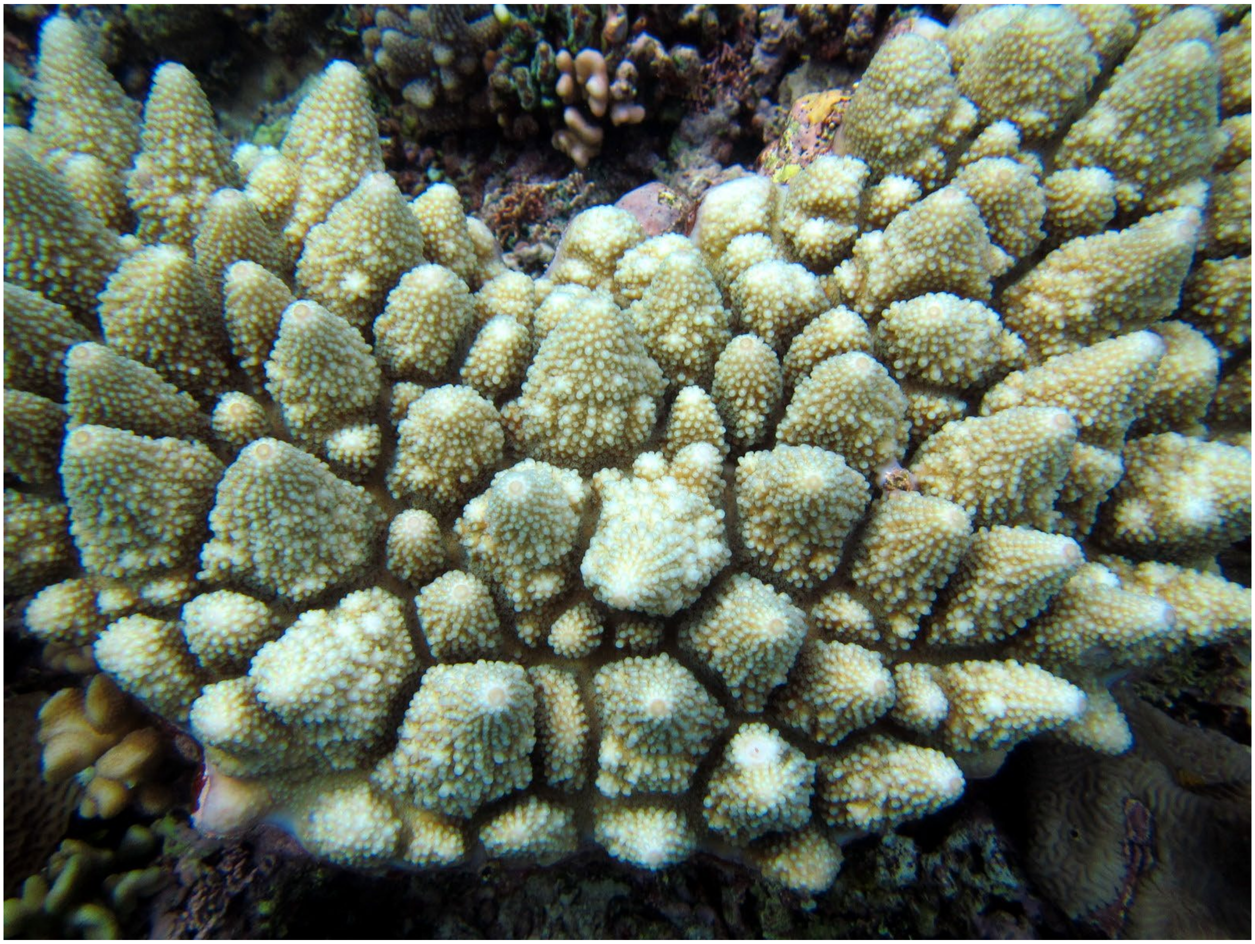
Colonies are encrusting with short, strongly tapering branches that do not have sub-branches. The axial corallite is small like the radial corallites. This species has branches that taper more than any other species of *Acropora*, and the branches are shorter.



A photo of a large colony of *Acropora monticulosa*.



A photo of a colony of *Acropora monticulosa*. The wide spaces in the center are very unusual, and may be a form of disease called a “growth anomaly.”



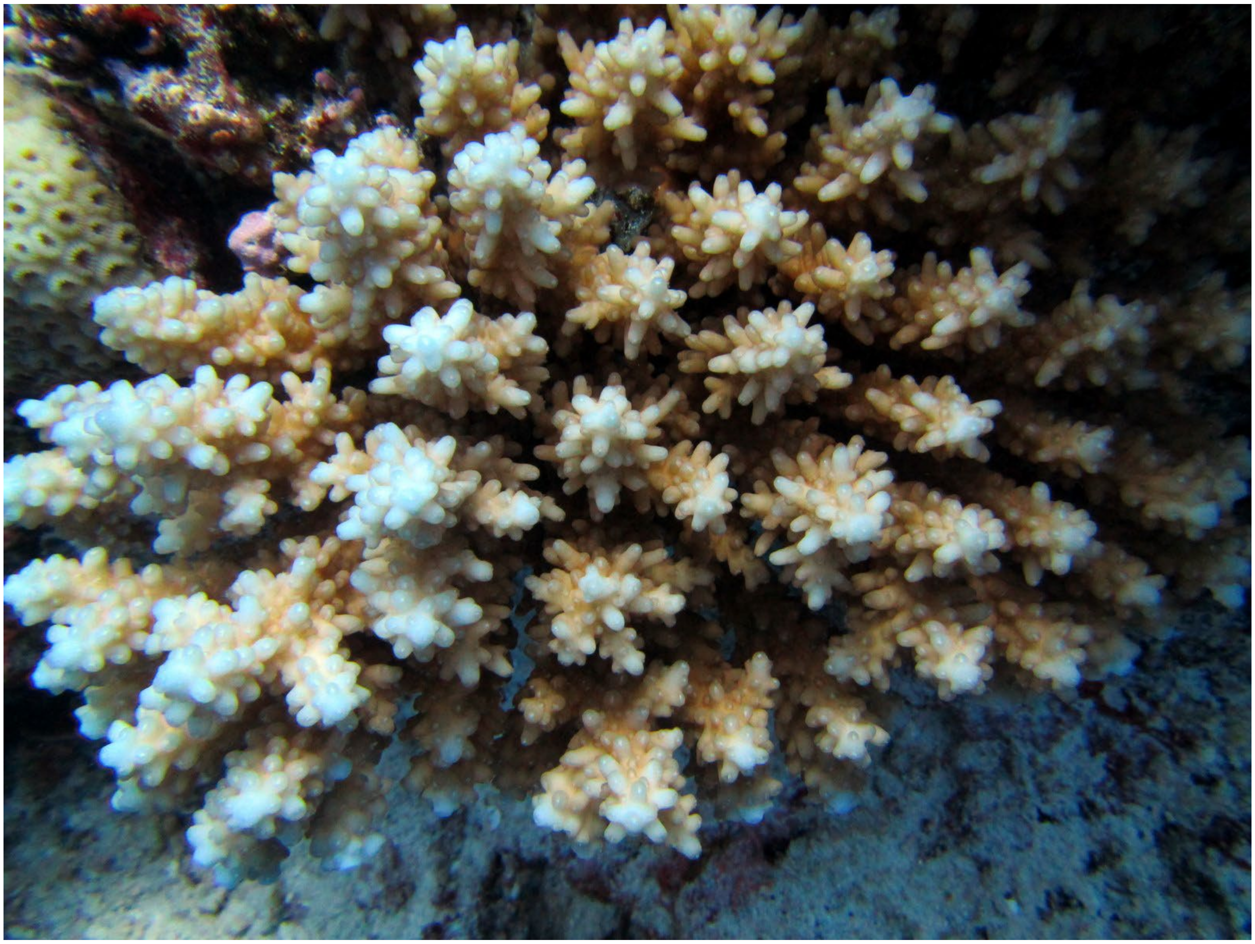
A photo of *Acropora monticulosa*. The cracks are unusual. Such cracks usually indicate the presence of little commensal fish or crabs in the cracks.

A close-up photo of *Acropora monticulosa*.

Acropora retusa Vulnerable Threatened

Colonies are digitate, with branches that are fairly short, close together, and that look very spiky. The axial corallite is not much larger than the radial corallites, though may extend fairly far. Radial corallites are highly variable in length giving the spiky appearance. Radial corallites have thick walls and are rounded. Colonies look much spinier than any other digitate *Acropora*.

A colony of *Acropora retusa*.



A photo of *Acropora retusa*.

A close-up photo of *Acropora retusa*.

Acropora digitifera

Colonies are digitate, with thin branches that are close together and usually do not taper. Usually branches have blue tips, although the blue usually is much lighter in pictures taken with digital cameras (like here). The axial corallites are small and the radial corallites are short and have an extended lower lip, and point towards the branch tip. This species prefers shallow water, often near the reef crest. The branches are thinner than most digtate *Acropora,* usually have blue tips, and have short uniform radial corallites.

A photo of *Acropora digitifera*. This colony has especially light branch tips.

A photo of a colony of *Acropora digitifera* that has more blue branch tips but more side branching.

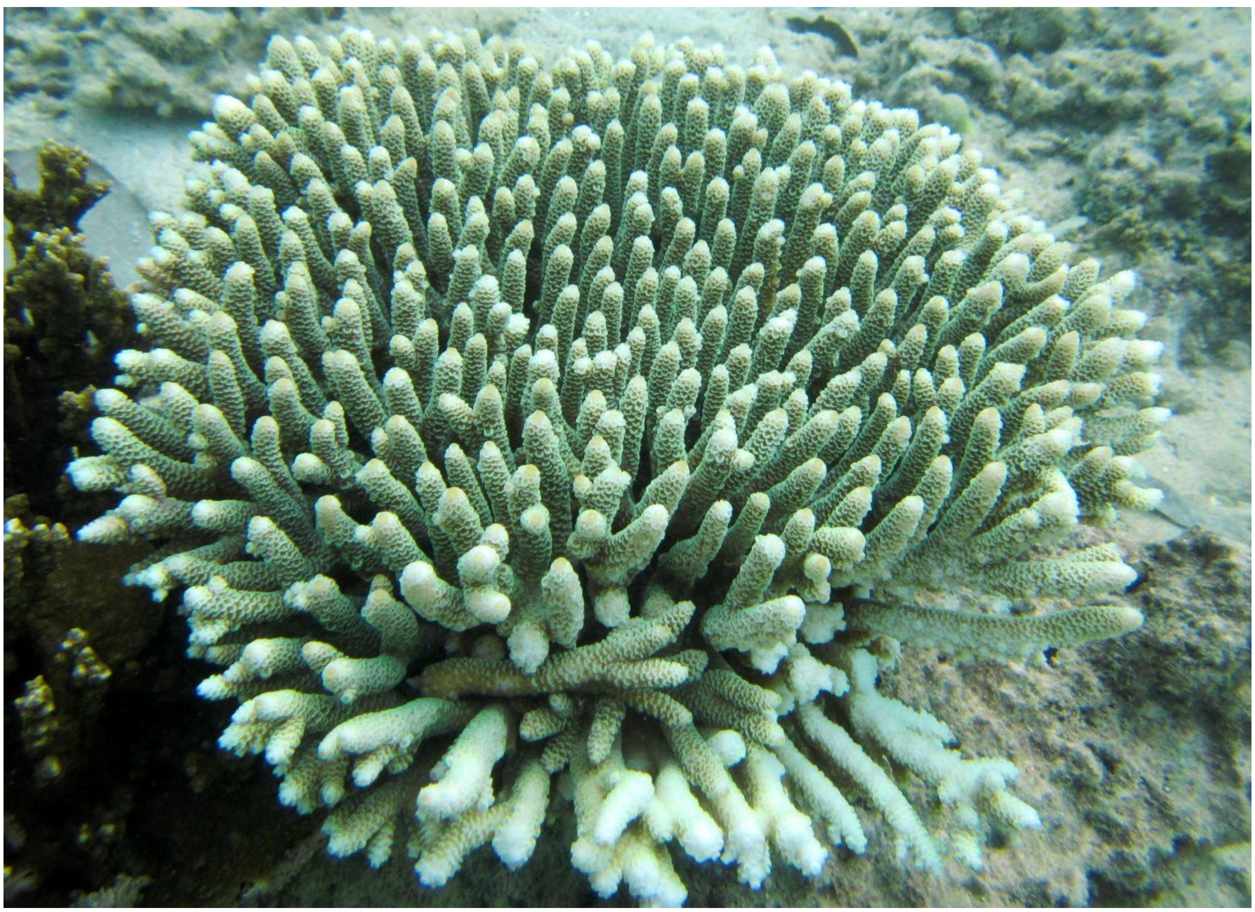
A close-up photo of *Acropora digitifera*.

Corymbose

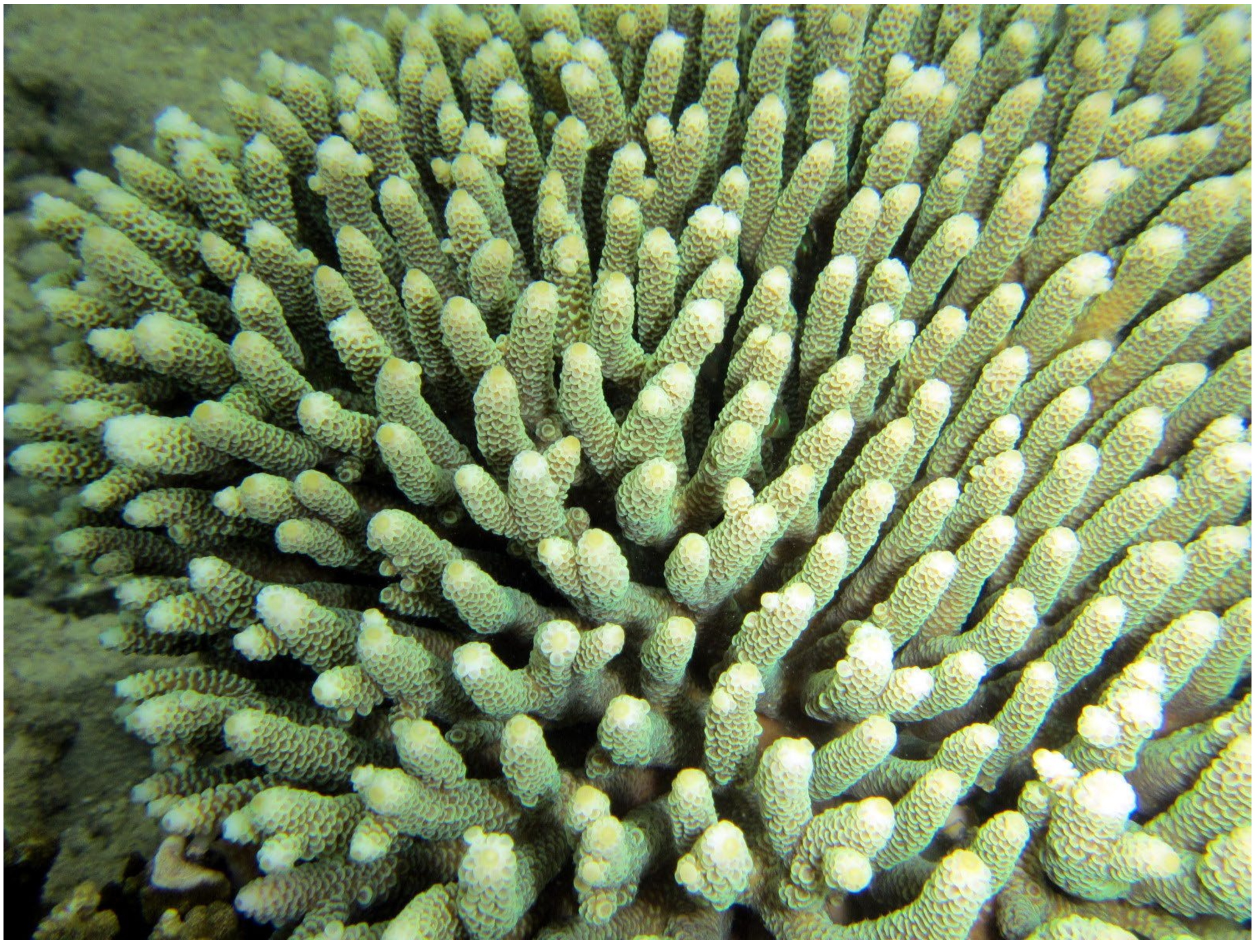
Colonies have a small central base, from which small branches radiate. Branches in the center grow upward a certain distance and then stop. Branches on the edge grow outward and then curve upward until they are vertical and then grow upward the same distance as other branches and stop. Where radiating branches start to grow upward, they branch and one branch continues to grow horizontally before branching again and curving upward. From above, the viewer sees vertical, parallel branchs that all grow to the same height and stop growing.

Acropora millepora

Colonies are corymbose with thin, fairly long branchlets growing vertically, parallel. The branches are neat and uniform, with no side branching. The radial corallites are flattened lower lips which are leaf-like and very close together. *Acropora digitifera* has less leafy radial corallites, usually has blue branch tips, and is restricted to shallow water. *Acropora tenuis* looks similar, but the radial corallites are more curved to be trough-like, and may be farther apart. *Acropora surculosa* has fused branches, long extended tentacles, and corallites do not extend as far from the branch.



A photo of *Acropora millepora*. The branches at the bottom have been broken.



A close photo of *Acropora millepora*.

A close-up photo of *Acropora millepora*.

Acropora tenuis

Colonies are corymbose with vertical branchlets. In some colonies there may be some short side branches. Radial corallites are U-shaped or trough shaped. Radial corallites are more U-shaped and may be farther apart than on *Acropora millepora*. *Acropora surculosa* has fused branches, long extended tentacles, and radial corallites do not extend as far.

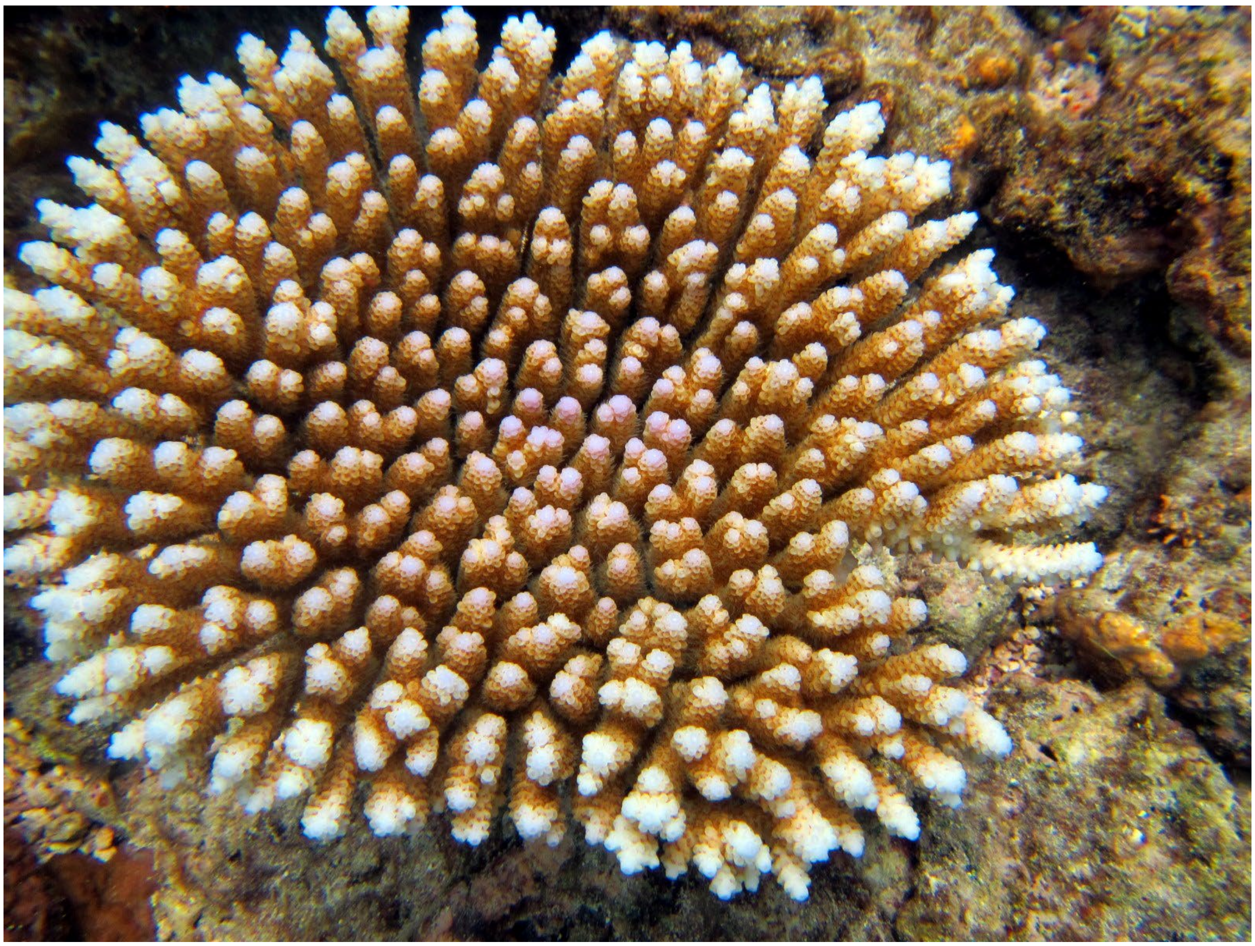
A photo of *Acropora tenuis*.

A photo of *Acropora tenuis*.

A close-up photo of *Acropora tenuis*. This colony has more side branches than usual.

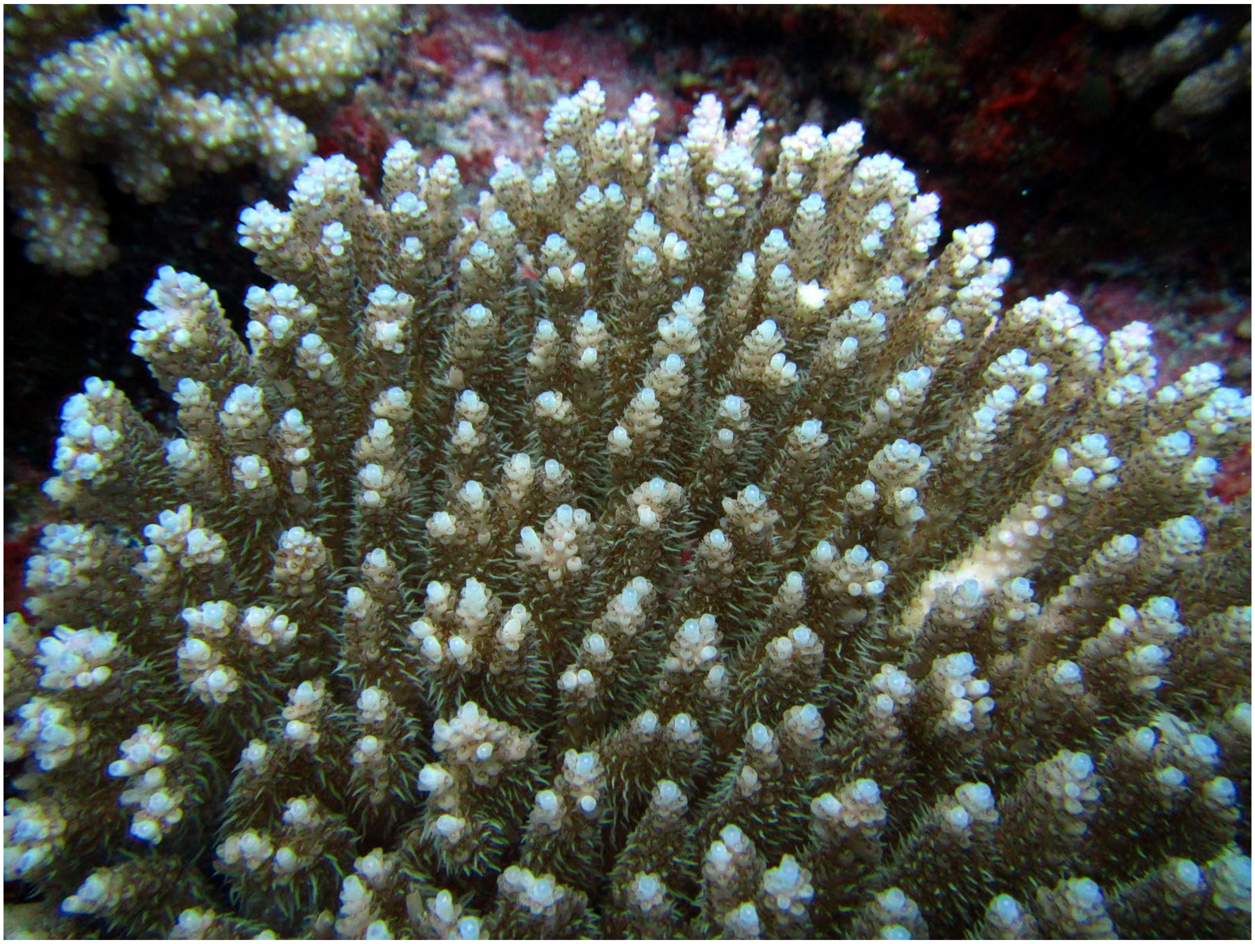
Acropora surculosa

Colonies are corymbose with vertical branches. Colonies reach about 20 or 30 cm diameter at most. Some of the branches fuse, anything from just a few fused branches to nearly every branch fused. Fused branches may appear to be branches with a crack between them, or a branch with multiple branch tips. There can be anything from just two fused branches to many in one cluster. Branch tips are usually rounded when it appears that two branches are fused with a crack between, while when it appears there are multiple branch tips the tips are sharper. Almost always, there are very long tentacles extended, at least near the base of branches. The radial corallites have lower lips that are trough-shaped but have no upper wall, they are fused to the branch and point towards the branch tip. They do not extend far from the branch and may be hard to see with the extended tentacles. They do not extend as far as on *Acropora millepora* and *Acropora tenuis* and branches are fused more often. Veron (2000), Veron et al (2020), Wallace (1999); and Wallace et al (2013) do not recognize this species, they consider it to be a synonym of *Acropora hyacinthus*. However, they are very different, *Acropora hyacinthus* is tabular and can be several meters across, with a thin table top, supporting column, and smaller, shorter branchlets with different radial corallites and no tentacle extension. Randall and Myers (1983) recognize this species.



A photo of a colony of *Acropora surculosa* with fused branches and rounded branch tips.

A photo of a colony of *Acropora surculosa* with nearly every branch being fused.



A close photo of a colony of *Acropora surculosa* with multiple branch tips and long tentacles visible.

A close-up photo showing the corallites in a colony of *Acropora surculosa*.

Acropora verweyi

Colonies are corymbose, with uniform branches and big axial corallites. Radial corallites are uniform, short, fat, and angled strongly towards the branch tip. The axial polyp can sometimes be seen as a tiny purple dot in the middle of the yellow axial corallite (which has very thick walls). Colonies are usually brown. Radial corallites are thicker and the axial corallites are larger than other corymbose species. The branches and radial corallites are more uniform than on *Acropora austera*.

A photo of *Acropora verweyi*.

A photo of *Acropora verweyi*.

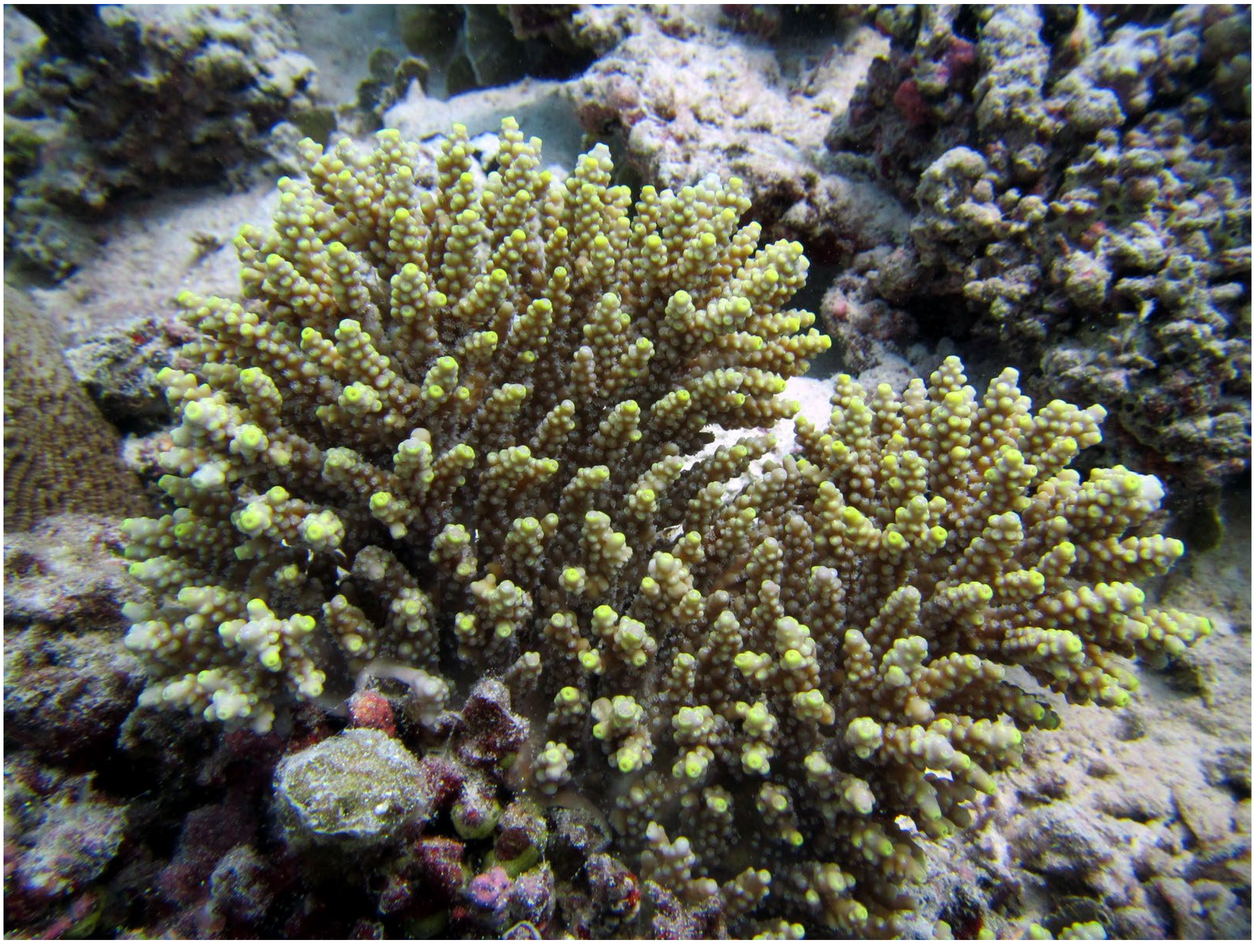
A close-up photo of *Acropora verweyi*, showing the uniform, short, fat radial corallites pointed towards the branch tip.

Acropora chesterfieldensis

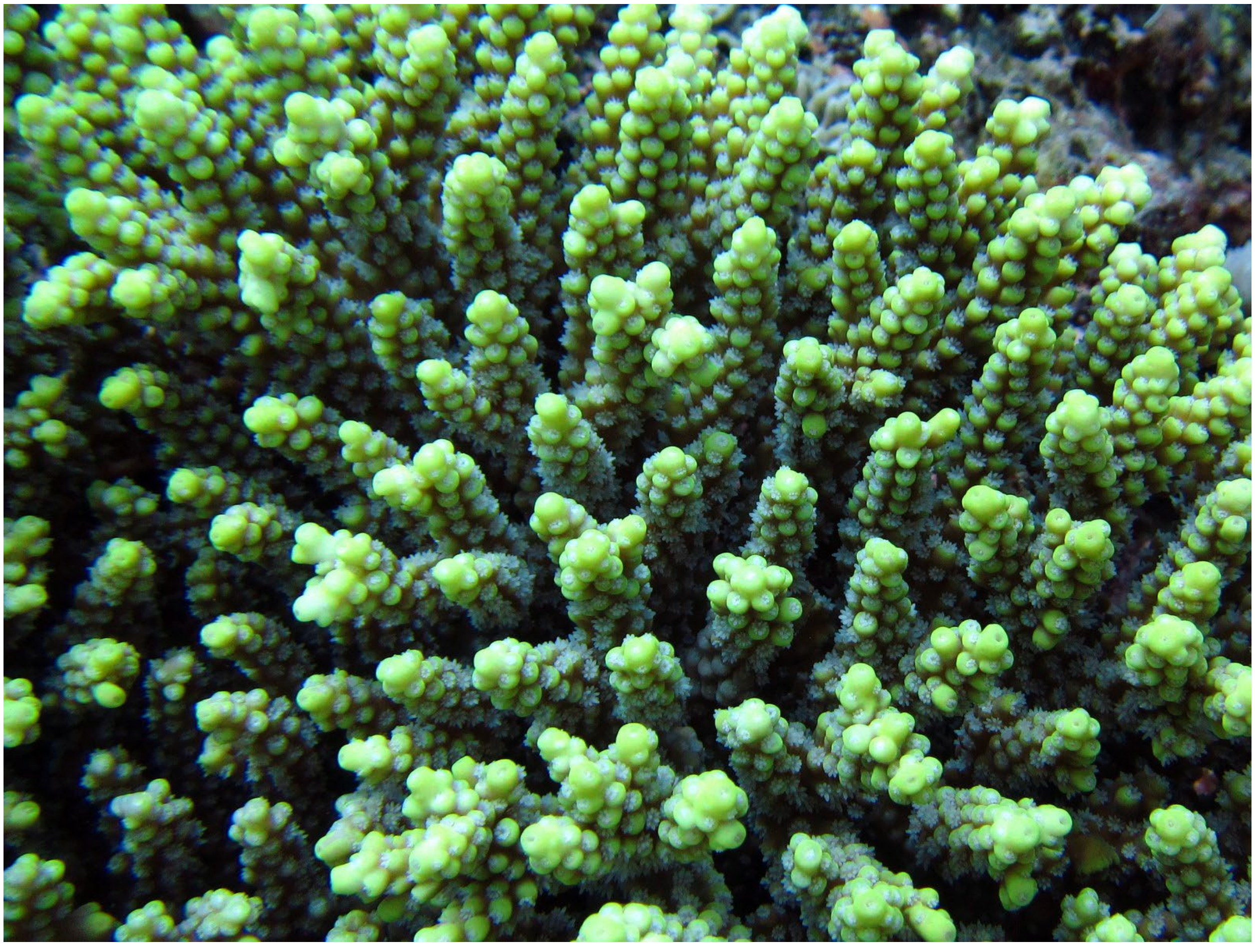
Colonies are corymbose, with parallel vertical branches. There is usually little side branching. Axial corallites are large, and radial corallites are uniform in size and shape, short with thick walls and pointing towards the branch tip. Colonies are most often green, light brown or grey, with axial corallites and polyps the same color as the rest of the colony. *Acropora verweyi* is very similar, but colonies are usually brown, the axials are larger and yellow with a tiny purple polyp.

A photo of *Acropora chesterfieldensis*.

A photo of a tan colony of *Acropora chesterfieldensis*.



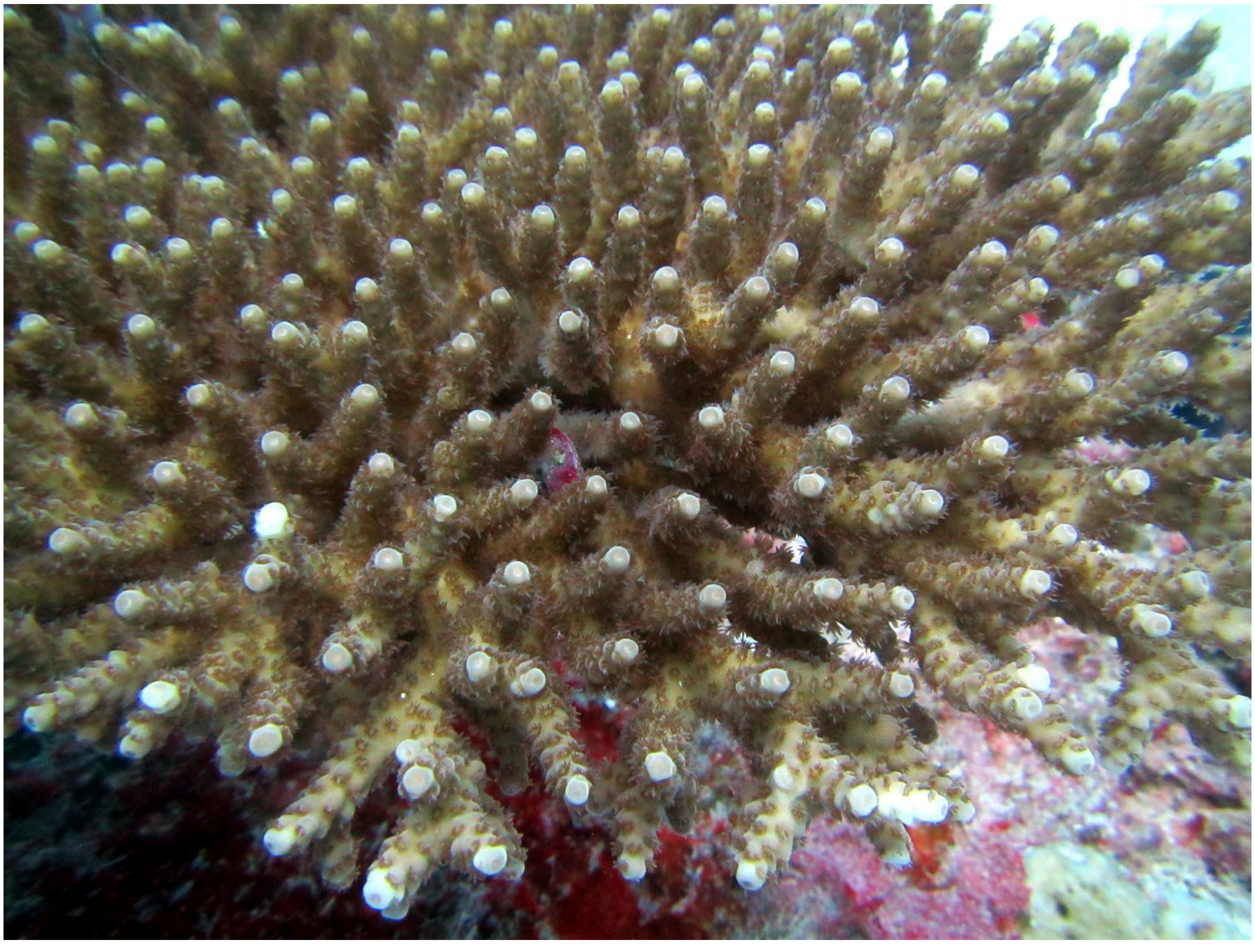
A closer photo of *Acropora chesterfieldensis*.



A close-up photo of *Acropora chesterfieldensis*.

Acropora dendrum

Colonies are corymbose and can reach perhaps a half meter diameter. Branches are uniform, vertical, widely spaced, thin and may taper a little. The axial corallite is medium sized. Radial corallite are small and nearly immersed. This seems to be a rare species. Other corymbose species have larger radial corallites.



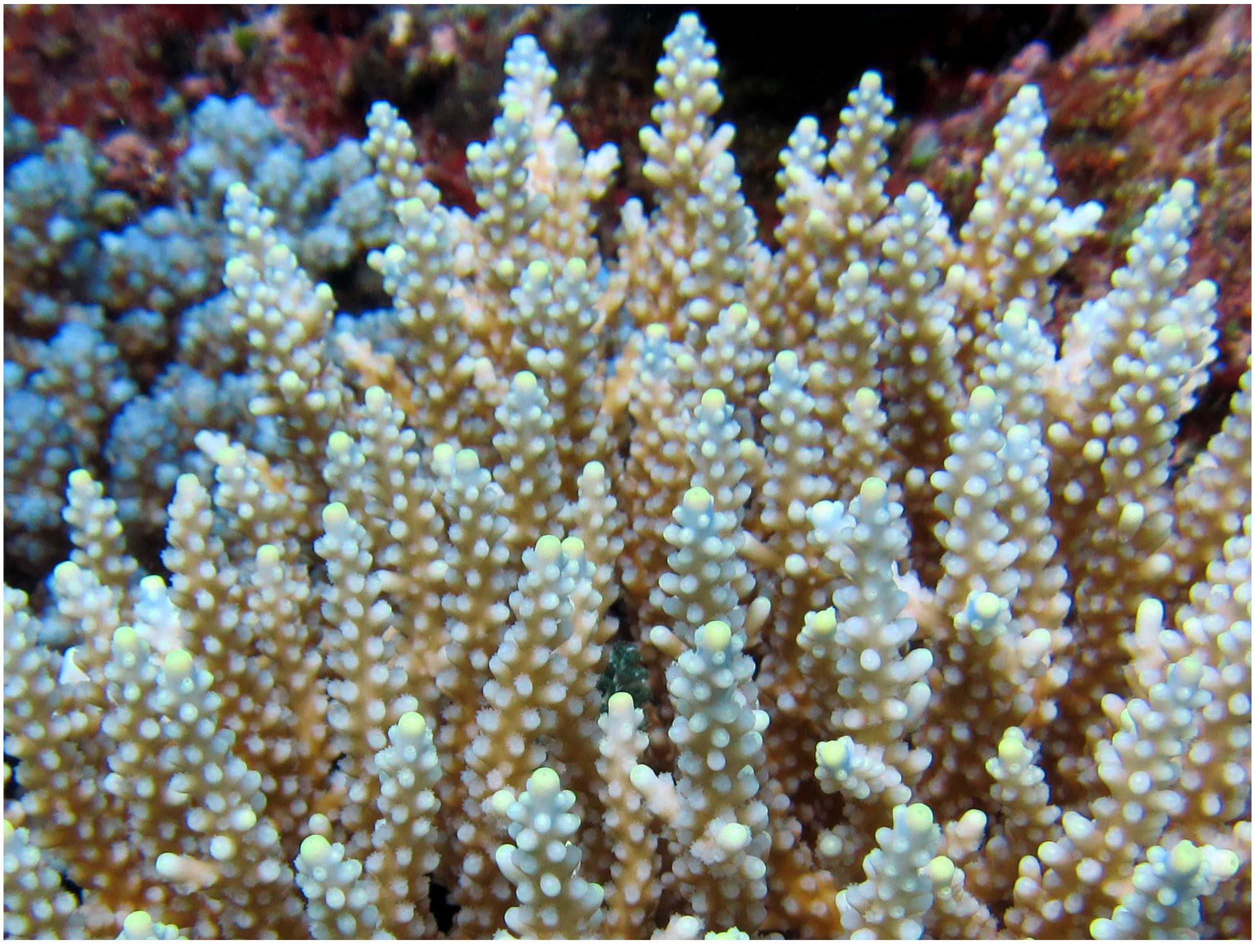
A close photo of *Acropora dendrum*.

Acropora secale

Colonies are corymbose and usually less than 30 cm diameter. Branches look rough because the radial corallites project variable amounts. Axial corallites are tubular and a bit larger than the radial corallites. Radial corallites are tubular, projecting from the branch, often at an angle towards the branch tip. Radial corallites are thick walled and smooth, with rounded lips. The longest radials are quite long. Colonies are often bright colors such as blue or purple. *Acropora nana* and *Acropora valida* can have similar coloration but their radial corallites do not extend from the branch. *Acropora polystoma* has larger branches with even longer radial corallites which have upturned openings. *Acropora cerealis* has thinner branches with radials closer together.

A photo of *Acropora secale* with blue branches, yellow axials, and reddish-brown branch bases. This is a common color pattern.

A close photo of a colony of *Acropora secale* with more reddish-brown and less purple.



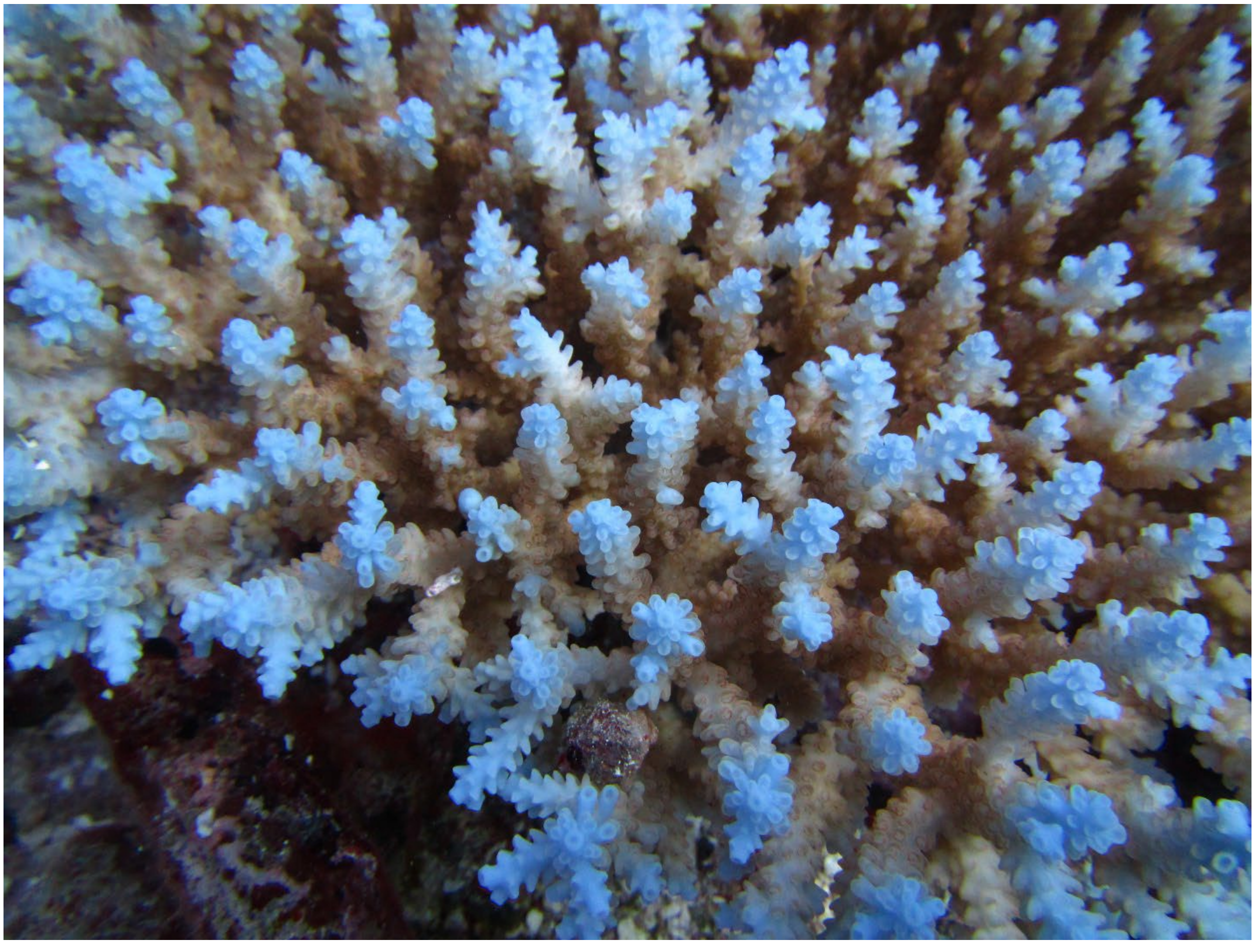
A close photo of a colony of *Acropora secale*.

Acropora cerealis

Colonies are corymbose with thin vertical branches. Axial corallites are small. Radial corallites are thin tubes that project from the branches. The radial corallites are a large part of the diameter of the branch. The branches and radial corallites are thinner than on *Acropora secale* and colonies do not have the intense blue or purple coloration. *Acropora nasuta* has thicker branches.

A photo of *Acropora cerealis.*

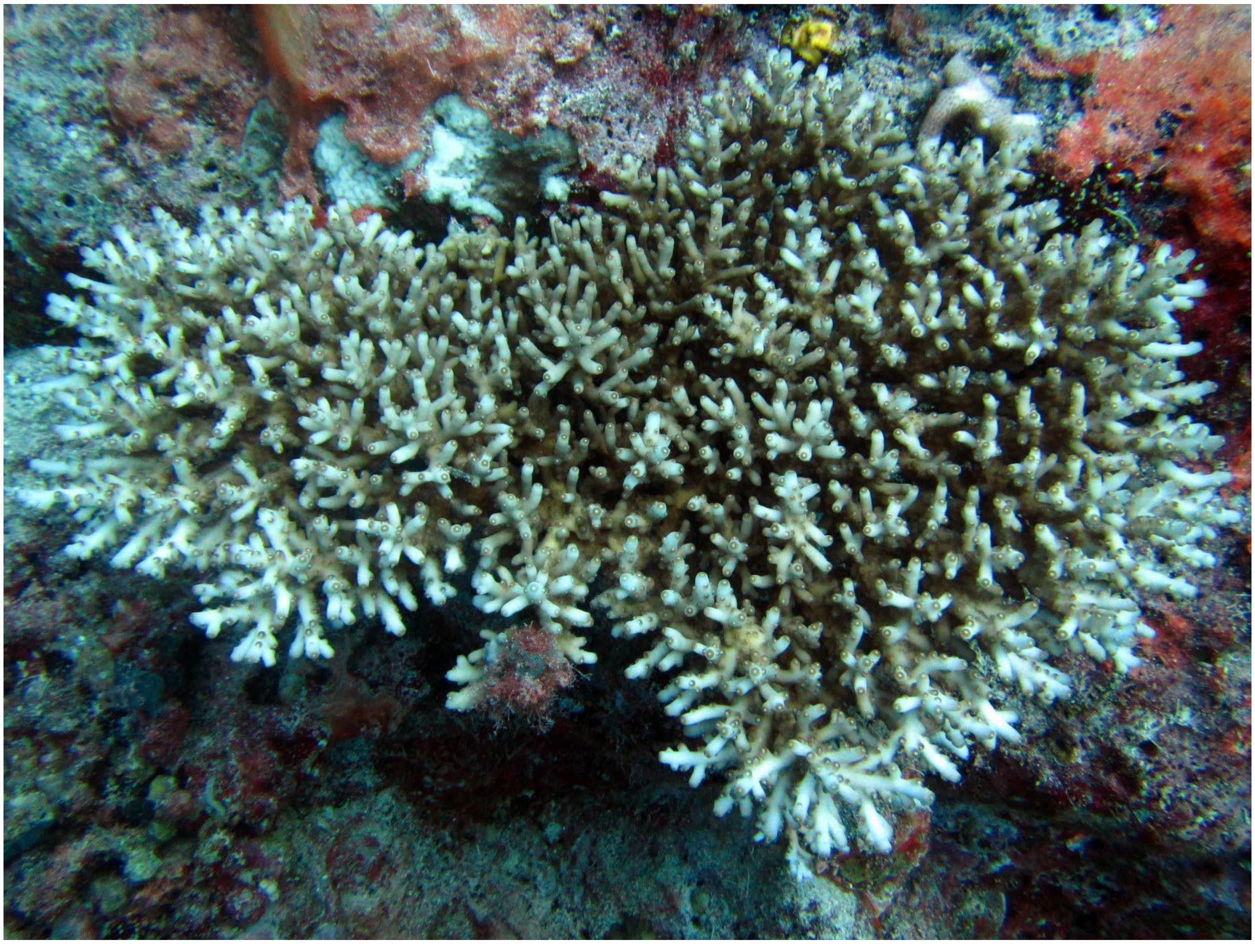
A colony of *Acropora cerealis*.



A close photo of *Acropora cerealis*.

Acropora granulosa

Colonies are cushions, usually with flat upper surfaces. Branchlets have very long tubular axial and "incipient axial" corallites. The latter come from the sides of the branchlets. The long tubular corallites are smooth and have thick walls and do not taper. The long tubular corallites of *Acropora carolineana* form radiating "Christmas tree" formations and/or taper. *Acropora speciosa* has thinner tubular corallites.

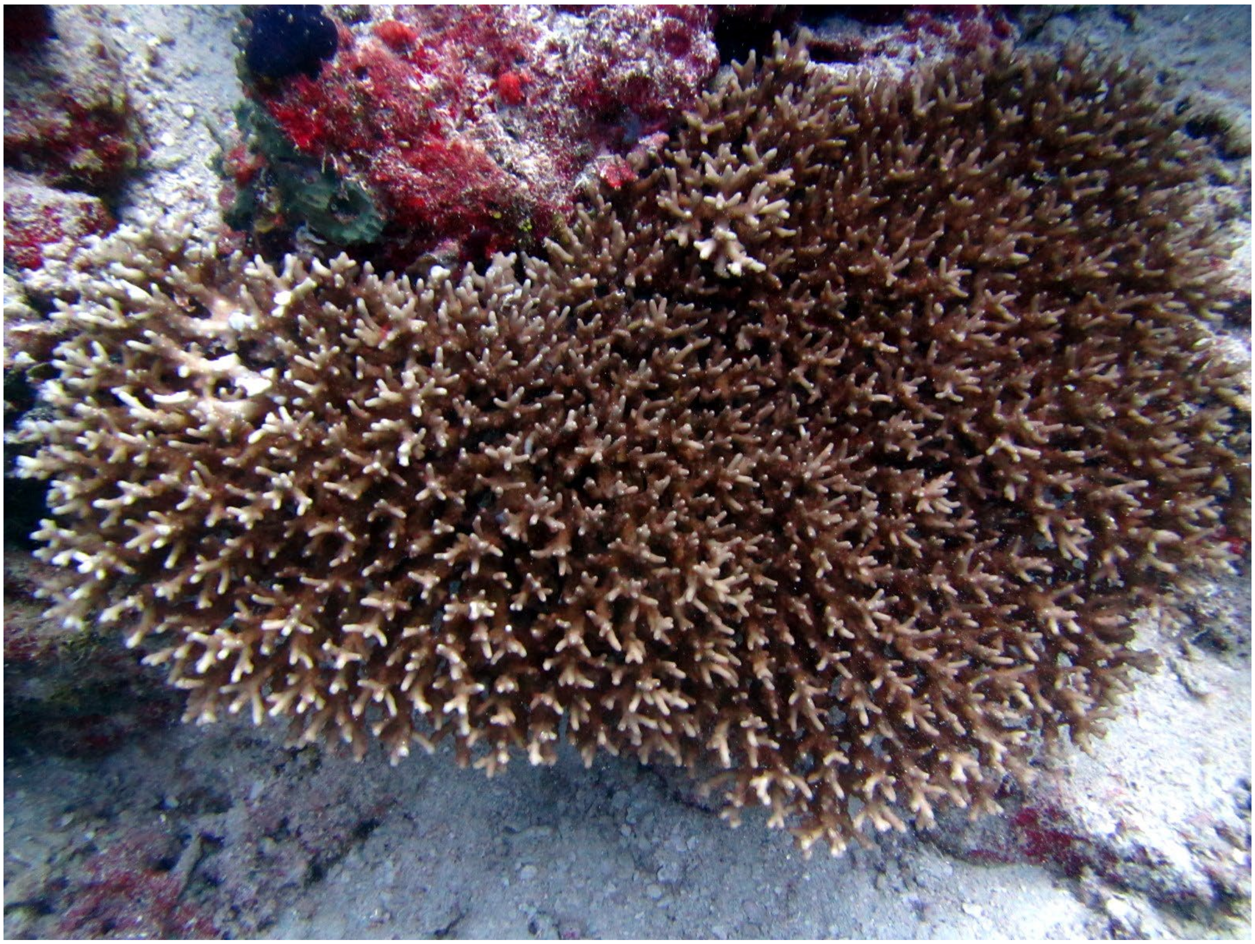


A photo of *Acropora granulosa*.

A close photo of *Acropora granulosa*.

Acropora speciosa

Colonies are flat-topped cushions or brackets. Axial corallites and incipient axials are long, smooth, thin tubes. Corallites are thinner than on *Acropora granulosa* and do not taper or form radiating “Christmas tree” type formations like *Acropora carolineana*. *Acropora jacquelineae* can only be distinguished reliably under the microscope from this species. Both *Acropora speciosa* and *Acropora jacquelineae* are more common in deeper water.

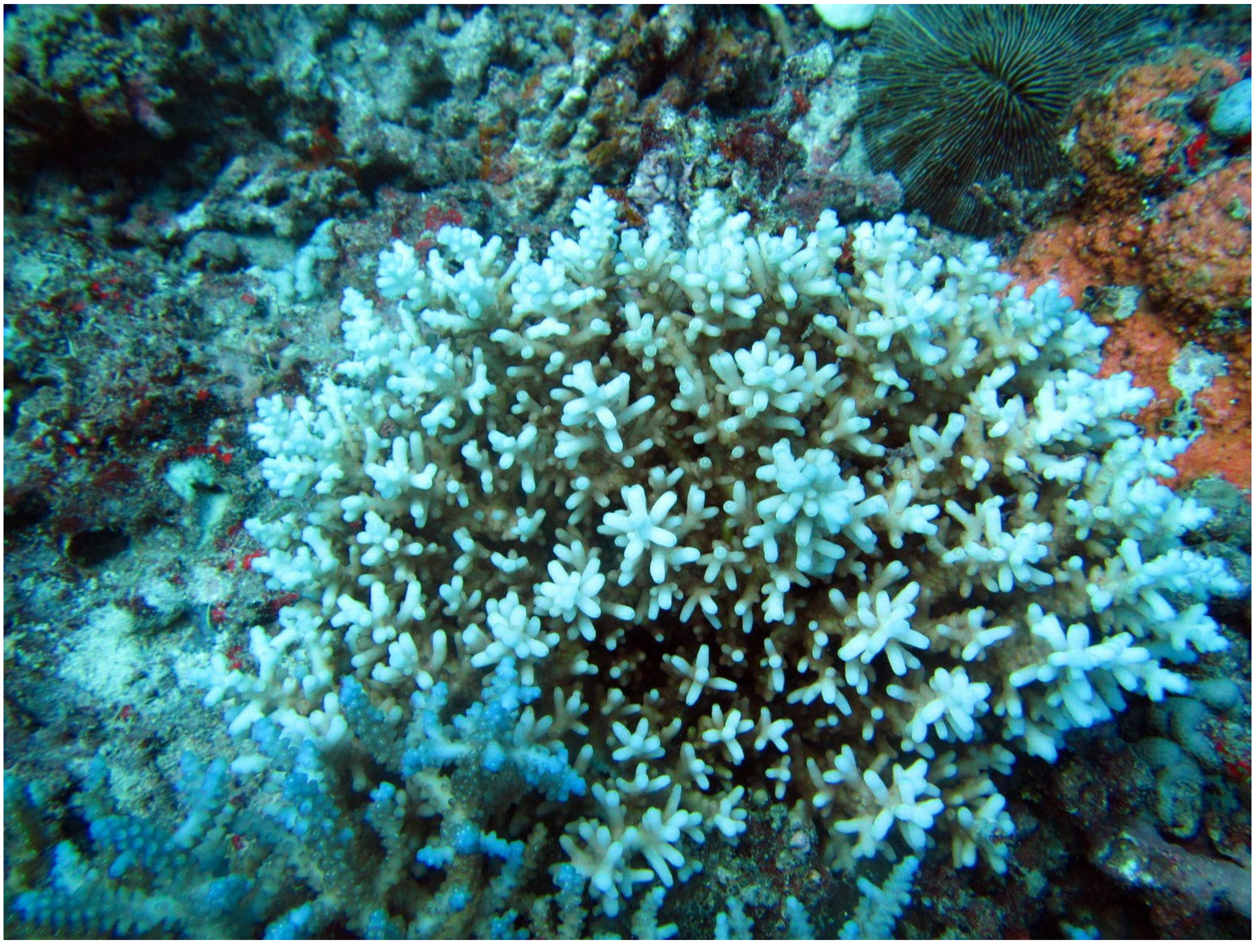


A colony of *Acropora speciosa*.

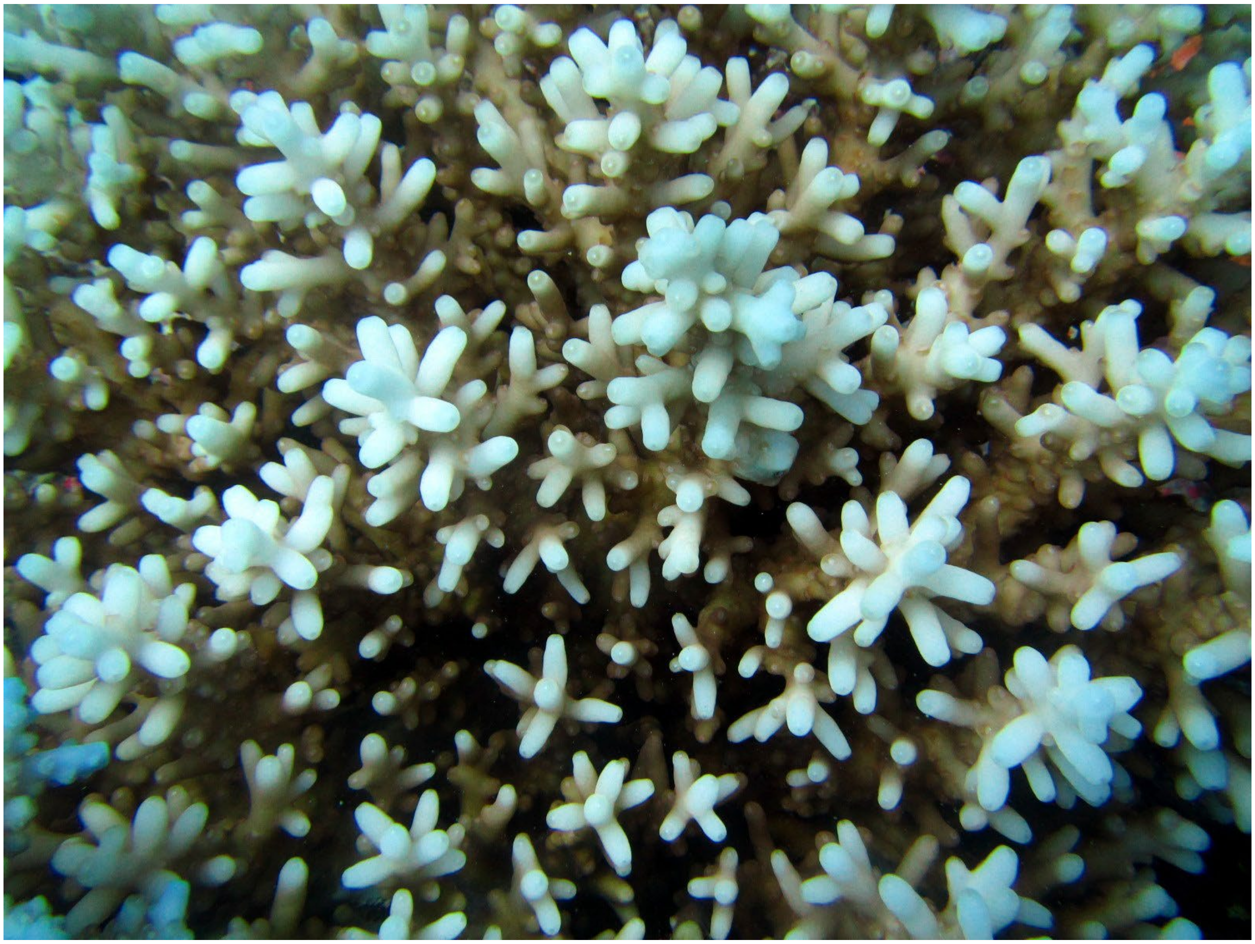
A close photo of *Acropora speciosa*.

Acropora carolineana

Colonies are small cushions. The upper surface is flat and has long tubular axial and incipient axial corallites. The corallites are relatively thick as on *Acropora granulosa*. Corallites taper and/or form "Christmas tree" like formations of radiating corallites. Corallites on *Acropora granulosa* do not taper or form Christmas tree like formation. Corallites on *Acropora speciosa* are thinner.



A photo of *Acropora carolineana*.



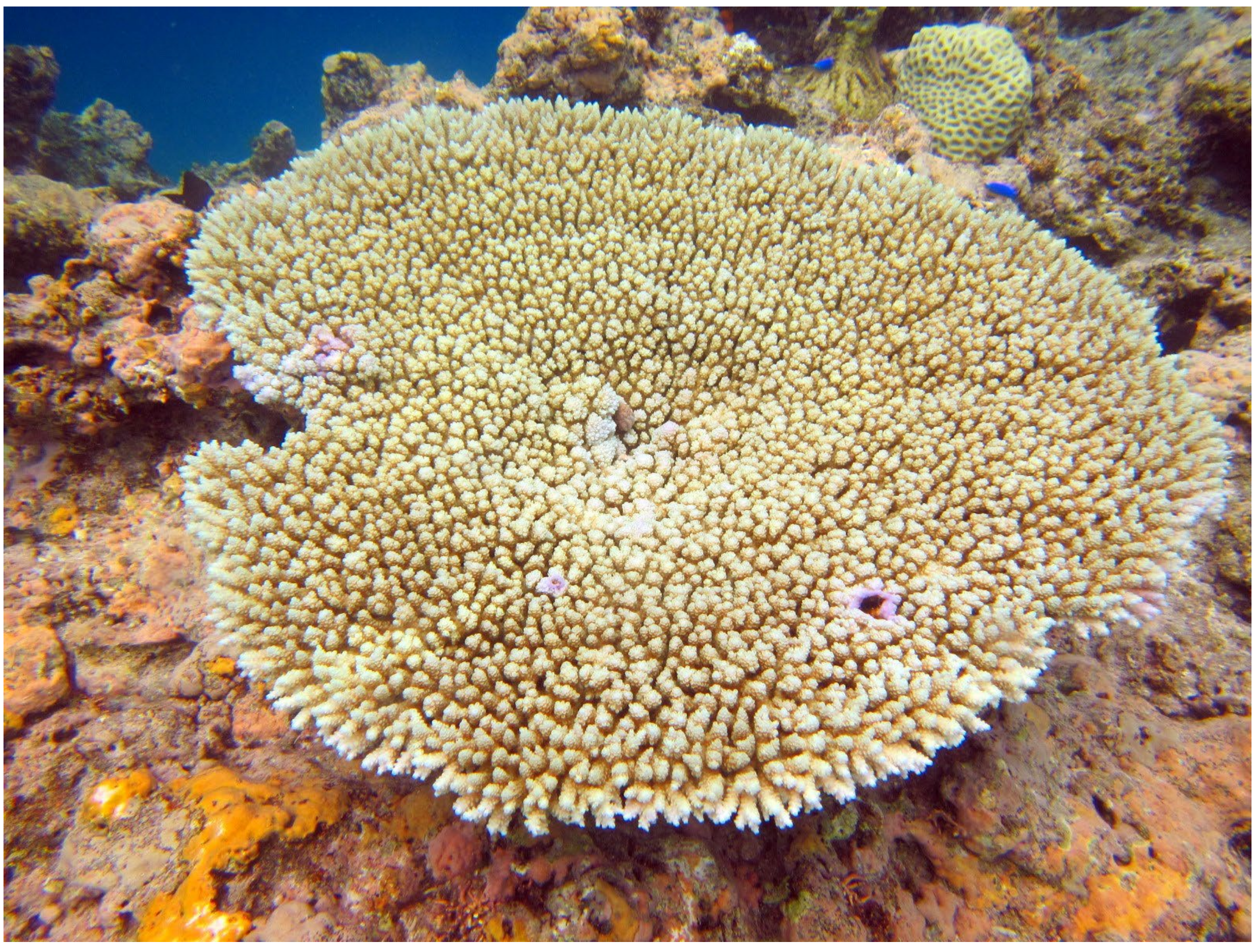
A close-up photo of *Acropora carolineana*.

Table Corals

Young colonies initially spread out to form an encrusting base. Then they grow a column up from that base, and then they grow horizontal branches out from the edge of the top of the column to form a nearly flat top which eventually can become quite large, and the whole coral resembles a table. Most species have branchlets on the upper surface which grow vertically and stop growing after growing a short distance. The branchlets are smaller than on corymbose corals.

Acropora hyacinthus

Colonies are table corals which can reach several meters across and have more then one tier. A young colony first builds an encrusting base, then a strong column, then starts building a nearly flat table-top. The top surface of the table has little branchlets which are vertical and thick. The axial corallite is small and tubular. Radial corallite are lower lips, looking leafy. *Acropora cytherea* has much thinner branchlets. *Acropora paniculata* has groups of diverging long incipient axial corallites. This species is more common in shallower water but can be found at a range of depths.



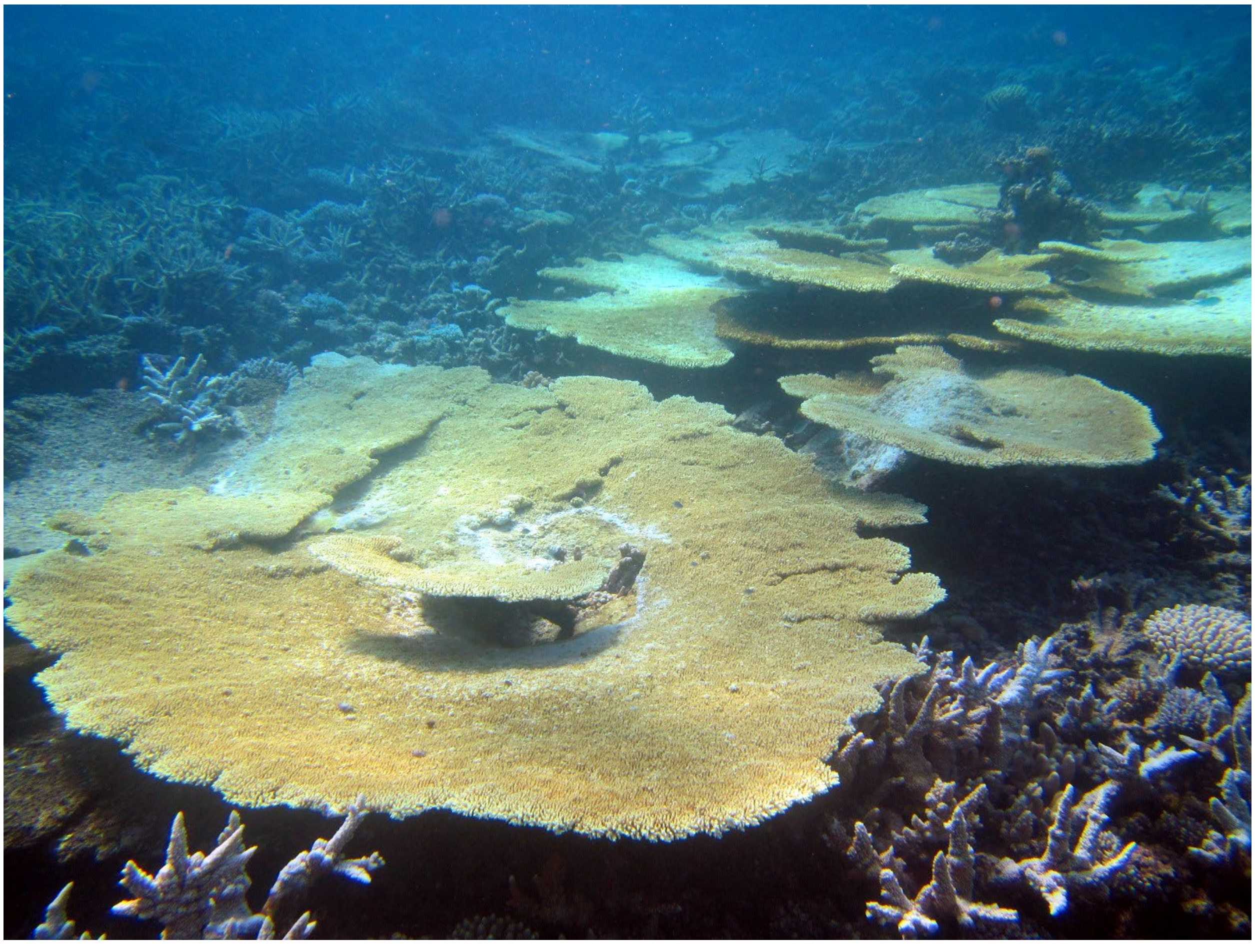
A photo of *Acropora hyacinthus*.

A close photo of *Acropora hyacinthus*.

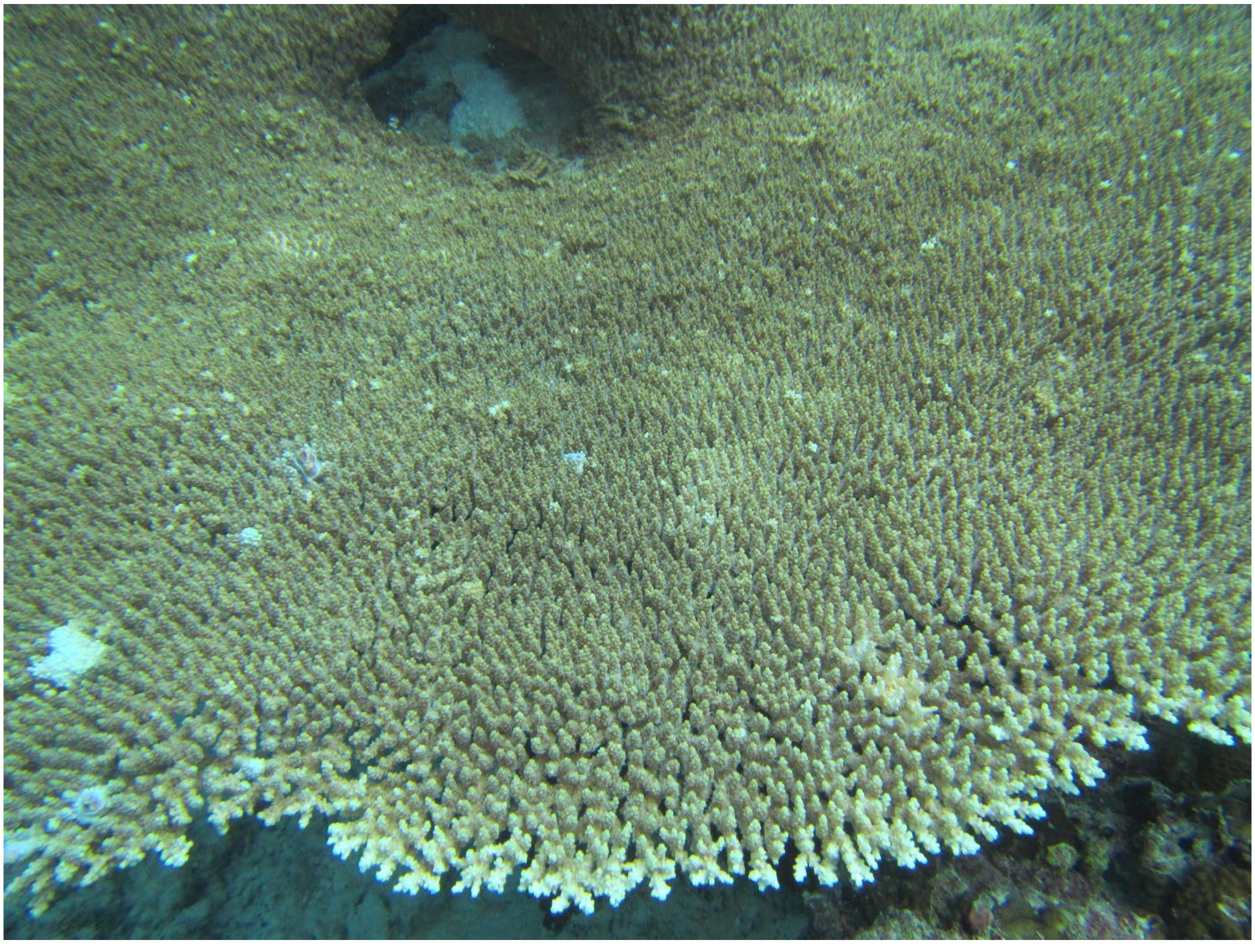
A close-up photo of *Acropora hyacinthus*.

Acropora cytherea

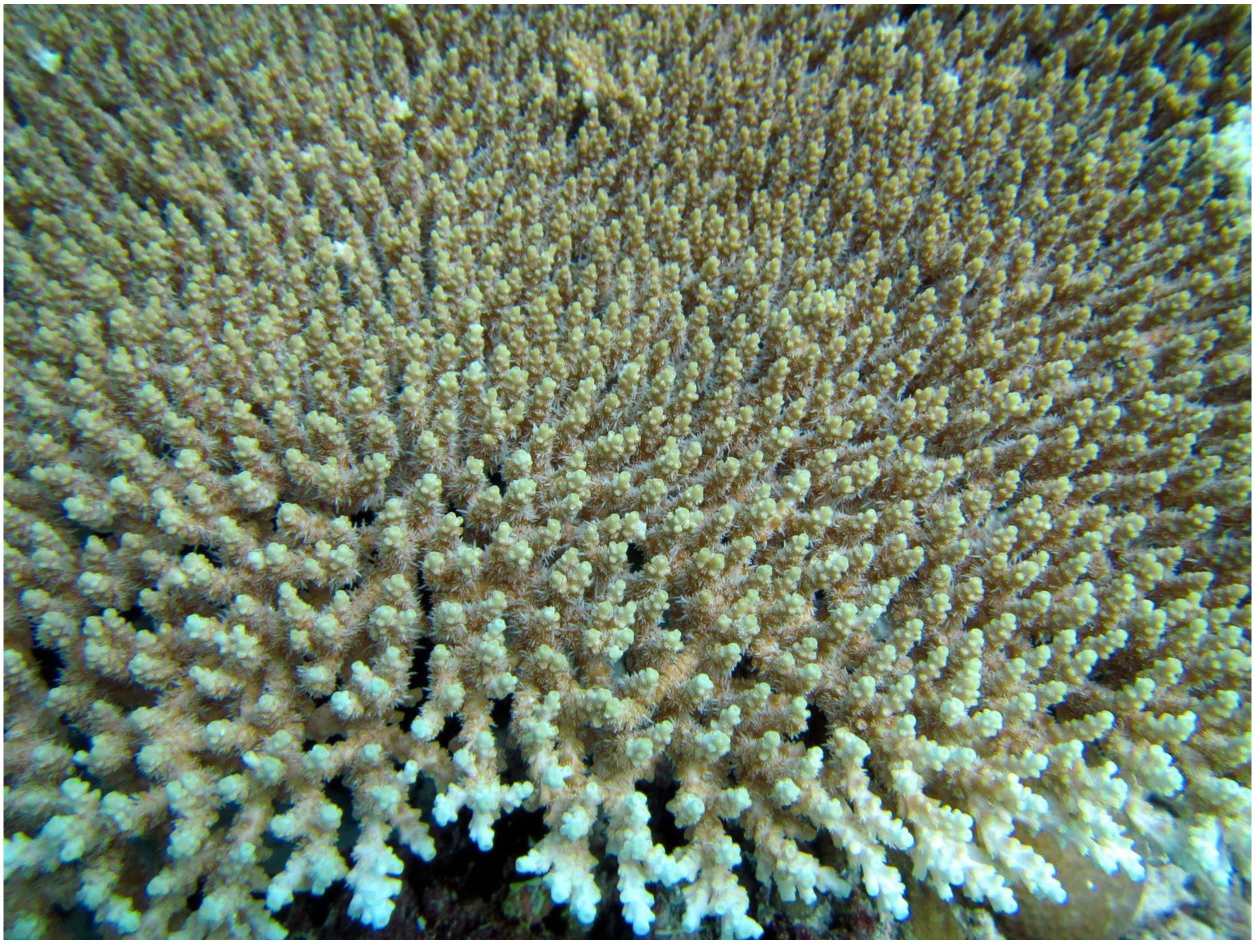
Colonies are table corals which can reach several meters across and have more than one tier. A young colony first builds an encrusting base, then a strong column, then starts building a nearly flat table-top. The top surface of the table has little branchlets which are vertical and thin. Axial corallites are thin tubes that can be moderately long. Sometimes branchlets have multiple tips. Radial corallites do not project from the branch. Branchlets are much thinner than on *Acropora hyacinthus*. Long incipient axials do not diverge from short branchlets as on *Acropora paniculata*.



A photo of *Acropora cytherea*.



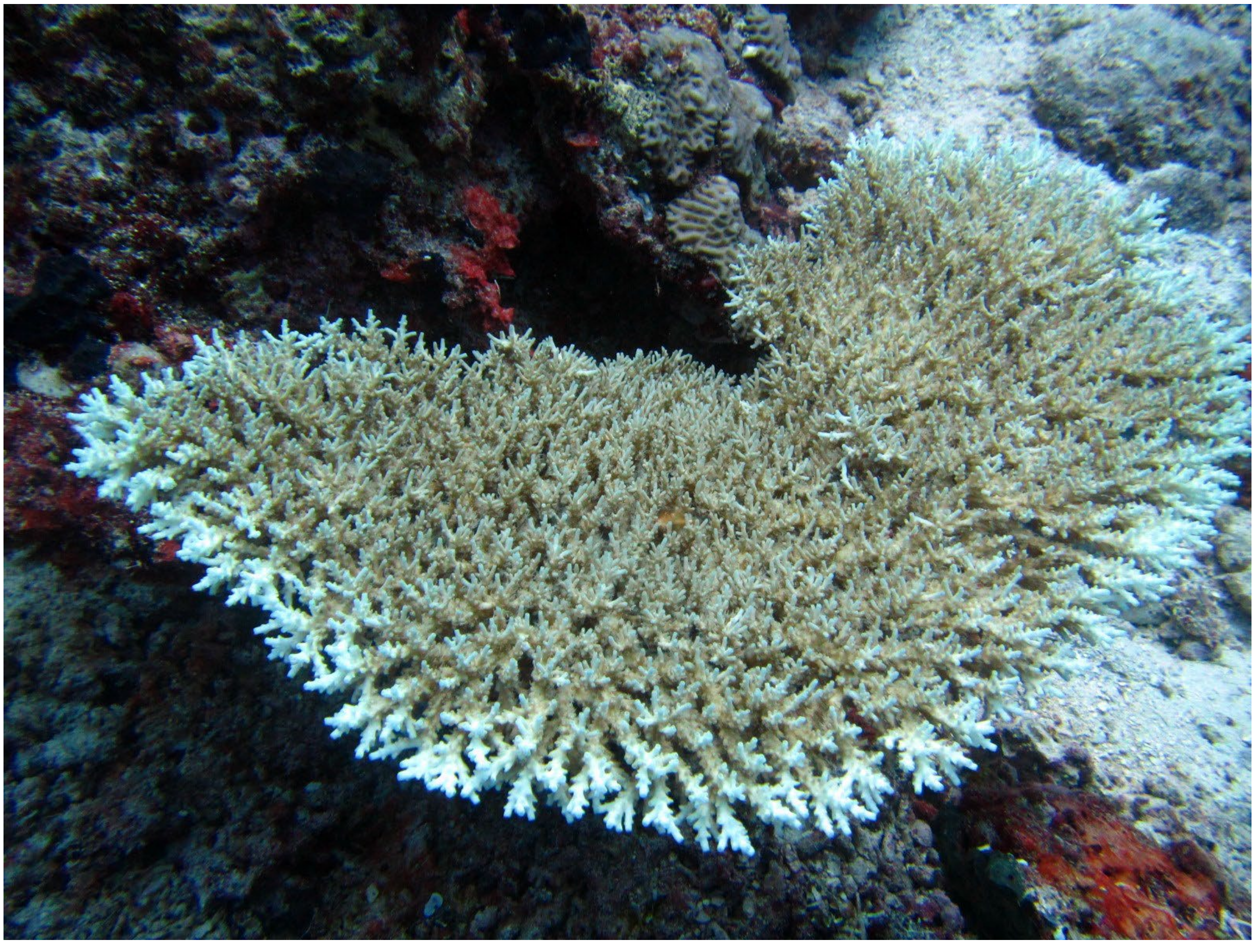
A closer photo of *Acropora cytherea*.



A close-up photo of *Acropora cytherea*.

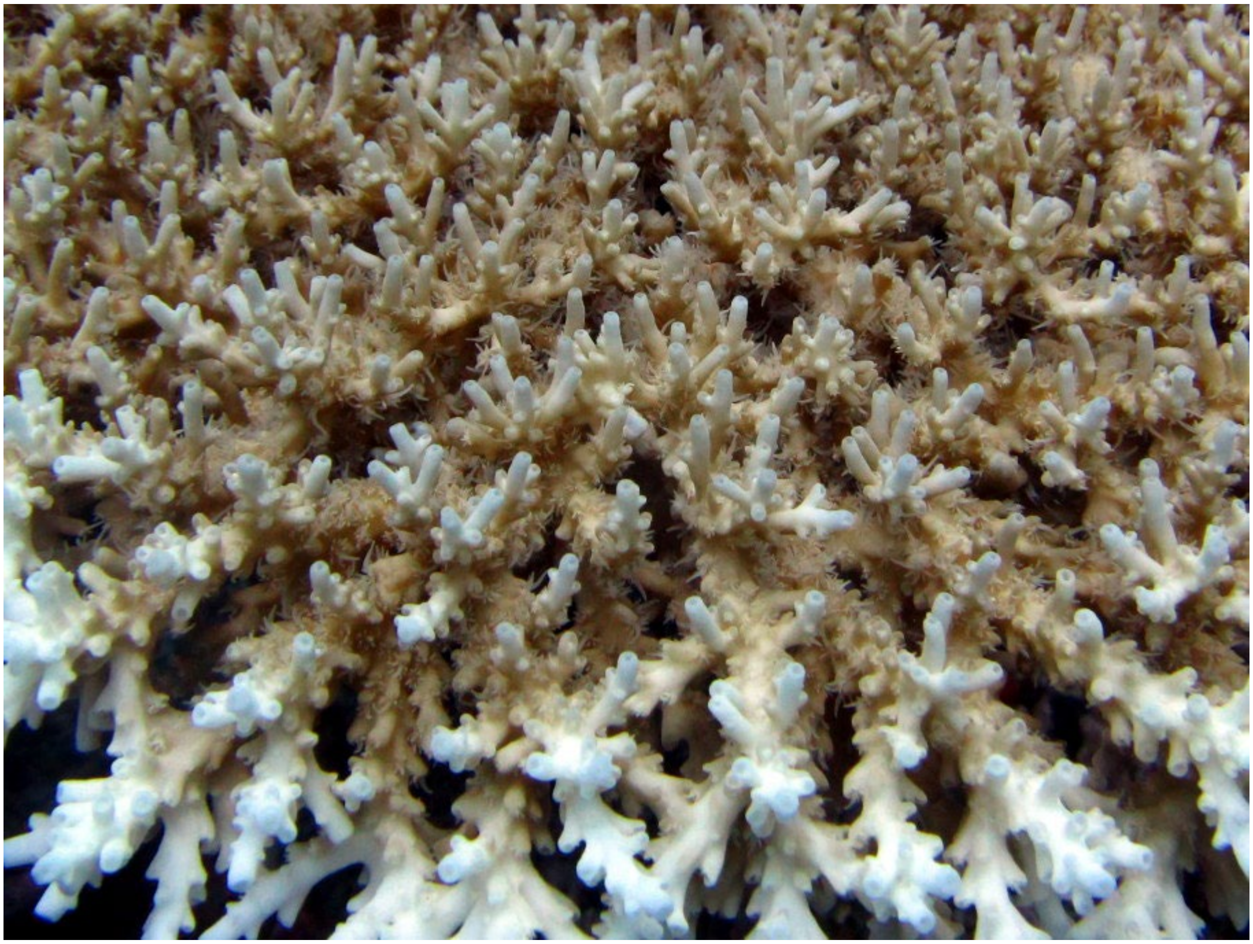
Acropora cf. paniculata sensu Wallace, 1999

Colonies can form tables but may be close to the substrate. The upper surfaces have very short branchlets that have long radiating axial and incipient axial corallites radiating from them. These corallites are very thin, only about 1 mm thick. *Acropora cytherea* has longer branchlets and does not have long radiating axial and incipient axial corallites. This species appears to match Wallace's (1999) concept of this species, but not the growth form of the type specimen.



A photo of *Acropora* cf. *paniculata*.

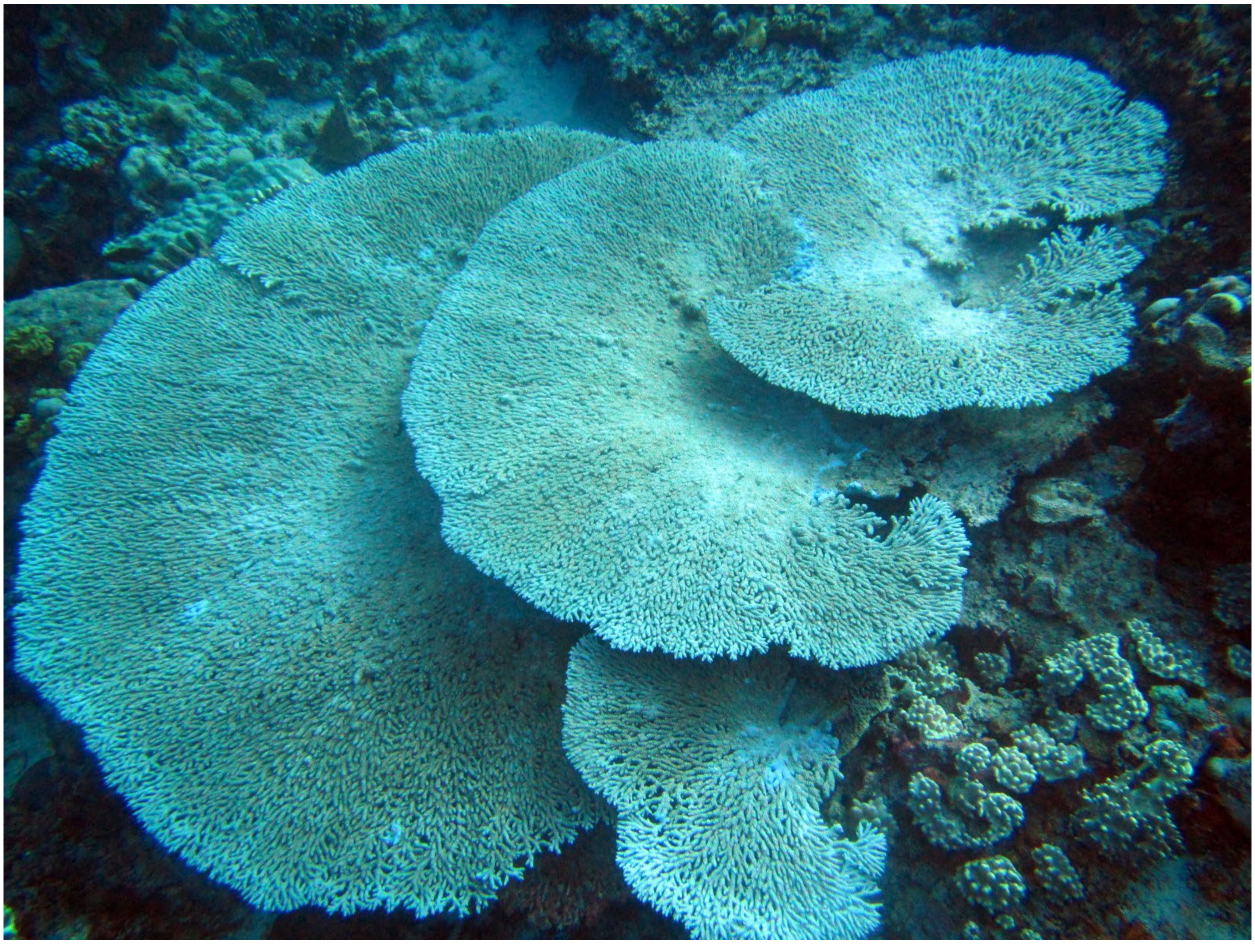
A closer photo of *Acropora* cf. *paniculata*.



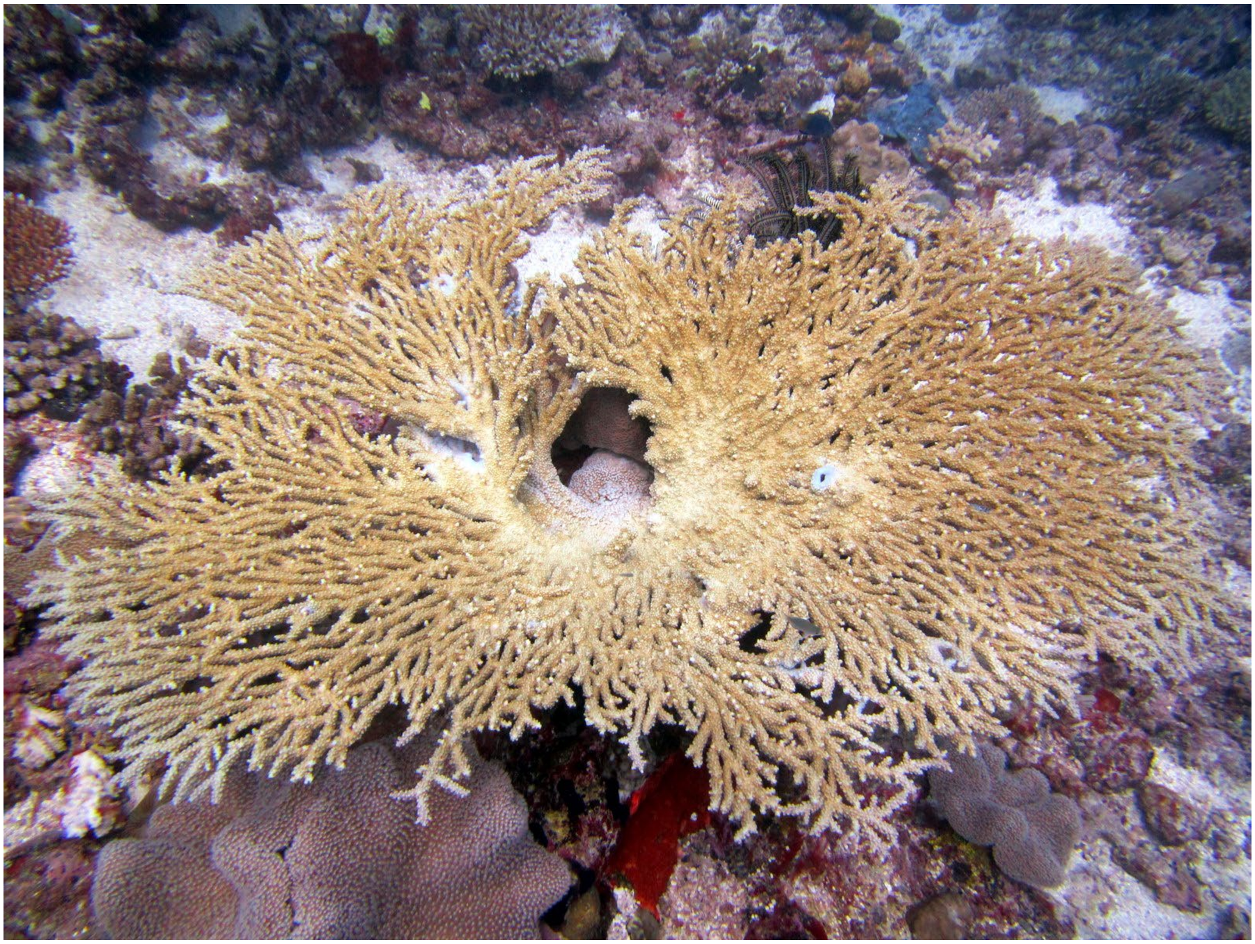
A close-up photo of *Acropora* cf. *paniculata*.

Acropora clathrata

Colonies form tables that can be several meters across. The table is formed of radiating horizontal branches that are pencil to small finger in thickness. There are no vertical branchlets. However, the tips of radiating branches are raised slightly above the plane of the table, but still point outward. The radiating horizontal branches may be fused together (though still distinguishable) or have gaps of various sizes in between branches. Most other tables have small vertical branchlets.

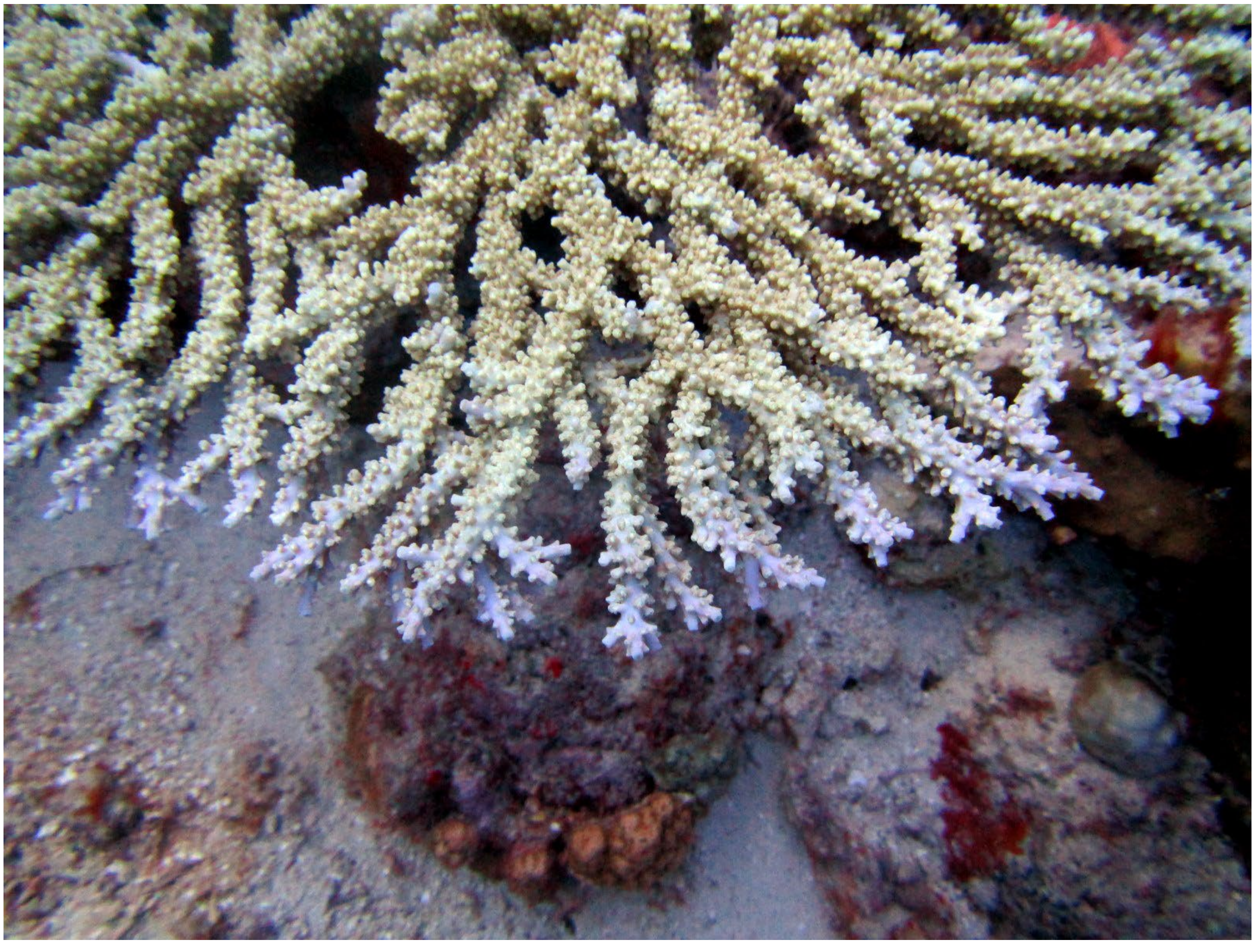


A photo of large *Acropora clathrata* tables



A photo of a colony of *Acropora clathrata* with spaces between branches.

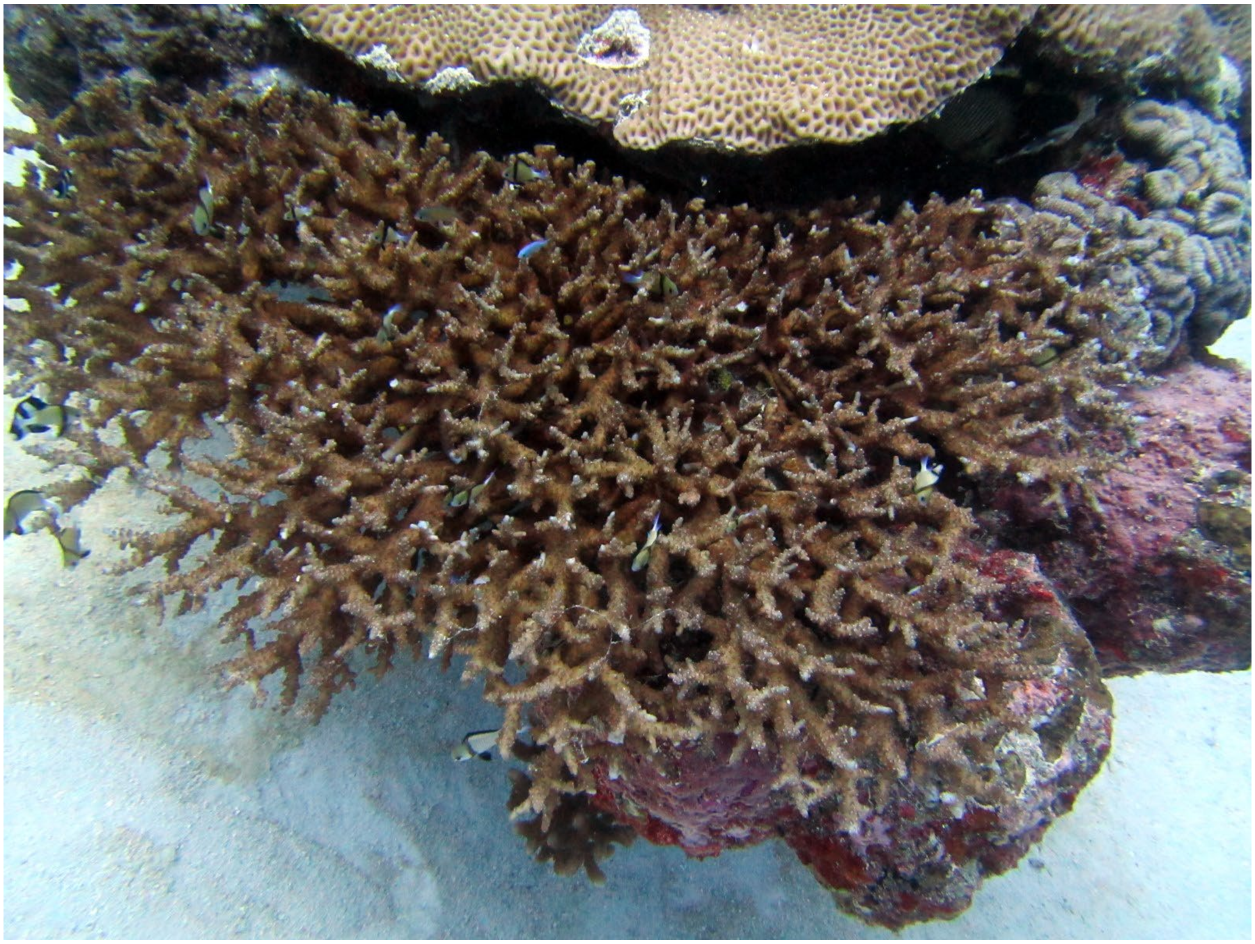
A photo of an *Acropora clathrata* table that is almost completely solid.



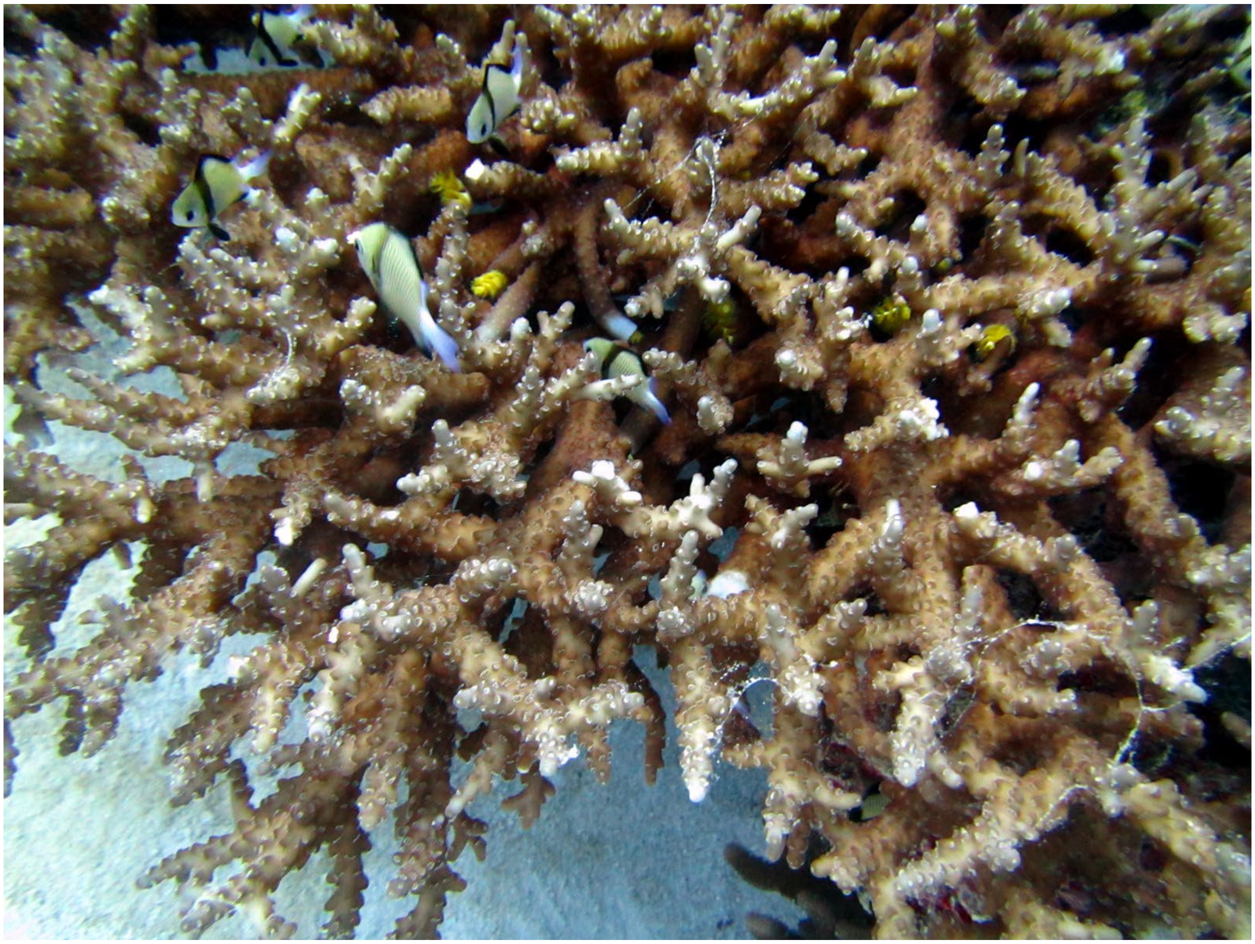
A close photo of *Acropora clathrata*.

Acropora solitaryensis

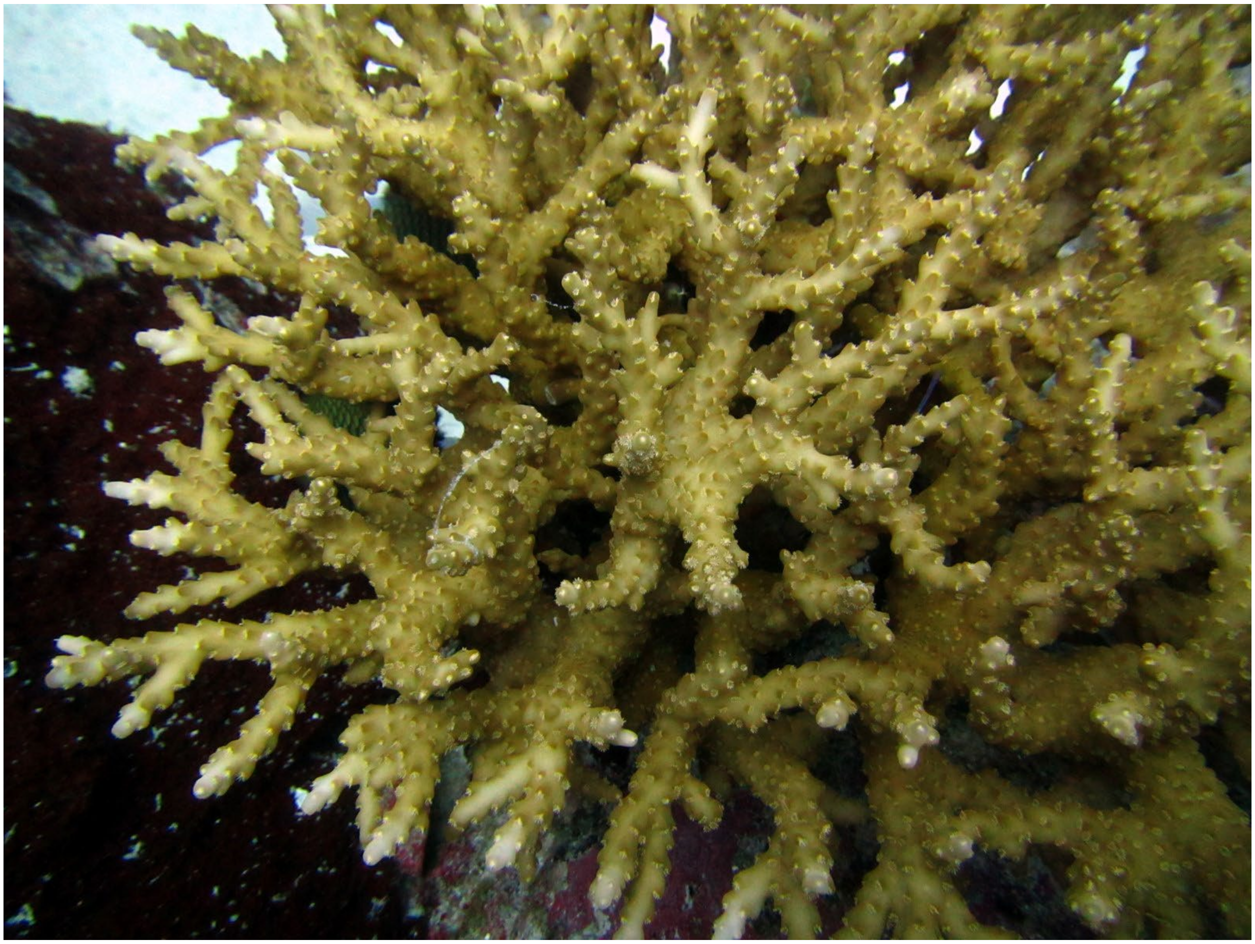
Colonies are horizontal and can be several meters across. Colonies can have fused horizontal branches or have wide spaces between horizontal branches. Usually there is some development of upward growing branchlets, though they may be long, widely spaced and quite irregular. Branchlets taper to sharp tips. This species is usually rare in the tropics. The table is more open between branches and branchlets than on other table corals.



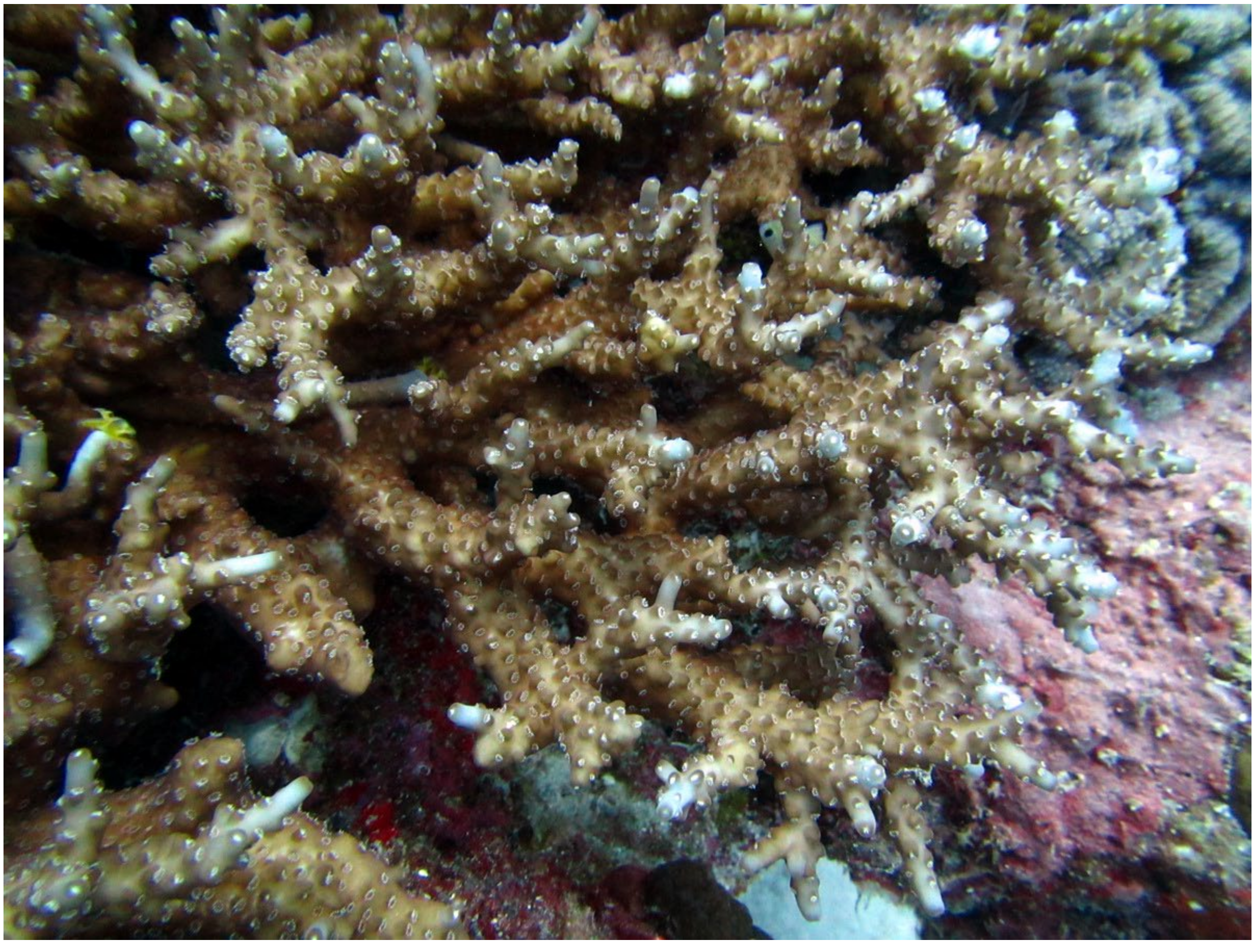
A colony of *Acropora solitaryensis*.



A closer photo of *Acropora solitaryensis*.



A closup photo of *Acropora solitaryensis*.



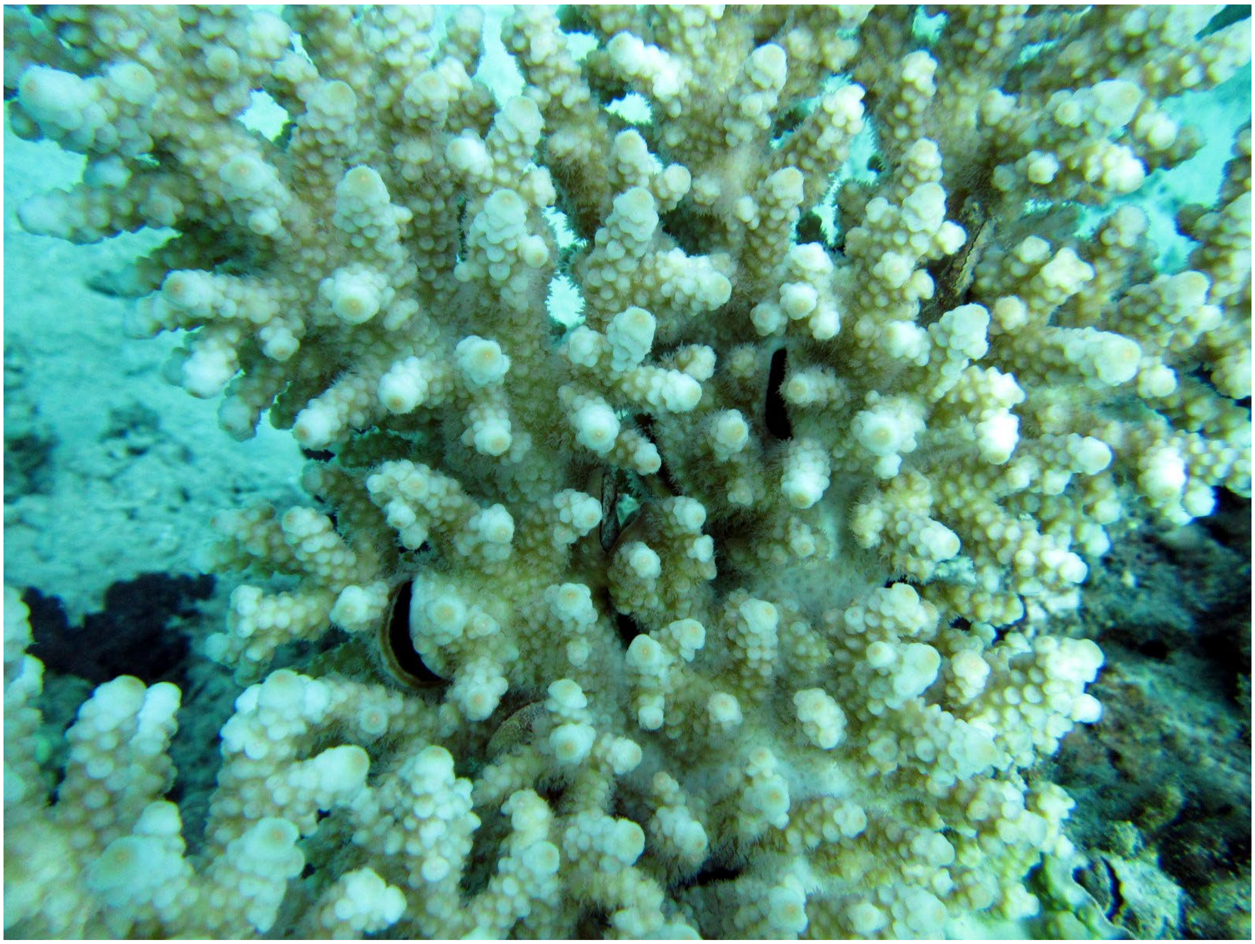
A close-up photo of *Acropora solitaryensis*.

Hispidose (“bottlebrush”)

Colonies have main branch with many smaller branches radiating from the main branch, much like a brush used to clean a bottle.

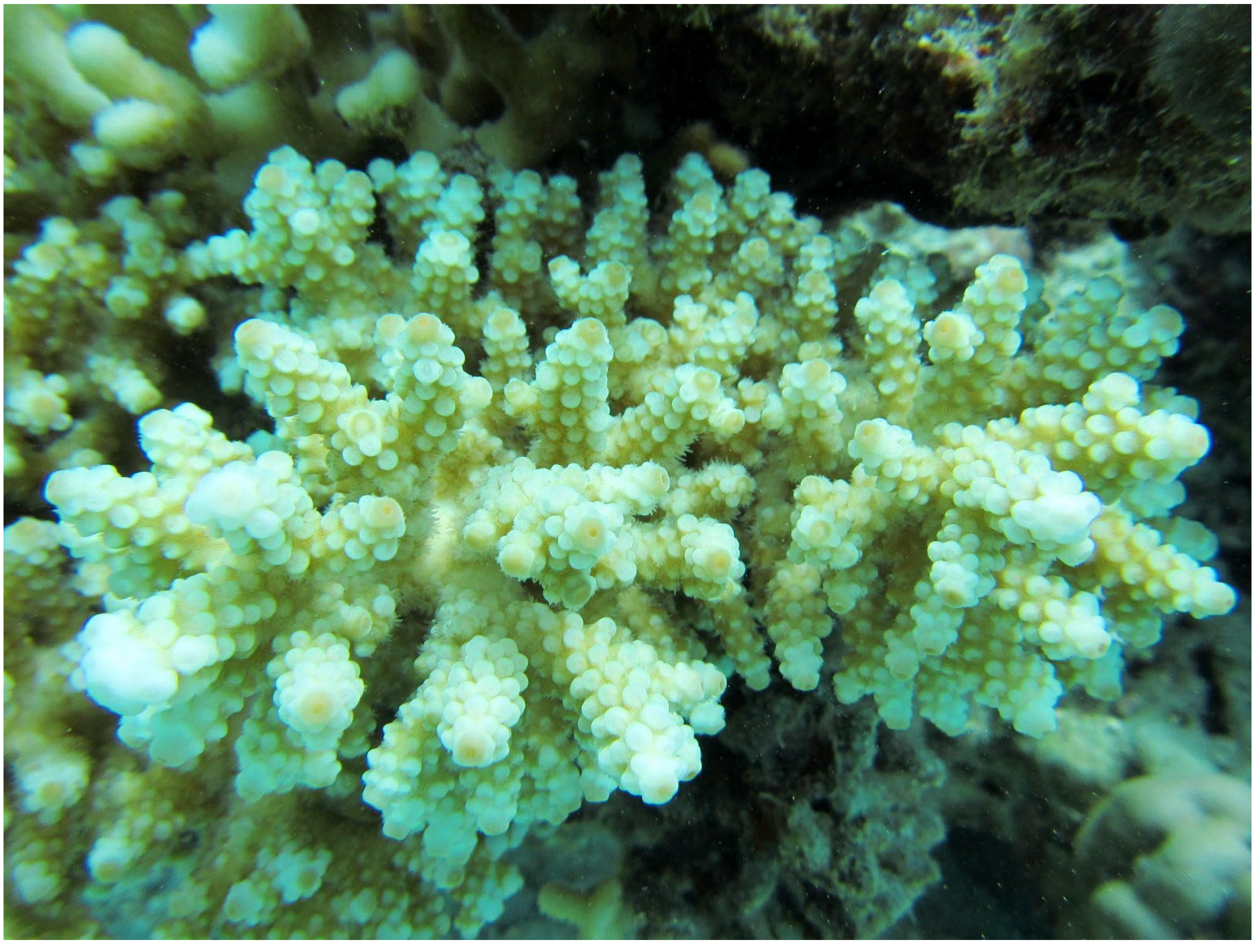
Acropora florida

Colonies are branching, with large branches that are oval in cross section, cylindrical, or irregular. Surfaces have an even cover of branchlets on them that are about 1-2 cm long, about pencil thickness, have a large axial corallite and radial corallites that have lower lips. *Acropora florida* has much larger branchlets than most other bottlebrush species.



A photo of *Acropora florida*.

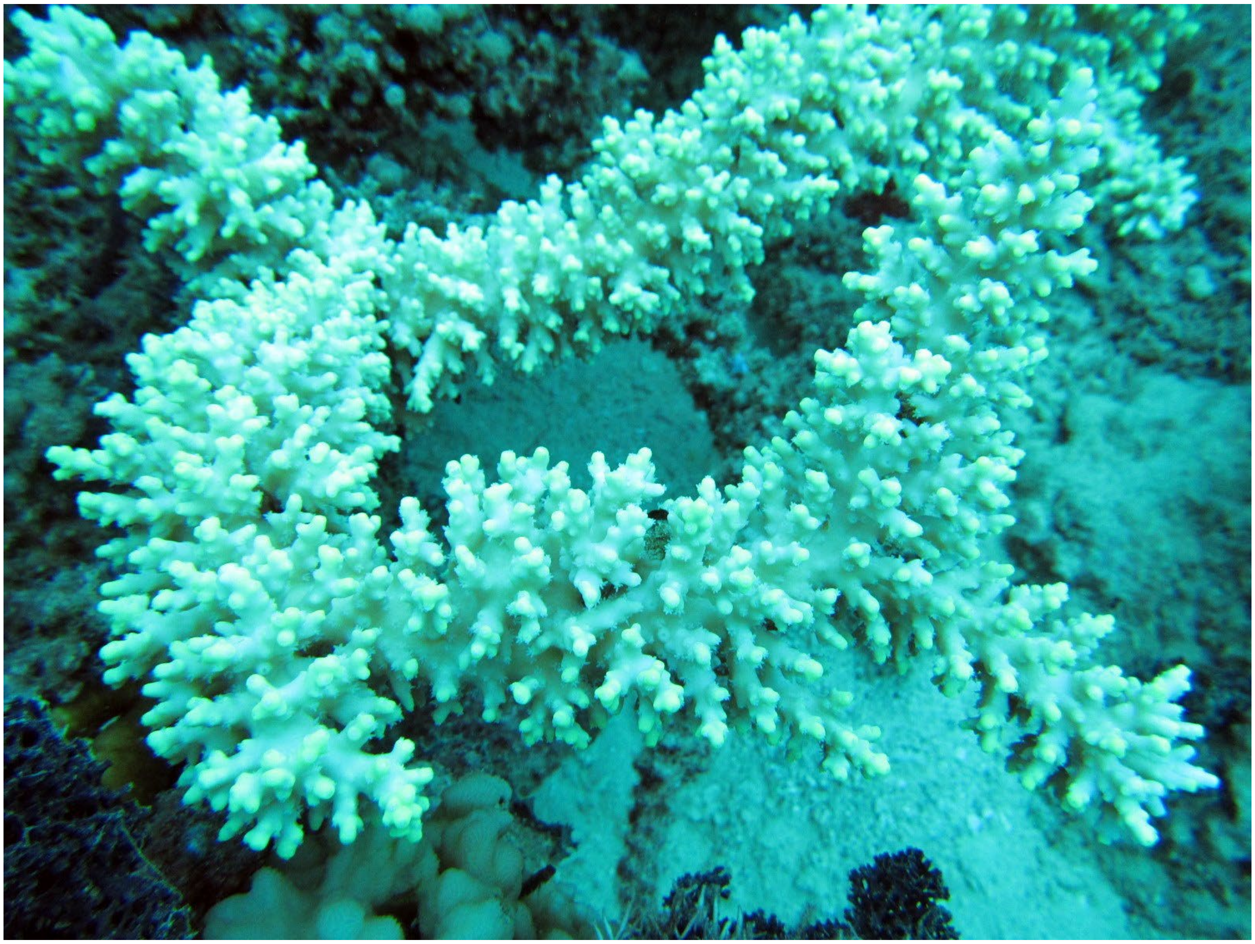
A photo of a colony of *Acropora florida*.



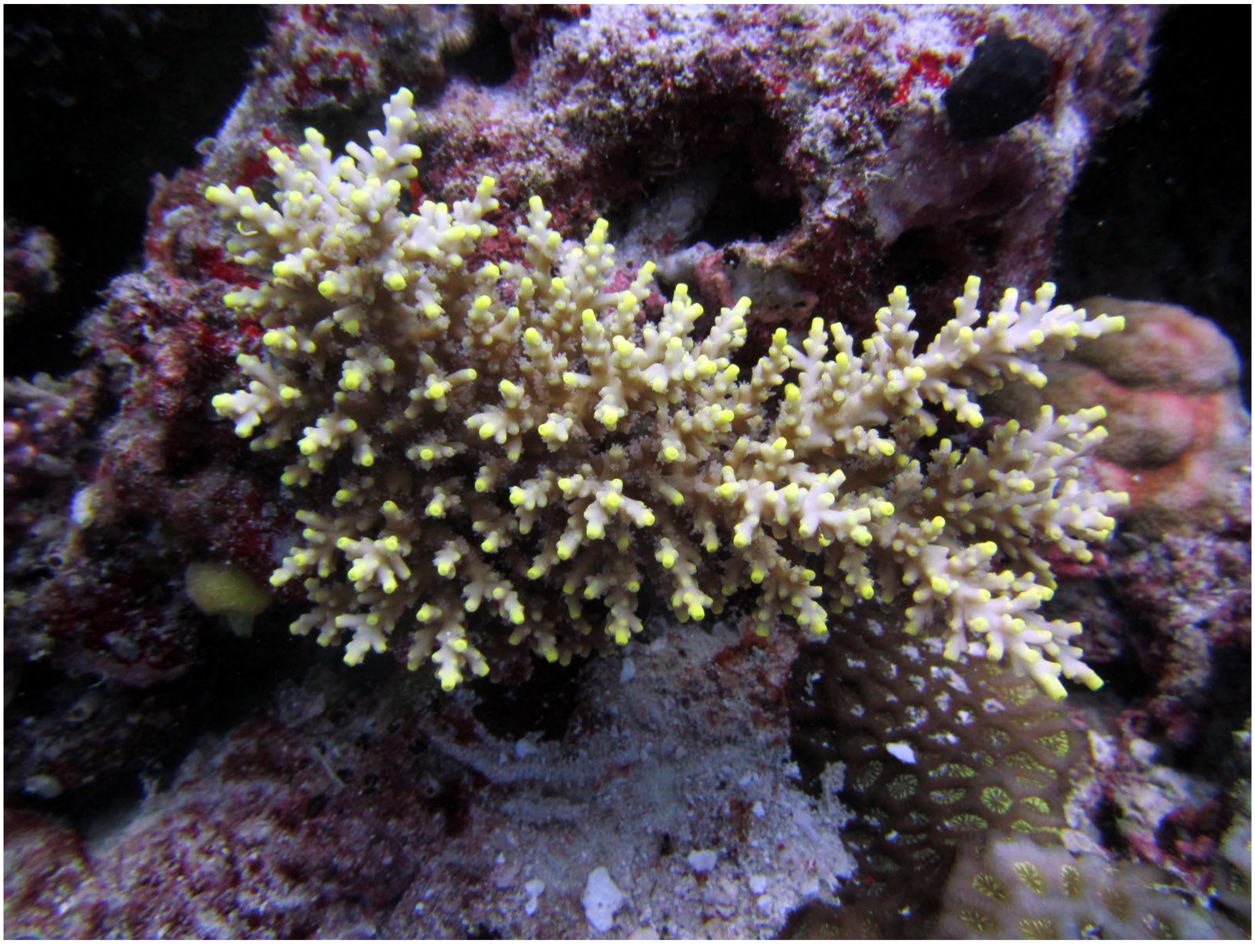
A close-up photo of *Acropora florida*.

Acropora carduus

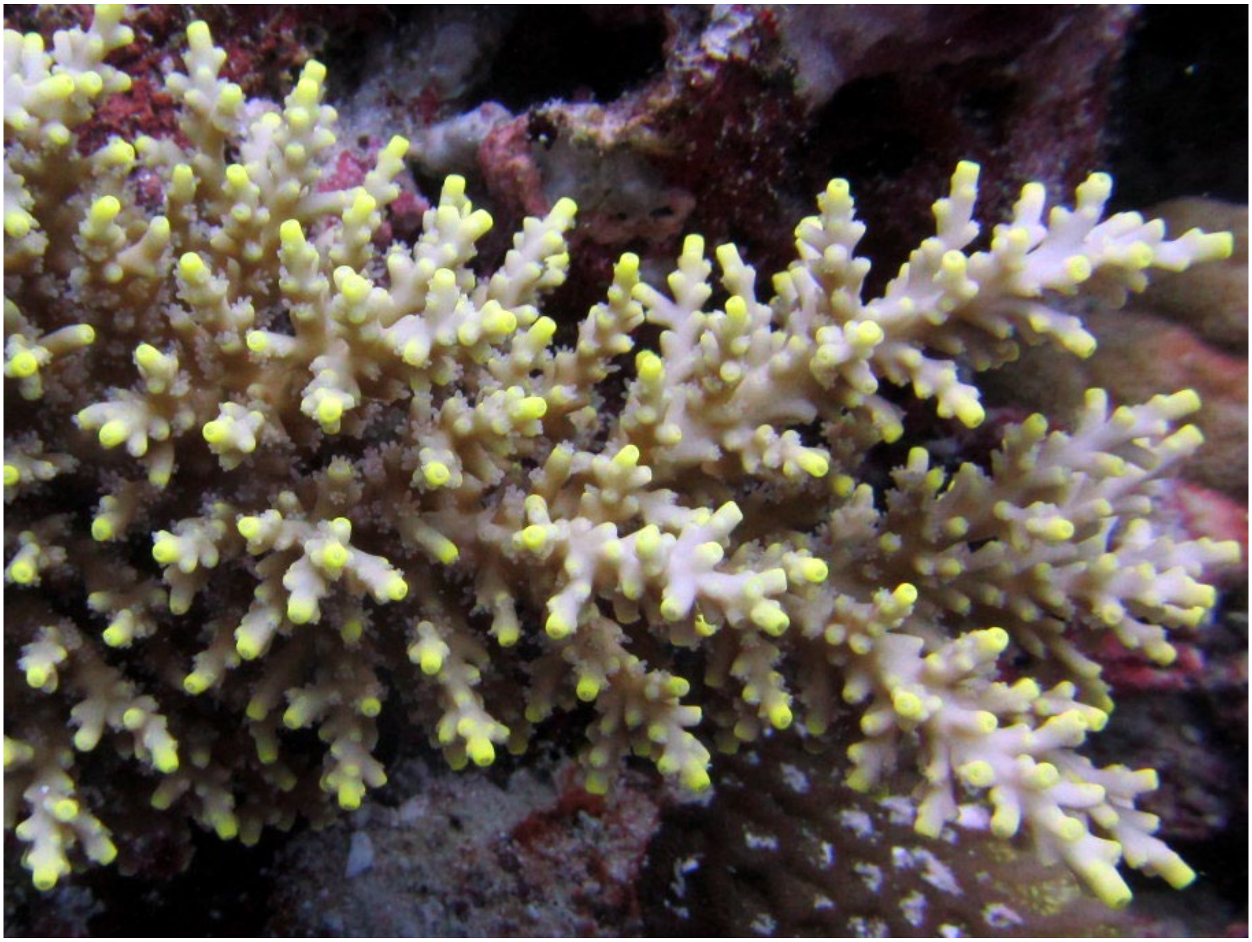
Colonies are branching, with radiating thin branchlets around the main branch. Branchlets have radial corallites that do not project far. Axial corallites are tubular with thick walls. Radial corallites point towards the branchlet end and are attached by their sides to the branchlet. The branchlets are much larger on *Acropora florida*.



A photo of *Acropora carduus*.



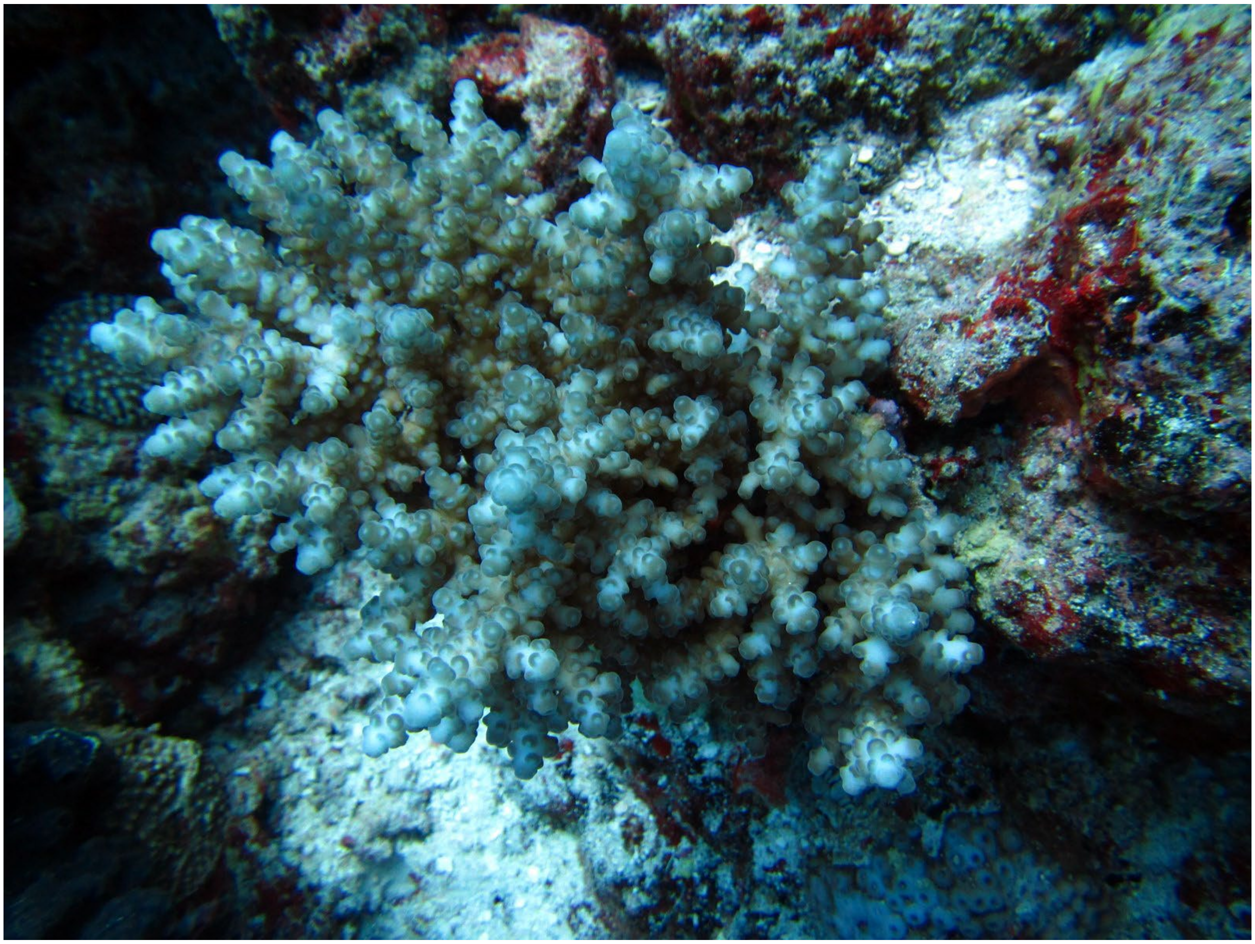
A photo of *Acropora carduus*.



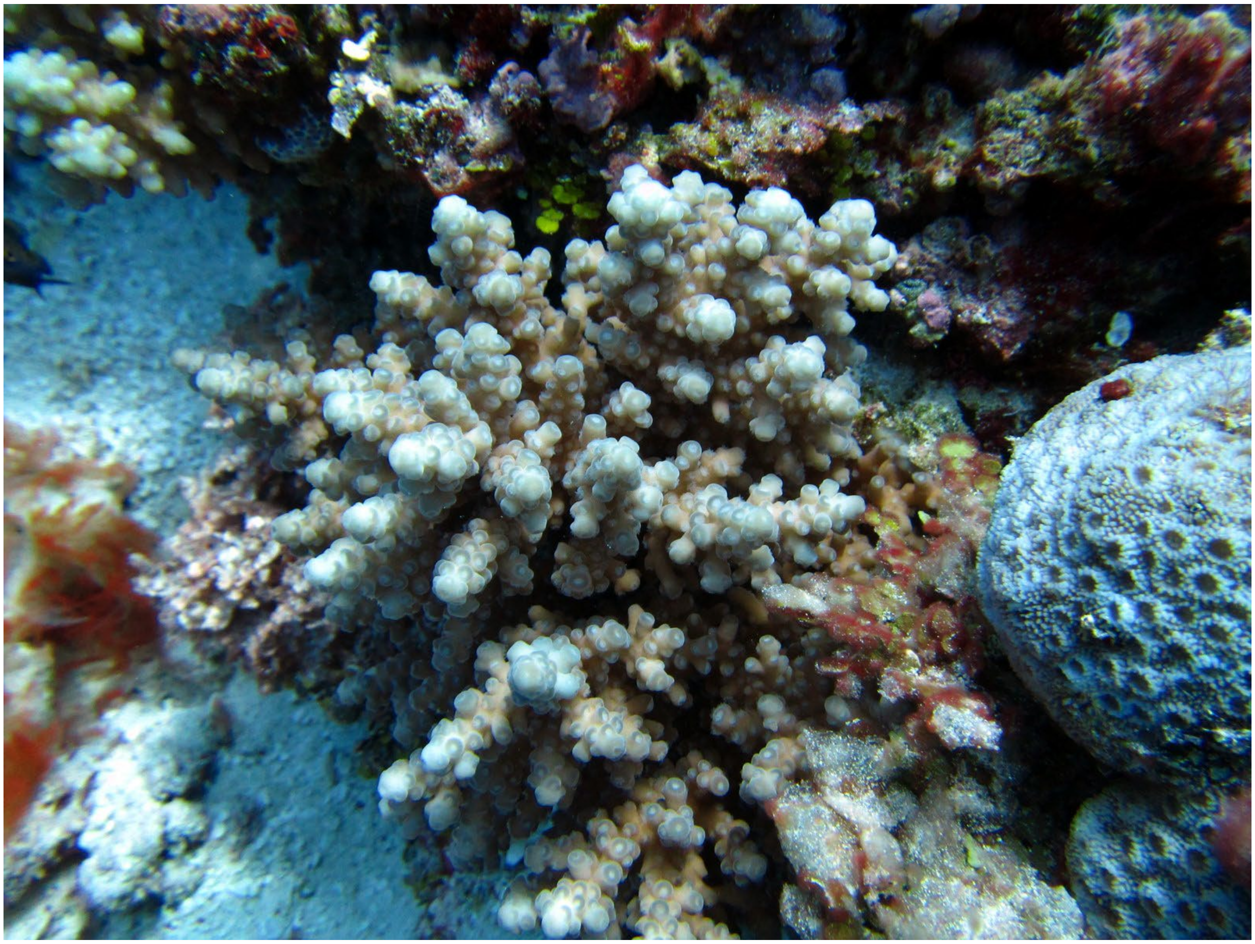
A close-up photo of *Acropora carduus*.

Acropora rosaria

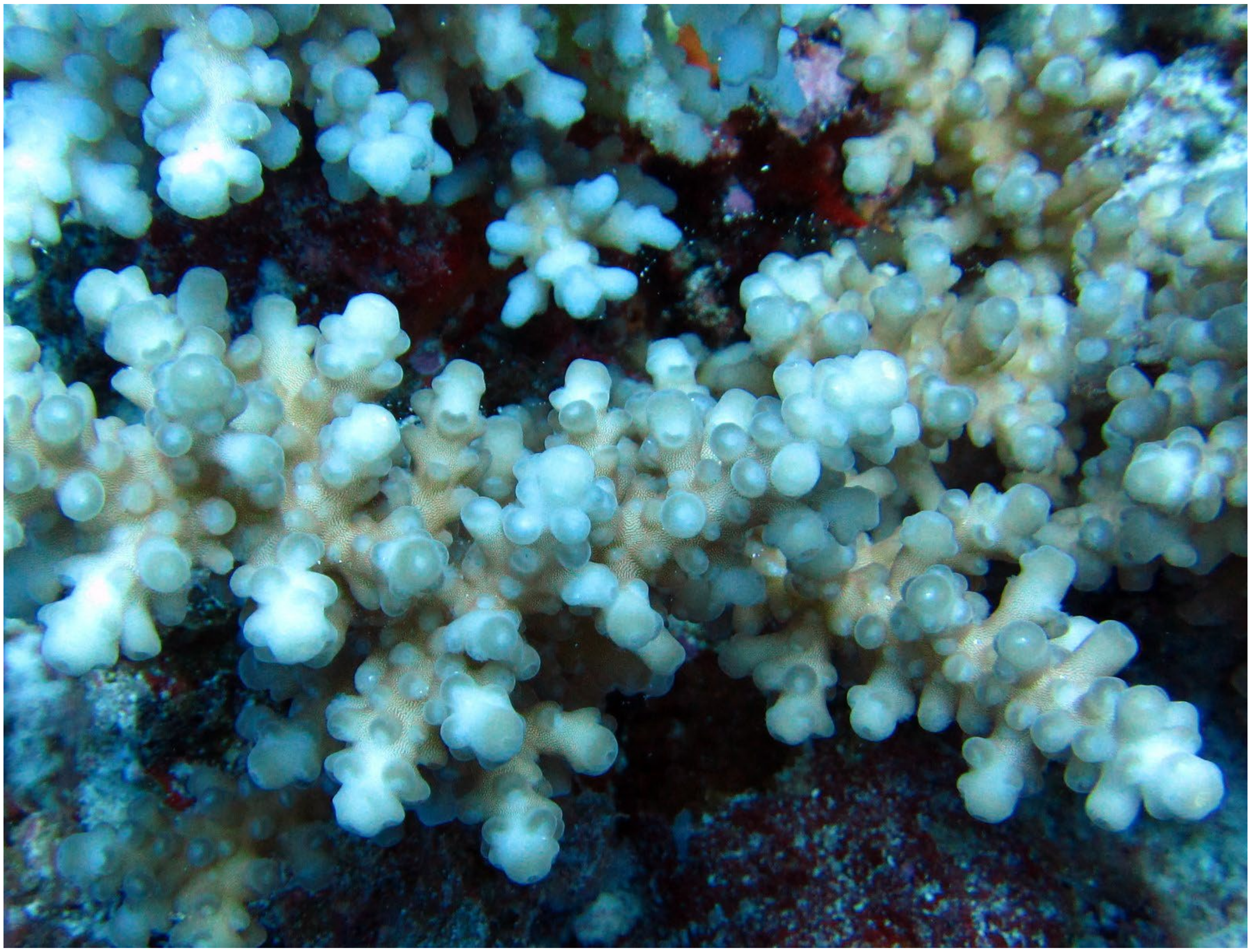
Colonies have short branches going in many directions, often forming tight clusters of branches. Axial corallites are large and radial corallites are short and thick. *Acropora loripes* has similar corallites but much more open branching.



A photo of *Acropora rosaria*.



A photo of *Acropora rosaria*.



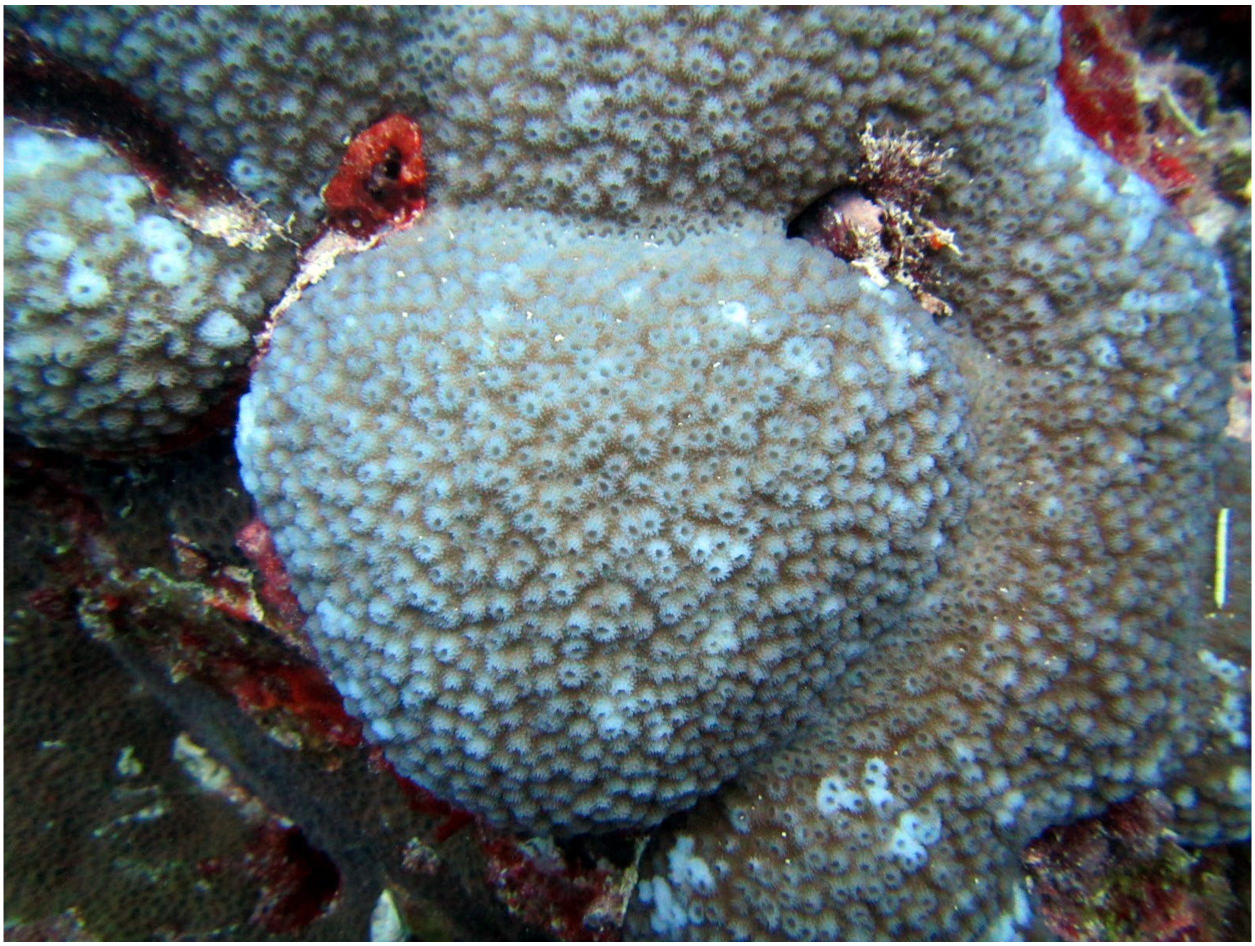
A close-up photo of *Acropora rosaria*.

Astreopora

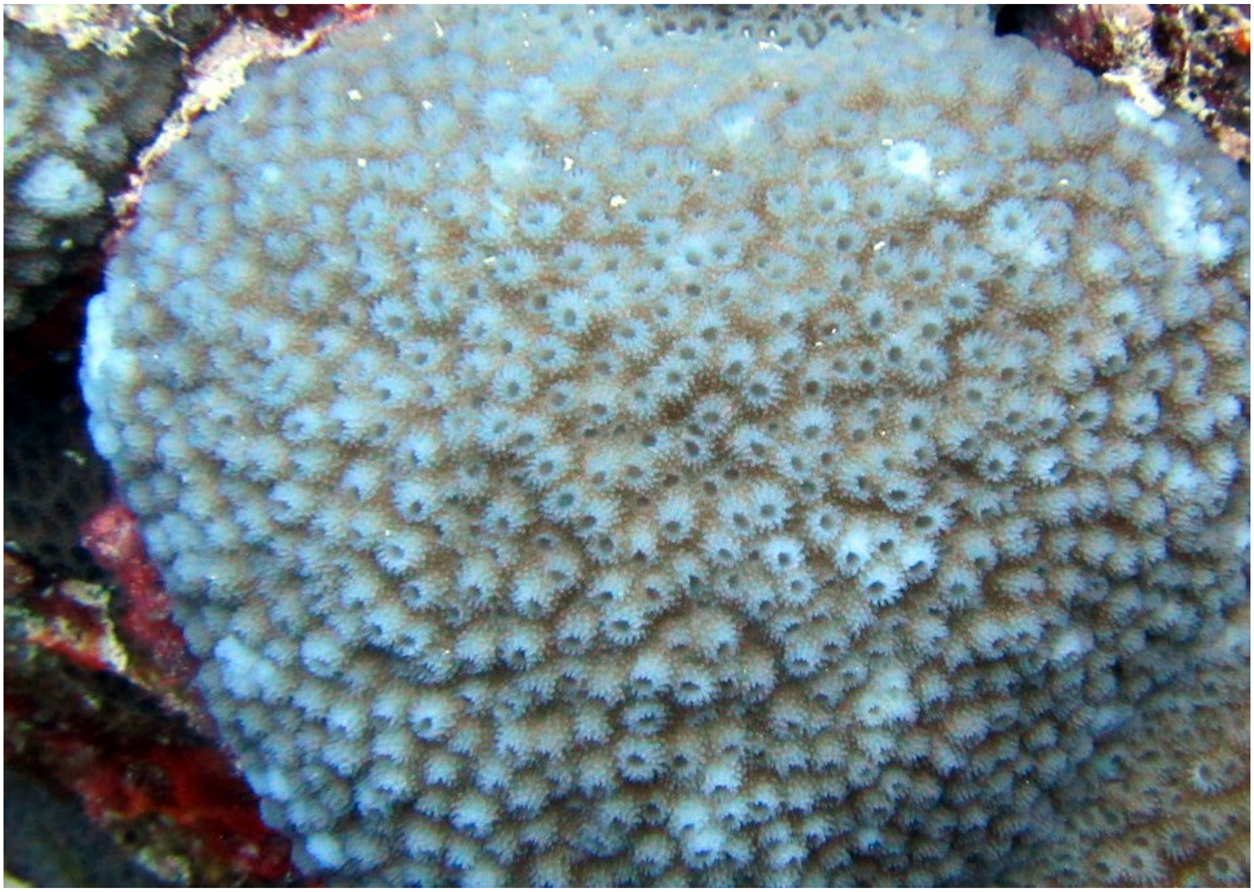
Colonies are most often massive, but can be encrusting or plates. Corallites are small and usually more or less volcano-shaped, about 3 mm diameter at the base with a 1 mm inside diameter. Corallites are smaller and more cone-shaped than on *Favia* and similar genera, and closer together and spinier than on *Turbinaria*.

Astreopora microphthalma

Colonies are massive. Corallites are small, about 3 mm outside diameter and 1 mm inside diameter, and cone-shaped. Corallites extend at right angles to surfaces, and are near uniform in size and shape, and are close together. Other species of *Astreopora* have corallites that differ in shape from this species.



A photo of a colony of *Astreopora myriophthalma*.

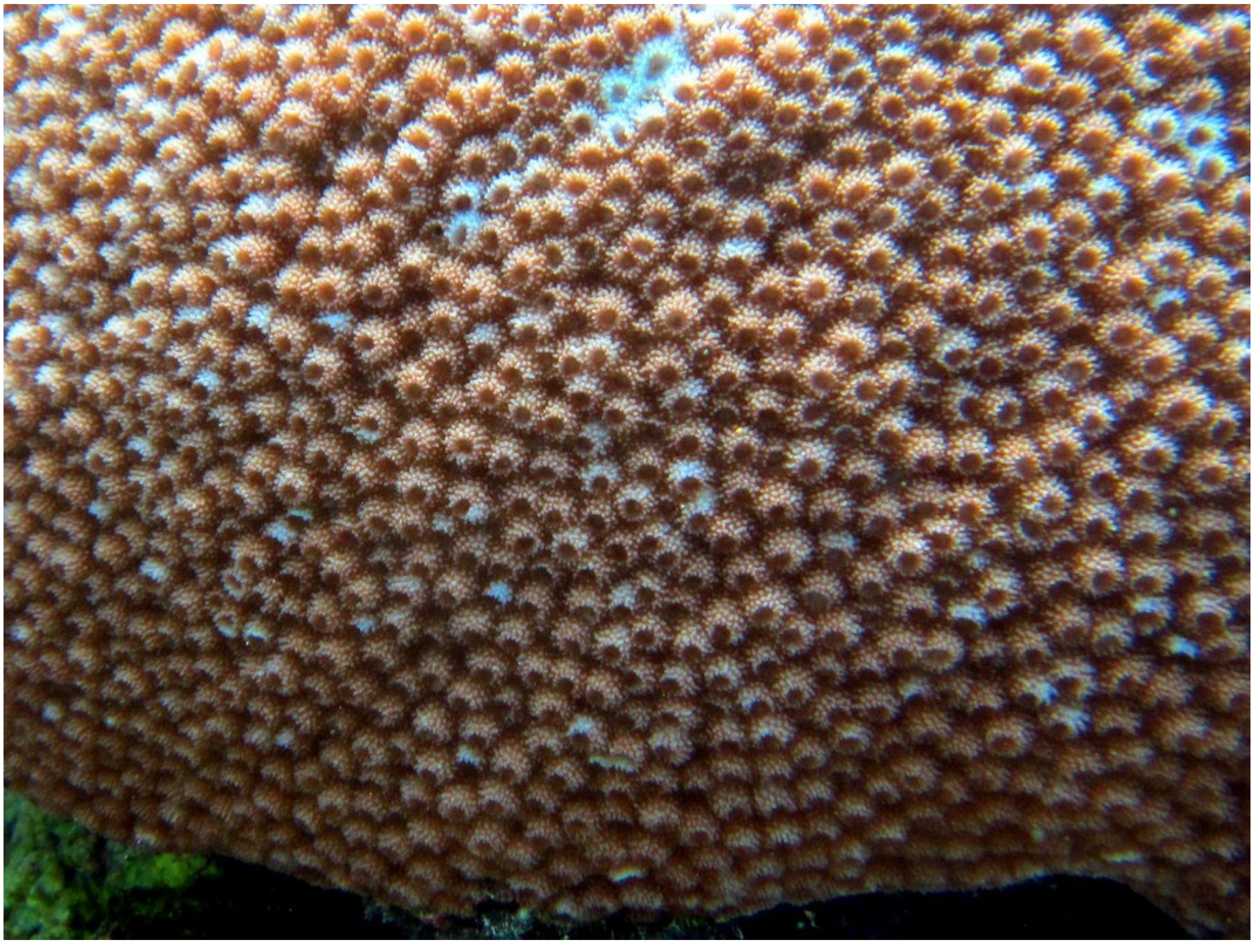


A close-up photo of a colony of *Astreopora myriophthalma*.

Astreopora cucullata

Colonies are massive. Corallites are small, cone-shaped, and about 3 mm outside diameter and 1 mm inside diameter, and uniform. Corallites project at right angles from the colony surface on the top of the colony but are angled downward on the sides of the colony. Colonies are the same as *Astreopora microphthalma* except that the corallites on the sides are pointed downward.

A photo of *Astreopora cucullata*.



A close-up photo of the side of a colony of *Astreopora cucullata*.

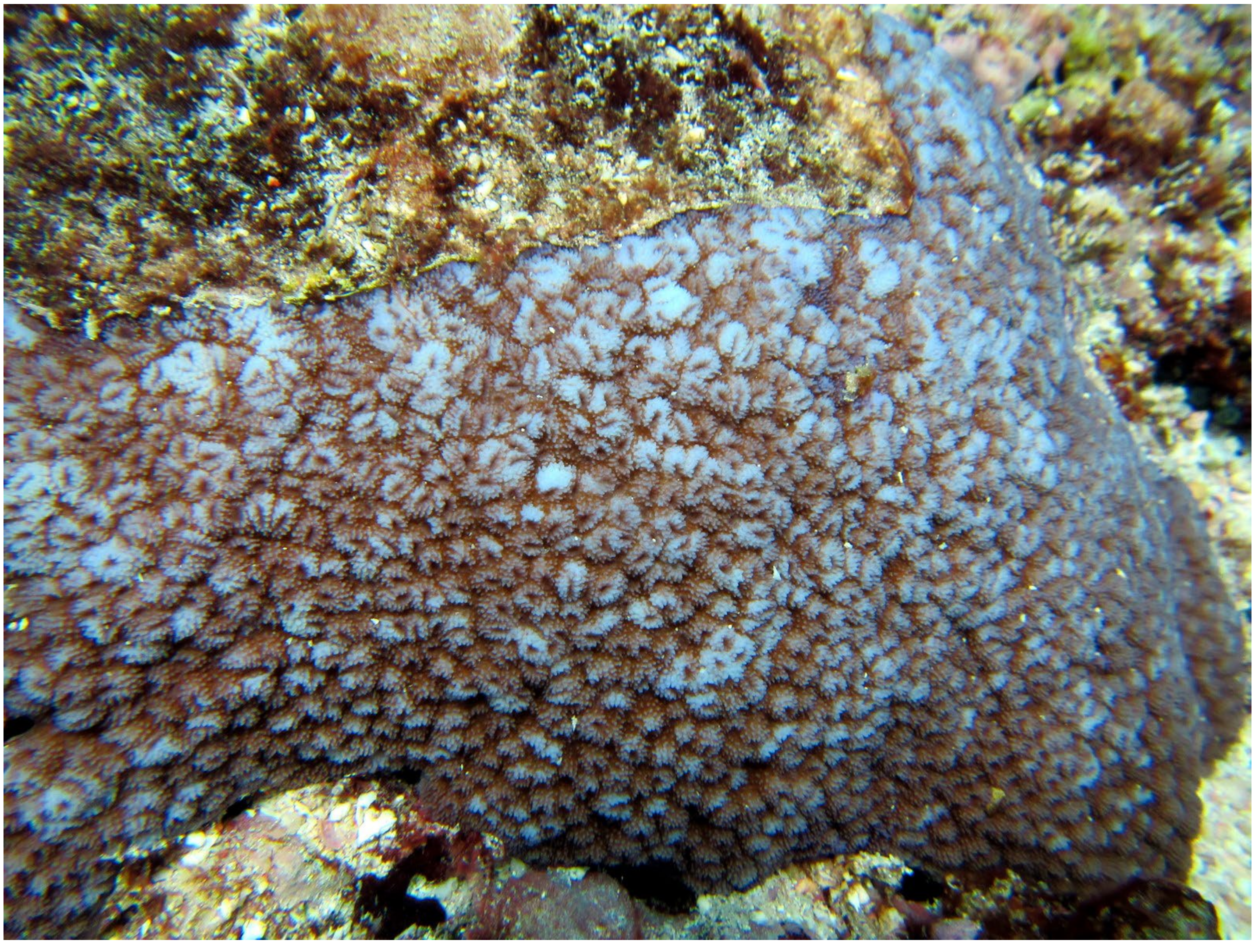
Astreopora gracilis

Colonies are massive. Corallites are small, with a maximum of about 3 mm outside diameter and 1 mm inside diameter. Corallites are cone-shaped but individual corallites vary in size and direction that they point. Colonies are the same as *Astreopora myriophthalma* except that corallites vary in size and point in different directions.

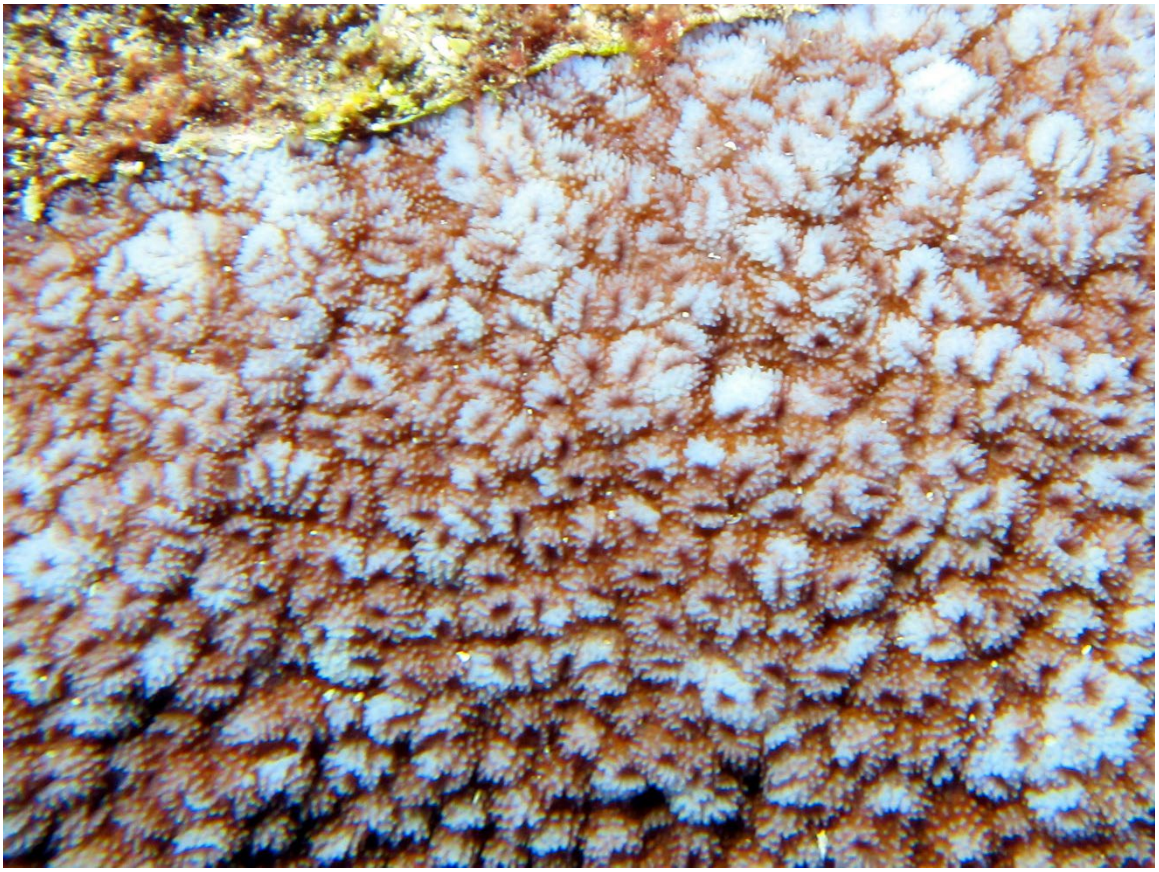
A close-up photo of *Astreopora gracilis*.

Astreopora elliptica

Colonies are massive. Corallites are small, about 3 mm outside diameter and 1 mm inside diameter. Corallites are cone-shaped. The openings of the corallites vary from circular to oval to a thin crack. This species differs from *Astreopora myriophthalma* by having some corallites with openings that are oval or a thin crack.



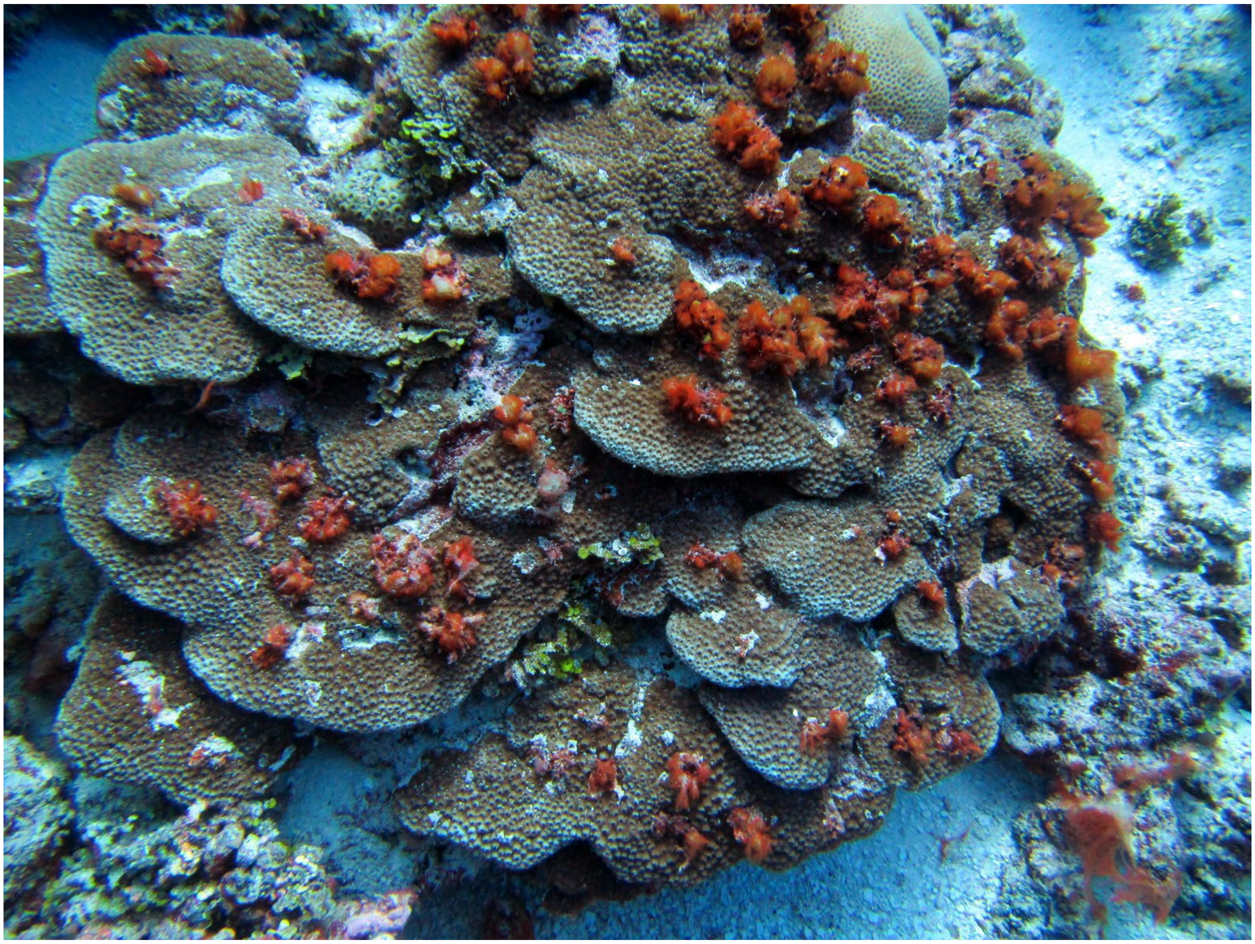
A photo of *Astreopora elliptica*.



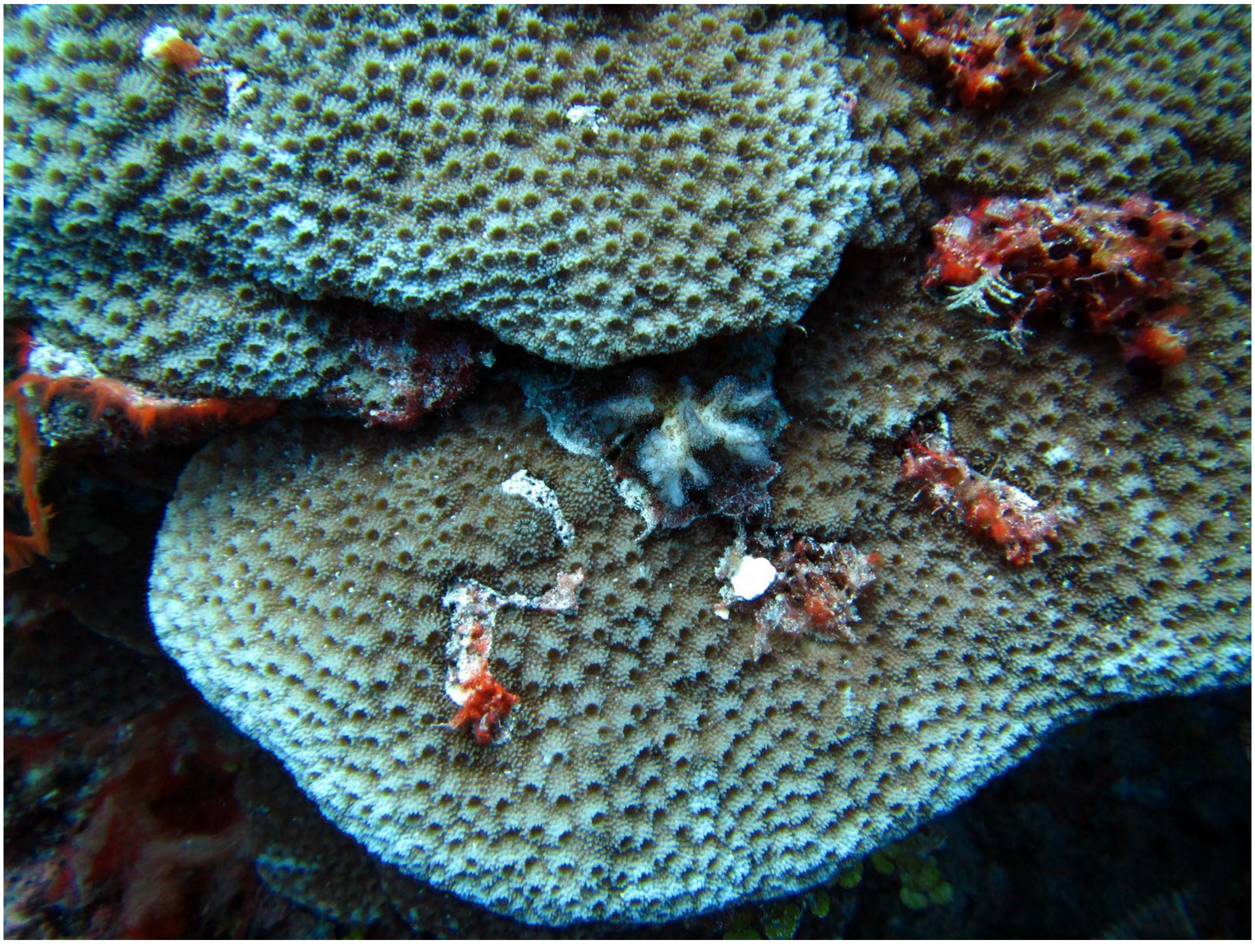
A closeup photo of *Astreopora elliptica*.

Astreopora expansa

Colonies are composed of flat, nearly horizontal plates. Corallites are small, about 3 mm outside diameter and 1 mm inside diameter. Corallites are cone-shaped and usually inclined towards the edge of the plate. Colonies are plates unlike most *Astreopora* species.



A large colony of *Astreopora expansa*. The red is cyanobacteria.



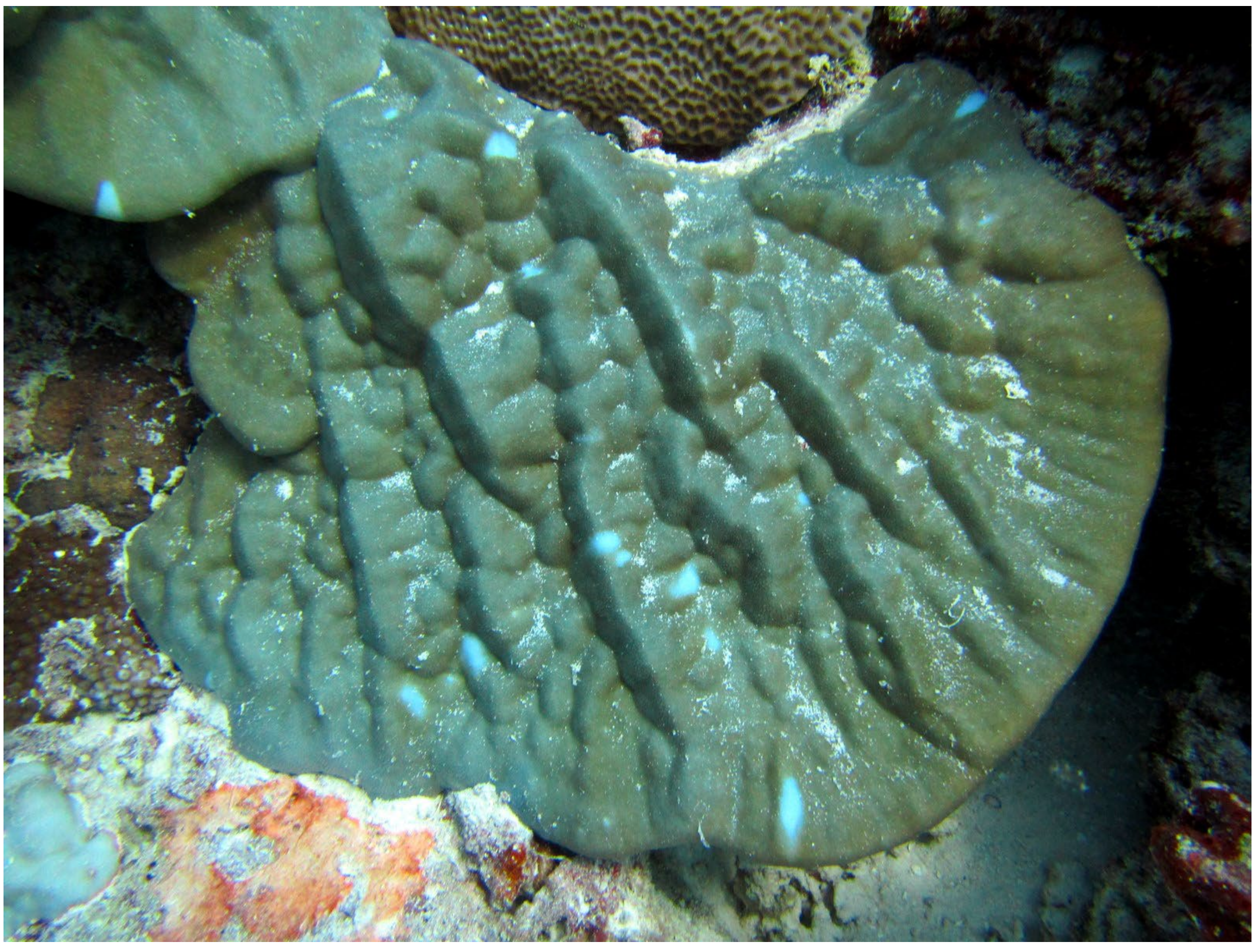
A close-up photo of *Astreopora expansa*.

Porites

Colonies can be massive, encrusting, plates, branching, or have columns. Corallites are tiny, about 1 mm diameter. In most species corallites are close to each other, but in a few they have space between them. In most species that have space between corallites the space is flat, but in a few there are small bumps between corallites. *Porites* is the third largest genus with about 65 species currently known.

Porites massive

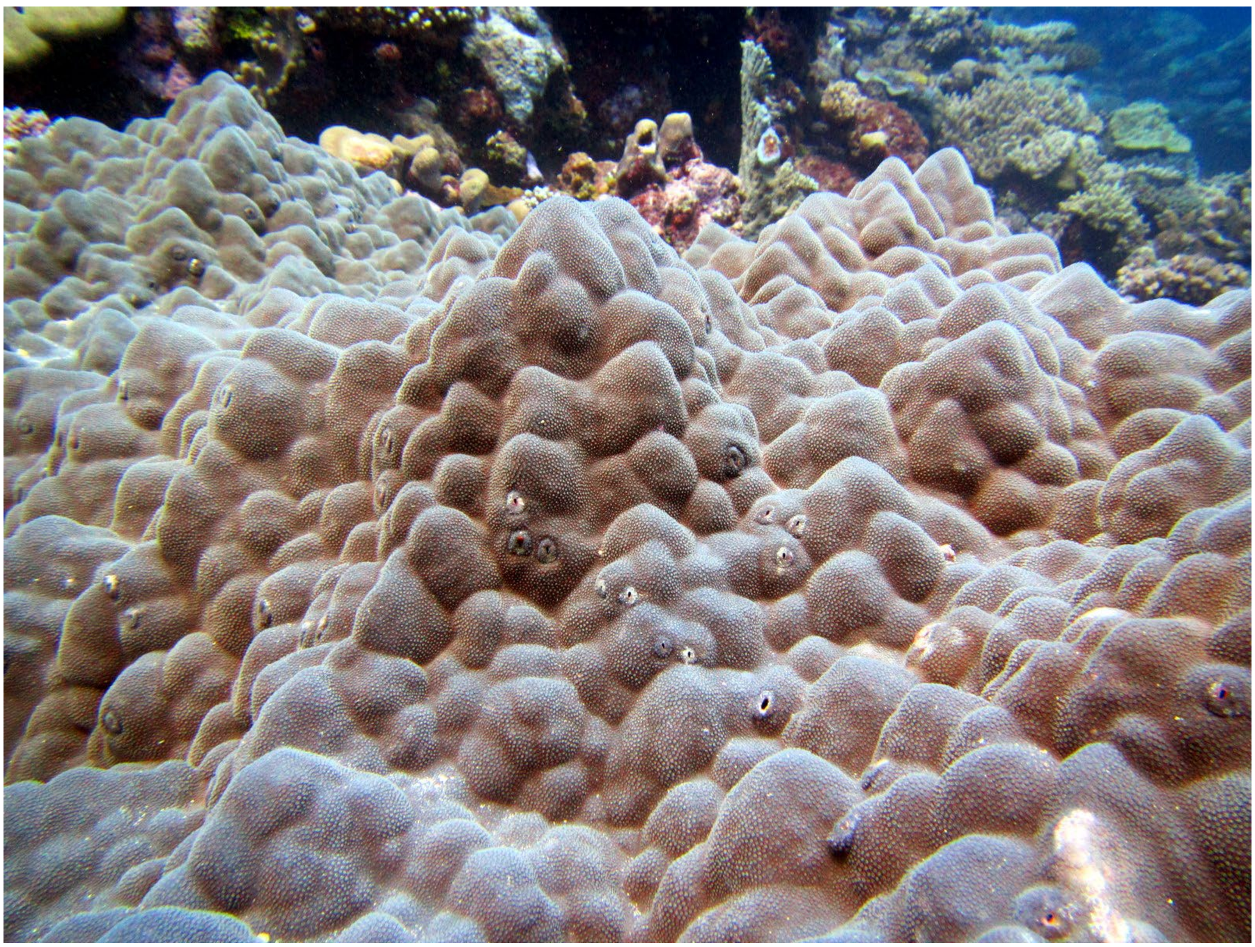
Colonies are massive and can range in size from small to gigantic. Surfaces are usually somewhat lumpy. The polyp tentacles may be retracted, revealing the corallites, or partway extended, often in a circle. There are about a half dozen species that can be distinguished under the microscope in this group of species, but they are the hardest of all corals to identify (even with skeleton), and most living colonies in diverse areas cannot be reliably identified in the field, with few exceptions.



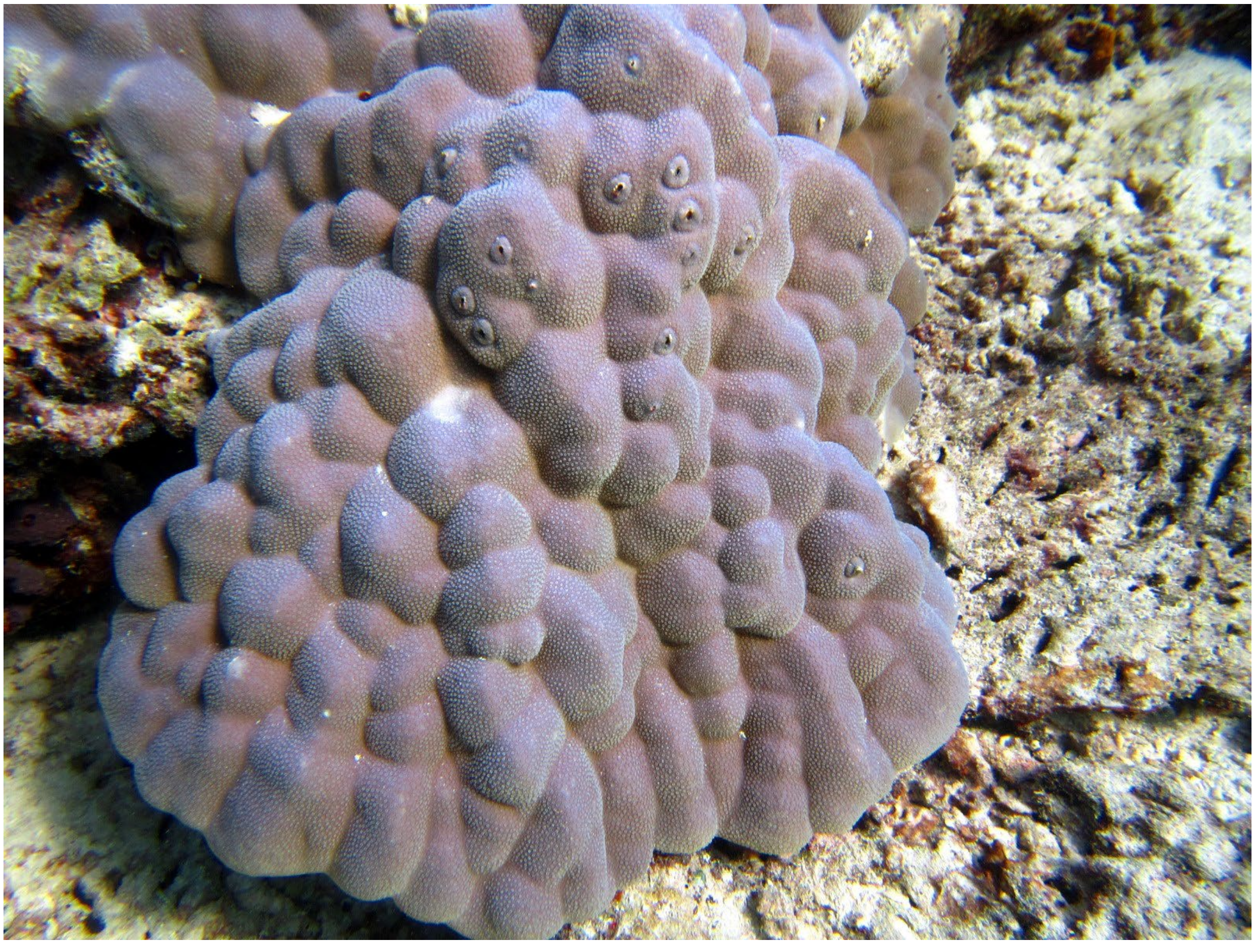
A photo of a massive *Porites* colony.

Porites evermanni

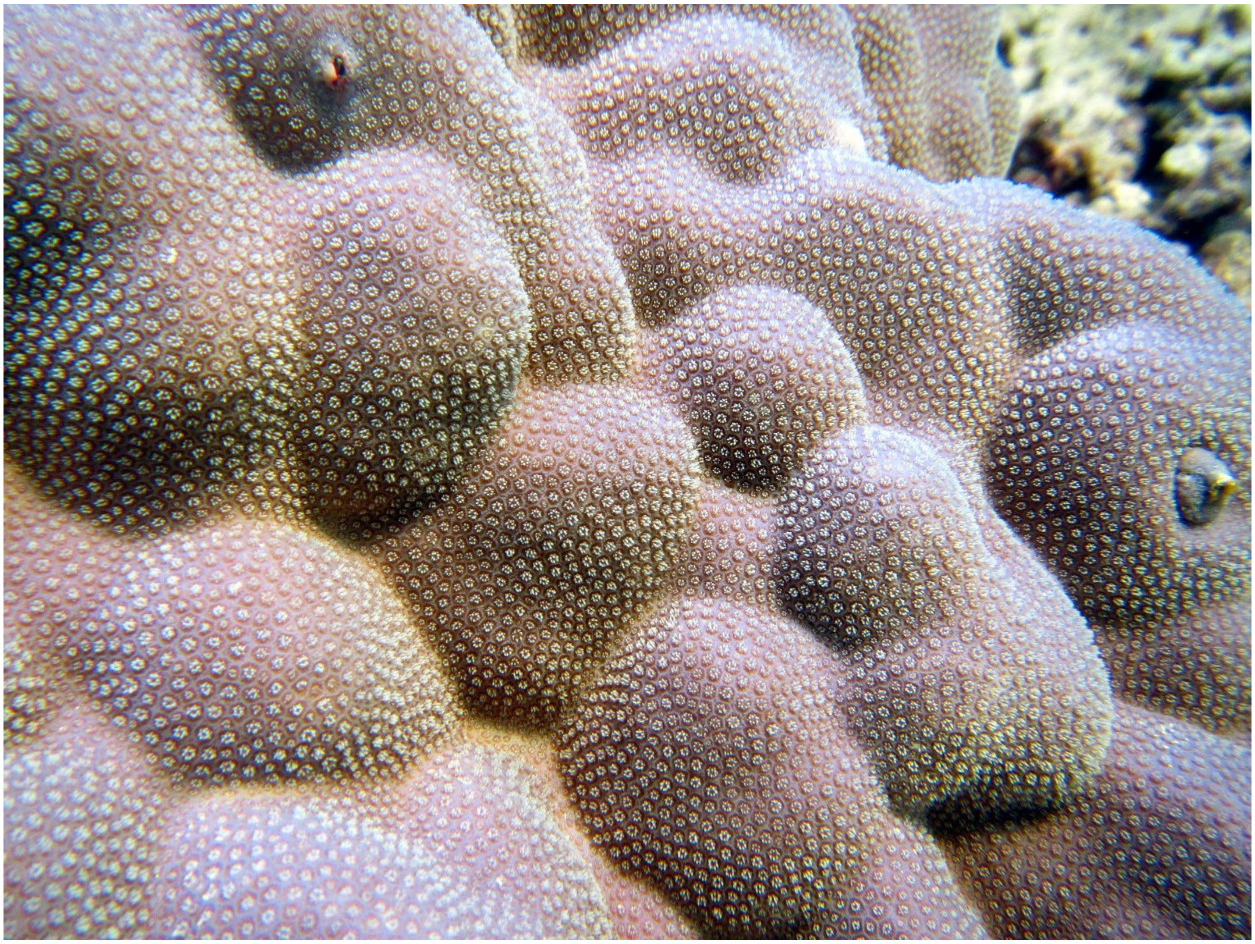
Colonies are massive and can be quite large. Lumps are tall and rounded and not very large, usually fairly uniform in size and shape. In some colonies, some lumps may be in parallel rows. Tentacles are extended partway, as a tuft of tentacles in the center of the corallite, not as a ring of tentacles. Colonies are usually brown, but sometimes are light tan, yellowish, with tinges of red, or other colors. The lumps are more rounded and tall and uniform in size than in most other massive *Porites*, and the tentacles are extended as a tuft in the center of the corallite instead of as a ring or retracted. *Porites annae* has similar color and tentacle extension but forms lumpy columns. *Porites lichen* has similar tentacle extension but forms thin horizontal plates with vertical fingers. The author called this species *Porites lutea* in his Hawaii book in 2005 because the septal plan is the same as in that species and it is a newer name. However, DNA sequencing reveals *Porites lutea* has three cryptic species within it. So I have reverted to calling this *Porites evermanni*, which was named in Hawaii where it is easy to distinguish once you know how. This question needs to be resolved by examining type specimens.



A photo of the surface of a large colony of *Porites evermanni*.



A photo of part of a colony of *Porites evermanni*.

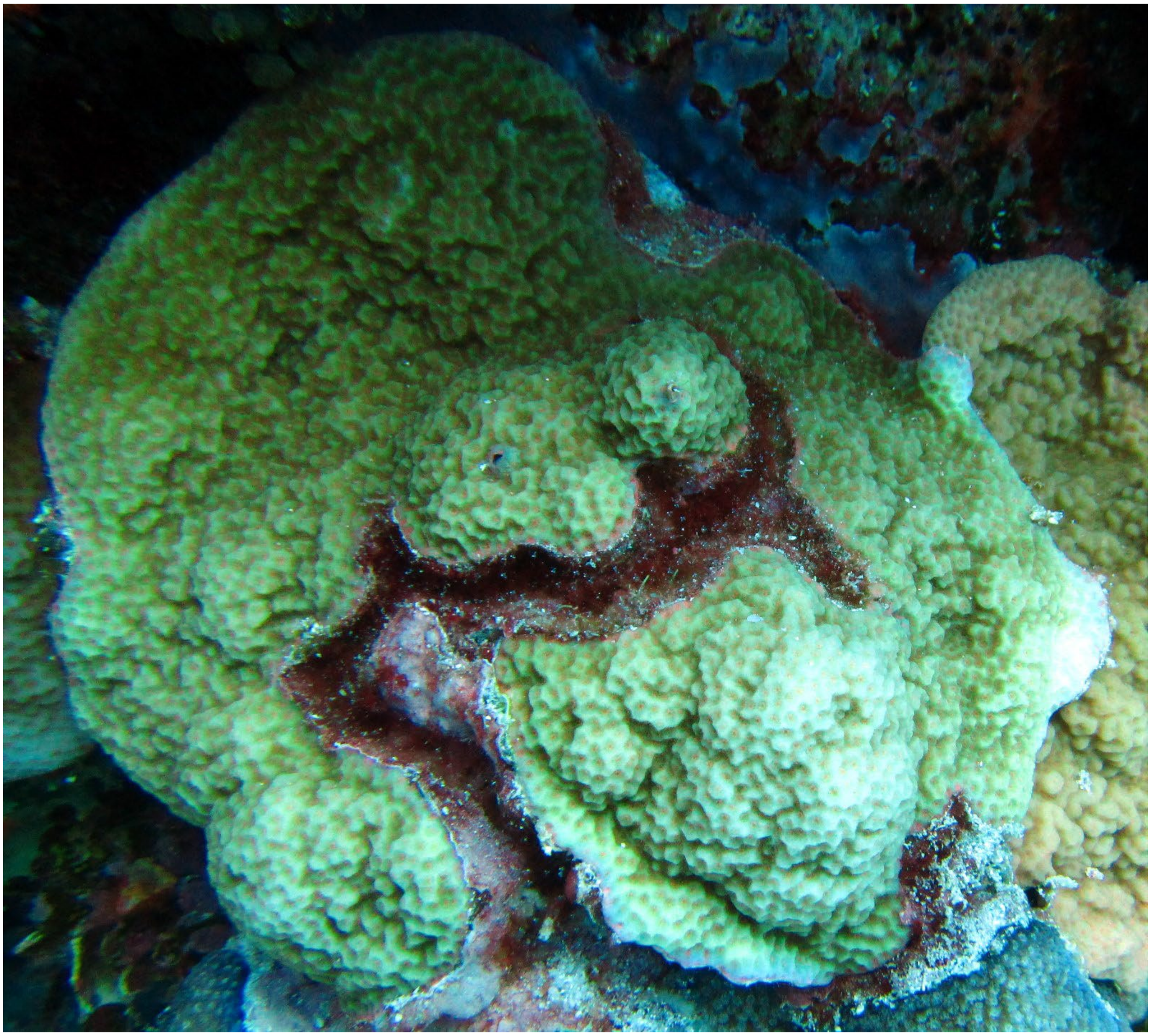


A close-up photo of *Porites evermanni*.

Porites myrmidonensis

Colonies are massive and always small except in Australia where they can be large. Surfaces are irregularly lumpy, and lumps are often close together with a crack between them. Corallites are deeply recessed into the colony. In some places corallites are in rows. Polyps are withdrawn. Colonies are often orange but can be other colors. Colonies are smaller than most other massive *Porites* species and have deeply recessed corallites which in some places are in rows.

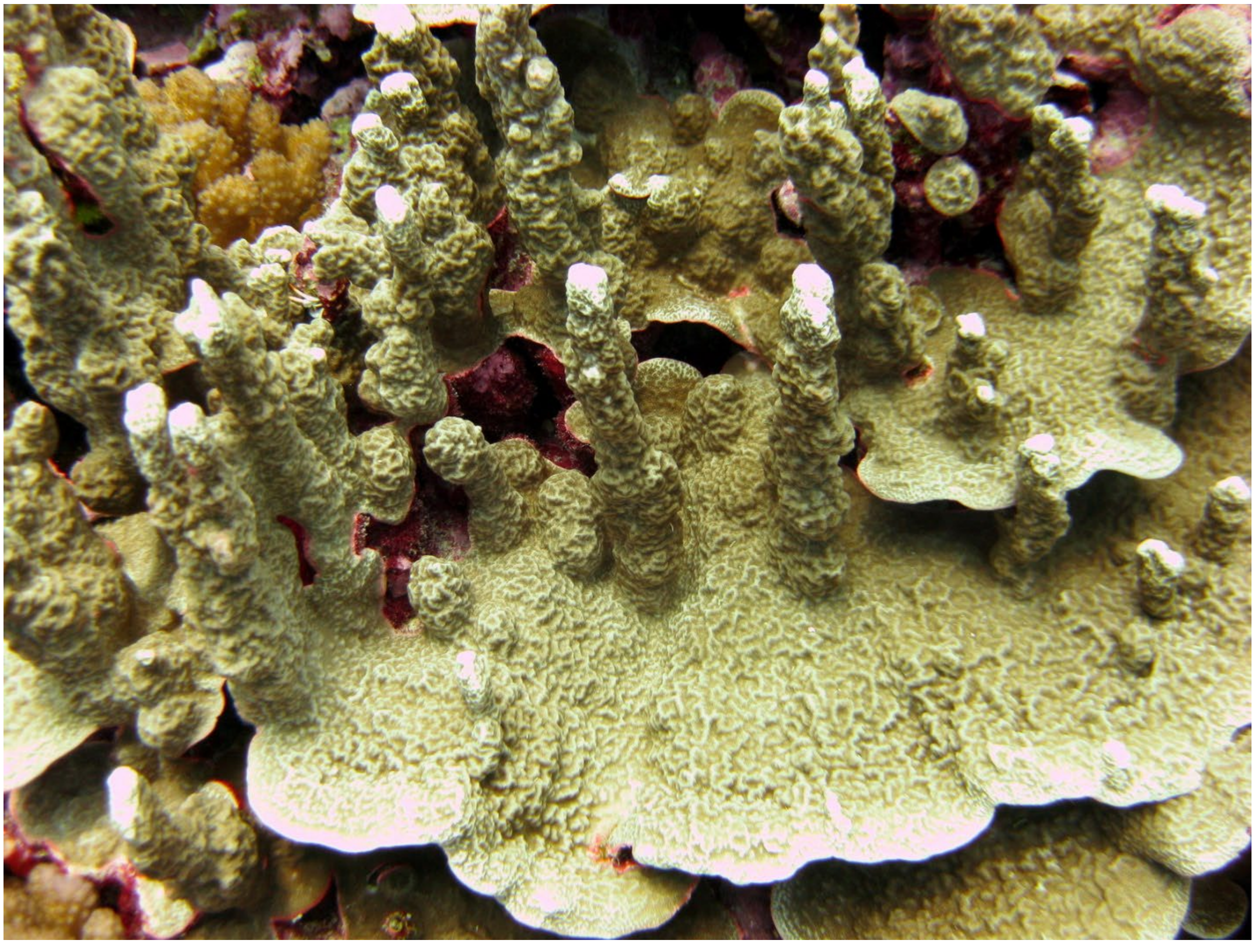
A photo of two colonies of *Porites myrmidonensis*.



A close photo of a colony of *Porites myrmidonensis*.

Porites rus

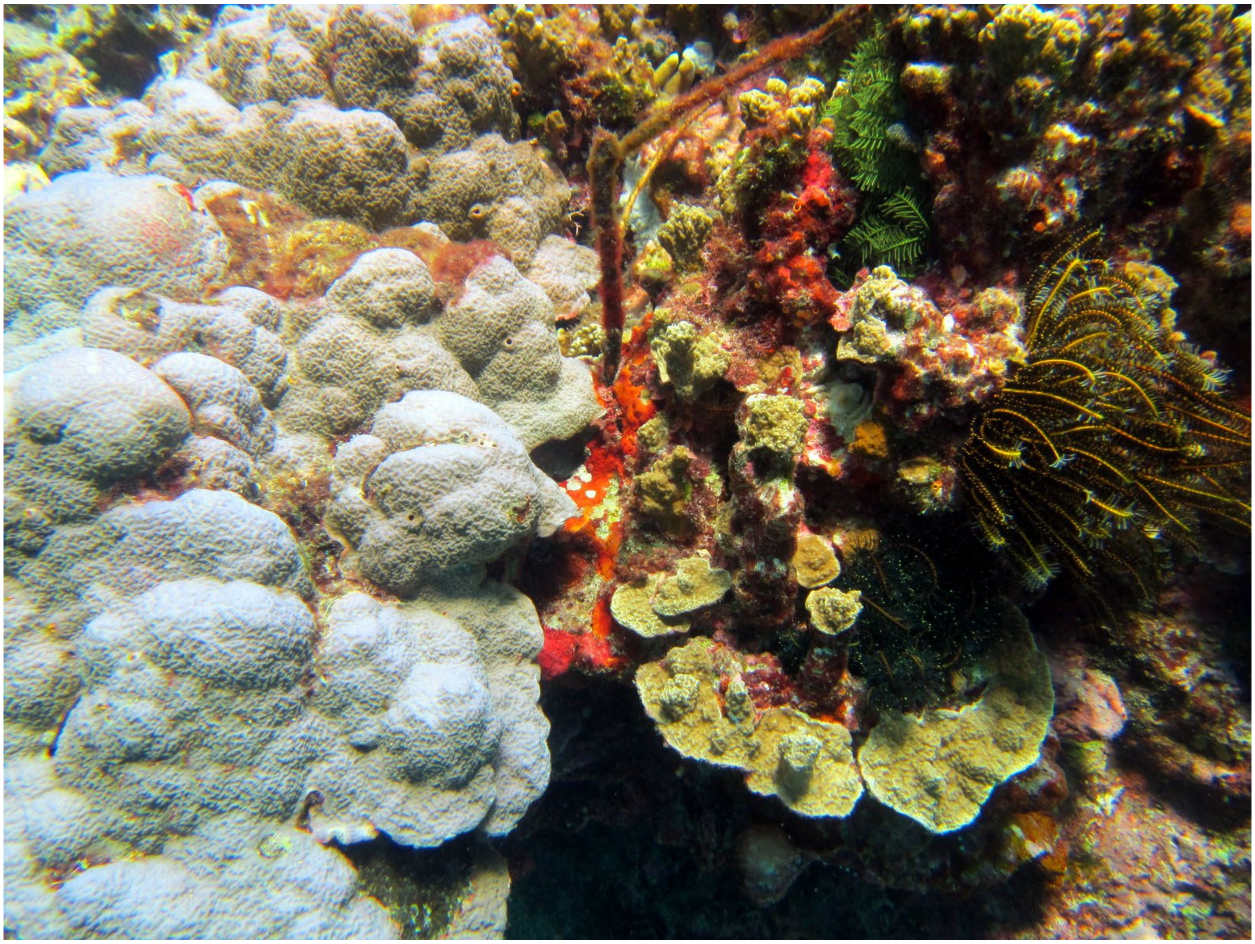
Colonies are usually a combination of thin horizontal plates and columns, with the columns growing up from the tops of the plates. The proportion of plates and columns has a wide range of variation. Columns are irregular and bumpy. Surfaces have little ridges in them that curve and may diverge but usually don't go far. The tops of columns often have winding, diverging ridges on them. Corallites are visible only if the mouths are white. *Porites monticulosa* is usually encrusting and has low rounded lumps instead of columns. Porites lichen has smooth, uniform, rounded finger columns and has thin plates but tentacles are extended.



A colony of *Porites rus*. This photo was taken in American Samoa.

Porites monticulosa

Colonies are encrusting, with low rounded lumps on them. Surfaces usually have little ridges on them that curve and may diverge but don't go far. Usually a bluish or grayish color. *Porites rus* has plates and irregular columns.

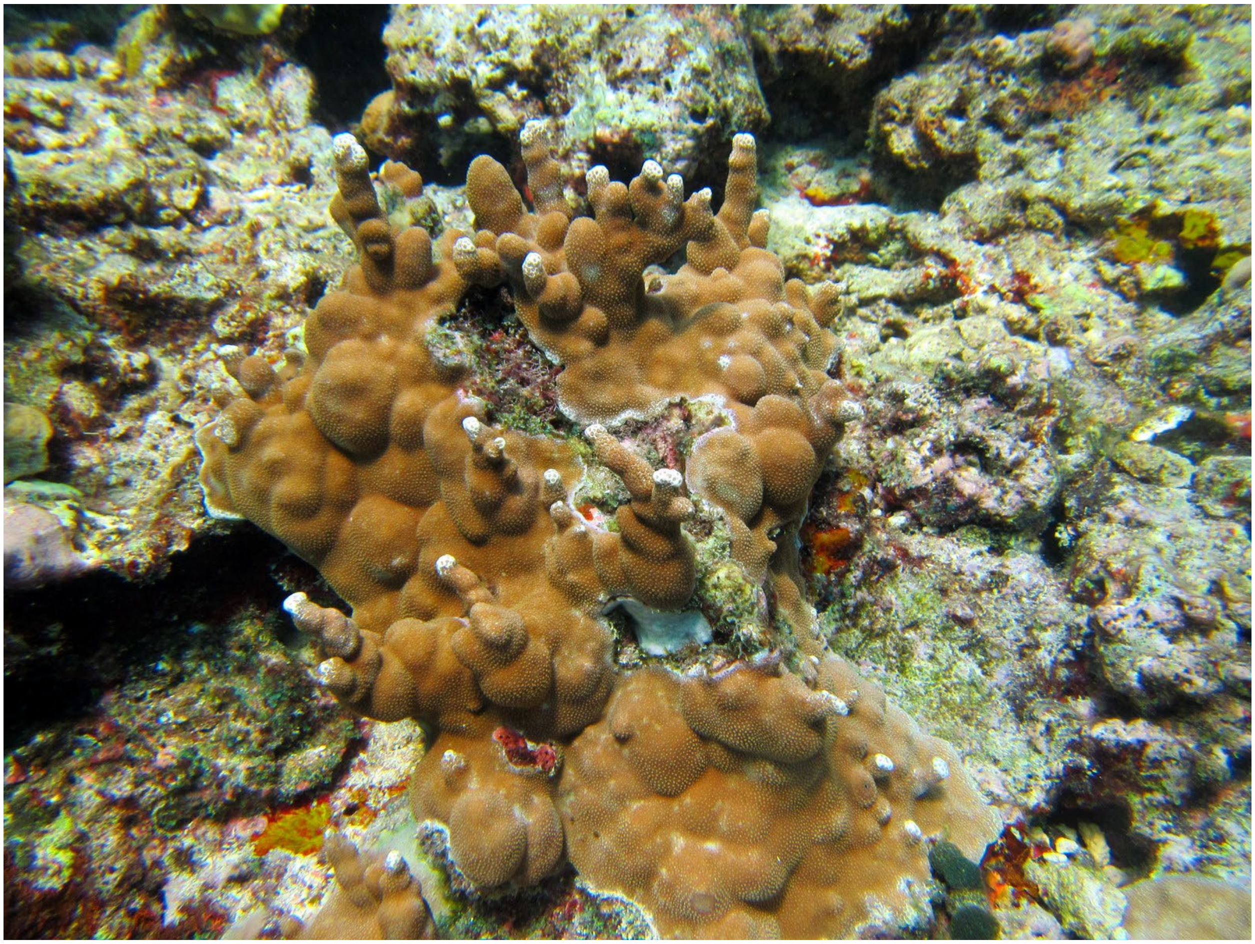


A photo of *Porites monticulosa* on the left and *Porites rus* on the right.

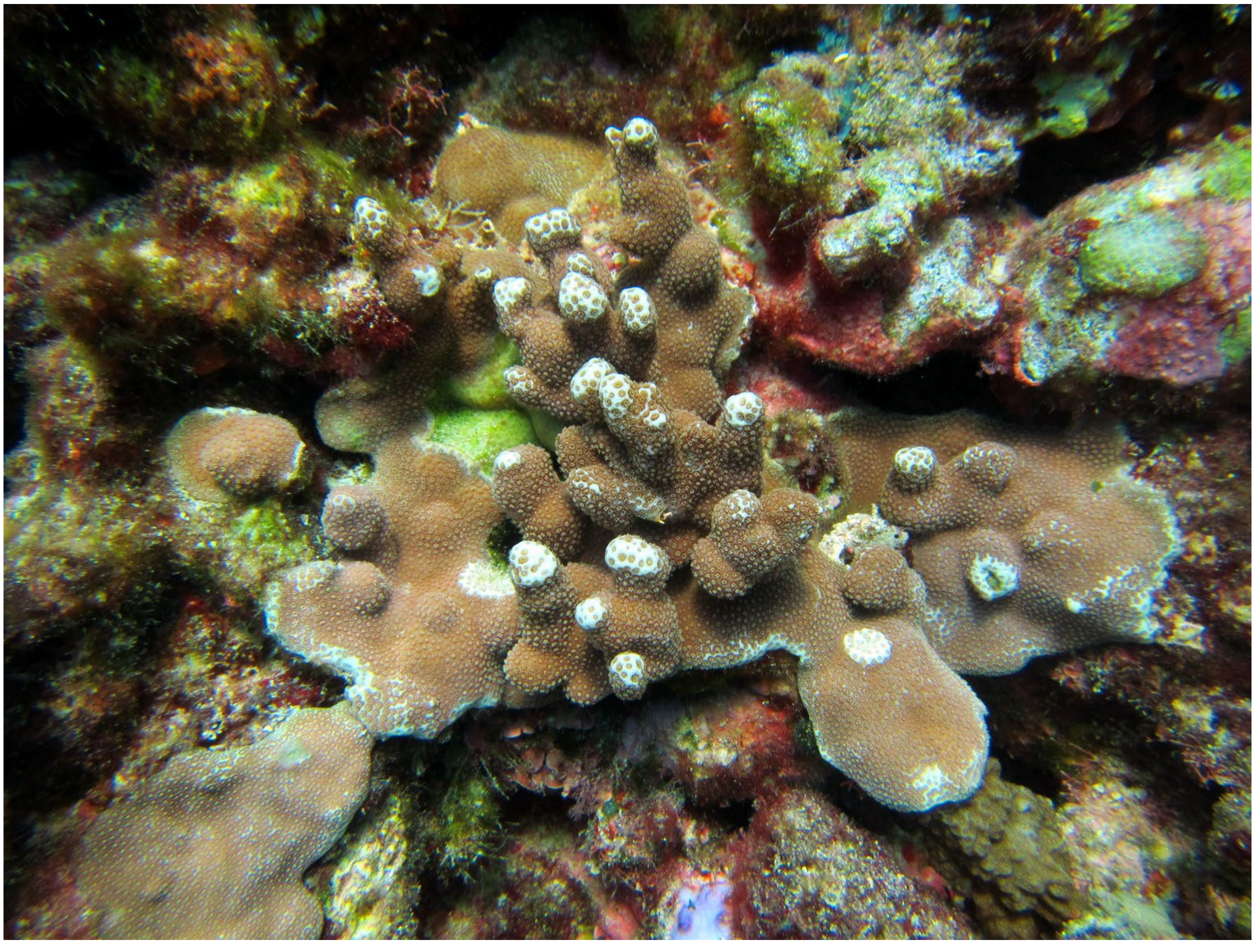
A close photo of *Porites monticulosa* on the left and *Porites rus* on the right.

Porites annae

Colonies in Tonga are usually encrusting, but usually also have at least a few short, lumpy columns. Polyps usually have tentacles partly extended as a tuft in the center of corallites. The tops of columns are often white between the recessed corallites. *Porites evermanni* has similar color and extended tentacles but forms large massive colonies with lumps. *Porites lichen* has extended tentacles but thin plate bases and uniform, smooth, finger shaped columns.



A photo of a colony of *Porites annae* that is mostly encrusting.

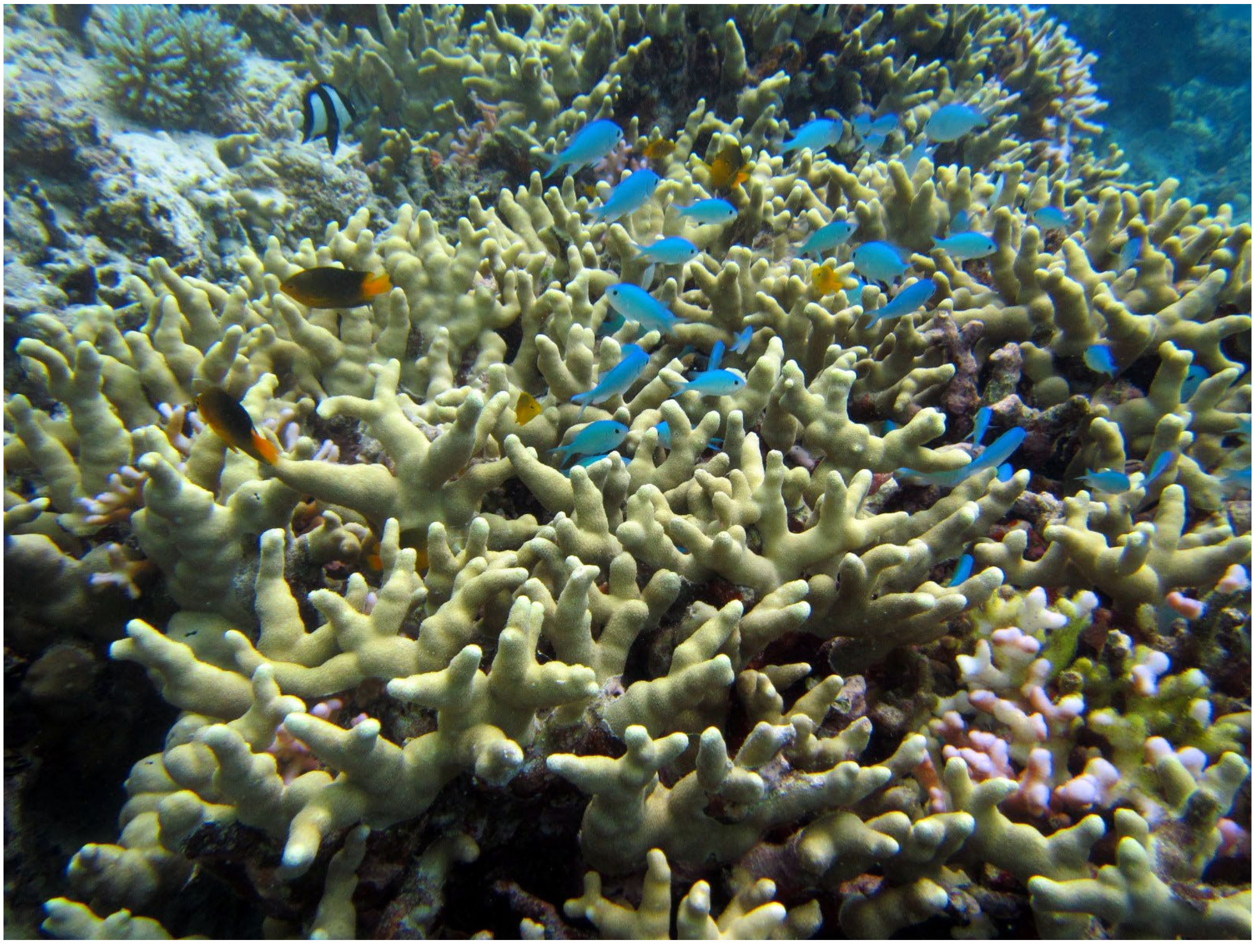


A photo of a colony of *Porites annae* that has more columns.

A closer photo of *Porites annae*. The colony on the right is *Porites myrmidonensis*.

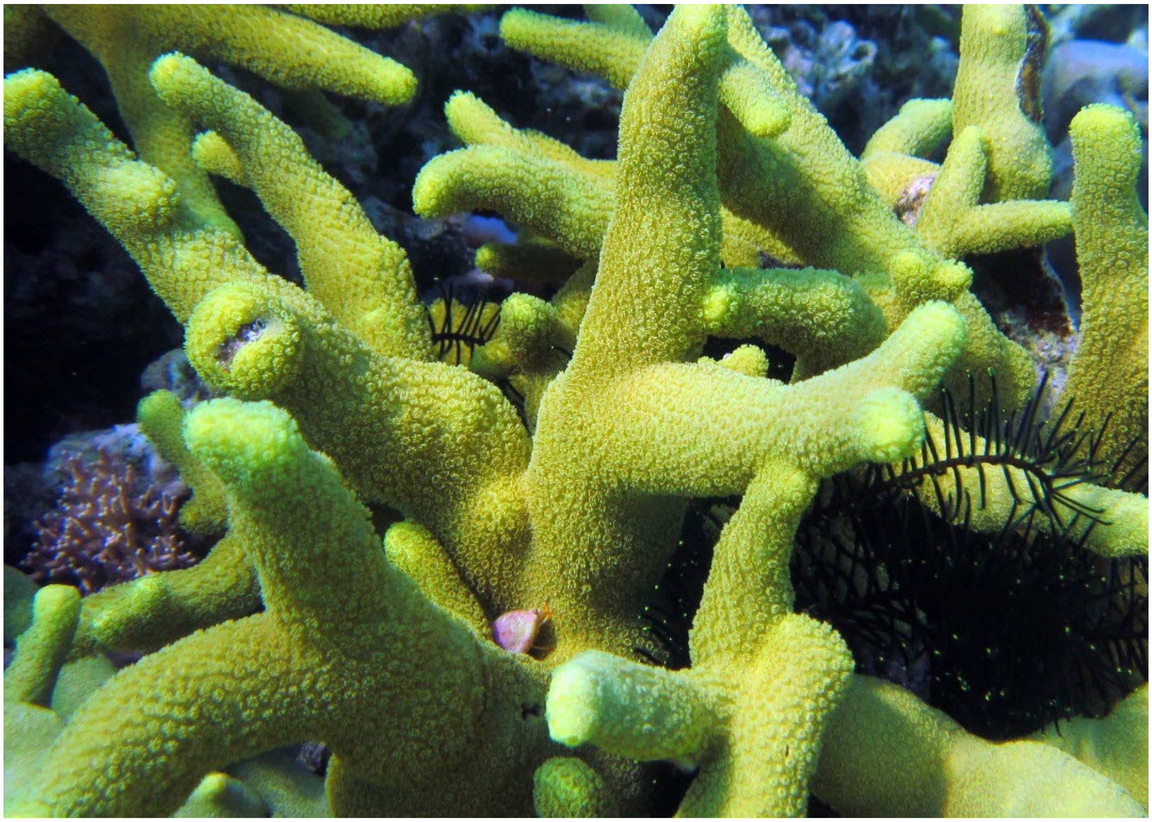
Porites cylindrica "finger coral"

Colonies are branching, with smooth cylindrical branches with rounded tips. Branches are usually just slightly lumpy. Colonies range from small to fields of branches. Polyp tentacles are usually slightly extended giving them a fine fuzzy appearance. *Porites lichen* has uniform finger-shaped columns and plate base and tentacle extended in tufts like *Porites evermanni*.



A photo of a large colony of *Porites cylindrica*.

A photo of a yellow-green colony of *Porites cylindrica*.



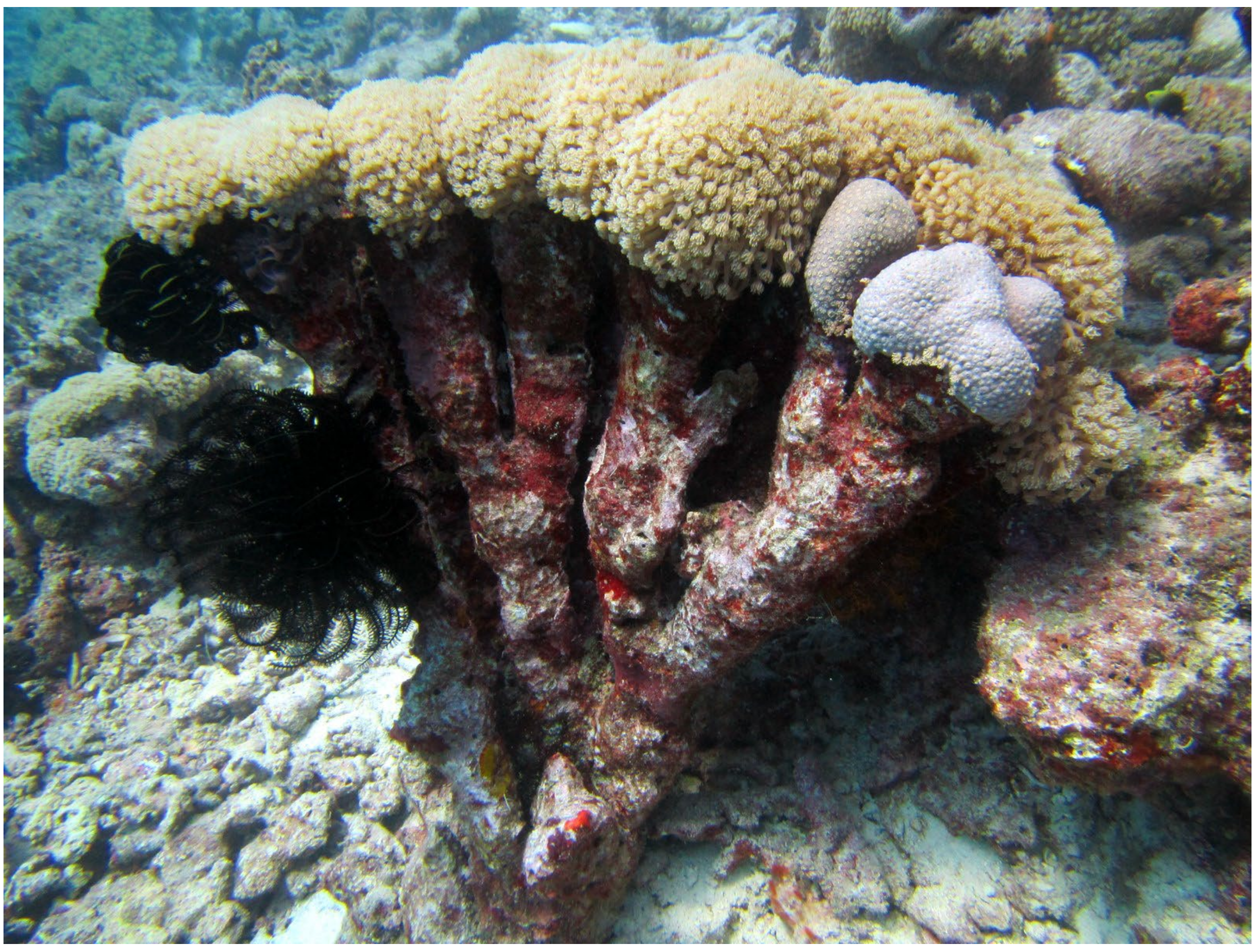
A close-up photo of *Porites cylindrica*.

Goniopora

Colonies are encrusting, massive, branching, or columnar. Polyps are daisy-shaped, with a long column topped by a ring of tentacles. Polyps can be as tall as about 15 cm or so short no column is visible. Some branching or columnar species have branches close enough together and large enough polyps that colonies may appear massive, and so could be called “sub-massive.” Species are often hard to distinguish, making identifications uncertain. Polyps have 24 tentacles. *Alveopora* looks nearly identical, but has 12 tentacles. Tentacles are hard to count accurately in magnified pictures and near impossible underwater. *Goniopora* has a very solid skeleton, but *Alveopora* has an extremely porous skeleton. A simple test in the water is to try to push a finger nail into the skeleton. It will sink in easily in *Alveopora,* but will not sink in, in *Goniopora*.

Goniopora columna

Colonies are columnar, with columns roughly wrist diameter. Polyps are only on the top ends of columns, and are about 5 cm long. Most other *Goniopora* species are massive and have larger or smaller polyps.



A photo of a colony of *Goniopora columna* from the side, with contracted polyps on the right. Often the columns can’t be seen, only the top ends of the columns with polyps on them.

A closer photo of *Goniopora columna*.

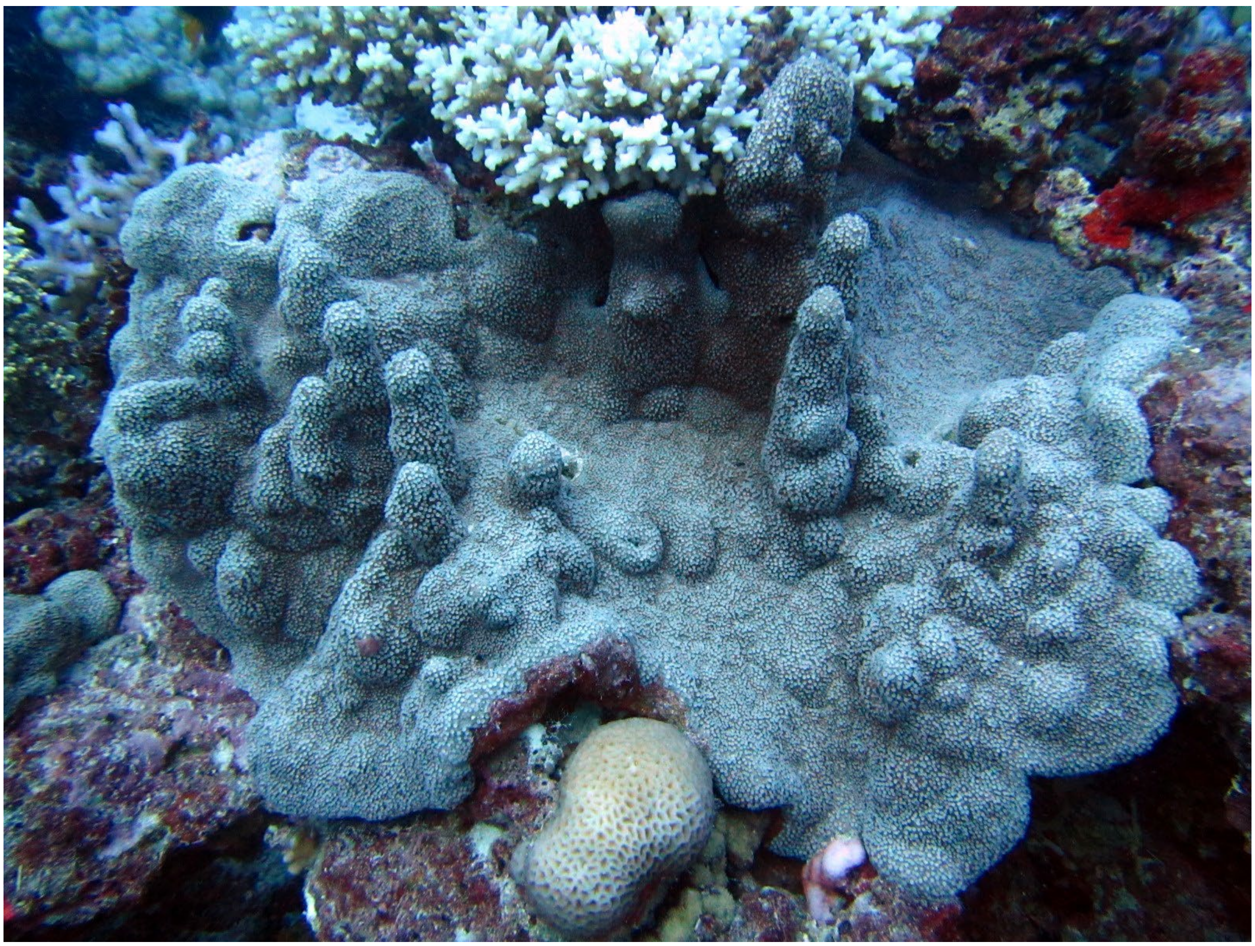
A close-up photo of *Goniopora columna*.

Alveopora

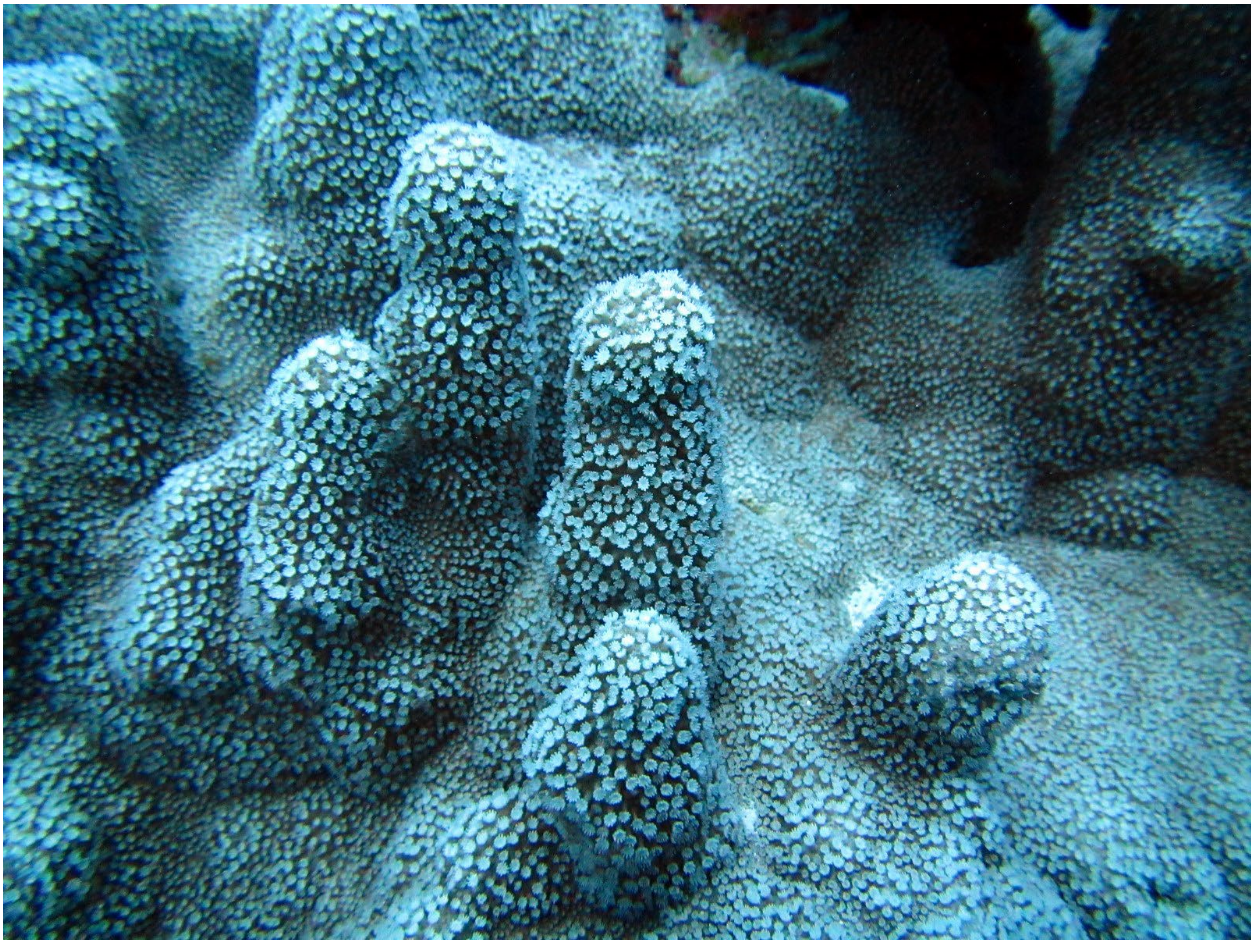
Colonies are encrusting, massive, branching, or columnar. Polyps are daisy-shaped, with a long column topped by a ring of tentacles. Polyps can be as tall as about 15 cm or so short no column is visible. Species are often hard to distinguish, making identifications uncertain. *Goniopora* looks nearly identical. *Alveopora* has 12 tentacles but *Goniopora* has 24. It is difficult to count tentacles accurately in photos, and near impossible underwater. *Alveopora* has a very porous skeleton and *Goniopora* has a very solid skeleton. They can be distinguished under water by using a finger nail. A finger nail will sink into *Alveopora* skeleton easily, but not into *Goniopora*.

Alveopora viridis

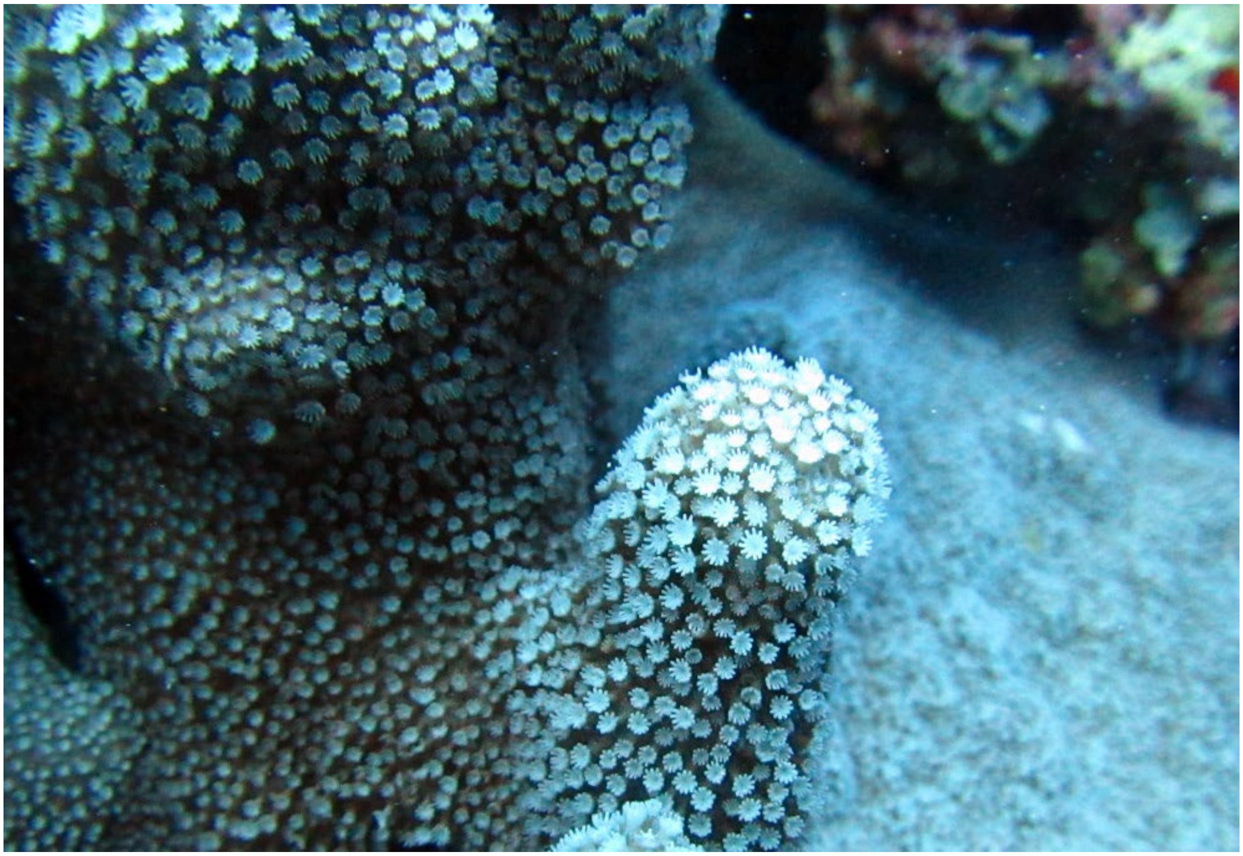
Colonies are encrusting with columns. Polyps are tiny, with no column visible, just tiny rings of tentacles on the skeleton. *Alveopora minuta* has even slightly smaller polyps.



A colony of *Alveopora viridis*.



A close picture of *Alveopora viridis*.



A close-up photo of *Alveopora viridis*.

Alveopora minuta

Colonies are small clusters of lumps. The polyps are tiny, the smallest of any *Alveopora* species.

A close photo of a colony of *Alveopora minuta*.

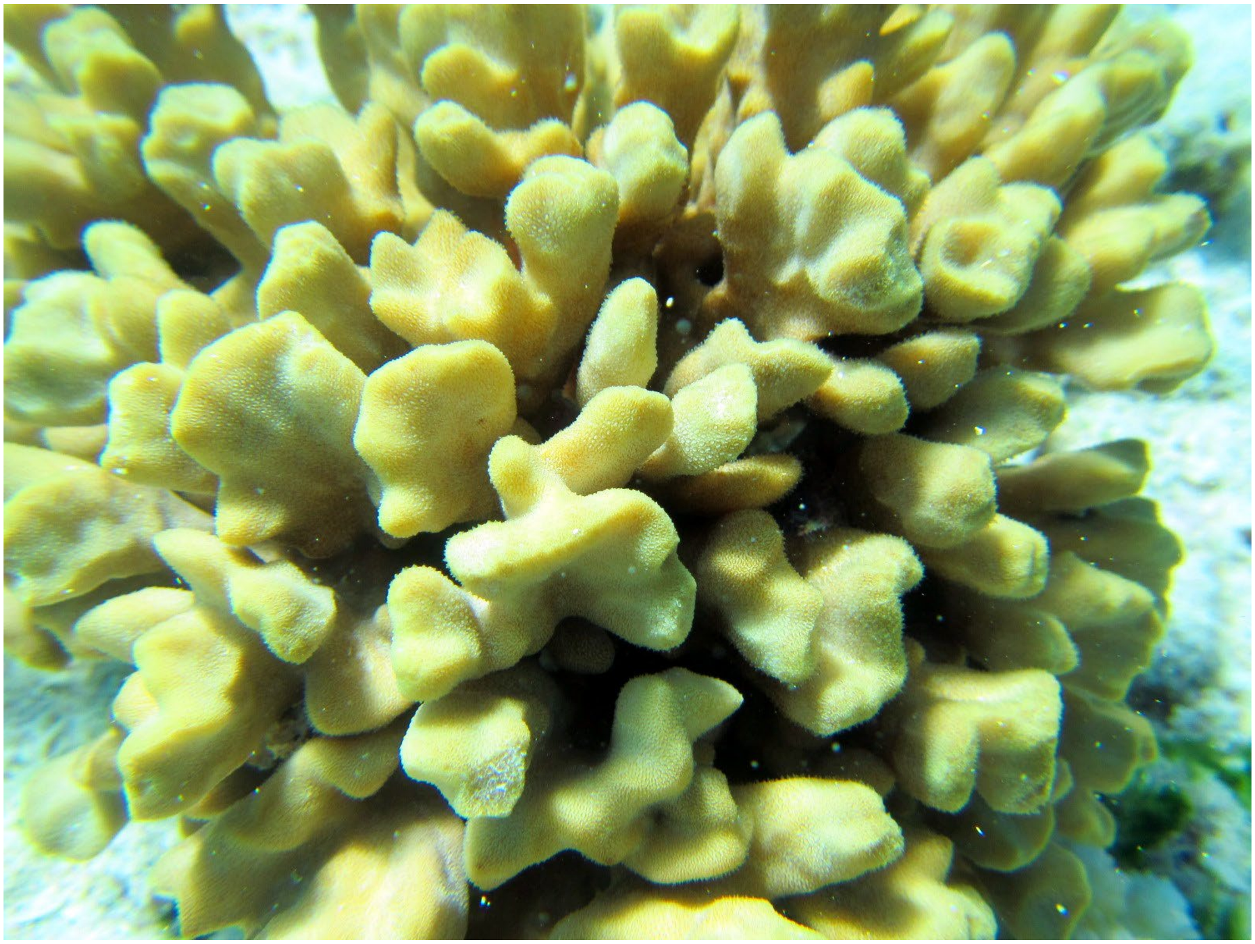
Psammocora

Colonies are branching, encrusting, massive, or columnar. In some species the corallites are too small to be seen in living colonies. In a few species corallite centers are visible, and in at least one corallites are easily distinguishable. But there is no one single feature that distinguishes this genus in living colonies. Each species must be distinguished, and they tell you what the genus is.

Psammocora contigua

Colonies are branching. Branches are about finger diameter, commonly angular and not rounded. Corallites cannot be seen. It may be more common on reef flats than on reef slopes. Some colonies are not attached. Most other *Psammocora* species are not branching. *Pavona frondiifera* has thinner, sharper branches and small plates, and s more orange.

A colony of *Psammocora contigua*.

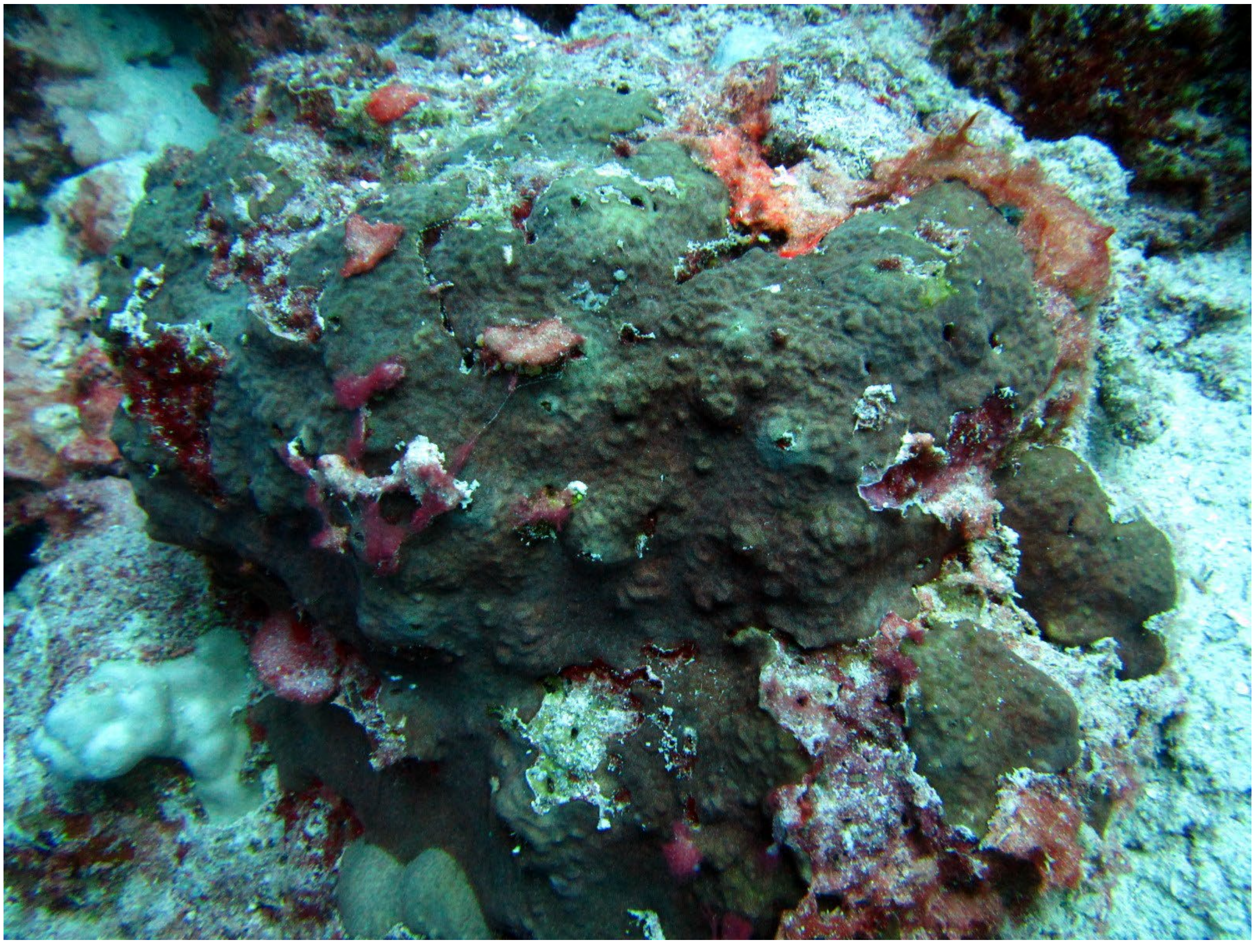


A close-up photo of *Pammocora contigua*.

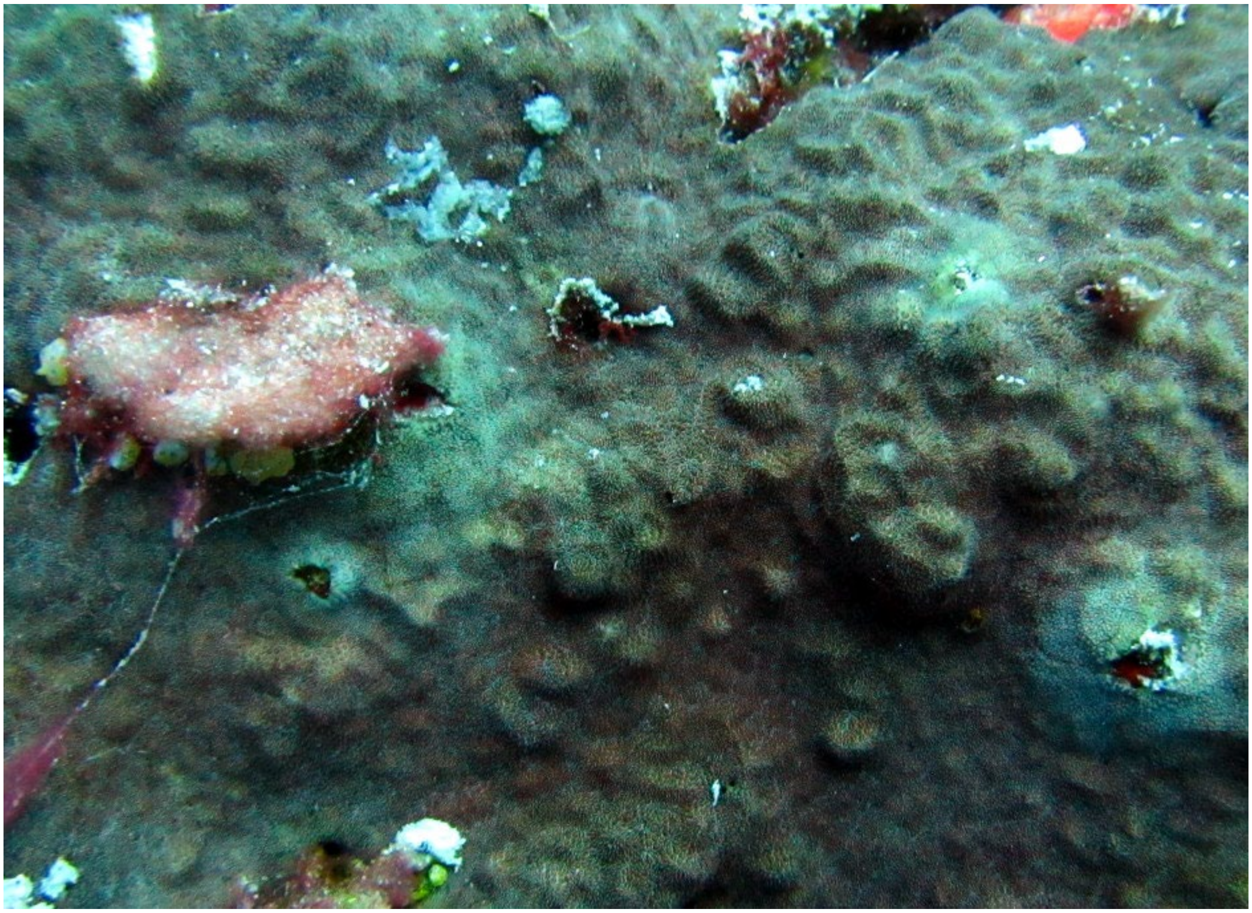
Psammocora nierstraszi

Colonies are encrusting, and have small winding rounded smooth ridges on them. The ridges usually don't connect or go far on the colony. Corallites cannot be distinguished in the water. Few *Psammocora* species are encrusting. *Pavona varians* has sharper ridges that usually connect.

A phot



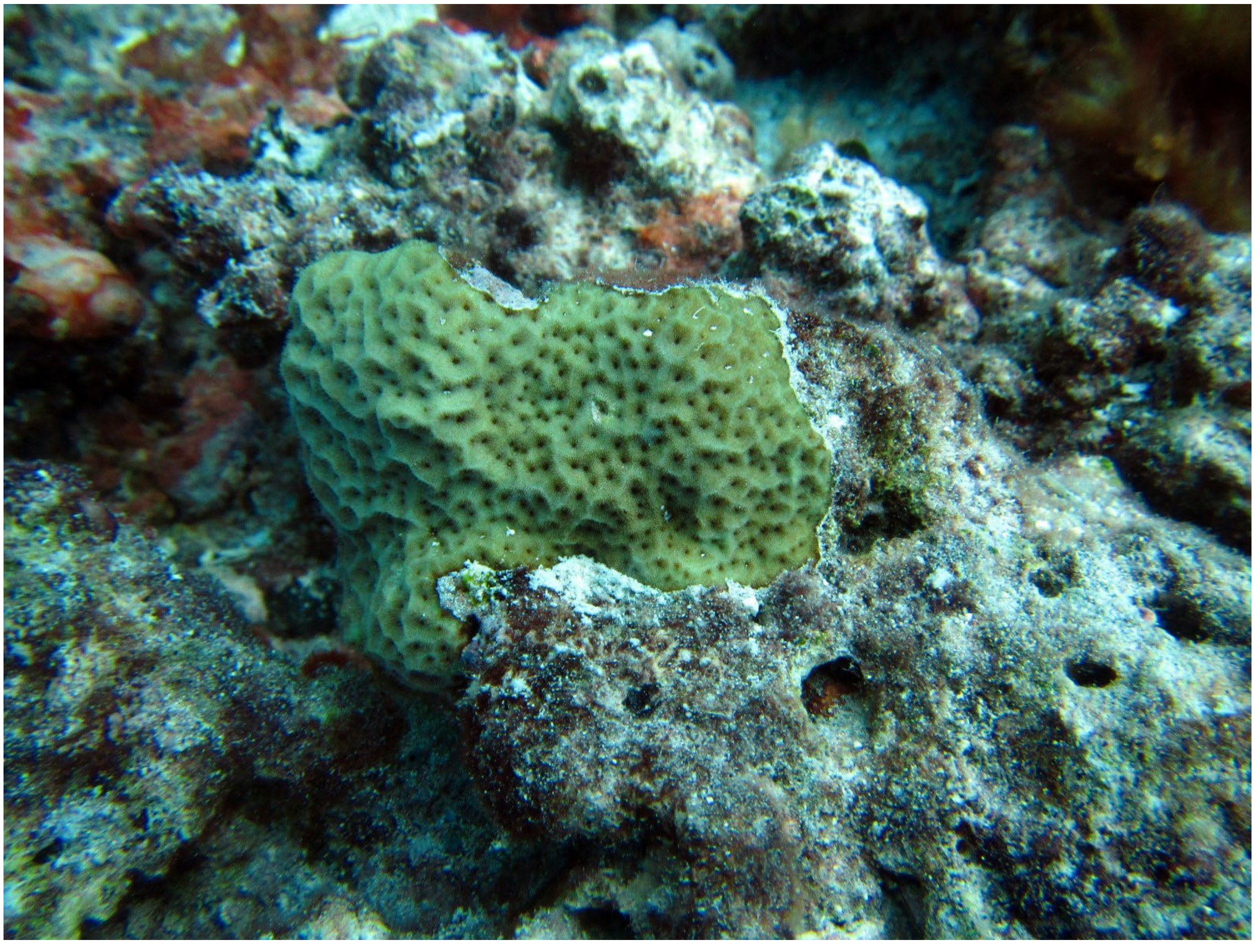
A photo of *Psammocora nierstraszi*.



A close-up photo of *Psammocora nierstraszi*.

Psammocora profundacella

Colonies are small and encrusting to slightly massive. Corallites have sharp raised ridges between them, and a tiny pit in the center. Colonies are smaller than in most other *Psammocora* species and this is the only *Psammocora* with sharp ridges between corallites. *Pavona venosa* has sharper ridges between corallites, doesn't have a little hole in the center of corallites, and is usually a golden color and colonies can be larger with multiple lumps separated by cracks..



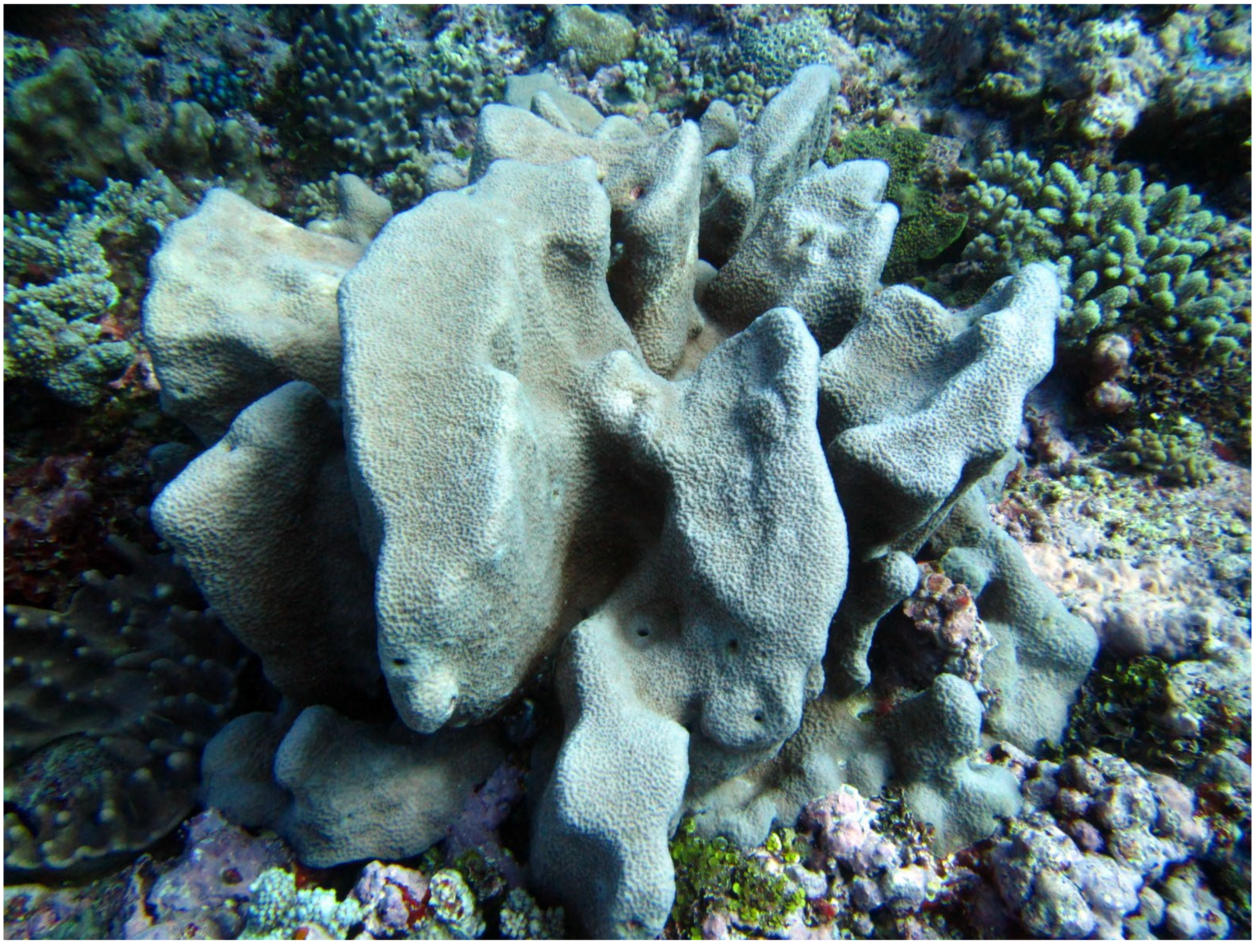
A photo of a colony of *Psammocora profundacella*.

A close-up photo of *Psammocora profundacella*.

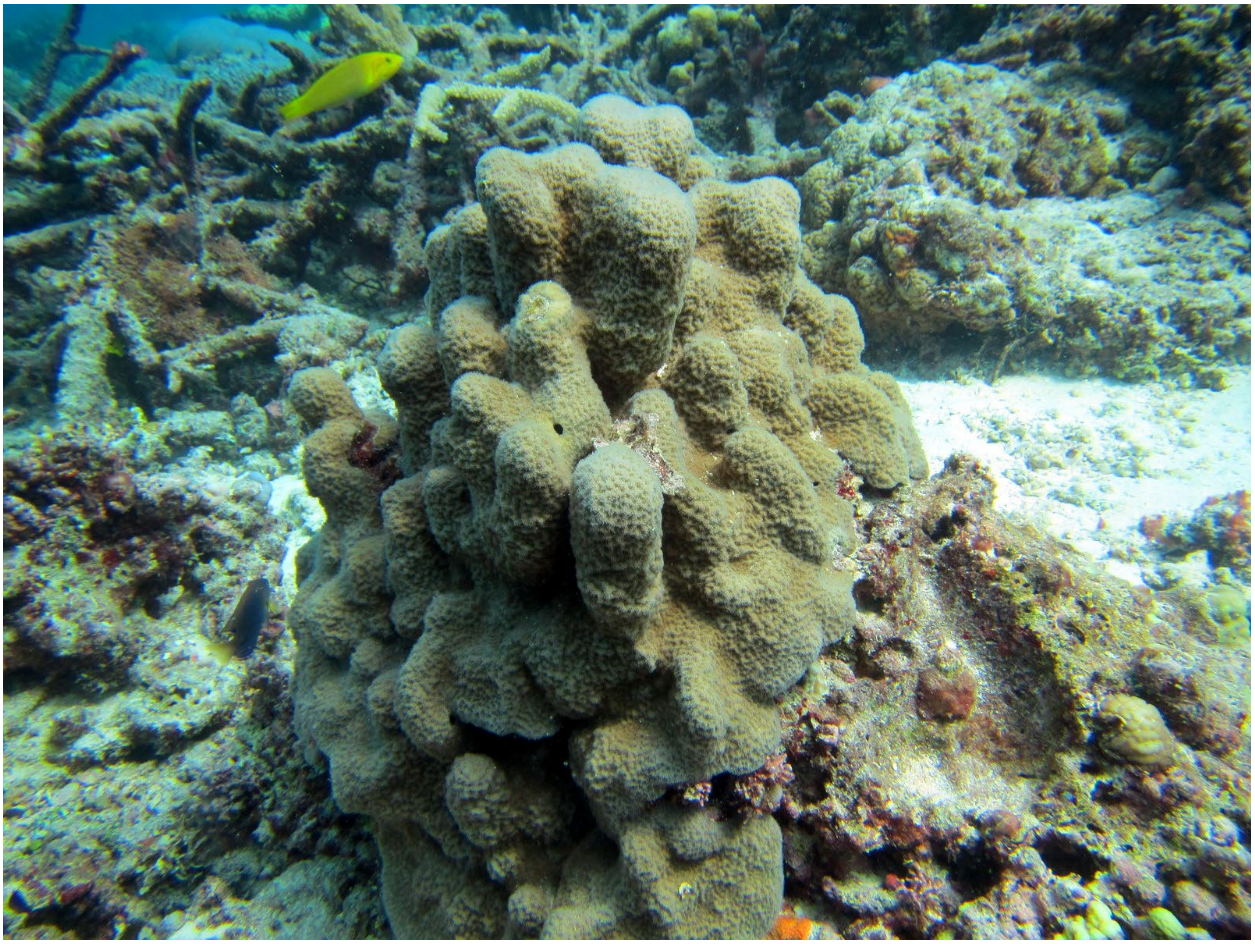
Psammocora digitata

Colonies can be encrusting, massive, or columnar. Massive colonies can be as large as two meters tall and at least a meter wide. Some colonies have parallel ridges, some have raised areas between the parallel ridges. The surface has little pits at the center of corallites, and tiny spines. This name was only recently found to apply to this species, previously it was applied to a species that only has cylindrical columns, but has a similar looking surface when seen close-up. This is the only large massive Psammocora. Pavona duerdeni and Pavona diffluens can have this shape but not nearly as large colonies, and have septa visible radiating from corallites.

A photo of a large massive colony of *Psammocora digitata* with some parallel ridges.

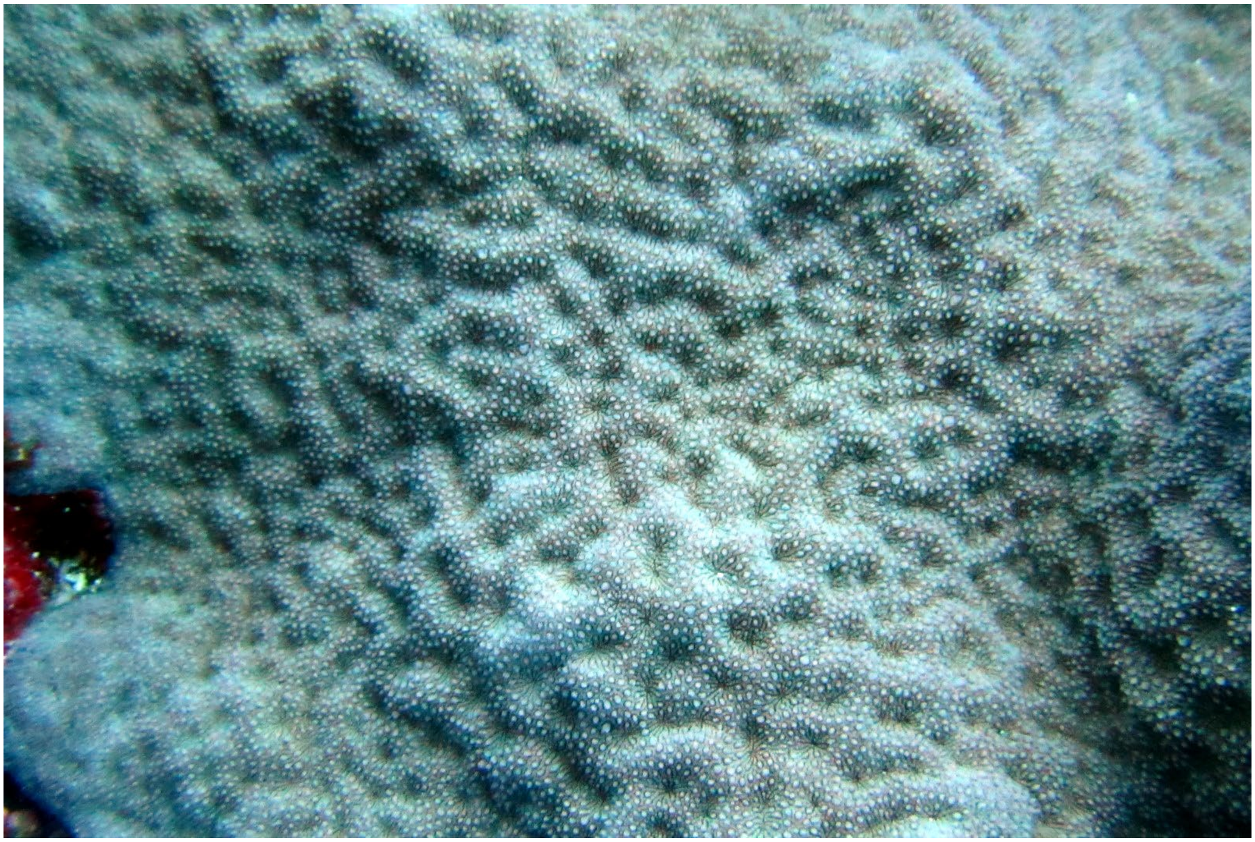


A photo of a colony of *Psammocora digitata* with large parallel lobes.



A photo of a colony of *Psammocora digitata* with cylindrical columns.

A close photo of *Psammocora digitata*.



A close-up photo of the surface of *Psammocora digitata*.

Coscinaraea

Colonies can be massive, encrusting, or columnar. Corallites range from small to medium size, and often have ridges between them. Few details of the coralltes can be seen in live colonies other than the shapes of the colonies, corallites, and ridges.

Coscinaraea cf. monile

Colonies are massive but can have thick short columns. The corallites are up to the diameter of a little finger. Corallites are smooth, shallow, V-shaped depressions between ridges that do not extend above the level of the corallite, and which do not have spines. Coralliites are polygonal in outline. In the center of a corallite there is a small hole. *Coscinaraea columna* has tiny corallites between high ridges. *Favites* has visible radiating ridges that are septa and can have spines.

A columnar colony of *Coscinaraea* cf. *monile*.

A close-up photo of *Coscinaraea* cf. *monile*.

Gardineroseris

This genus only has one speciies, so the properties of the genus are those of the species.

Gardineroseris planulata "Honeycomb coral"

Colonies are encrusting to massive. Corallites are roughly the size of a pea, deeply recessed, wth very sharp ridges between them. The septa are very even, tiny, and close together, and so the corallites have a smooth, rounded look inside. Some corallites are dividing, with a shorter, smaller wall inside a larger corallite. Colonies look like honeycomb. Colonies are often brown or green. *Pavona venosa* is often a group of lumps, is less of a honeycomb look and iis often a golden color. *Psammocora profundacela* has thicker, less sharp ridges and only forms small massve coloneis..

An encrusting colony of *Gardineroseris planulata*.

A close-up photo of *Gardineroseris planulata*.

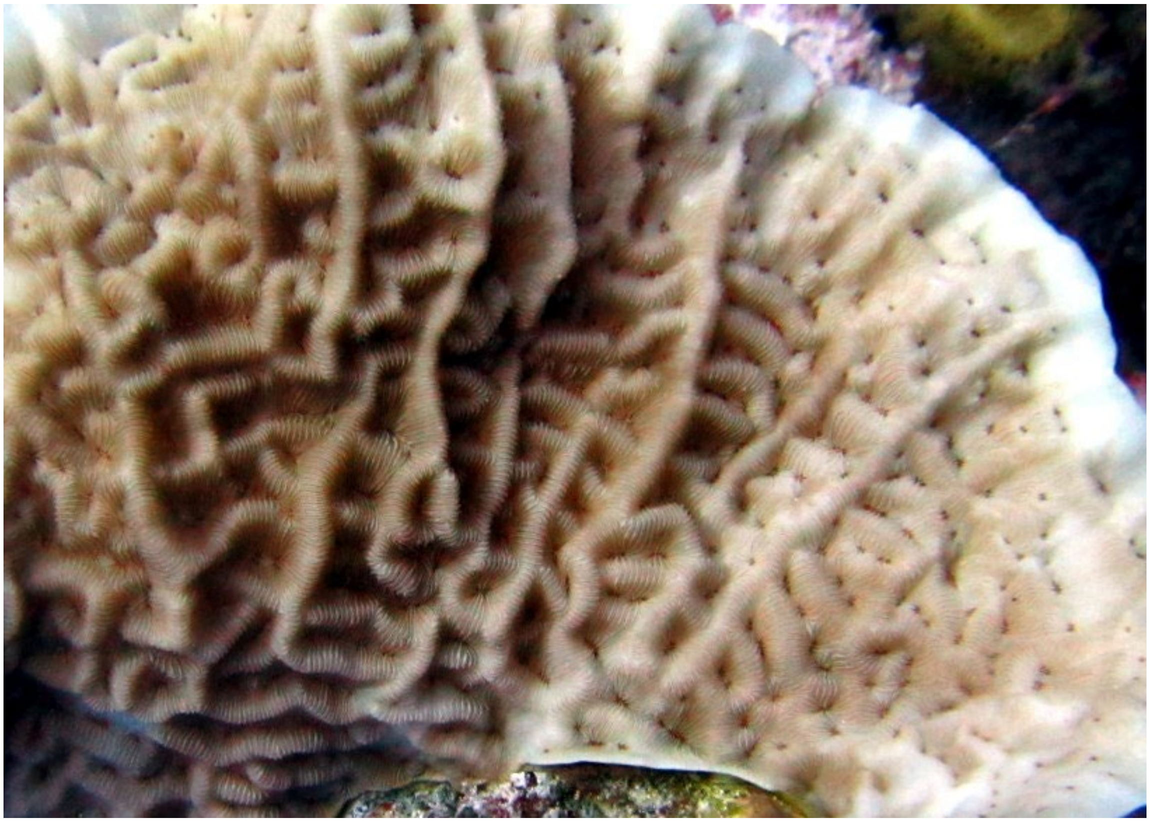
Leptoseris

Colonies are most often thin plates or fronds, but can be encrusting. Corallites are on the upper surface and may be raised as rounded cushions, often are inclined towards the outer edge of the plate. In some species the corallites are not raised, and in encrusting species corallites may be between ridges. Septa inside corallites extend up over the sides of corallites, down to the plate, and extend to nearby corallites where they run up over the sides into the inside of the corallites. Thus they are continuous between septa and costae, and are called septo-costae. This genus is usually in reduced light conditions such as overhangs or deeper water. *Pavona* has similar septo-costae, but is more often massive, or thick vertical plates, or branches, does not have corallites extended as round cushions, and is found in the light.

Leptoseris yabei

Colonies are thin plates which may be in one or more whorls. The upper surfaces of plates are covered with small ridges, some of which run radially and others are roughly concentric. The corallites are in beween the ridges, and their centers sometimes are visible as black dots. *Leptoseris mycetoseroides* is encrusting and has similar ridges which run in all directions.

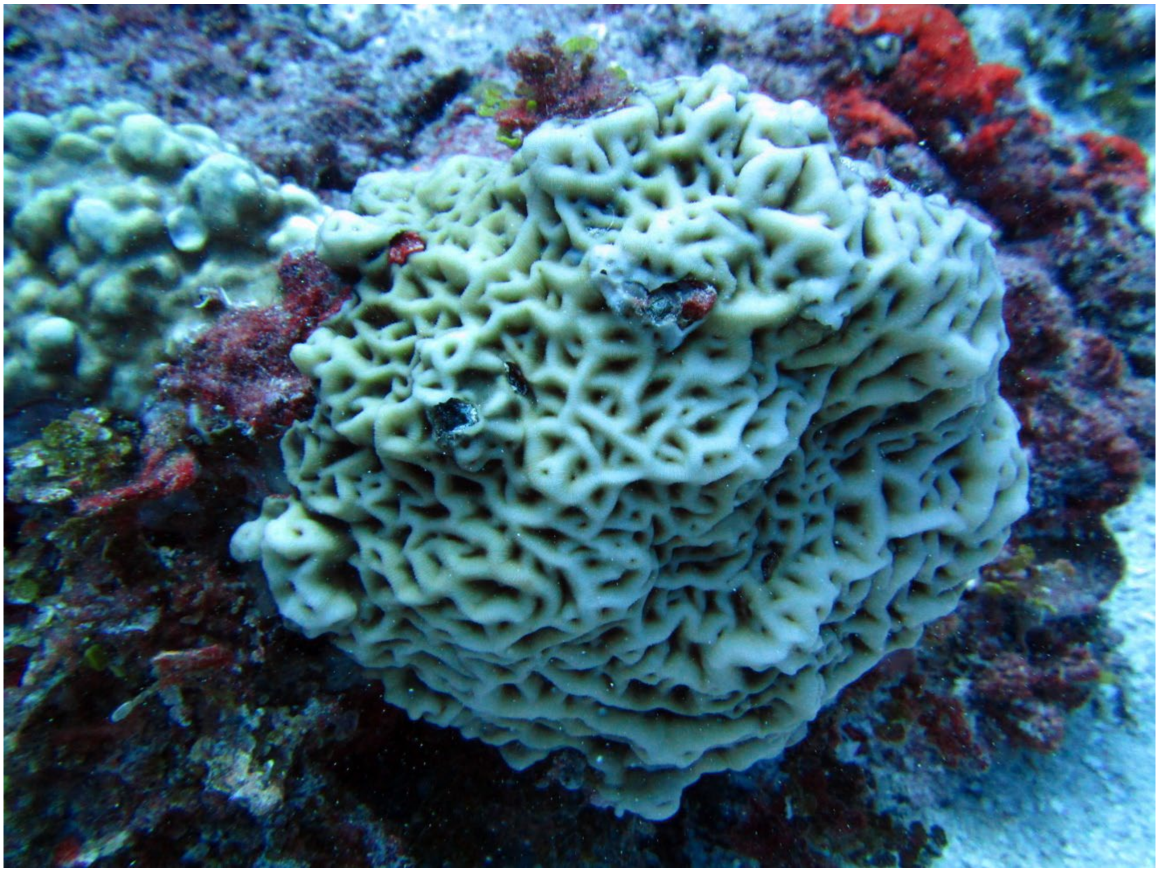
A colony of *Leptoseris yabei*.



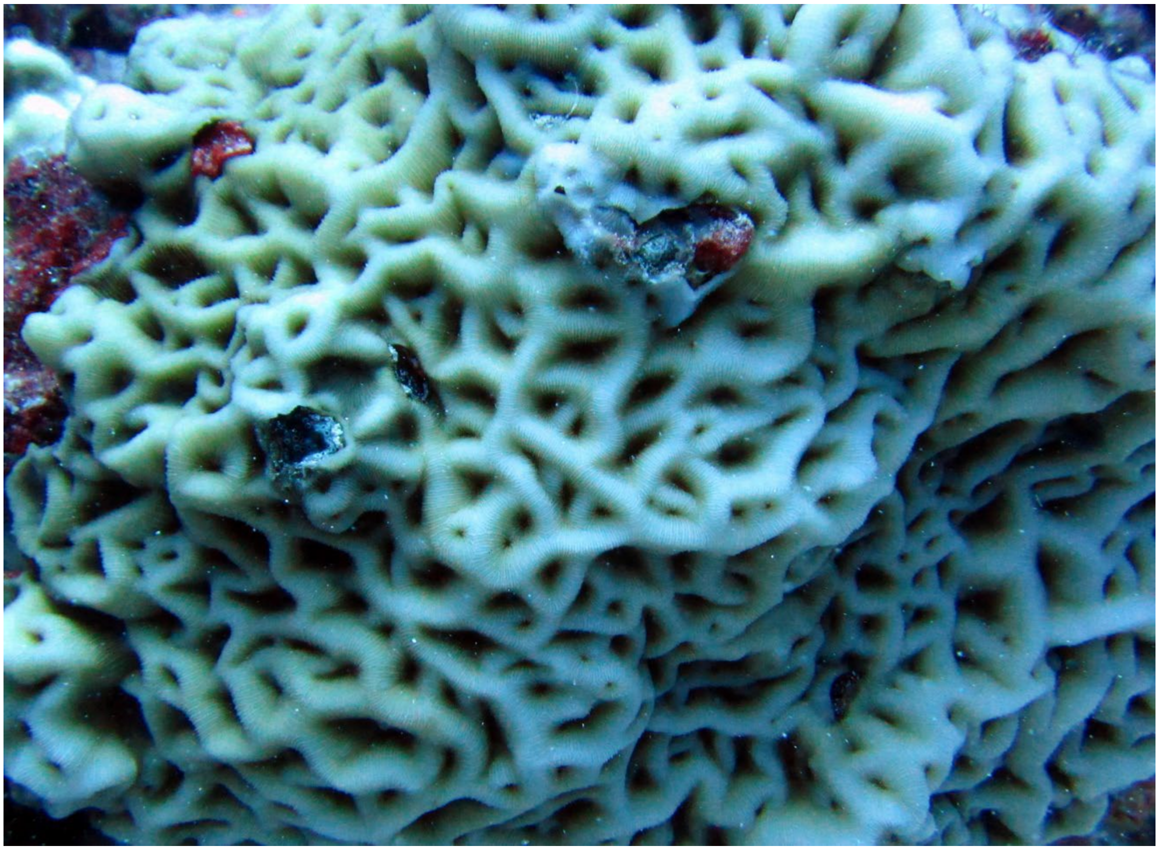
A closer photo of *Leptoseris yabei*.

Leptoseris mycetoseroides

Colonies are encrusting, and have ridges on them which run in all directions. The corallites are between the ridges. *Leptoseris yabei* forms thin plates with similar ridges, but the ridges run radially to the edge of the plate or concentrically.



A photo of *Leptoseris mycetoseroides*.



A close-up photo of *Leptoseris mycetoseroides*.

Leptoseris scabra

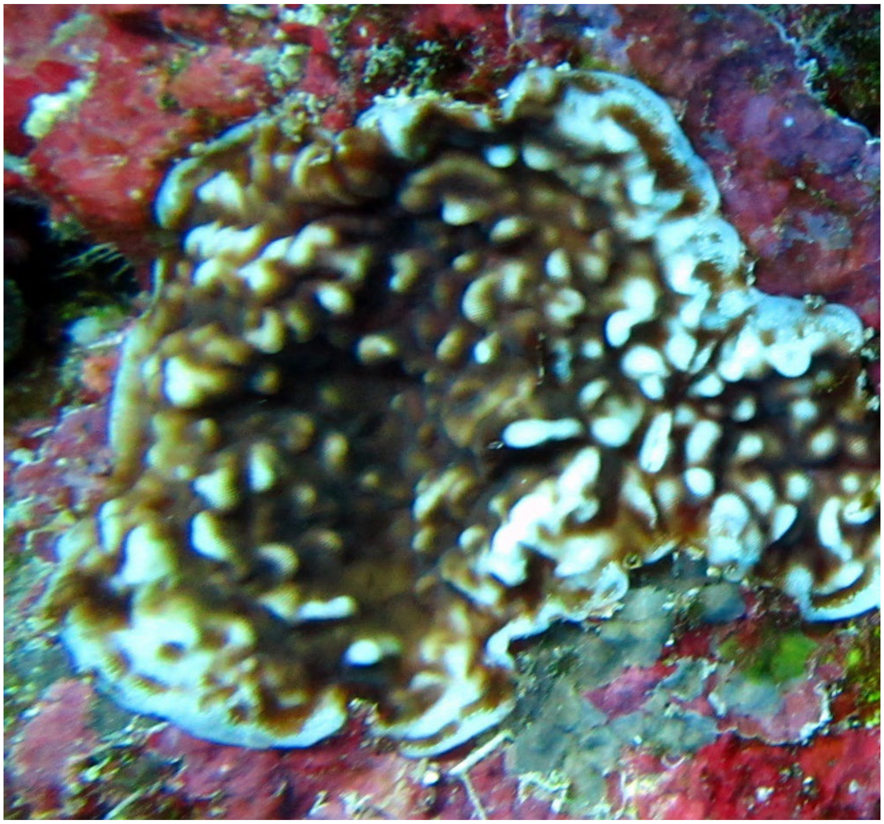
Colonies are thin plates that are nearly encrusting but with lifted edges. Corallites are rounded raised cushions which are inclined towards the edge of the colony. Septo-costae alternate in height. All rounded lumps are corallites and have a depression where the center of the corallite is. On *Leptoseris incrustans* most rounded lumps are not corallites. On *Leptoseris hawaiiensis* septo-costae are equal in height.

A photo of *Leptoseris scabra*. This colony is unusally lumpy. The dark spots on lumps are the corallite centers.

Leptoseris incrustans

Colonies are encrusting and have small lumps, most of which are not corallites. Most corallites are between lumps and hard to see. This species seems to be most common on overhangs. On other *Leptoseris* species that have lumps, the lumps are corallites.

Two *Leptoseris incrustans* under an overhang. The white spots are bumps.



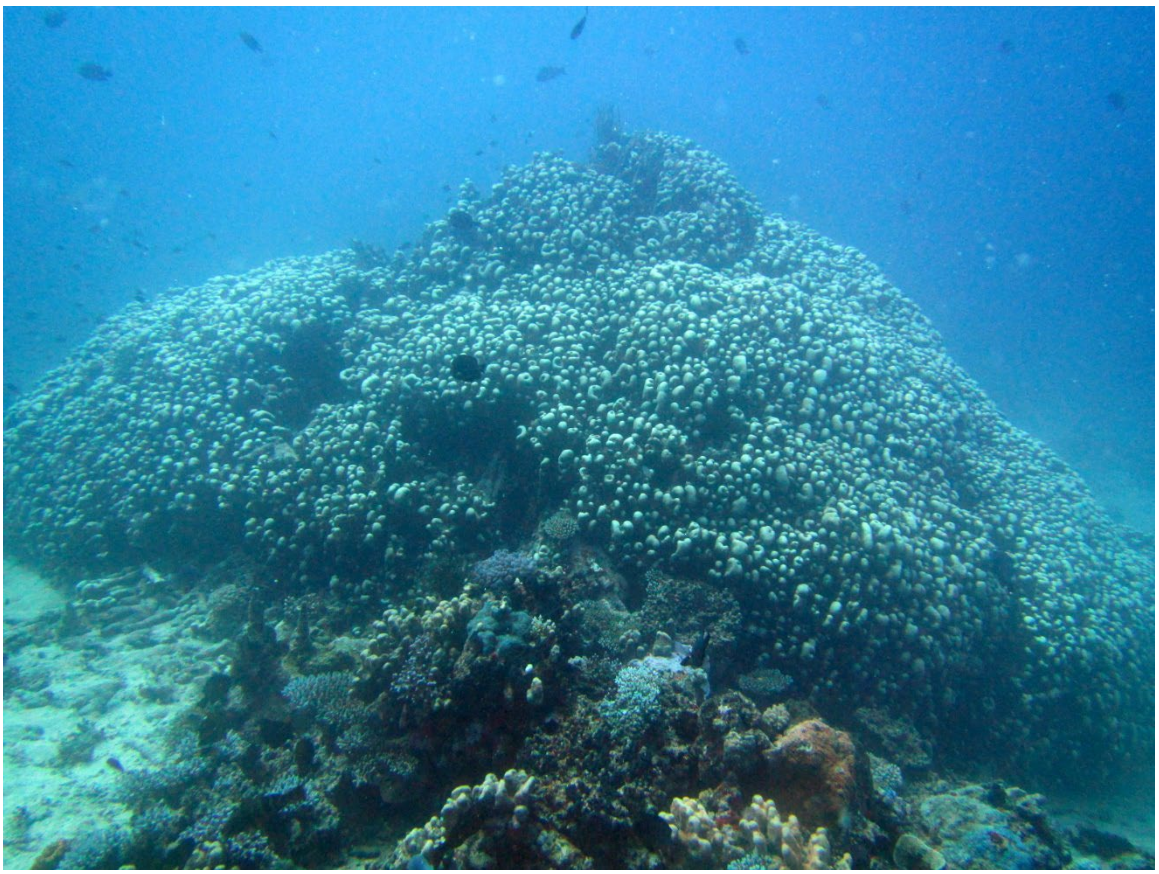
A closer photo of *Leptoseris incrustans*.

Pavona

Colonies can be massive, thick or thin vertical plates, branching, columns, or encrusting which may have plate edges. Corallites range in size from about 2 mm diameter up to about pea size. Septa inside corallites continue outside as costae and continue to nearby corallites where they continue inside the corallite as septa, and thus are known as septo-costae. *Pavona* is found in full light. *Leptoseris* has similar septo-costae, but are usually thin plates and usually found in lower light, and may have corallites extending as rounded cushions.

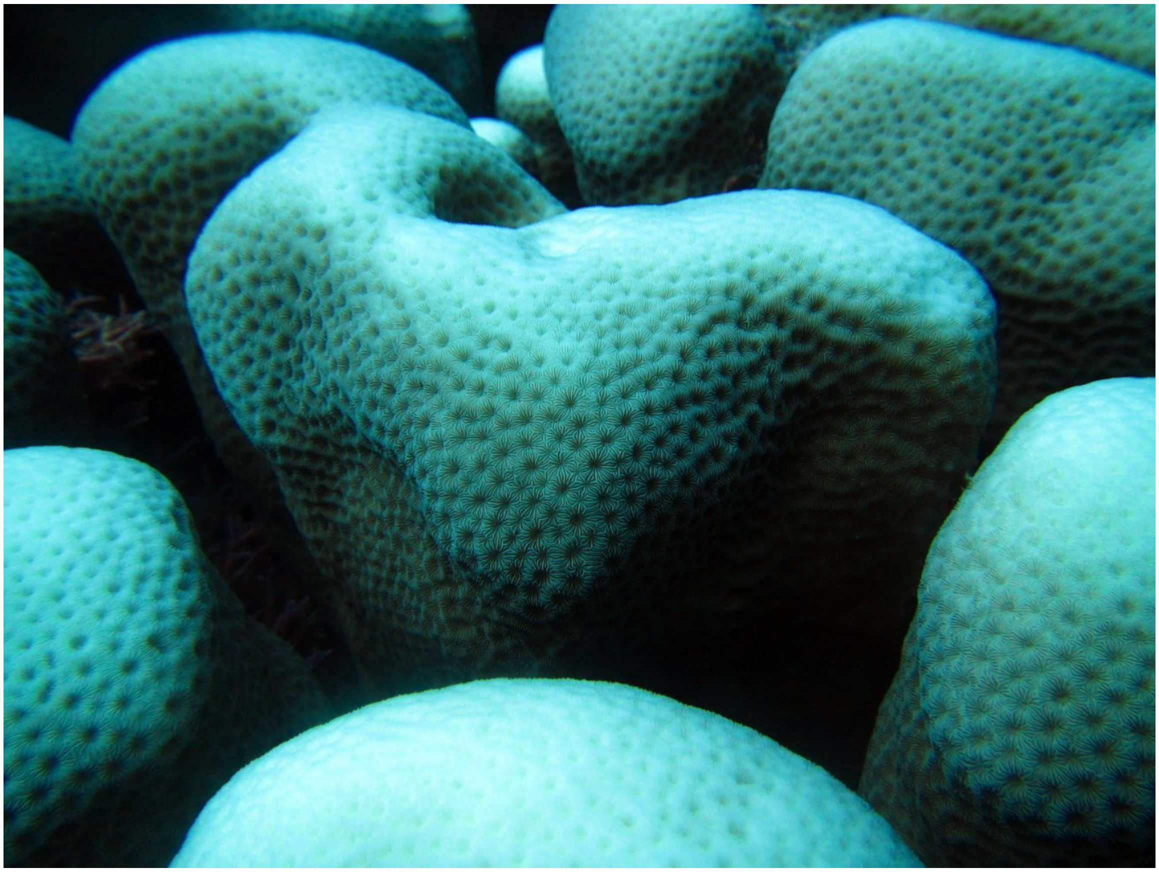
Pavona clavus

Colonies are columnar and can range from a few columns to some of the largest of all coral colonies, a colony in Japan is 71 m circumverence. The columns are about the diameter of a wrist, reach a fairly uniform height, do not taper, and have rounded upper ends. Corallites are small depressions on the column surfaces, with radiating septocostae. Colonies are usually cream colored. *Pavona bipartita* is similar except it ranges from encrusting to lumpy to short irregular or tapering columns instead of uniform non-tapering columns, doesn't form huge colonies, and often has slight rounded ridges running between a few corallites, and is more often brown than cream .



A large colony of *Pavona clavus*. Most colonies are not huge.

A photo looking across the tops of columns on a large colony of *Pavona clavus*.

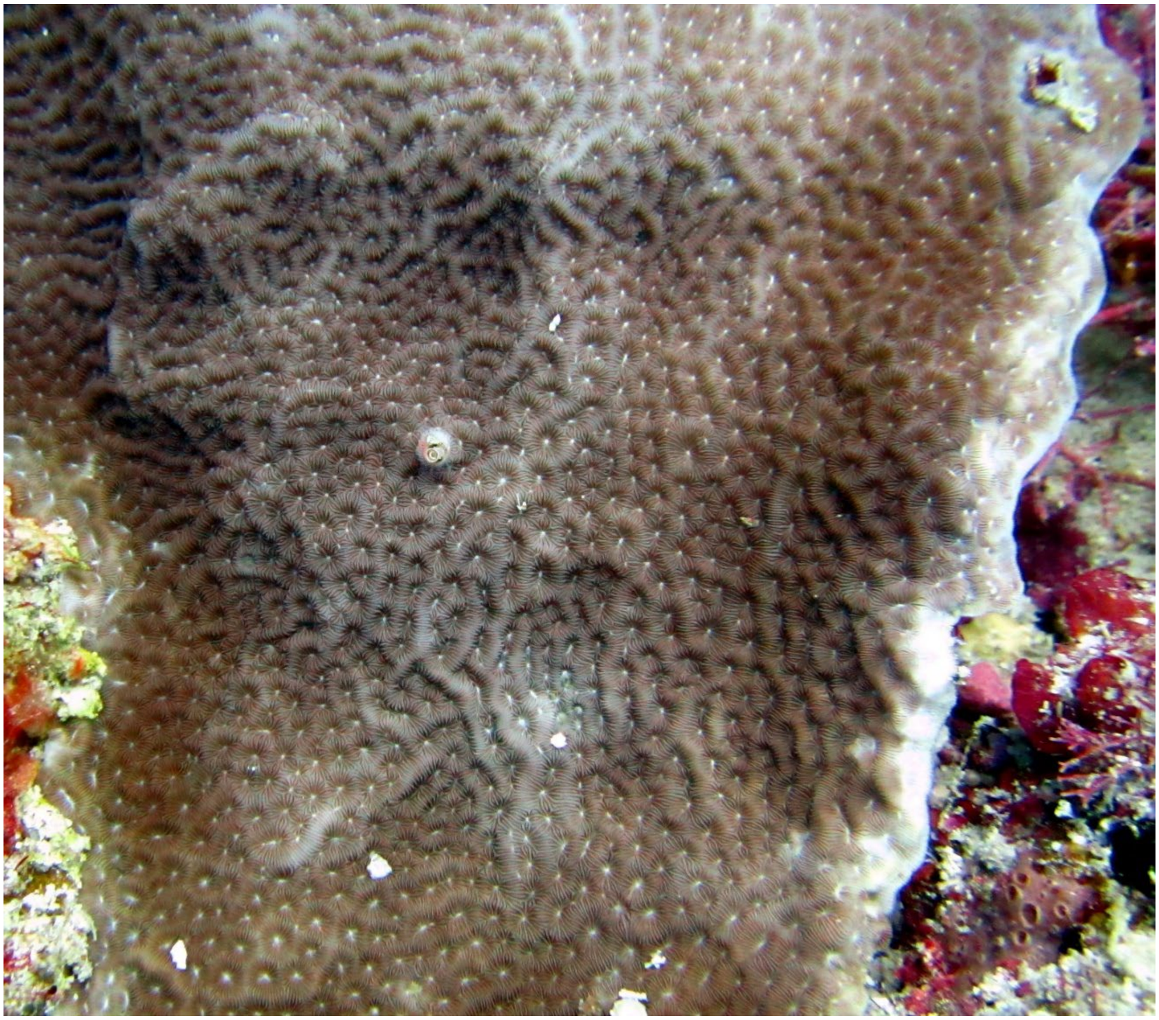


A close photo of the surface of *Pavona clavus* columns.

Pavona bipartita

Colonies range from encrusting to lumpy to short tapering irregular columns, and colonies can include all three. Surfaces have small indentations which are corallites, with tiny septo-costae which go from one corallite to another. There are usually small round ridges between at least a few of the corallites. Colonies are most often brown. *Pavona clavus* has near identical corallites, but uniform, non-tapering columns, little or no ridges between corallites, can form huge colonies, and is usually cream colored.

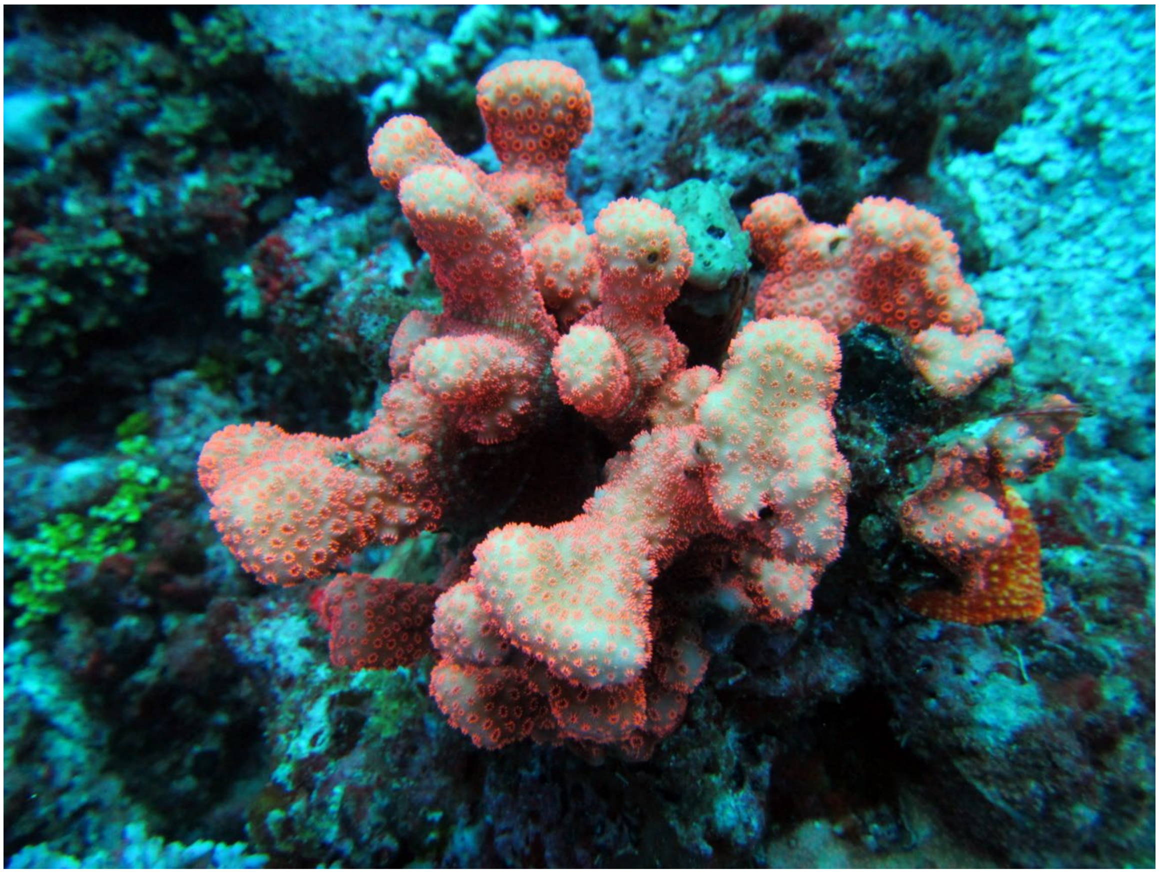
A colony of *Pavona bipartita* with irregular, tapering columns, lumps and an encrusting base.



An encrusting colony of *Pavona bipartita* showing the small rounded ridges between corallites.

Pavona maldivensis

Colonies are branching or nodular. Branches or nodules are typically about the diameter of a thumb or perhaps a little larger. Colonies can be up to about 40 cm diameter, but are usually much smaller. Branches in larger colonies are usually uniform in length, shape, and parallel, radiating from the colony. Small colonies can be encrusting with small nodules. Corallites project, and are only about 2-3 mm diameter.   Some colonies may have fluorescent copper colored, red, or green polyps but most colonies are light brown most places. Branches are much smaller than the columns on *Pavona clavus*.



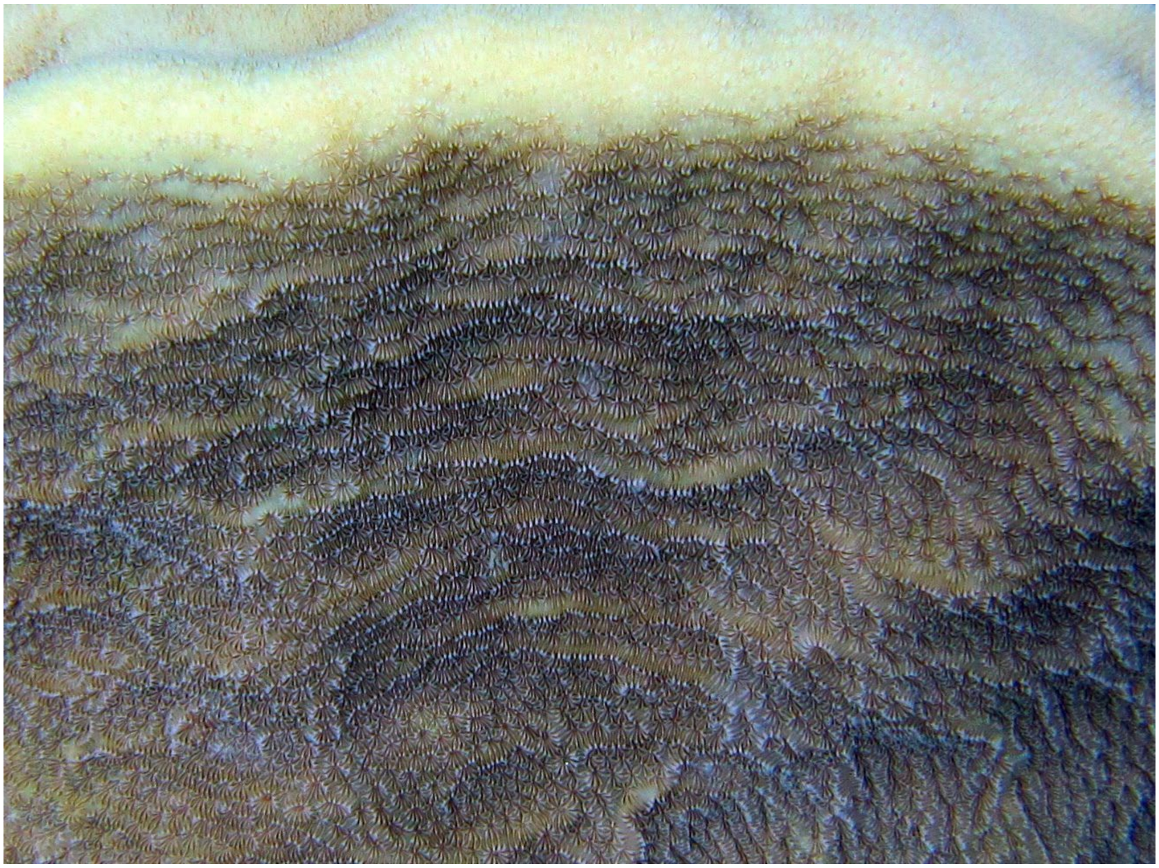
A modest size colony of *Pavona maldivensis*, with fluorescent red polyps. Branches are more uniform on many colonies.

A close-up view of *Pavona maldivensis*.

Pavona duerdeni

Colonies usually have one or more vertical, thick plate lobes, which can resemble a thick pork chop on its edge. Other colones can be a mix of such shapes with small lumps and columns. Corallites are tiny, about 2 mm diameter, and usually not raised. Corallites can be quite hard to see. *Pavona diffluens* can produce a similar shape or be lumpy, and the corallites are larger and have a hole in the middle. *Pavona gigantea* usually forms a cluster of parallel thick plates or oval columns, has larger corallites and usually is covered with little white tentacles so corallites can't be seen.

This is the typical thick vertical plate shape of *Pavona duerdeni*, and usually colonies have at least part of their colony in this shape.

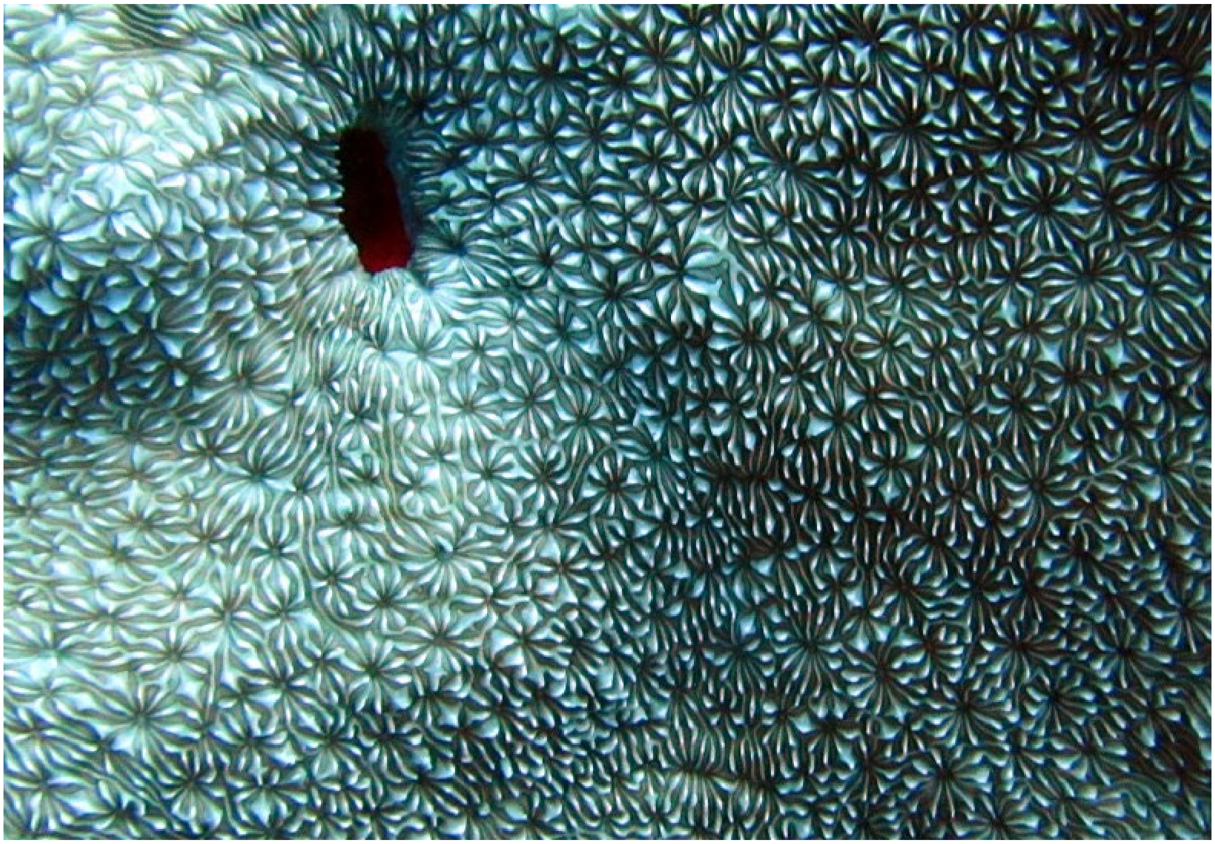


A close-up photo of *Pavona duerdeni*, showing the tiny corallites. Many colonies do not have little ridges like this one has.

Pavona cf. diffluens

Colonies range from small lumps to large vertical plates as little as 2 cm thick. The latter were not seen in Tonga. Colonies have polyps about the size of a small pea, with a circle of rased septa and a relatively large, deep hole in the center. The species by this name was originally described from the Red Sea, only colonies there are this species for sure. It is now known from a variety of locations in the Pacific from Guam to Amercan Samoa. But it has not been reported from most of the Indian Ocean. Veron's opinion is that Pacific colonies are a different species that is very similar to the one by this name. *Pavona duerdeni* often has some vertical thick plate in a colony, and corallites are much smaller and lack the central hole.

A small colony of *Pavona* cf. *diffluens*.

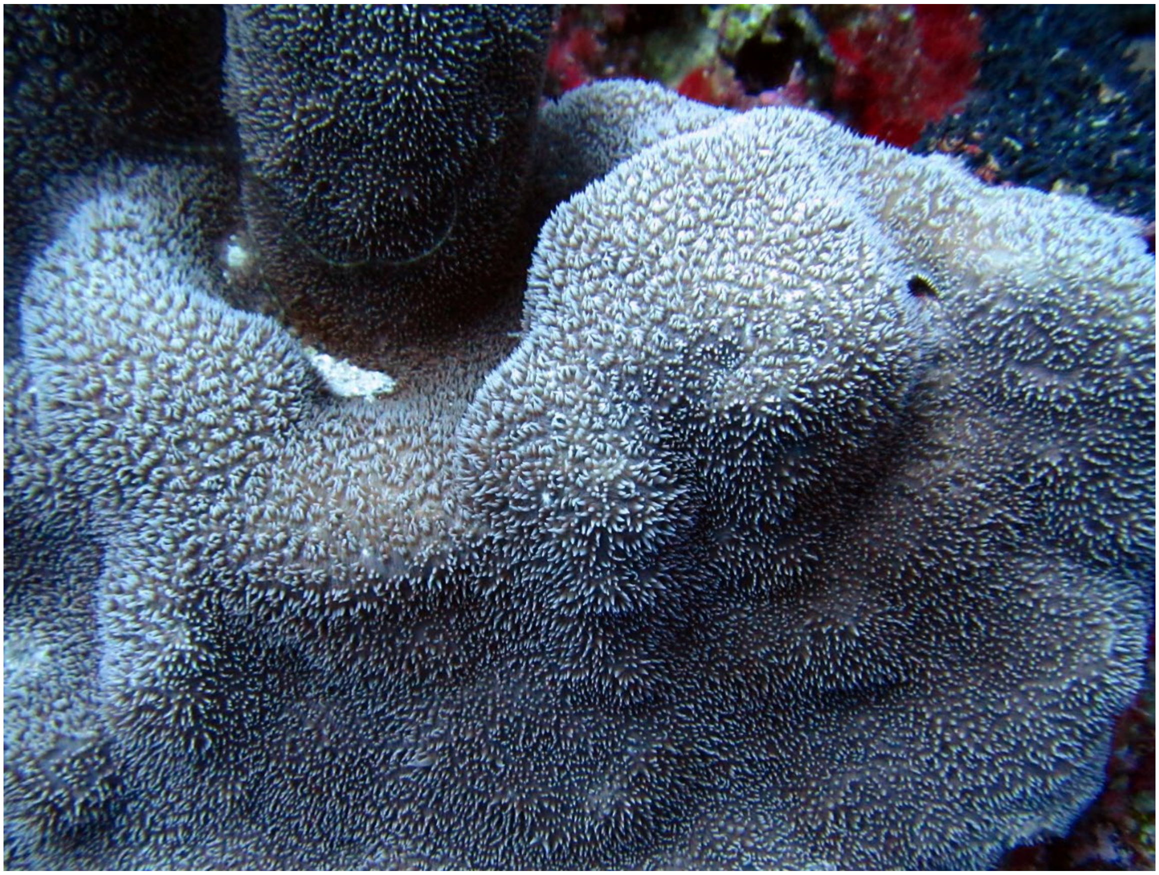


A close-up photo of the surface of *Pavona* cf. *diffluens*.

Pavona gigantea

Coloniies form thick columns that are usually oval or flattened, and often form a group of these columns. Colonies have little white tentacles extended during the day. The tentacles are thick enough that the corallites cannot normally be seen. Only one colony was seen in Tonga. The corallites are very similar to *Pavona explanulata,* however the latter is encrusting, and has much smaller tentacles so the corallites can always be seen. Also, corallites on the top of the *Pavona gigantea* lobes are very deep and have thin walls. This species was named from the Eastern Pacific. Colonies can get quite large iin the Eastern Pacific, hence the name. One colony in American Samoa is two meters wide and tall and consists of many flattened, parallel, lobes.

A colony of *Pavona gigantea*.



A closer photo of *Pavona gigantea*. The tentacles are white and are often in circles or tufts. The tiny projectiosn you see are not spines, they are soft tentaces.

Pavona varians

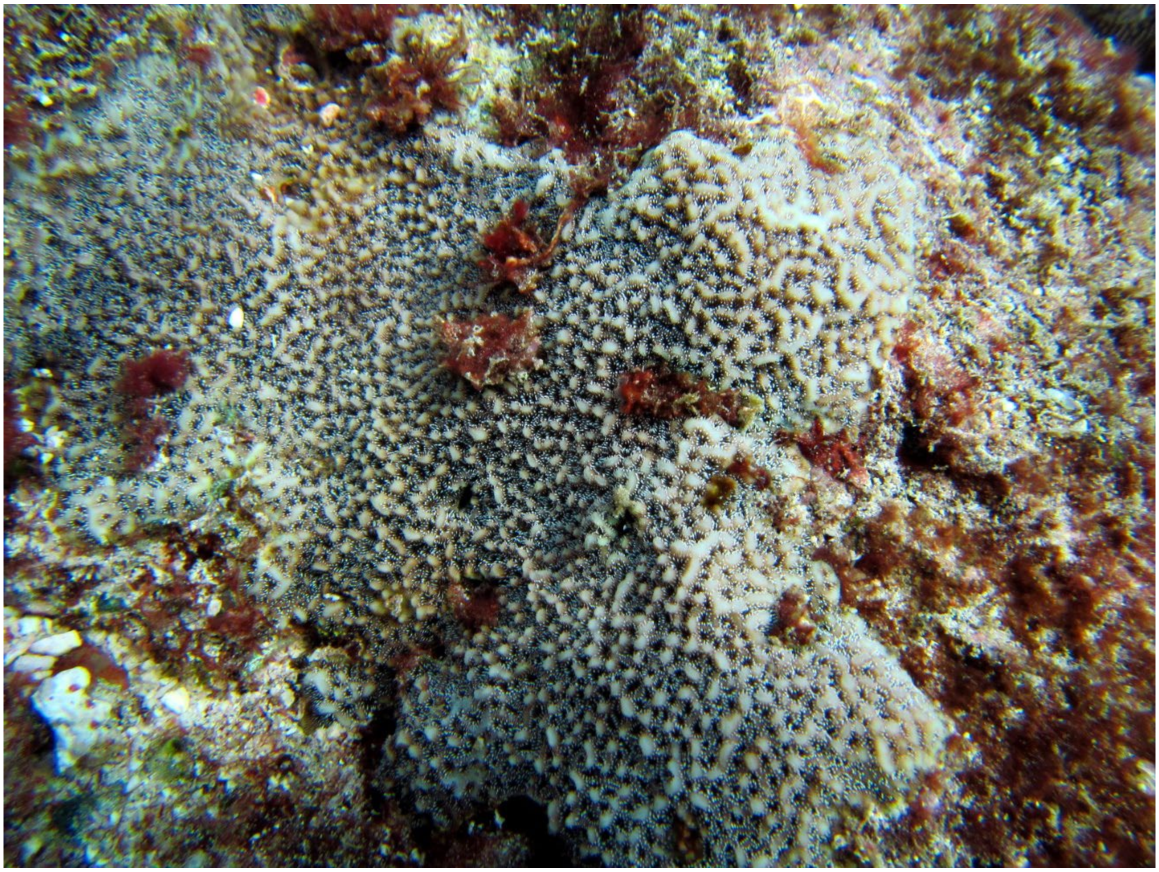
Colonies are encrusting or small plates. Colonies are usually less than 30 cm dameter. The surfaces are covered with small ridges that are fairly sharp. Corallites are between the ridges and tiny septa run up the sides of ridges. The ridges are often fairly long and may wind around or connect. The corallite centers may be seen sometimes as tiny dark holes. The species name comes from the fact that colonies are quite variable. *Psammocora nierstraszi* is somewhat similar, but the ridges are more rounded and shorter and do not connect. Also corallite centers cannot be seen and the surface may have a very fine granular texture.

A colony of *Pavona varians*.

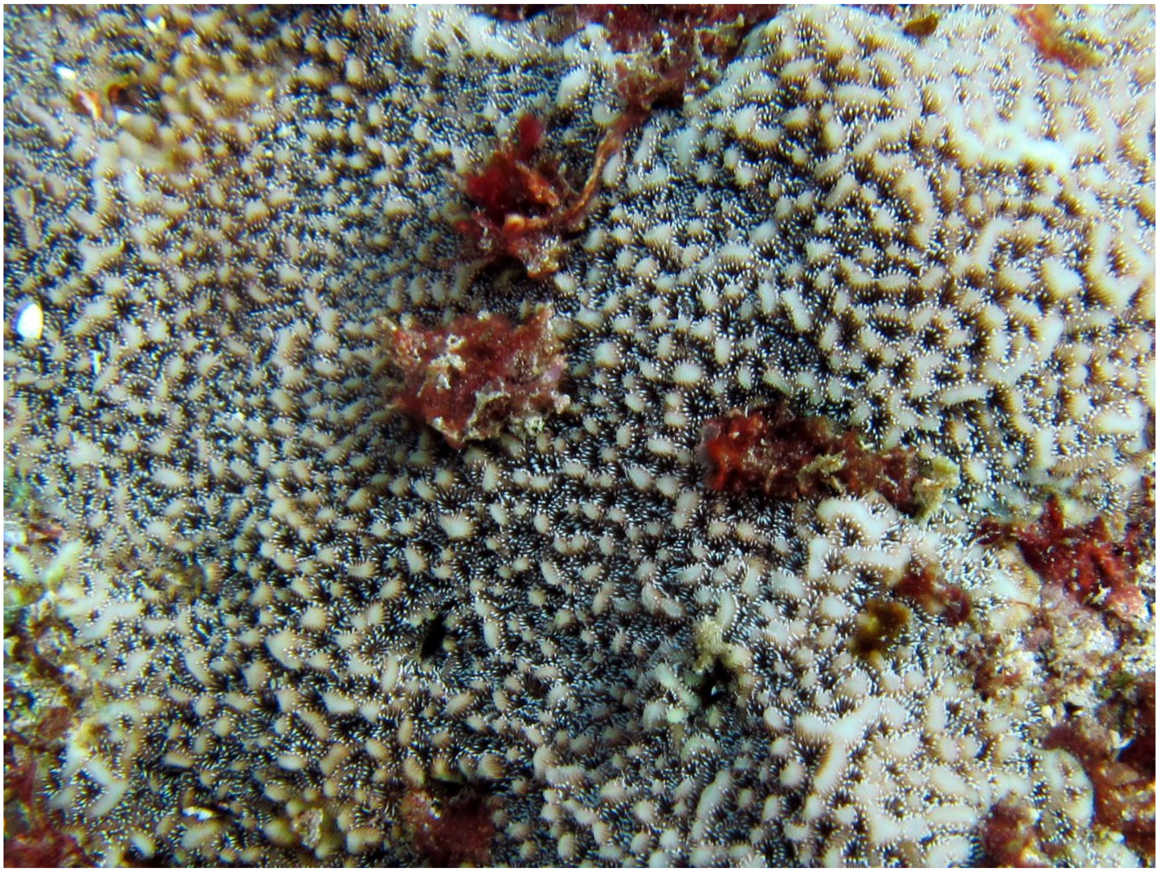
A closer photo of *Pavona varians*. Corallite centers can be seen here as dark spots between ridges.

Pavona chiriquiensis

Colonies are usually encrusting and not large. The surface has small bumps, and the corallites are between the bumps. This species is essentially identical to *Pavona varians* colonies except the ridges are cut into very short sections that are small bumps.



A photo of a colony of Pavona chiriquiensis.



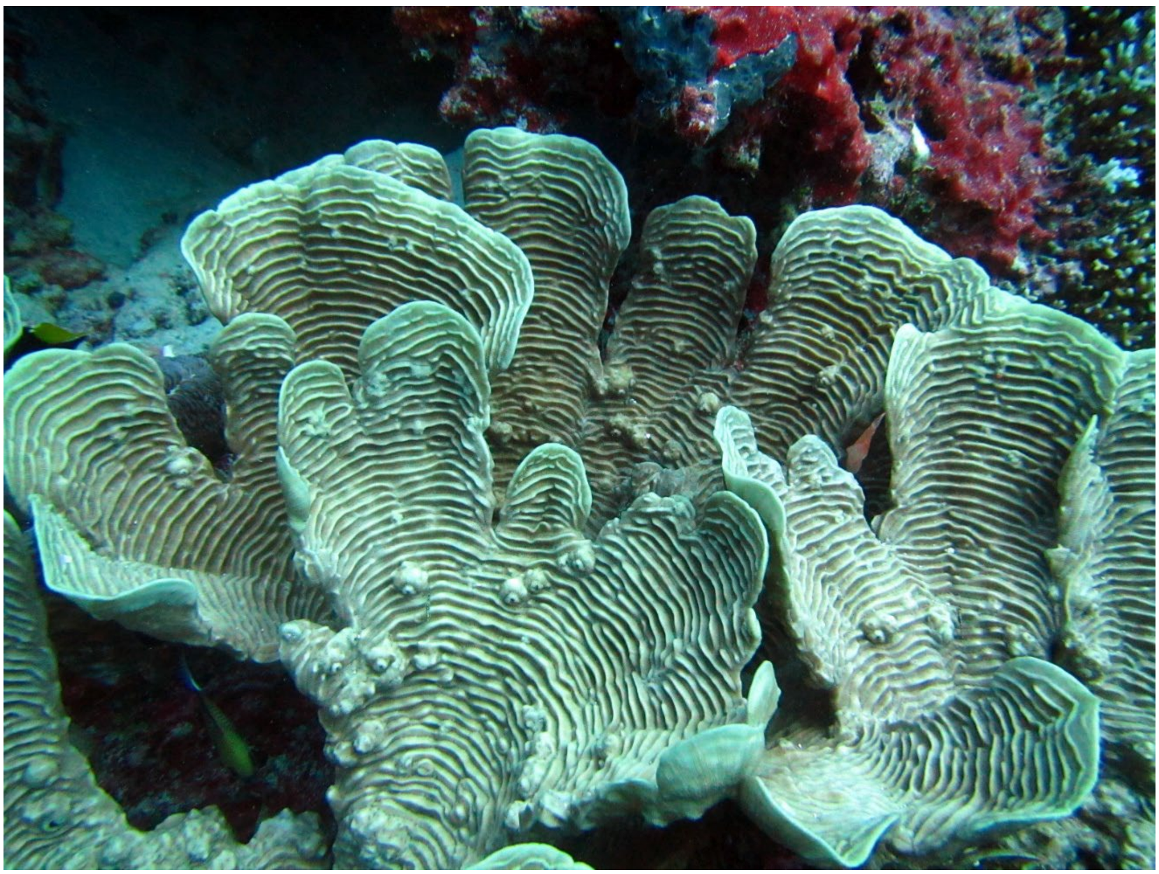
A close-up photo of *Pavona chiriquiensis*. Some colonies have tiny white tentacles around the corallite centers.

Pachyseris

Colonies are plates which can be horizontal, angled, or vertical. On horizontal and angled plates there are small ridges on the upper side but not the lower side. Vertical plates have small ridges on both sides. The ridges are more uniform than on *Montipora.*

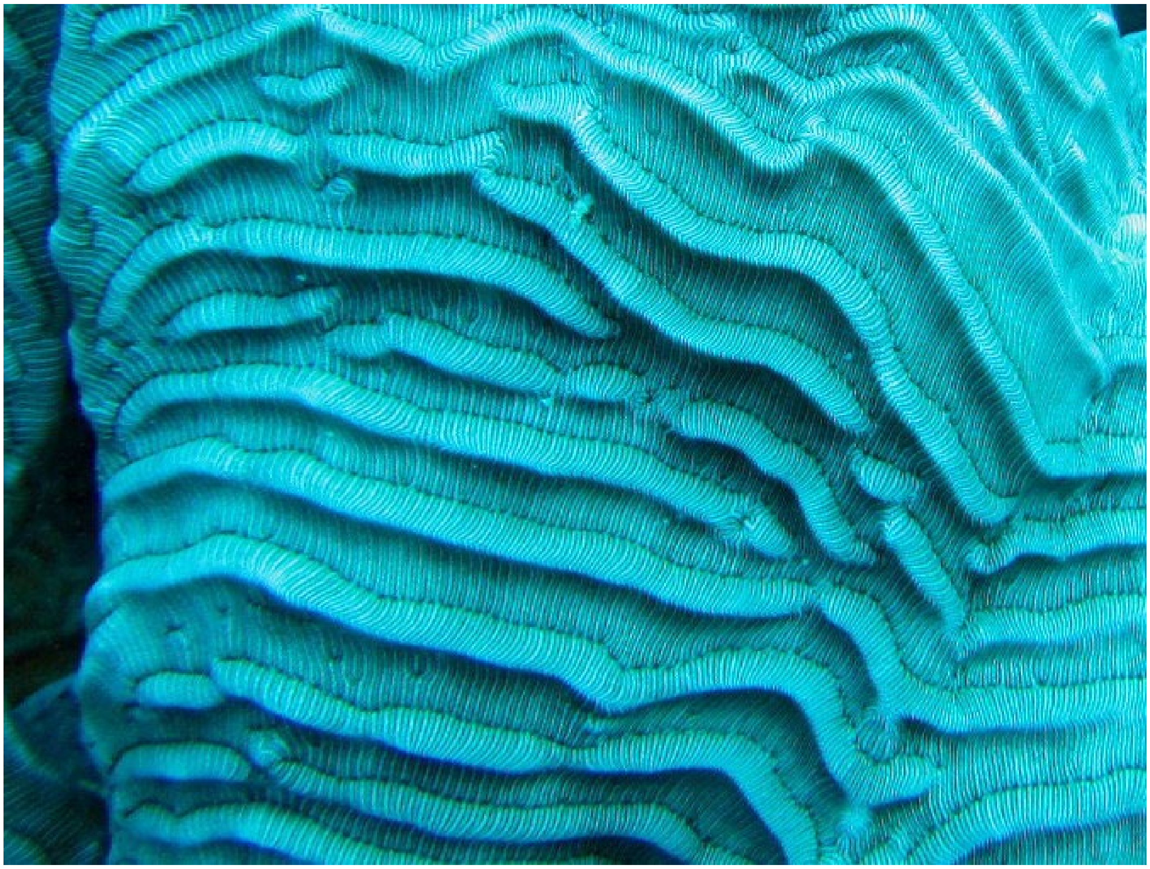
Pachyseris foliosa

Colonies are thin plates divided into strips that grow upward at a 45 degree angle or steeper. They do not form continuous or circular plates. The upper surface of plates have concentric ridges that are tall and narrow and do not taper. The space between them is flat. The corallite centers at the base of the ridge on the side nearest the outer, upper edge of the plate.   *Pachyseris speciosa* forms continuous, nearly circular, usually nearly flat, plates. The ridges have V shaped valleys between them with the corallite ceenters at the bottom of the V. *Pachyseris gemmae* is similar to Pachyseris speciosa, but the ridges go up and down in waves.



Plates of *Pachyseris foliosa* divided into fronds, growing upward at a steep angle. The round lumps on the plates are barnacles.

A closer photo of *Pachyseris foliosa*. The flat floor between ridges can be seen near the edge of the plate.

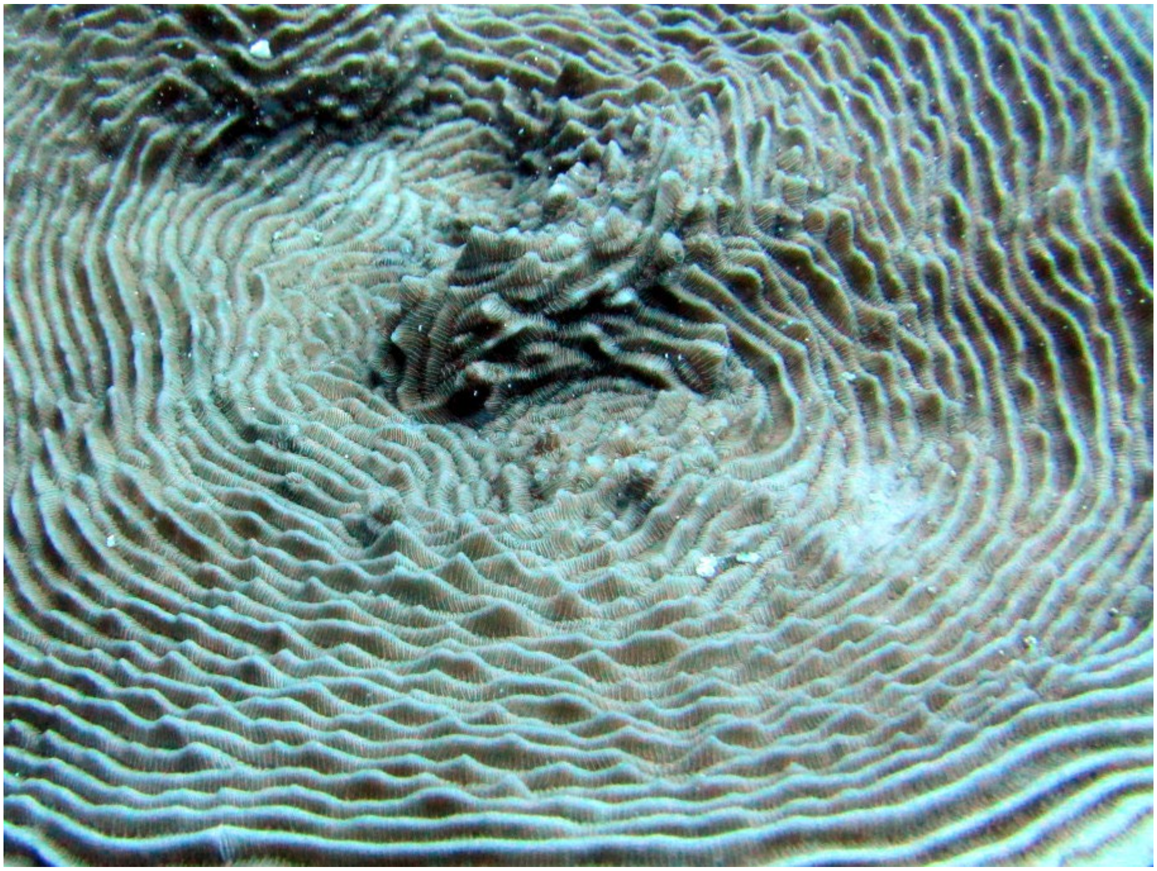


A close-up photo of *Pachyseris foliosa*. The tiny striations running radialy on the plate are septa. On the floor right at the base of the ridges on the upper side is a row of tiny dark dots which are the corallite centers. These things are too small to normally be seen under water.

Pachyseris gemmae

Colonies are circular plates that are usually nearly flat. The upper surface has small, concentric ridges. The ridges vary in height in wave-like shapes. *Pachyseris speciosa* is similar, but does not have the waves.

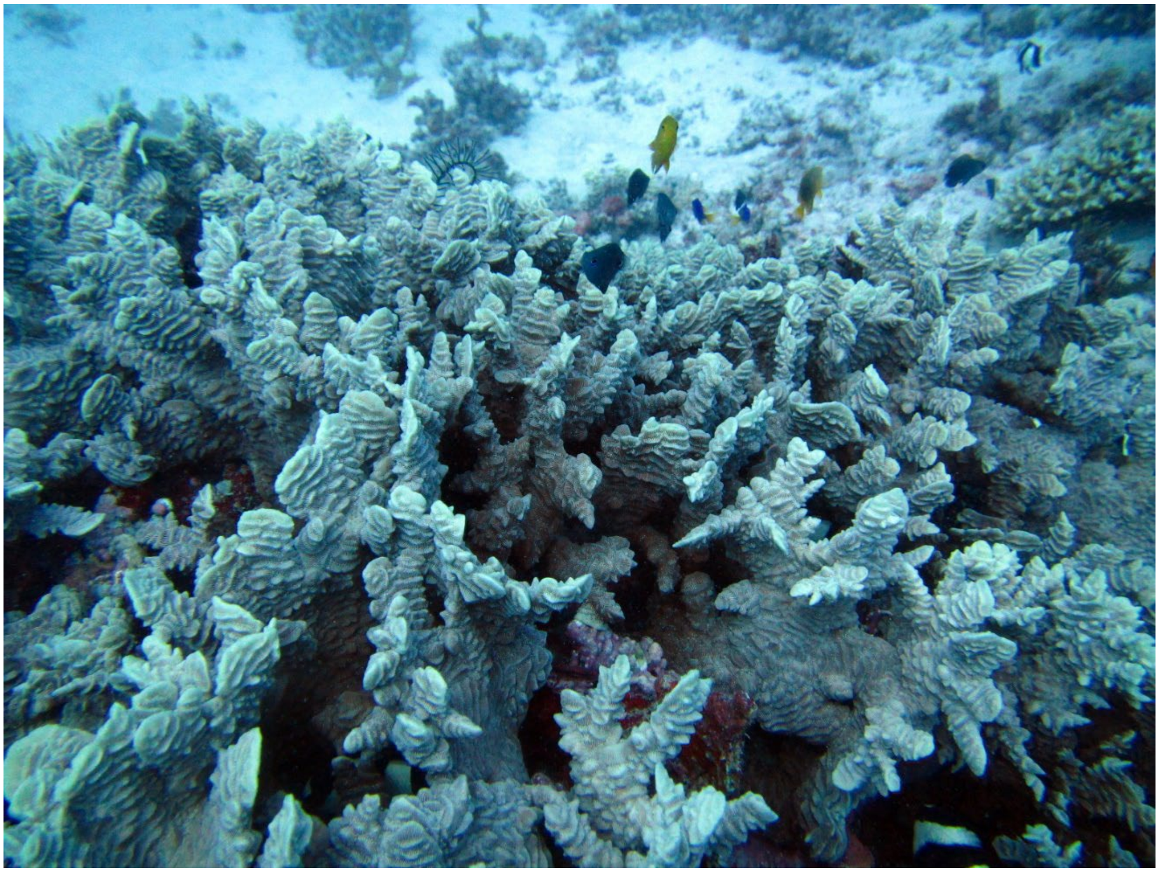
A photo of *Pachyseris gemmae*.



A closer photo of *Pachyseris gemmae*.

Pachyseris rugosa

Colonies form small vertical plates which may curve and which can be thick. There are small ridges on both sides of the vertical plates. The ridges curve and often wind around each other. Rarely, colonies can grow very large like massive *Porites*. Other species of *Pachyseris* only have ridges on the upper side, and the ridges are parallel and concentric instead of curving and winding. Also, the plates on other *Pachyseris* species are large and thinner.



A photo of small vertical plates on *Pachyseris rugosa*.

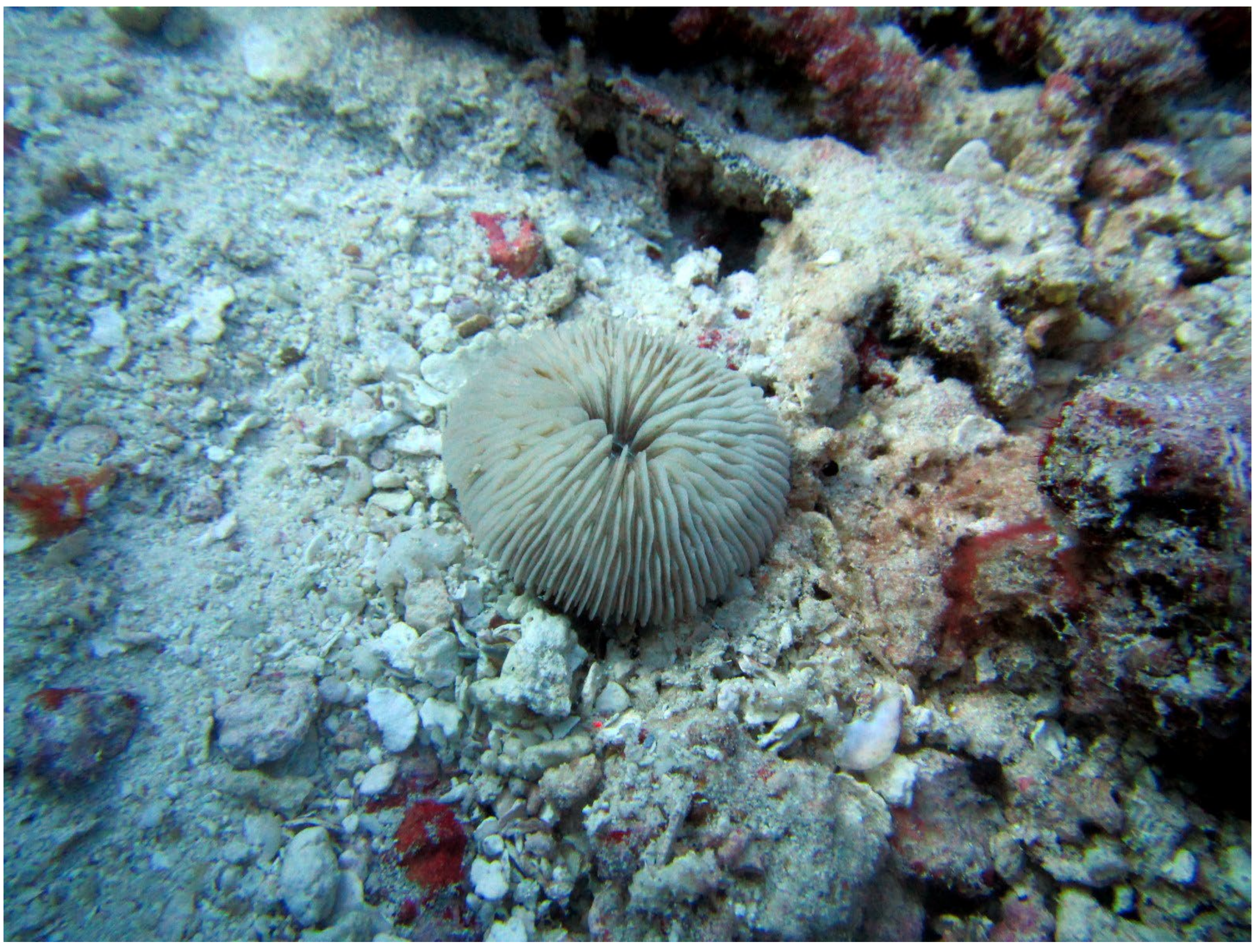
A closer photo of a *Pachyseris rugosa* colony with narrow paddles projecting upwards.

Cycloseris *"mushroom corals"*

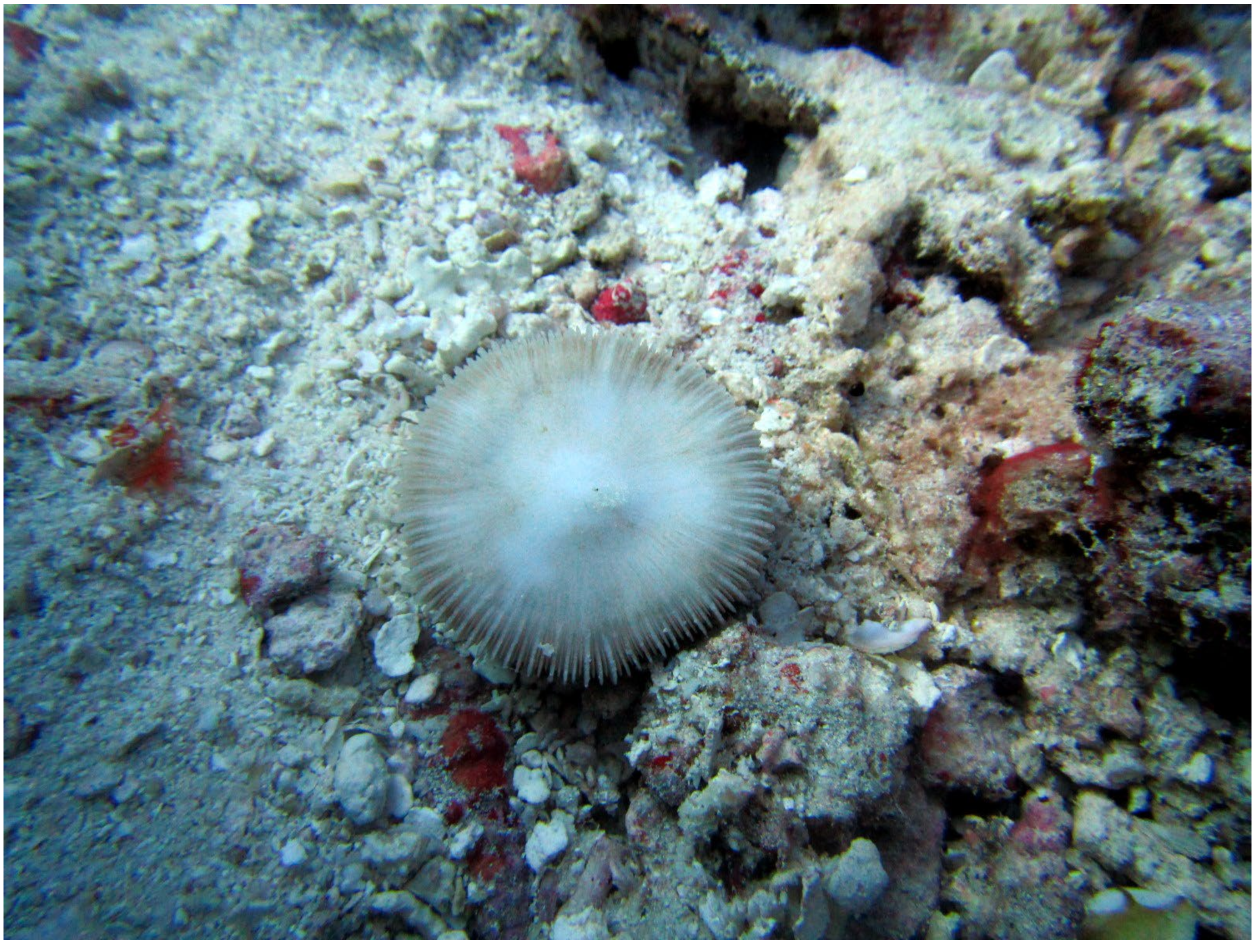
Corals are solitary (single corallite) and not attached. The upper surface has a crack in the middle that is the mouth, and radiating ridges that are the septa. The radiating ridges make the coral look like an overturned mushroom cap, hence the common name "mushroom corals." The underside has uniform tiny granules. All but one species in this genus remain small as adults, with maximum sizes about 3 cm diameter for most species. Corals in genus *Fungia* almost always reach larger sizes as adults, but young corals can be sizes similar to *Cycloseris*. Most *Fungia* have radiating rows of spines on the underside, but a few have uniform granules.

Cycloseris tenuis

Corals are small discs which usually have a slightly thickened and rounded upper surface. Septa are nearly even in height. Most of the underside is covered with granules, but near the edge there are small radiating ridges. *Cycloseris vaughani* is usually flatter and the radiating ridges on the under side are thicker and longer.



A photo of *Cyloseris tenuis*.



A photo of the underside of *Cycloseris tenuis*.

A close-up photo of *Cycloseris tenuis*.

Cycloseris vaughani

Corals are small and usually fairly thin. First order septa may appear thickened near the mouth. On the underside, there are sharp radiating ridges. Living corals often have mottled coloration. Corals are usually thinner than *Cycloseris tenuis*.

A photo that is likely to be *Cycloseris vaughani*.

Lithophyllon

Corals are in two different shapes. Some are small, thin plates with multiple mouths, and there are solitary corals, having only one polyp, which are not attached. This second kind forms disc-shaped corals, with radiating ridges (septa) that make them look like overturned mushroom caps, hence they are commonly called "mushroom corals". Adults are commonly about 10-15 cm diameter. The upper surface has a crack in the middle that is the mouth. The underside has radiating rows of spines.

Lithophyllon concinna or Lithophyllon repanda "mushroom corals" These used to be in Fungia.

Corals reach about 10 cm diameter. Some of the radiating septa are taller than others, they appear relatively widely spaced, and serrations ("teeth") on the upper edge of the septa are usually too small to see but can be felt. These two species are difficult to distinguish in the water. The only difference is tiny the presence or absence of tiny slits on the underside but tissue makes it so you can't see the slits. The teeth on the septa are smaller than on other disc species and the septa are more widely spaced.

A photo of *Lithophyllon concinna* or *Lithophyllon repanda*. The lumps in the center are not normal, they are called "growth anomalies" and are some type of disease.

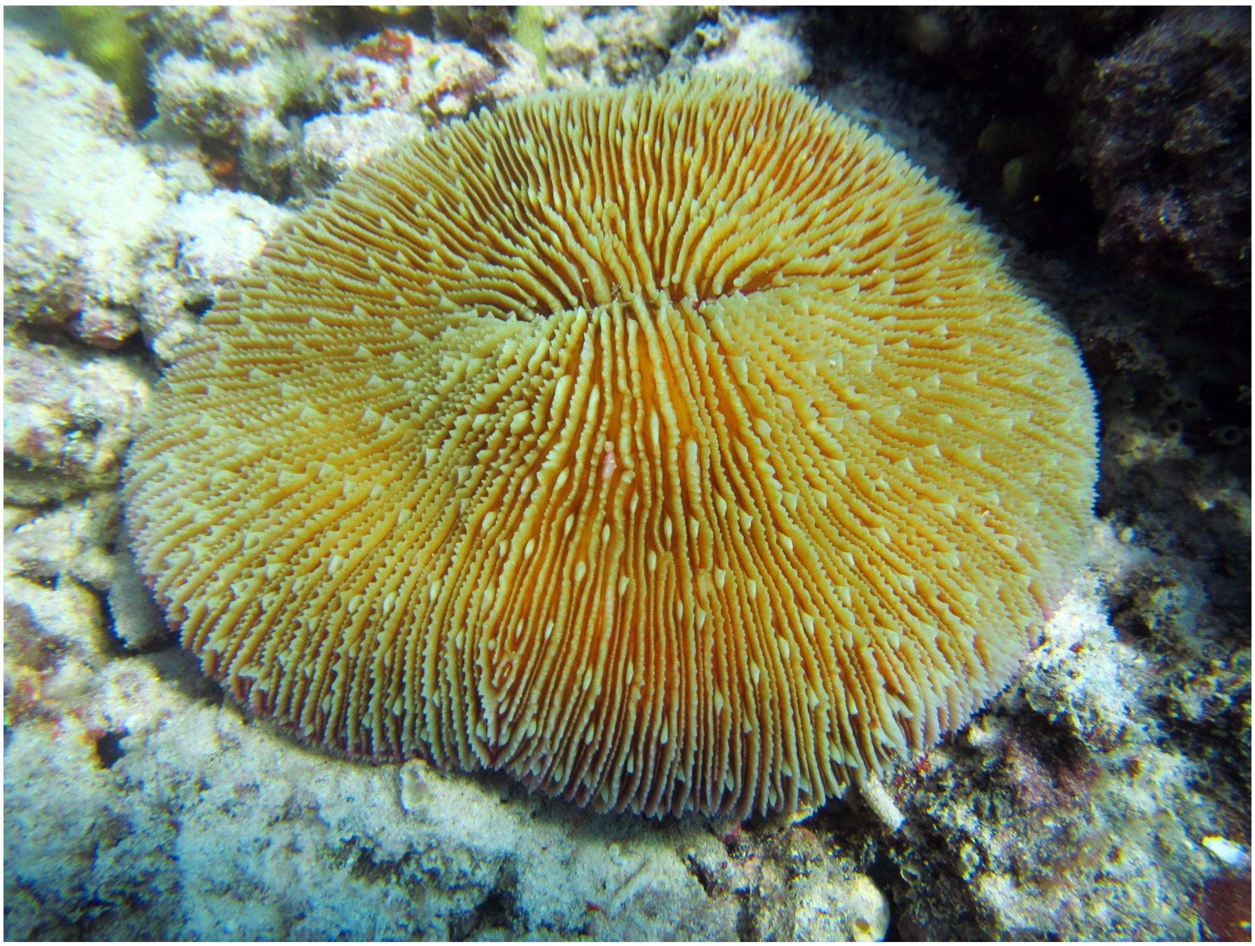
A photo of *Lithophyllon concinna* or *Lithophyllon repanda*.

Fungia *“mushroom corals”*

Corals are solitary, having only one polyp, and are not attached. They form disc-shaped corals, with radiating ridges (septa) that make them look like overturned mushroom caps, hence they are commonly called “mushroom corals” and the name *Fungia* also refers to this. Although adults are commonly about 10-15 cm diameter, they can reach nearly 30 mm diameter. The upper surface has a crack in the middle that is the mouth. The underside has radiating rows of spines.

Fungia fungites “mushroom coral”

Corals are up to nearly 30 cm diameter but commonly not that large. Septa are close together and uniform in height. Sometimes a group of septa curve together. Serrations (“teeth”) on the upper edge of septa are small but visible and fairly uniform. Short tentacles are usually extended and yellow, while the whole coral is usually green or brown. Corals fairly often have a purple edge or purple splotches, or sometimes be entirely purple-red. Most disc fungiids do not have extended tentacles or the septa so close together or the same colors.



A photo of *Fungia fungites*.

Danafungia   *"mushroom coral"*   *This used to be in Fungia.*

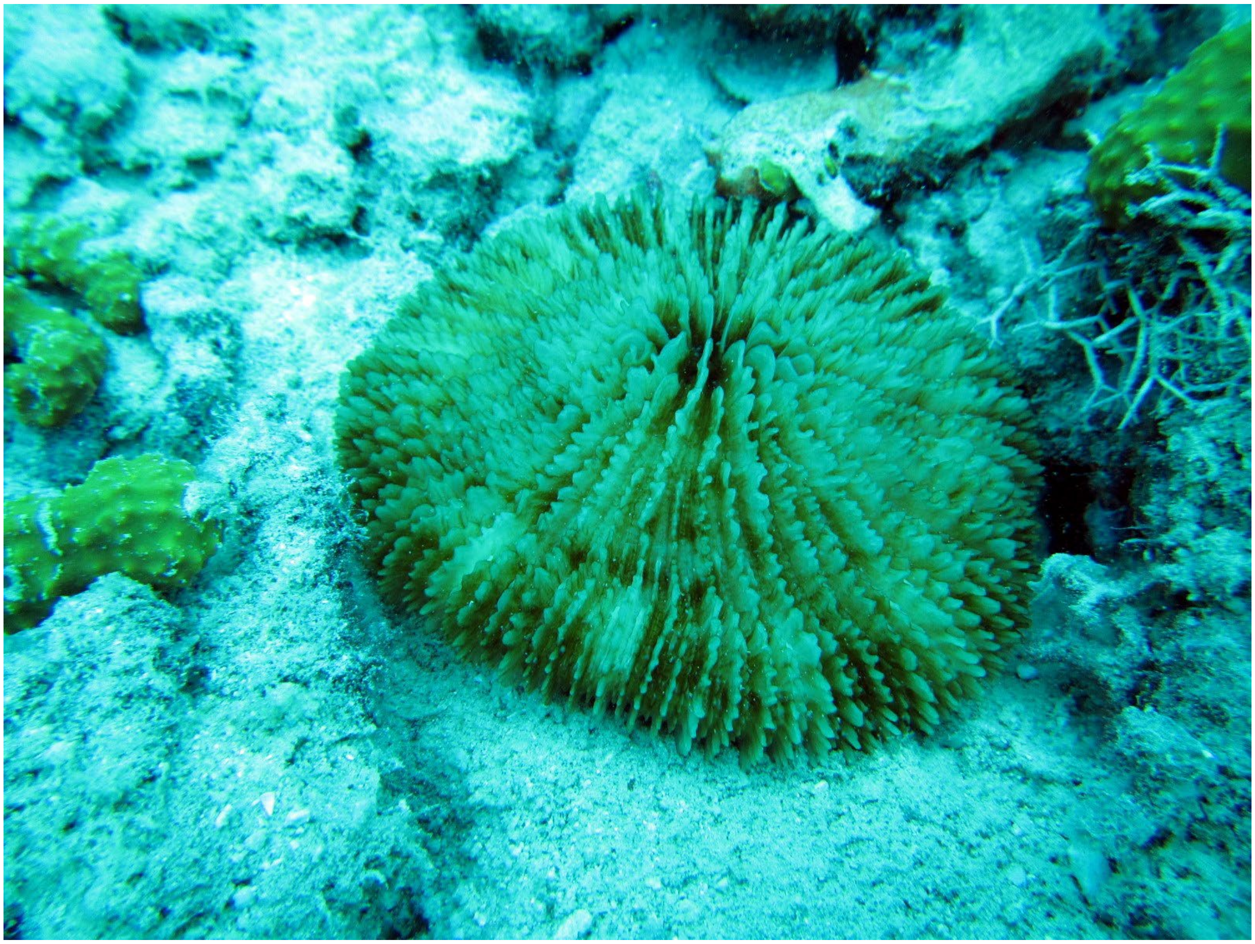
Corals are solitary, unattached discs. The septal teeth are larger than on other disc fungiids.

Danafungia horrida   "mushroom coral"   This used to be in *Fungia*.

Corals are mediumora` sized discs up to about 20 cm diameter. The septa have very large teeth, larger than almost any other species of disc fungiid.

A photo of *Danafungia horrida*.

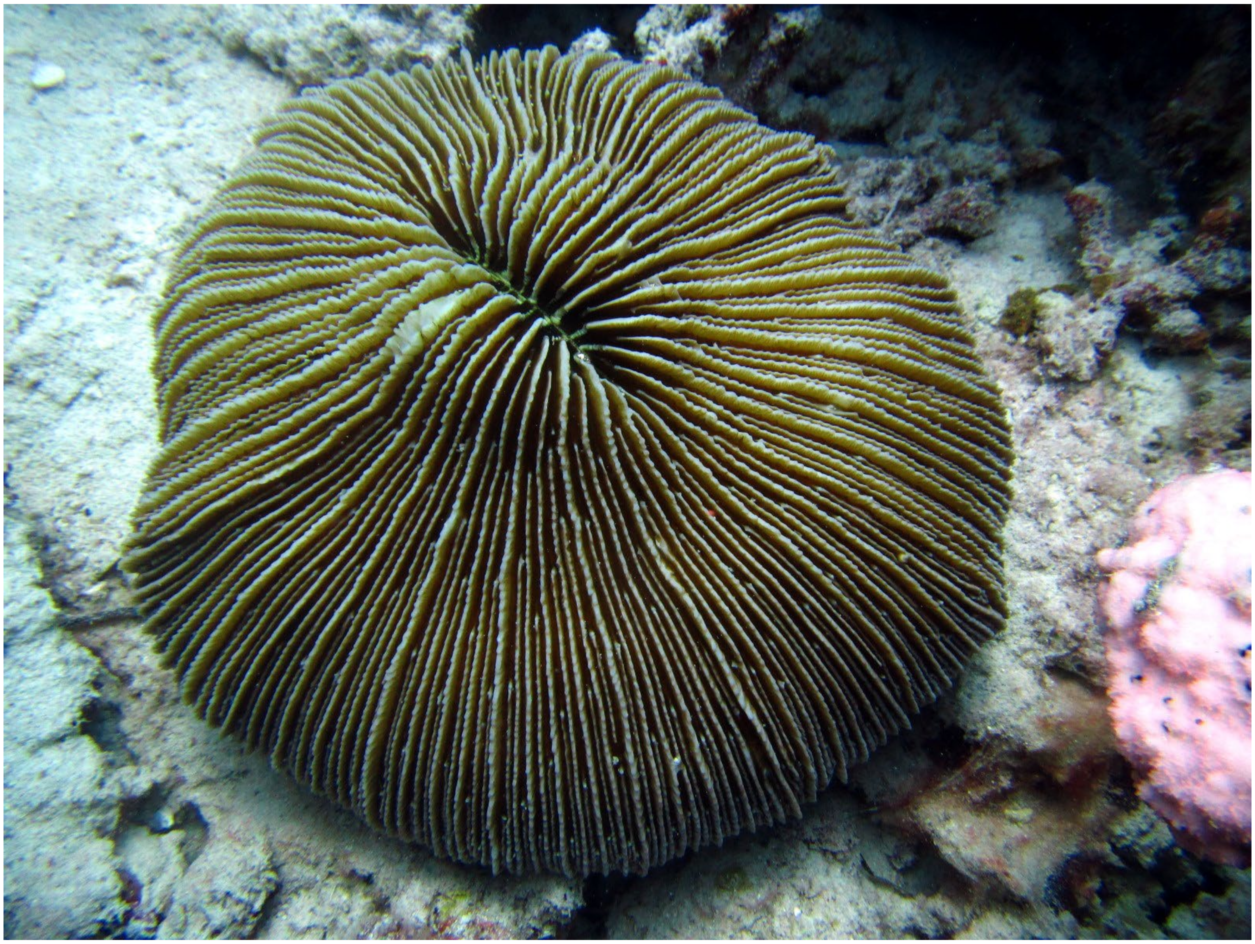
A photo of *Danafungia horrida*.



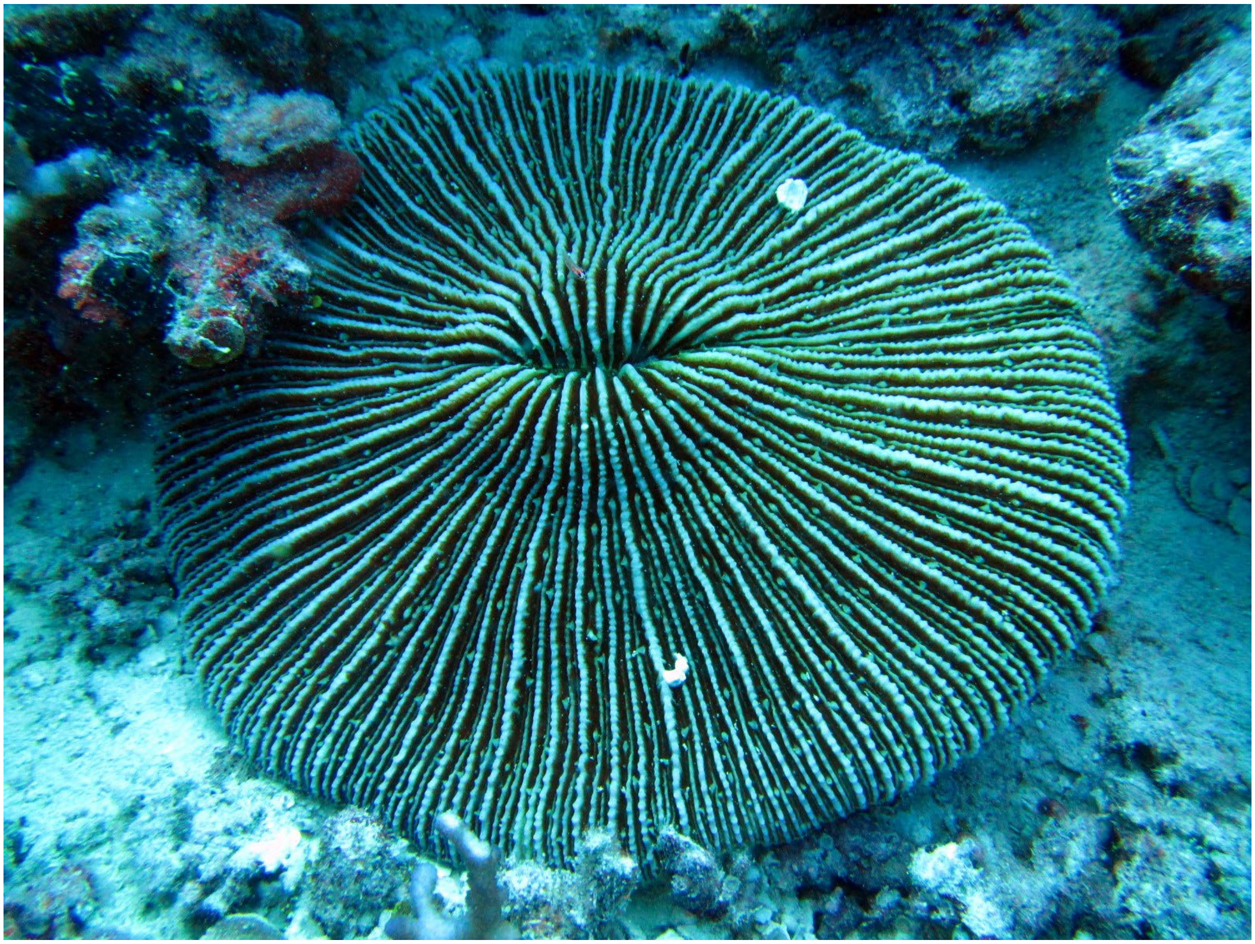
A photo of *Danafungia horrida*.

Danafungia scruposa

Corals are often fairly large, around 20 cm diameter, and may have a raised, conical-shaped upper surface or a central hump. A few septa are often taller than others. Teeth on septa are uniform and medium sized. Teeth are smaller than on *Danafungia horrida* but larger than on most other disc fungiid.



A photo of *Danafungia scruposa*.



A photo of *Danafungia scruposa*.

A photo of *Danafungia scruposa*.

A photo of *Danafungia scruposa*.

Pleuractis *"Mushroom corals"* *This used to be in Fungia.*

Corals are unattached, solitary discs, with fine granules on the underside instead of spines like *Fungia*, *Danafungia*, and *Lithophyllon* have. Most species are oval, but one is circular, but it is smaller than spcies of *Fungia*, *Danafungia* and *Lithophyllon* get.

Pleuractis granulosa "mushroom coral" This used to be in *Fungia*.

Corals are small discs, up to about 5 cm diameter. Septa are uniform, close together, and may be thick. Septa curve around the ends of other septa. Septa have serrations ("teeth") on their upper edge that are so tiny that they usually can't be seen but can be felt. The underside has uniform tiny granules. Other circular disc species get larger and have spines on the underside instead of granules like this species. Also the septa are wavier than on other circular species. Other *Pleuractis* species are oval.

A photo of *Pleuractis granulosa*.

Pleuractis gravis		"mushroom coral"		This used to be in *Fungia*.

Corals are oval, with a hump in the middle. The underside is covered with granules. *Pleuractis paumotensis* does not have a hump in the middle, and *Pleuracts molocensis* is asymmetrical and has more pointed ends.

A photo of *Pleuractis gravis*.

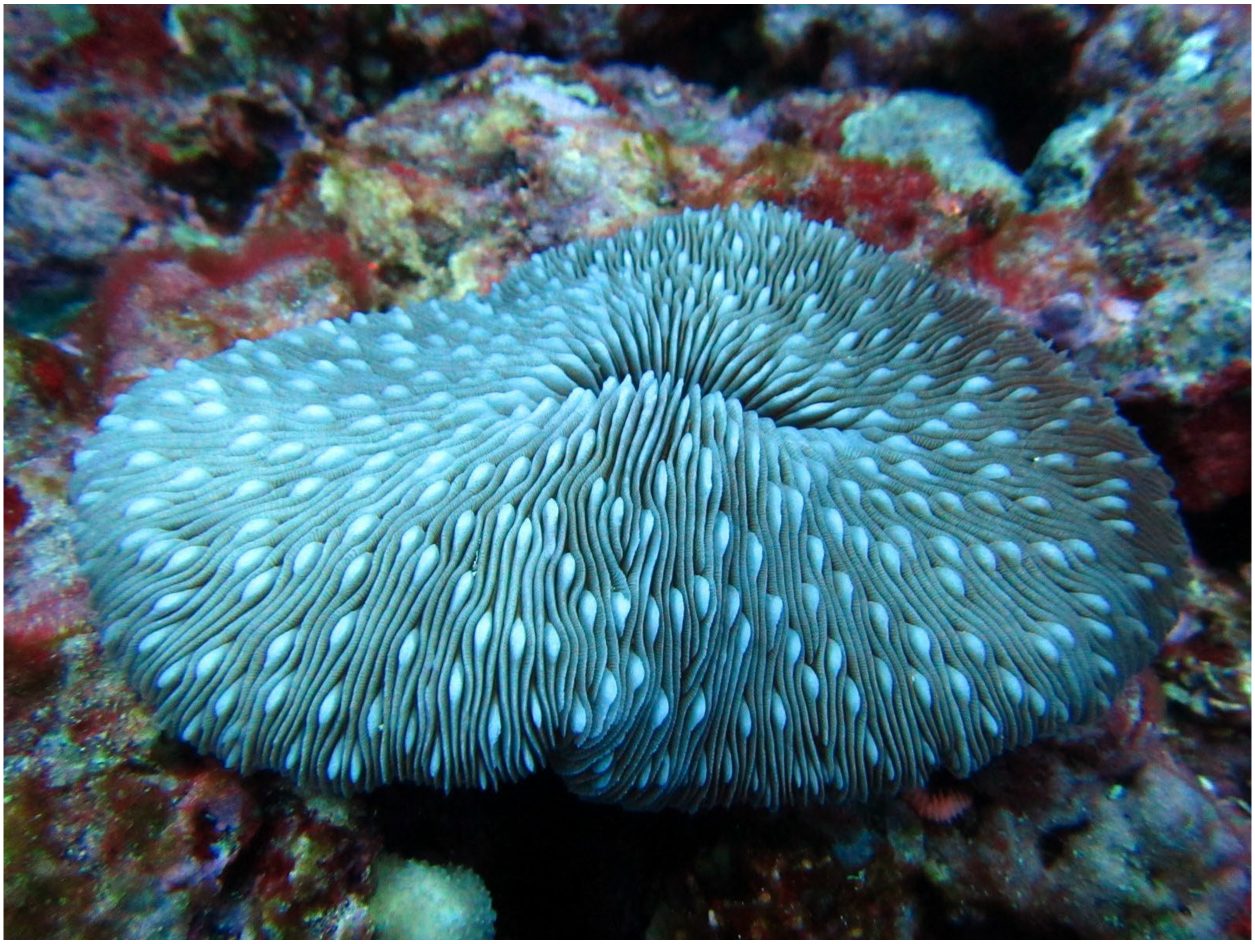
Lobactis *"mushroom coral"* *This used to be in Fungia.*

Corals are oval discs, solitary, and unattached. Septa have projecting small lobes called "tentacle lobes" because they support tentacles. This species has the largest and most obvious tentacle lobes of any fungiid.

Lobactis scutaria "mushroom coral" This used to be in *Fungia*.

Corals are oval and septa have obvious projecting tentacle lobes on their central ends. The underside is covered with granules. The tentacles lobes are larger than on any other species of fungiid.

A photo of *Lobactis scutaria*.



A photo of *Lobactis scutaria*.

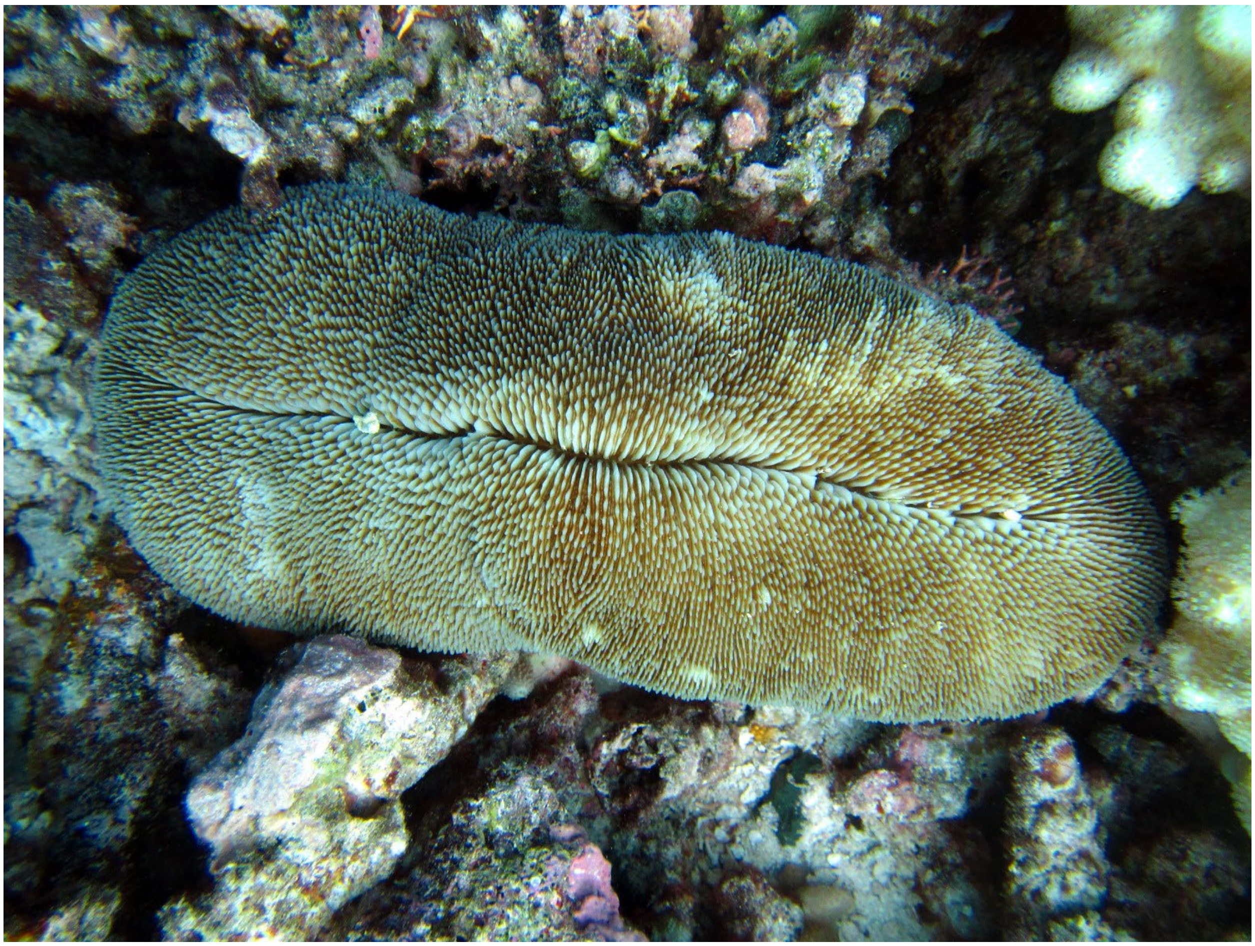
A photo of *Lobactis scutaria*.

Ctenactis

Corals are unattached large ovals. The upper surface may be flattened to rounded convex, and has a long central crack where there are one or more mouths. The radiating septa have visible uniform teeth on their edges. *Herpolitha* has elongated colonies that are usually not as wide and may have more pointed ends, plus the septa do not have visible teeth.

Ctenactis crassa

Corals have the central crack divided into several sections that are separate mouths. They are divided by septa that cross the crack. *Ctenactis echinata* has one long mouth and *Ctenactis albitentaculata* has white tentacles.



A photo of *Ctenactis crassa*.

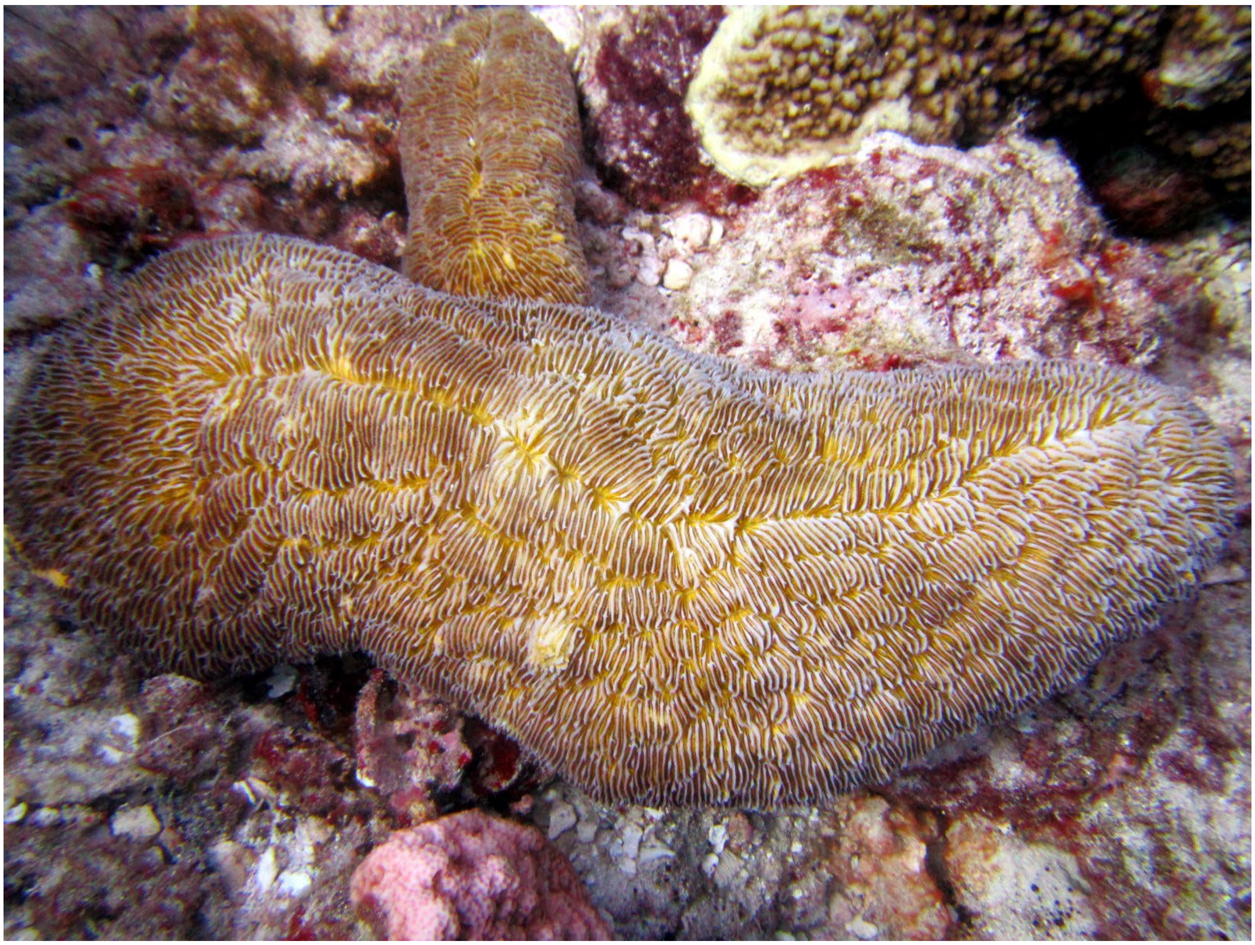
A photo of *Ctenactis crassa*.

Herpolitha

Corals are elongated and not attached. Colonies are more often rounded convex than flat but can be either. A central crack runs the length of the coral, with a series of mouths in it. Small mouths can be on the sides of the corals as well, between breaks in the septa, but are usually hard to see. Most corals are not as wide as *Ctenactis*, and septa have smooth looking edges.

Herpolitha limax

Colonies have breaks in the septa between the mouth and the edge.



A large, wide colony of *Herpolitha limax*.

An unusual colony of *Herpolitha limax*, where the mouths in the central crack are a lighter color than the rest of the colony.

A close-up of a very unusual colony of *Herpolitha limax* where you can see the green mouths on the side of the colony.

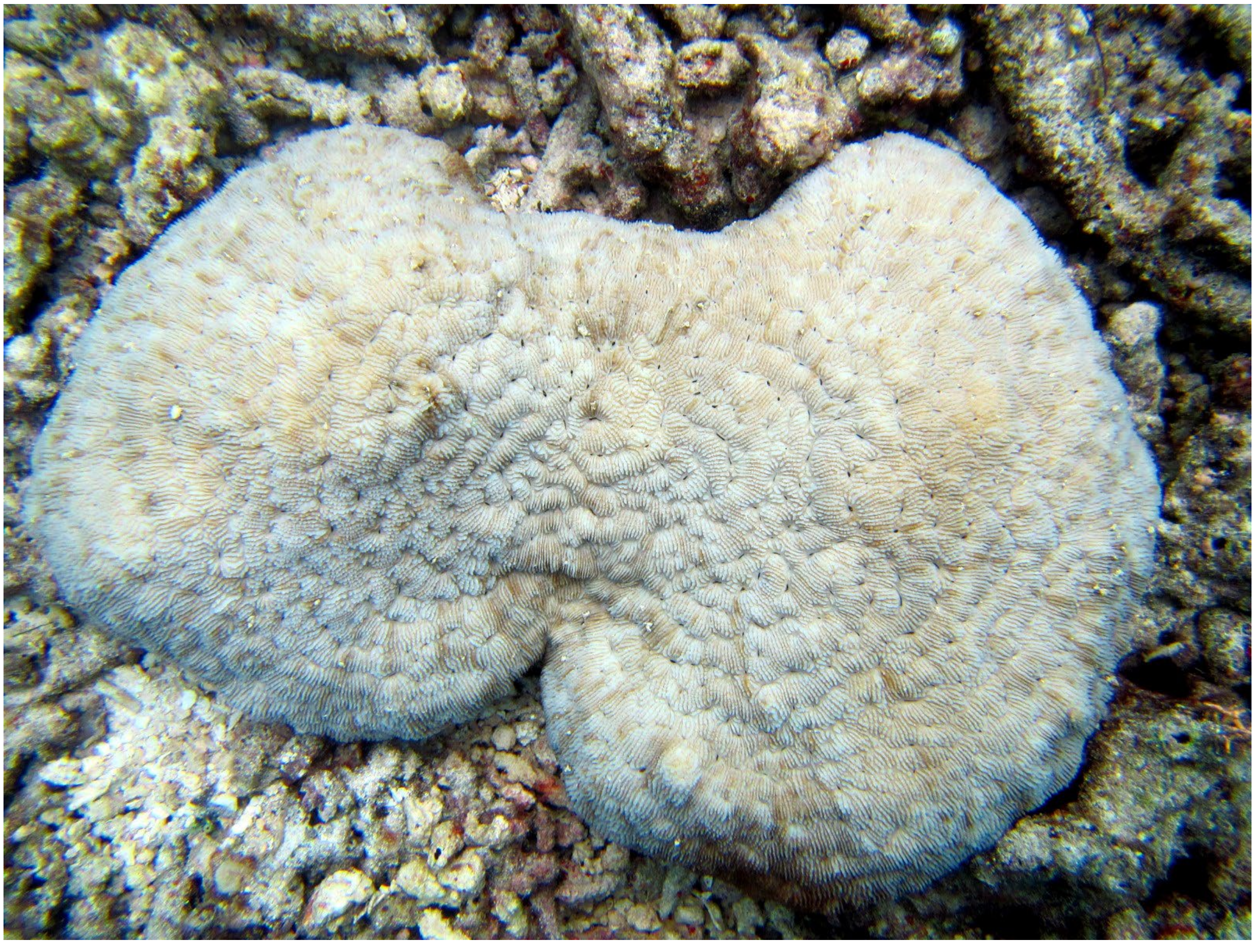
Sandalolitha

Colonies are wide ovals that are not attached. The upper surface is usually nearly flat. Colonies do not have a central crack but have mouths all over the surface or in the central area of the coral. *Ctenactis* and *Herpolitha* have central cracks, while *Halomitra* is a thin, circular upsidedown bowl.

Sandalolitha robusta

Colonies have mouths spread evenly all over the upper surface. Septa between the mouths have visible small teeth. Colonies may be slightly or greatly dumbbell-shaped. The skeleton is thick and heavy. *Sandalolitha dentata* has mouths clustered in the center of the upper surface and is thinner.

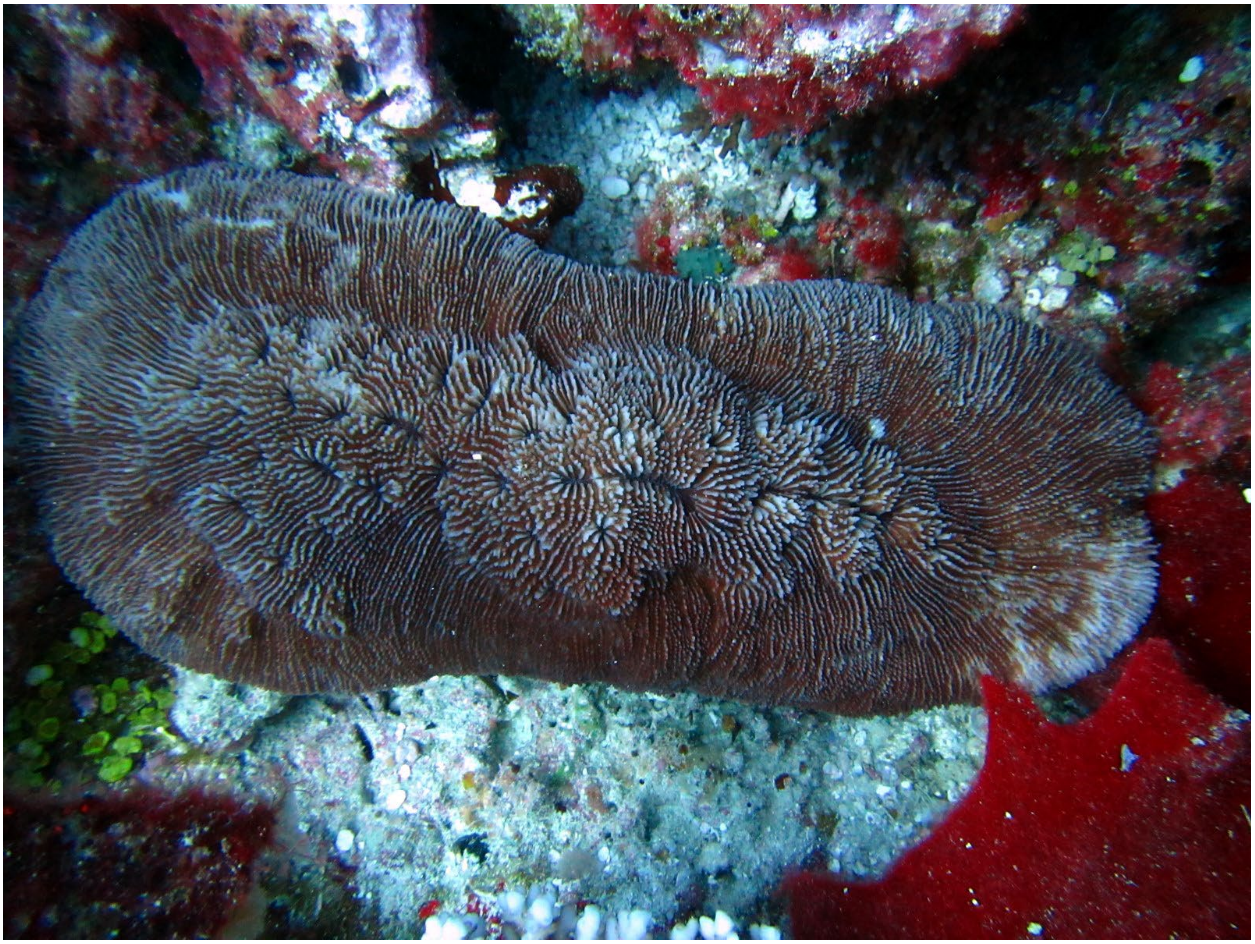
A colony of *Sandalolitha robusta*. The mouths are hard to see in this colony.



A large, strongly dumbbell-shaped colony of *Sandalolitha robusta* with easily visible mouths.

Sandalolitha dentata

Colonies are usually ovals. Mouths on the upper surface are in a group near the center, and a larger central mouth may be distinguishable. *Sandalolitha robusta* has mouths all over the upper surface.



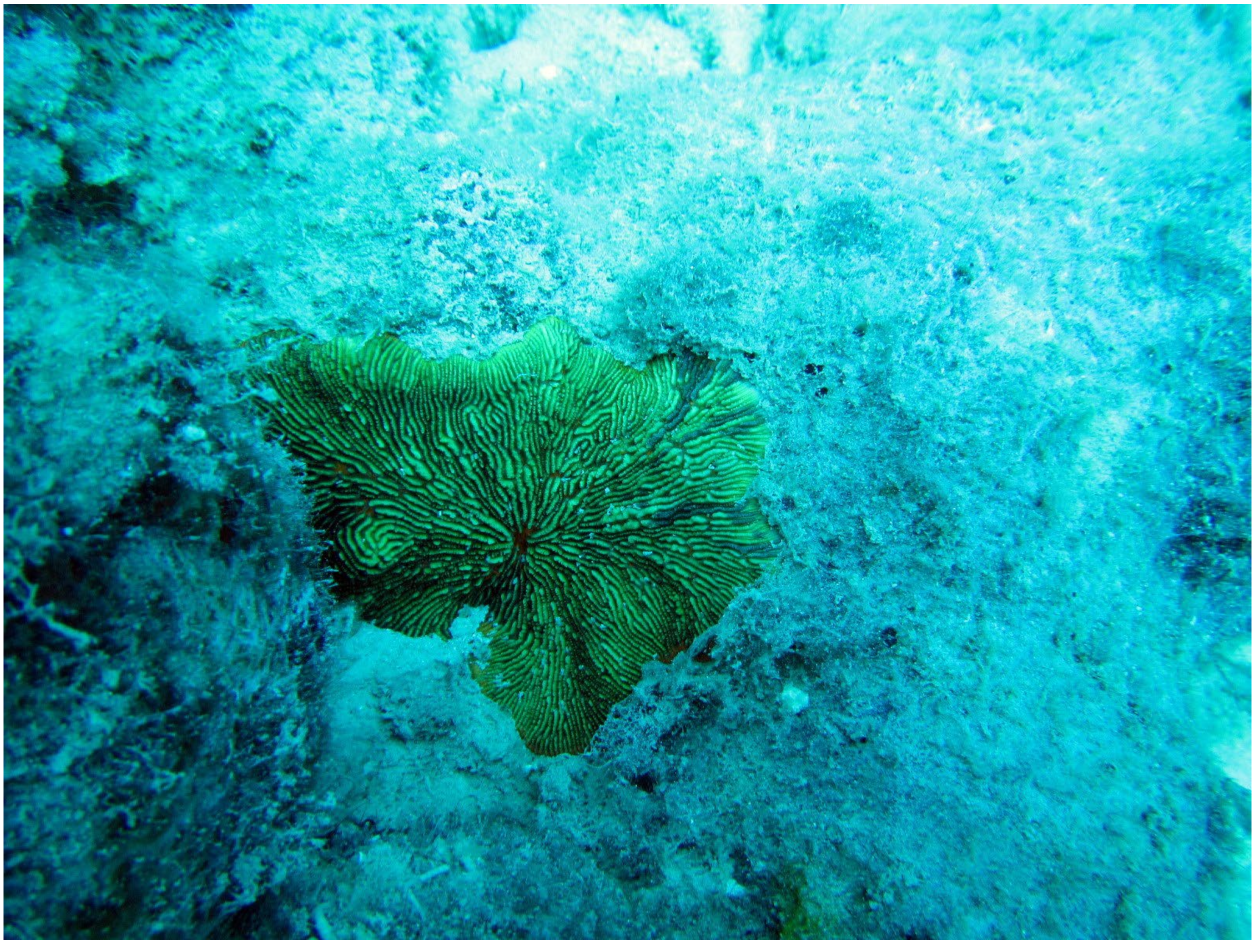
A photo of *Sandalolitha dentata*.

Cantharellus

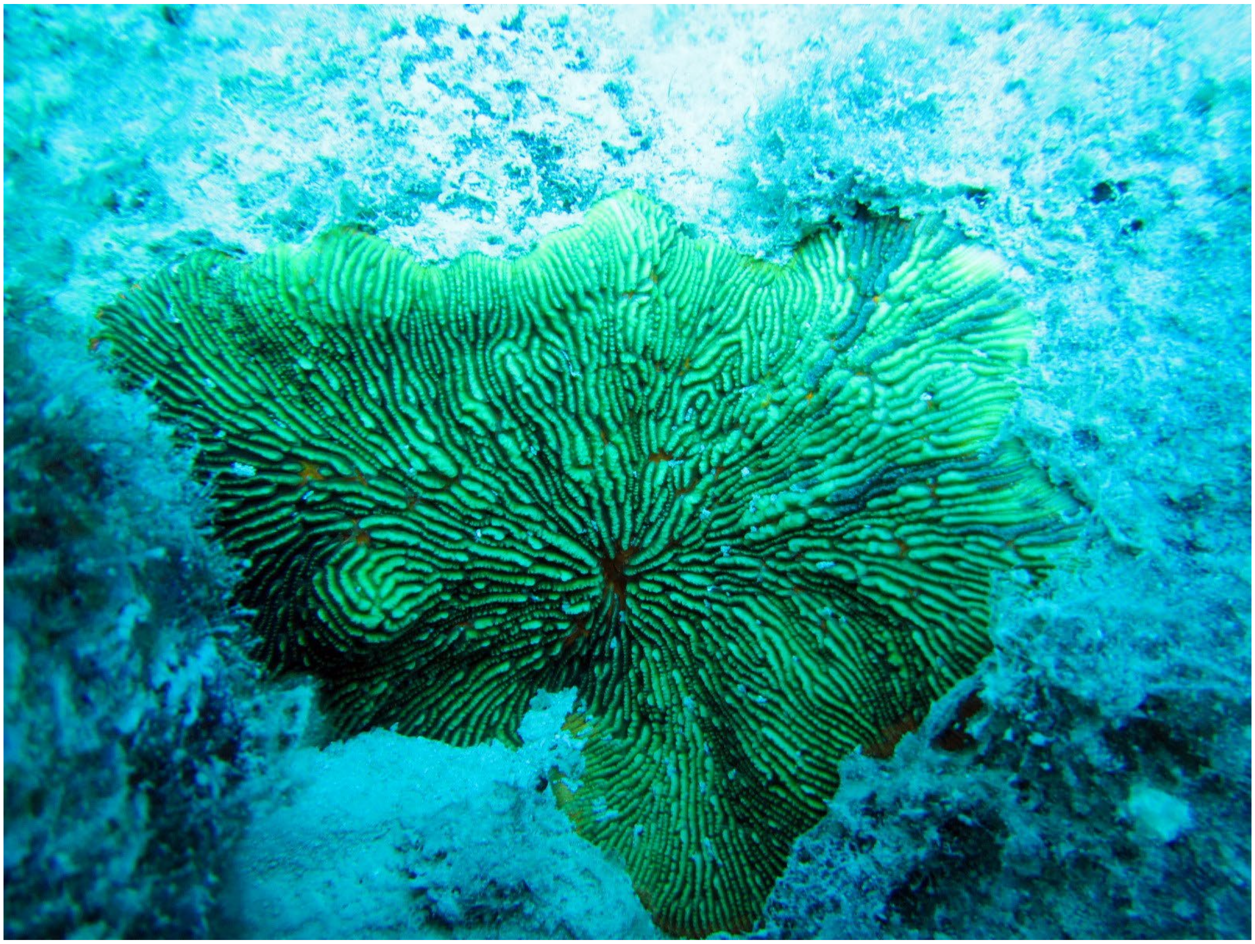
Corals are relatively small, attached and may be encrusting or cup-like. There may be only one mouth. Most fungiids are not attached.

Cantharellus jebbi

Corals are thin and encrusting with a central mouth and radiating thick septa that are wavy. There may be smaller mouths as well. This is the only encrusting *Cantharellus*.



A photo of *Cantharellus jebbi*.



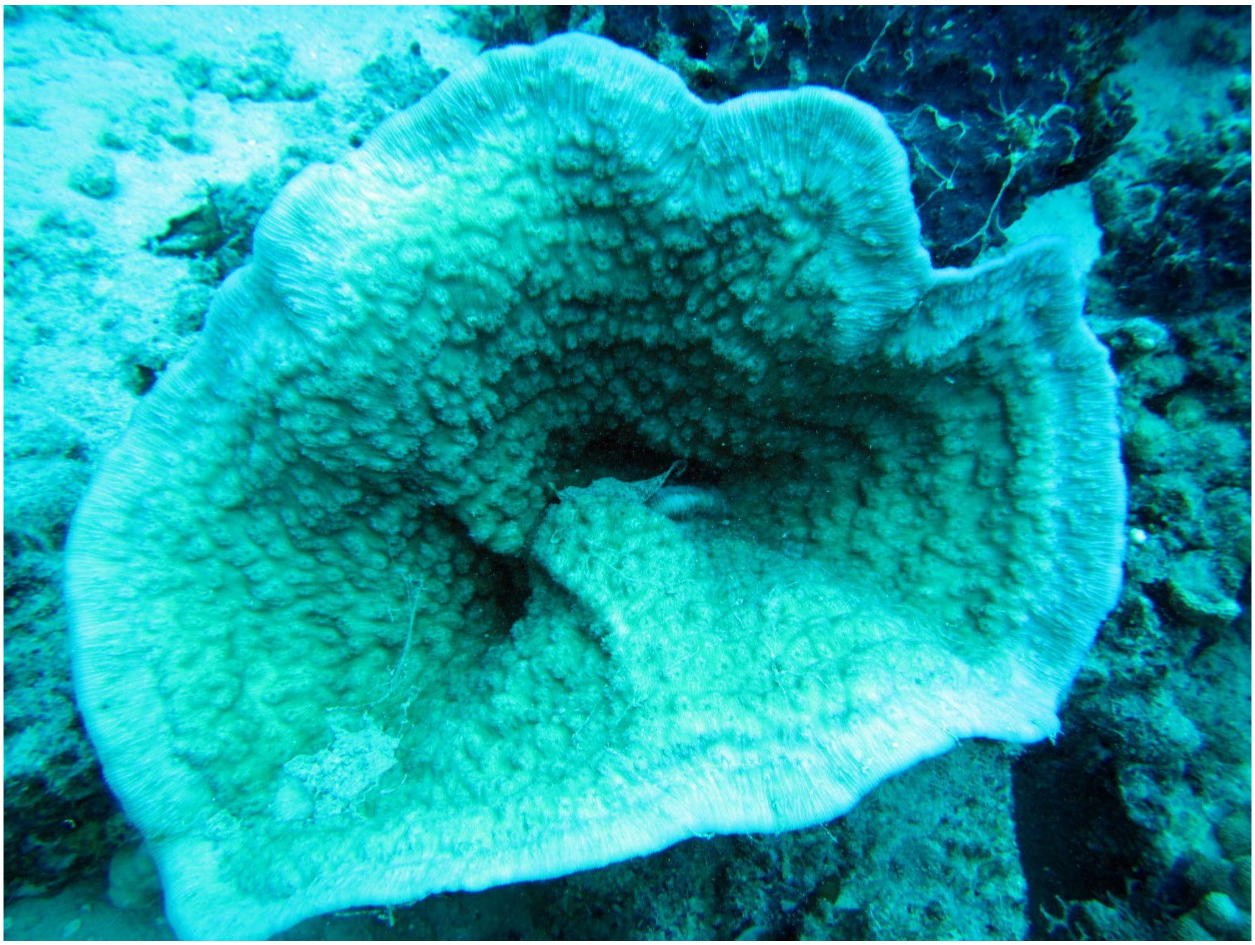
A close-up of *Cantharellus jebbi*.

Podabacia

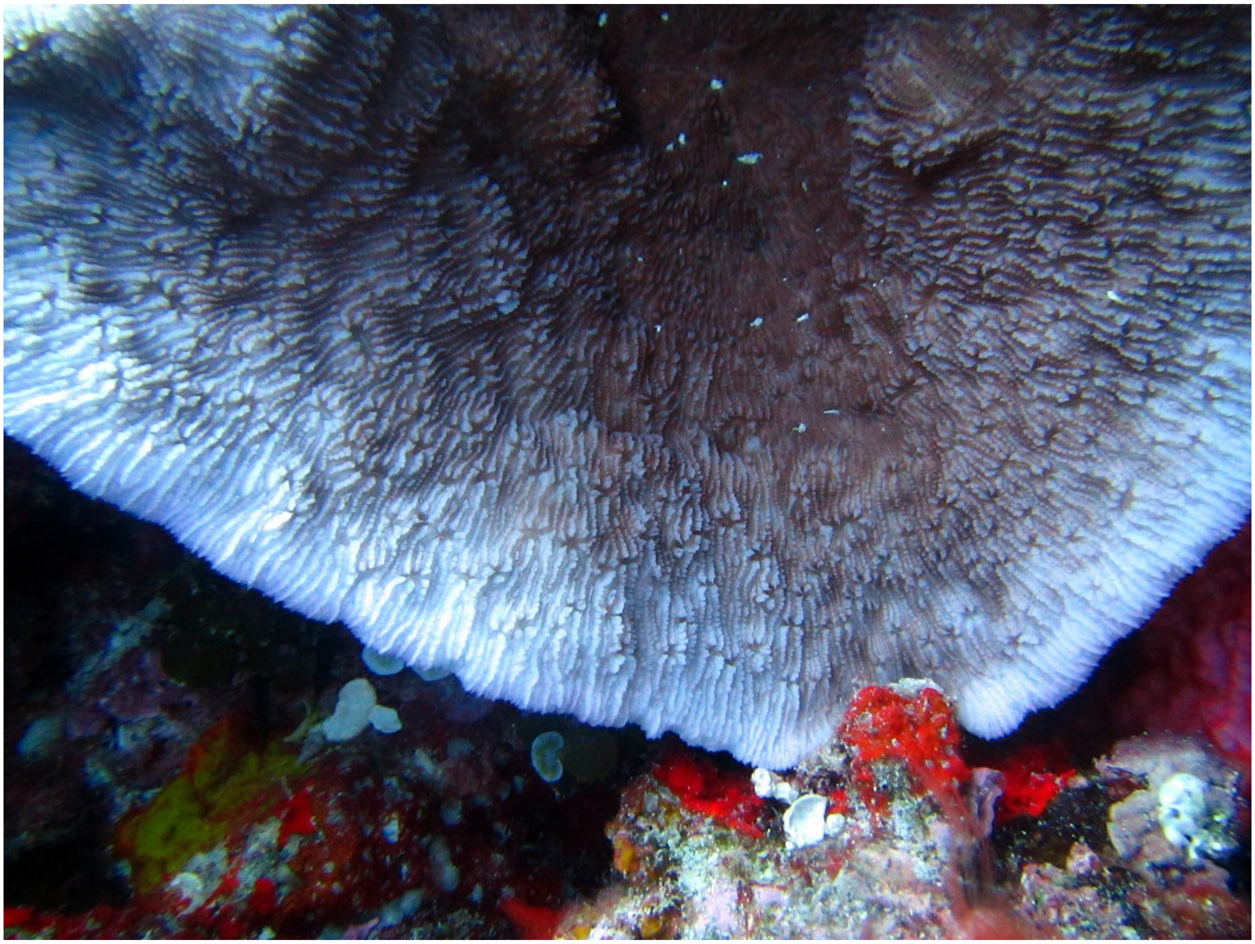
Colonies are attached plates, with many corallites. Corallites may be inclined towards the edge of the plate or not. Septa radiate on the plate, and have tiny teeth.

Podabacia motuporensis

Colonies have many small corallites which are usually not raised (but may be) and usually not inclined towards the edge of the plate. *Podabacia crustacea* has larger corallites which are inclined towards the edge of the plate. *Leptoseris* has septa radiating from the corallites and usually has thinner plates and often is orange.



A colony of *Podabacia motuporensis* which has raised corallites.



A close-up photo of *Podabacia motuporensis*.

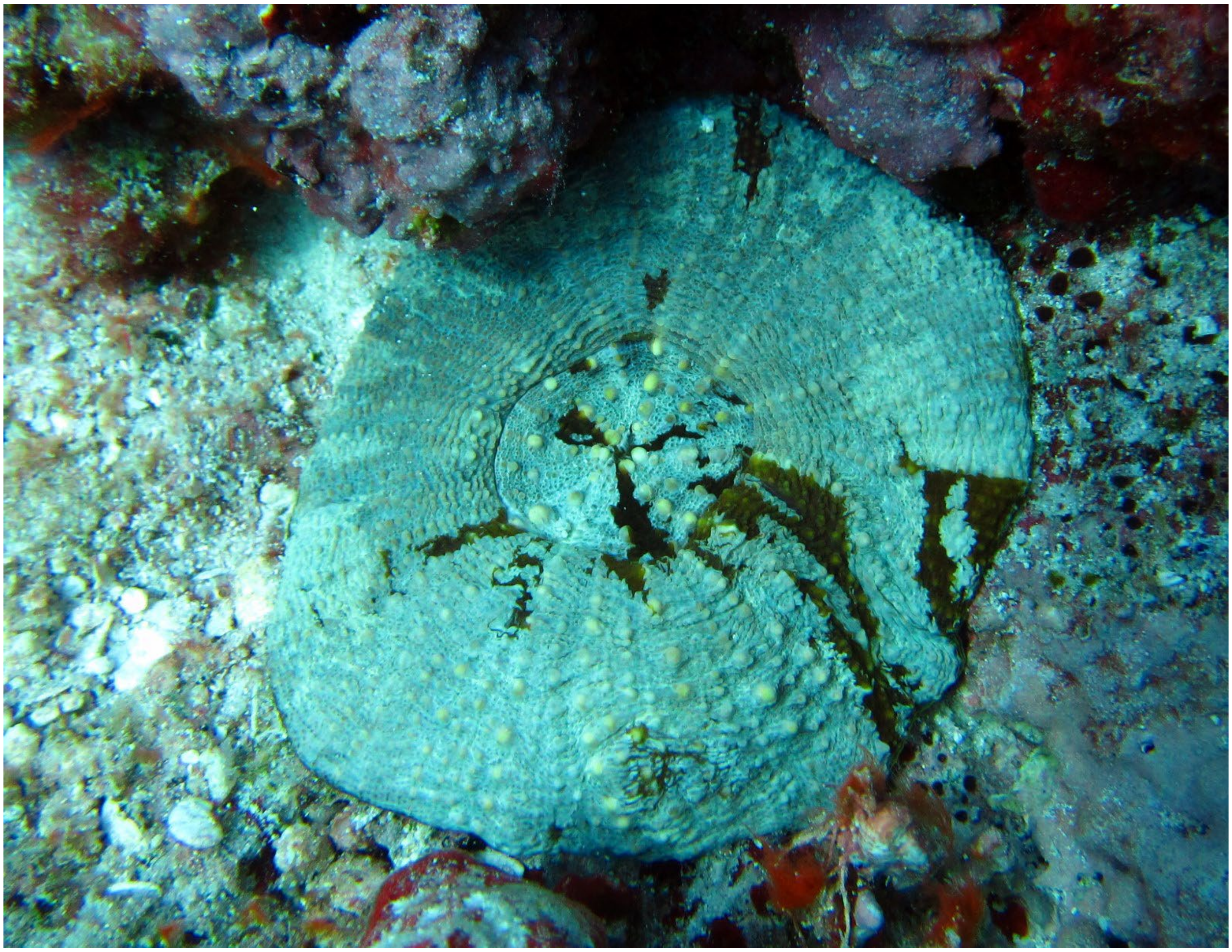
Echinomorpha

There is only one species in this genus, the properties of the genus are those of the species.

Echinomorpha nishihirai

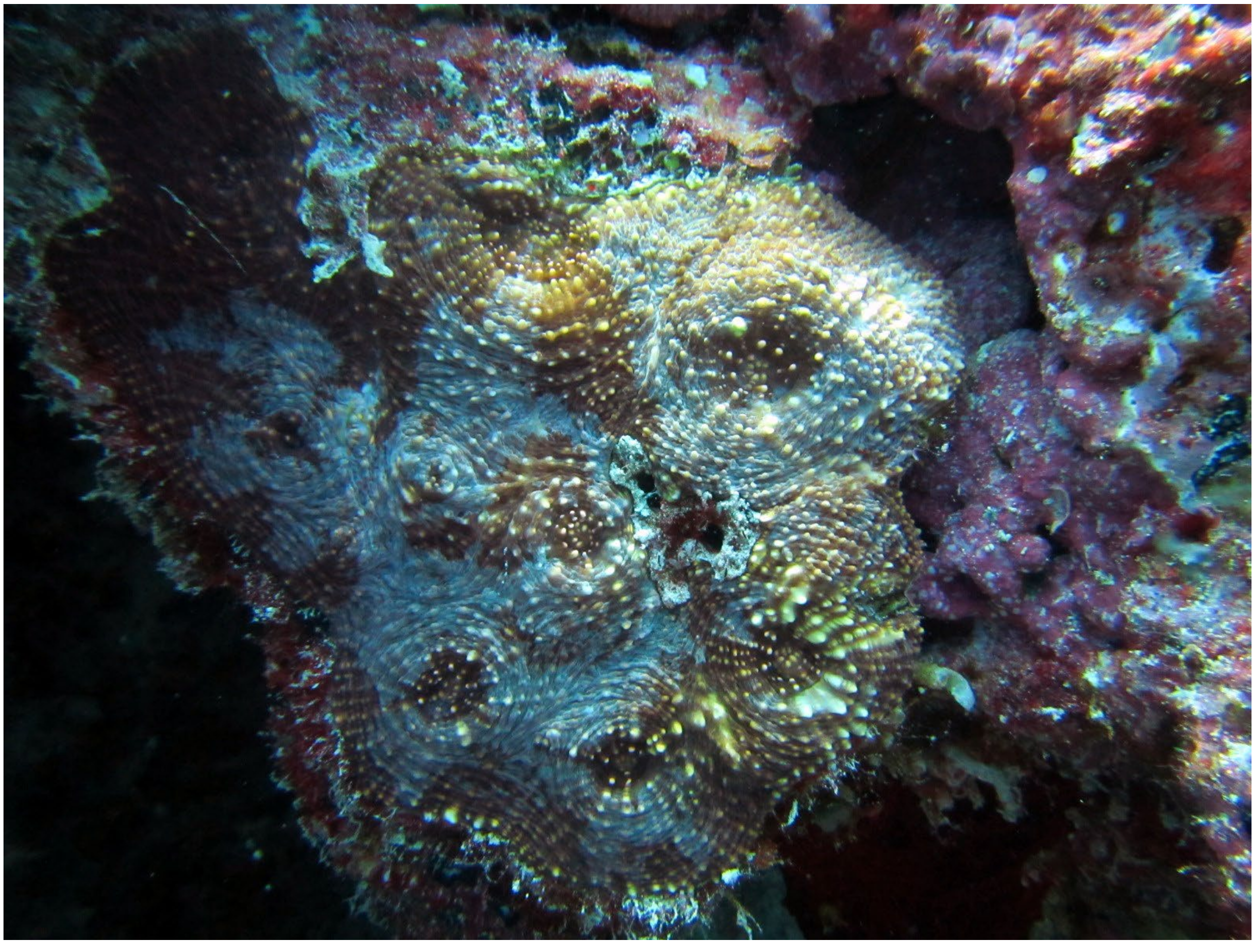
Corals are usually encrusting but may be domed. Colonies usually have only one corallite, but can have several. The calice is slightly depressed from the outer surface of the corallite. The outer surface has radiating rows of small spines with small concentric folds of tissue extending from them. A few rows of spines extend into the calice and reach the center. Corals are up to about 10 cm diameter. Most are shades of brown or grey but some can be bright orange to red. Usually rare, more common in Tonga than any other place the author knows of. *Parascolymia* is flatter and has more visible radiating septa.

A photo of *Echinomorpha nishihirai*.



A photo of *Echinomorpha nishihirai*.

A photo of a domed colony of *Echinomorpha nishihirai*.



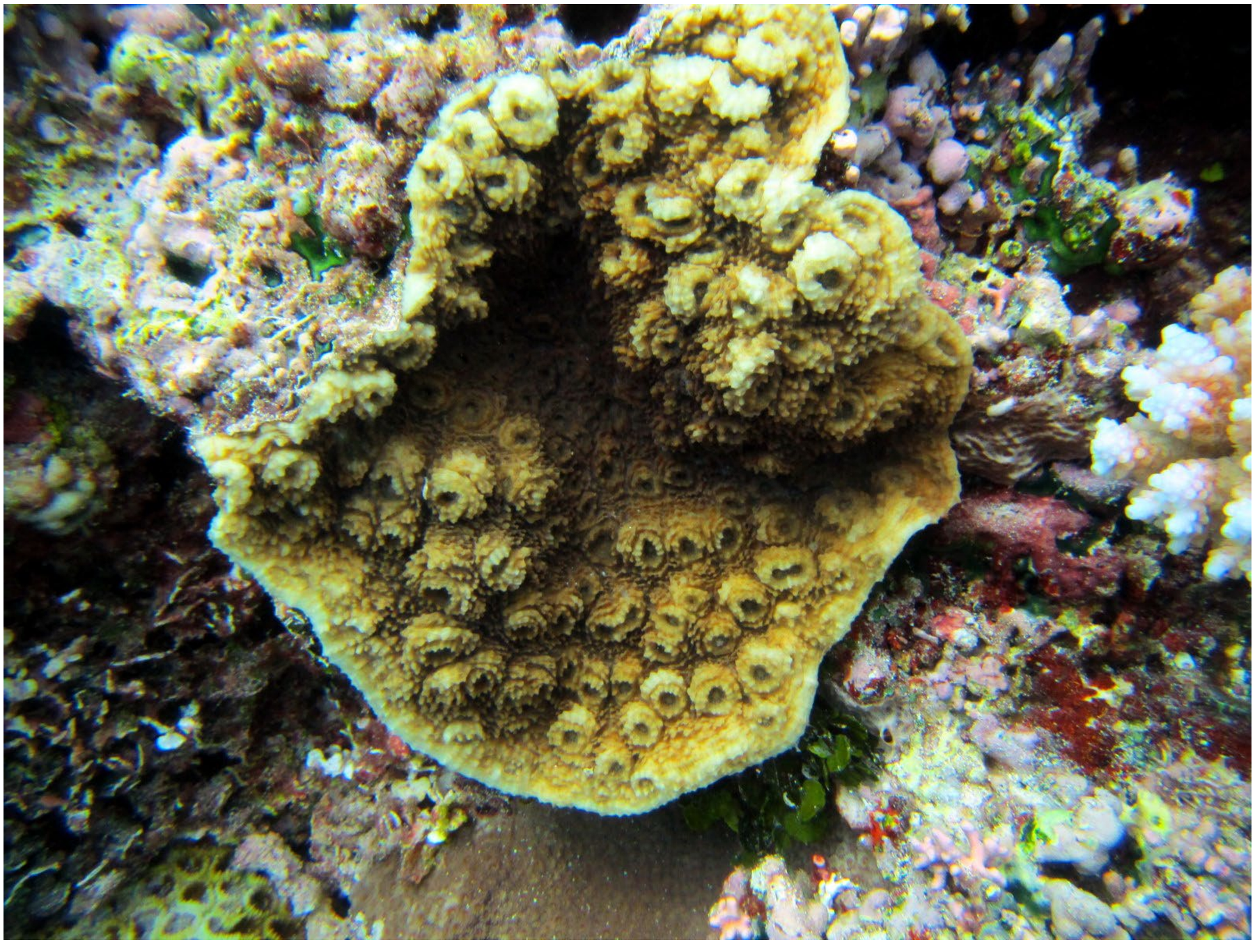
A photo of an unusual colony of *Echinomorpha nishihirai* with multiple corallites.

Echinophyllia

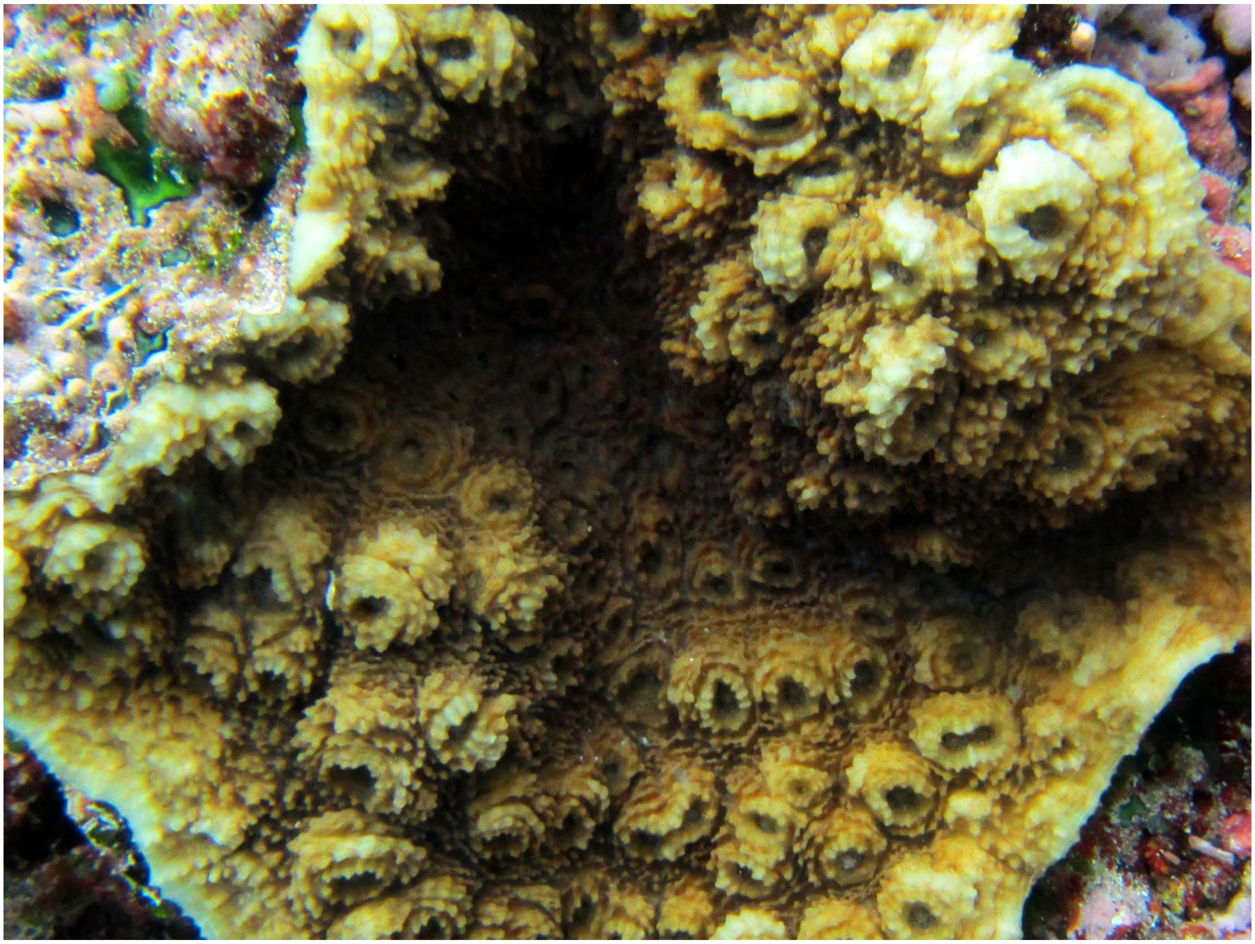
Colonies are encrusting or plates. Corallites may be rounded mounds, short projecting tubes, or flush with the surface. Corallites are not inclined. Species range from so spiny that corallites are hard to spot to nearly smooth.

Echinophyllia orpheensis

Colonies are usually encusting. Corallites are projecting tubes with thick walls, deep calices, and spines. Other species of *Echinophyllia* have smaller, more rounded corallites.



A colony of *Echinophyllia orpheensis*.



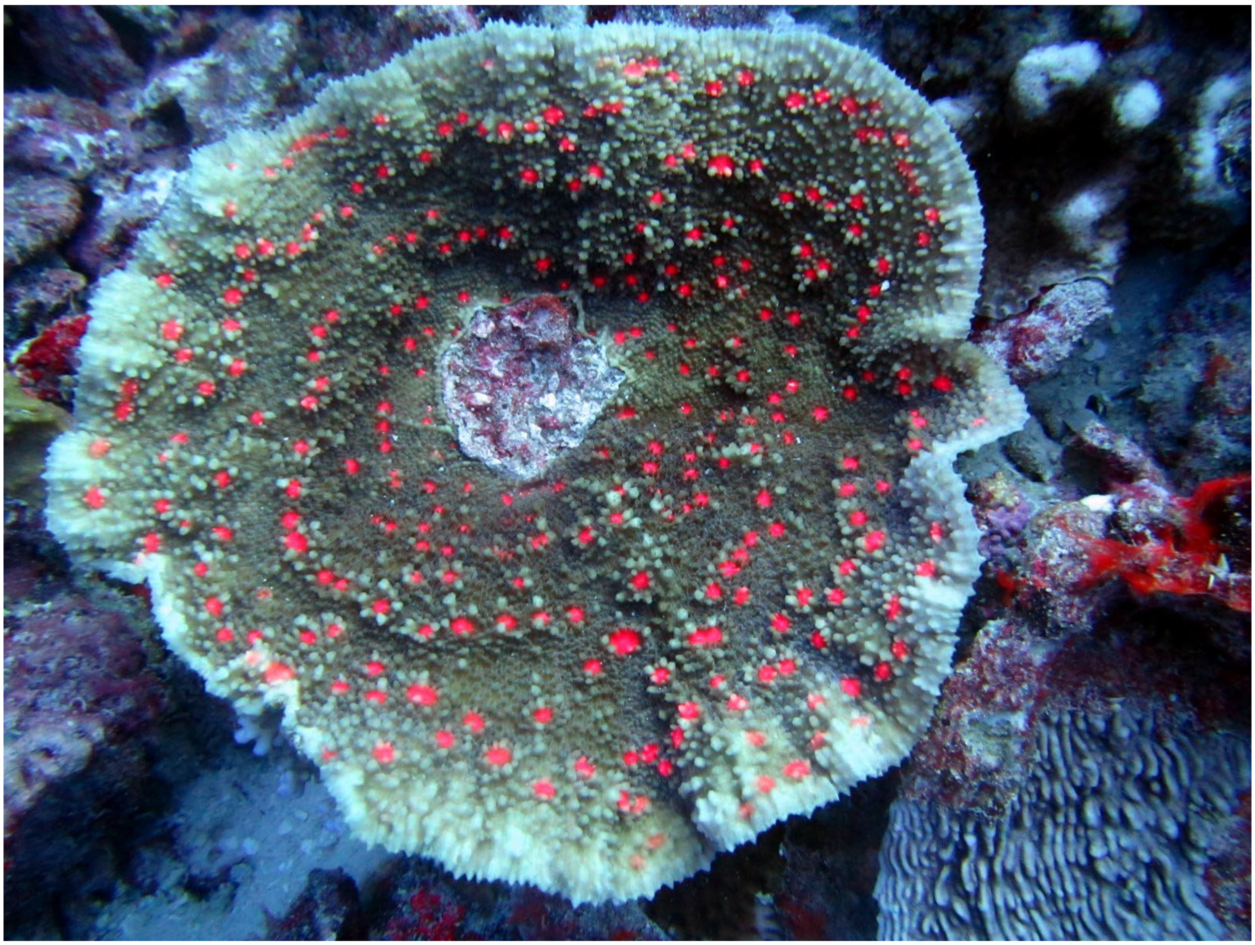
A close-up photo of *Echinophyllia orpheensis*.

Oxypora

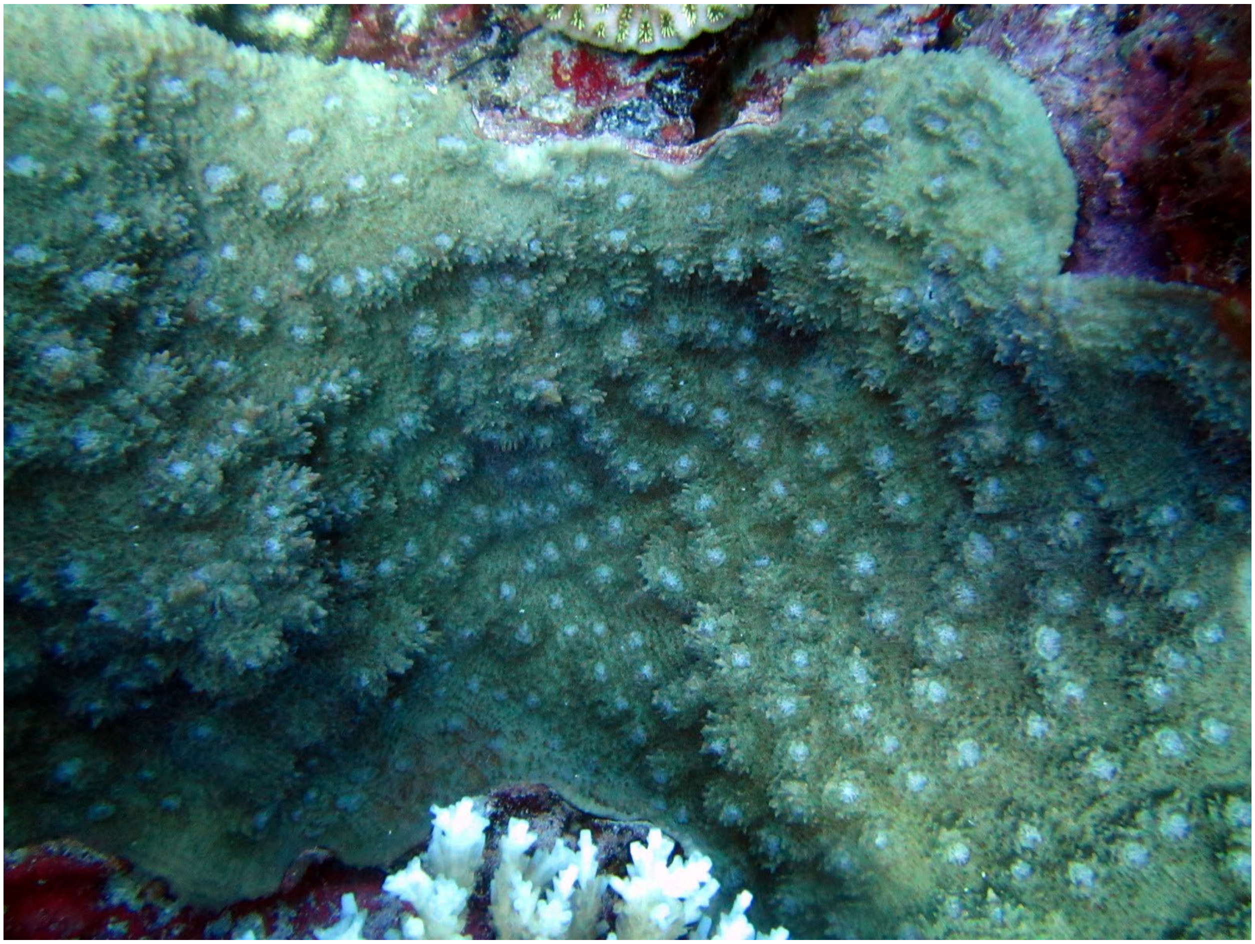
Colonies are plates or encrusting. Corallites usually project, but are small, about the size of a pea. Colonies are usually spiny enough that corallites are hard to see, but at least one species has so few spines that the corallites are easy to see. *Oxypora lacera* is hard to distinguish from *Echinophyllia aspera*, but other species are easier to distinguish.

Oxypora lacera

Colonies are thin plates with lots of small spines. The corallites are the size of a pea but can be hard to pick out of the spines. Sometimes the polyp mouths are a different color from the rest of the plate. *Echinophyllia aspera* has a little larger, more rounded-mound shaped corallites but otherwise is very similar. *Oxypora glabra* has many fewer spines between corallites, and *Oxypora crassispinosa* has very large, thick spines.



A photo of *Oxypora lacera*.

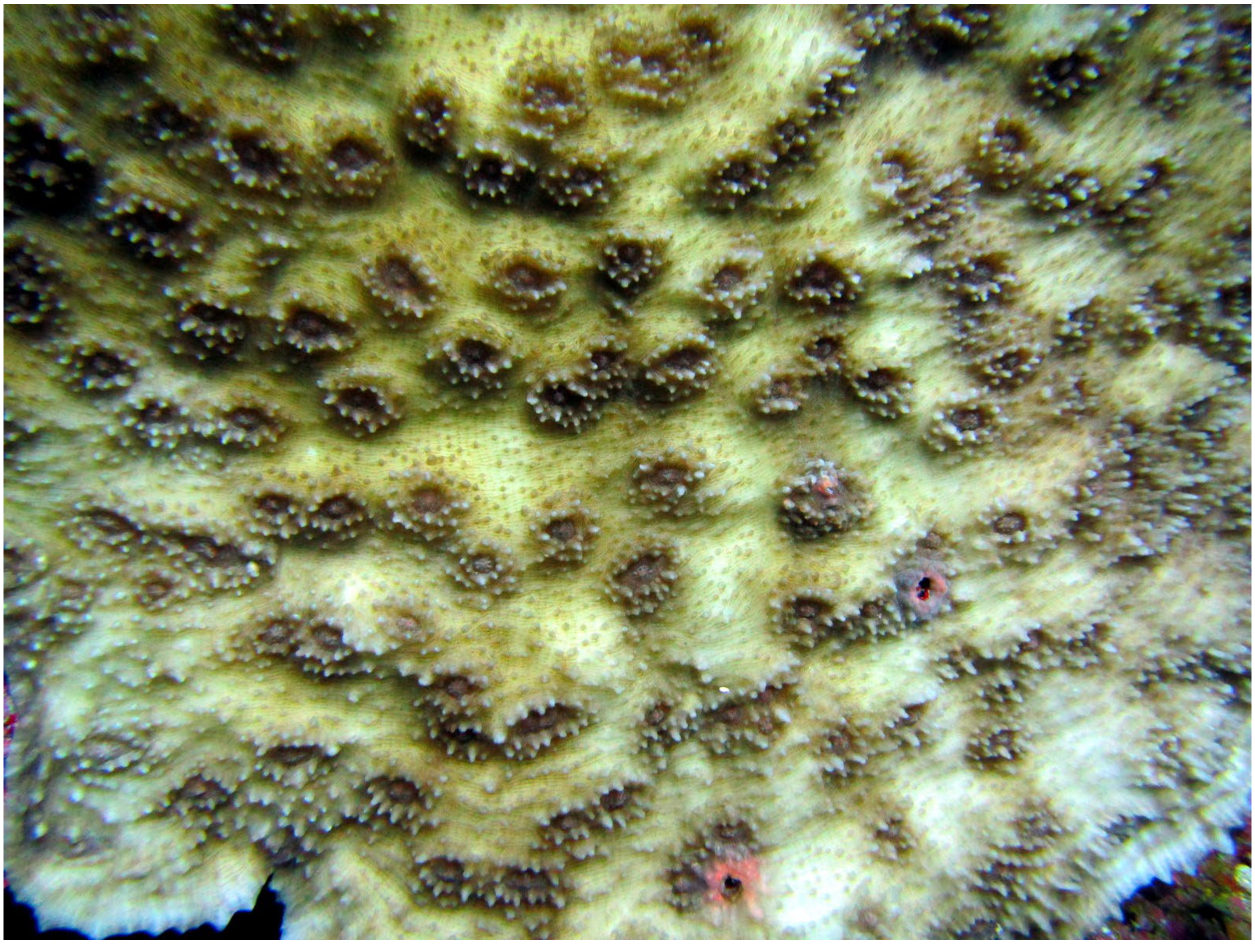


A close photo of *Oxypora lacera*.

Oxypora glabra

Colonies are thin plates. Corallites are about the size of a pea and are spiny. In between corallites there are few spines. *Oxypora lacera* and *Oxypora crassispinosa* have many more spines.

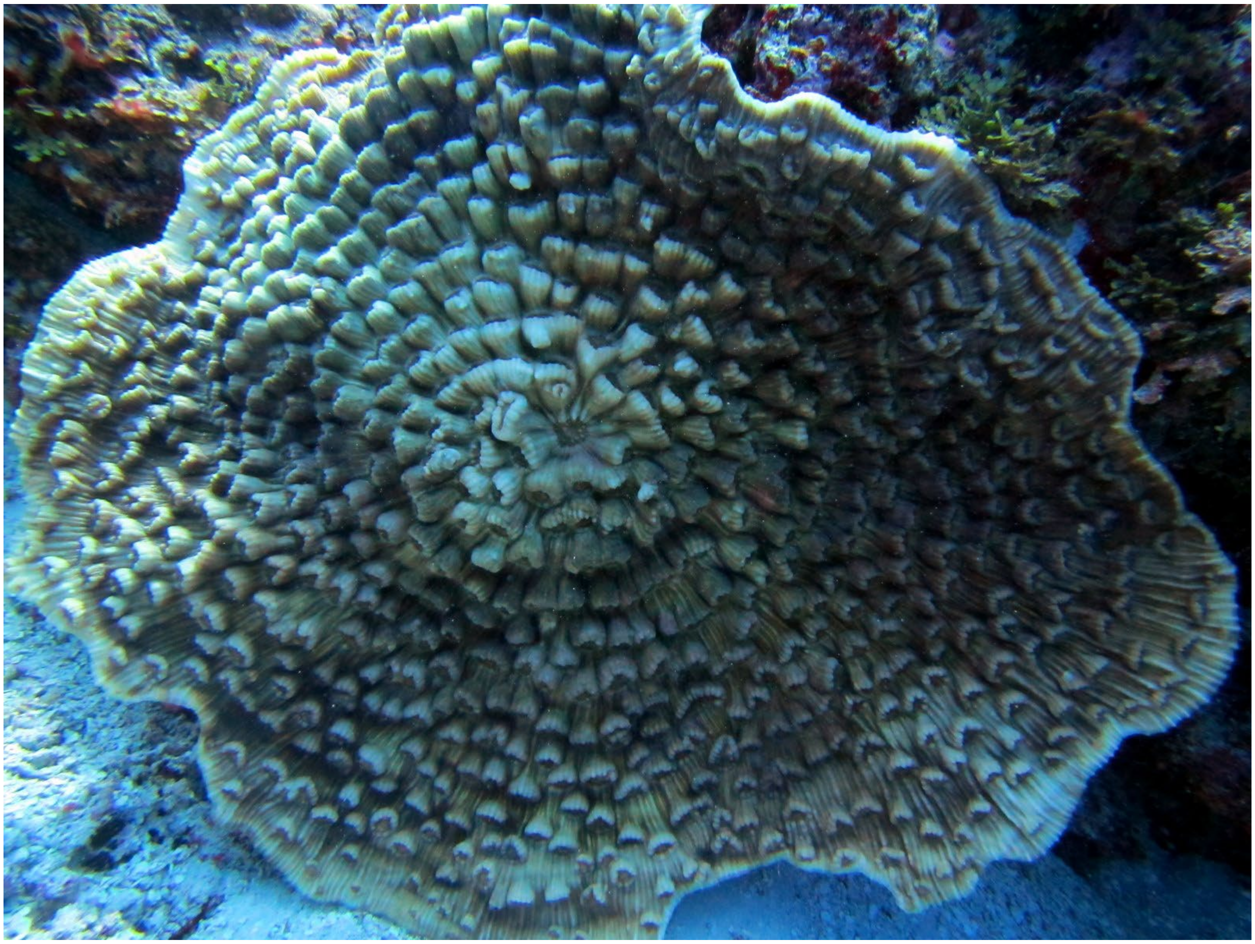
A photo of *Oxypora glabra*.



A close-up photo of *Oxypora glabra*.

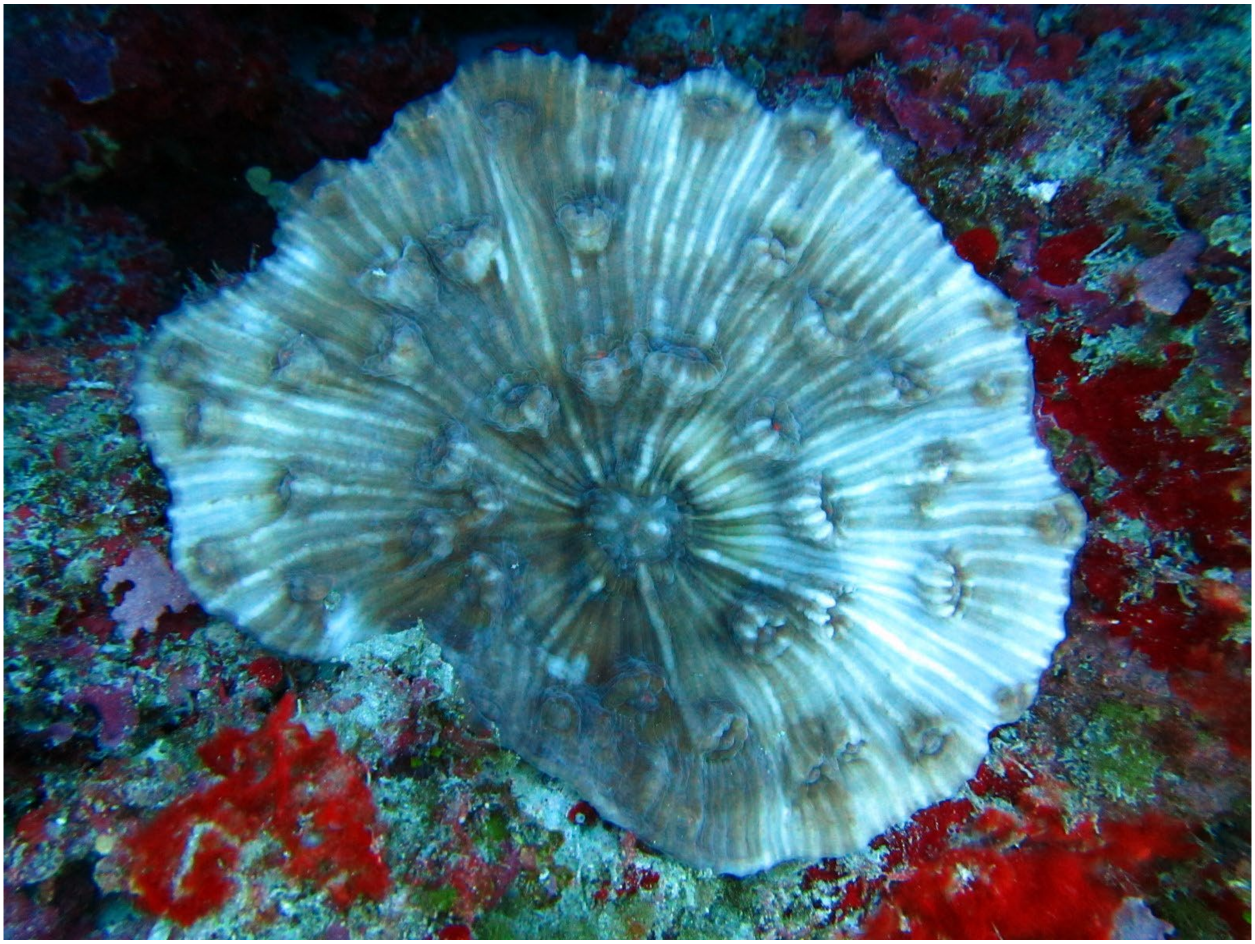
Mycedium
Colonies are thin plates. The corallites are raised and strongly inclined toward the outer edge of the plate. Usually the corallites are easy to see since there aren't many spines and they are small. The plate may have obvious radiating thin ridges on it. Other similar corals do not have corallites inclined towards the outer edge of the colony except *Leptoseris* which has smaller, more rounded corallites..

Mycedium elephantotus
Colonies have large, obvious, outwardly inclined corallites.



A photo of *Mycedium elephantotus*.

A photo of *Mycedium elephantotus*.



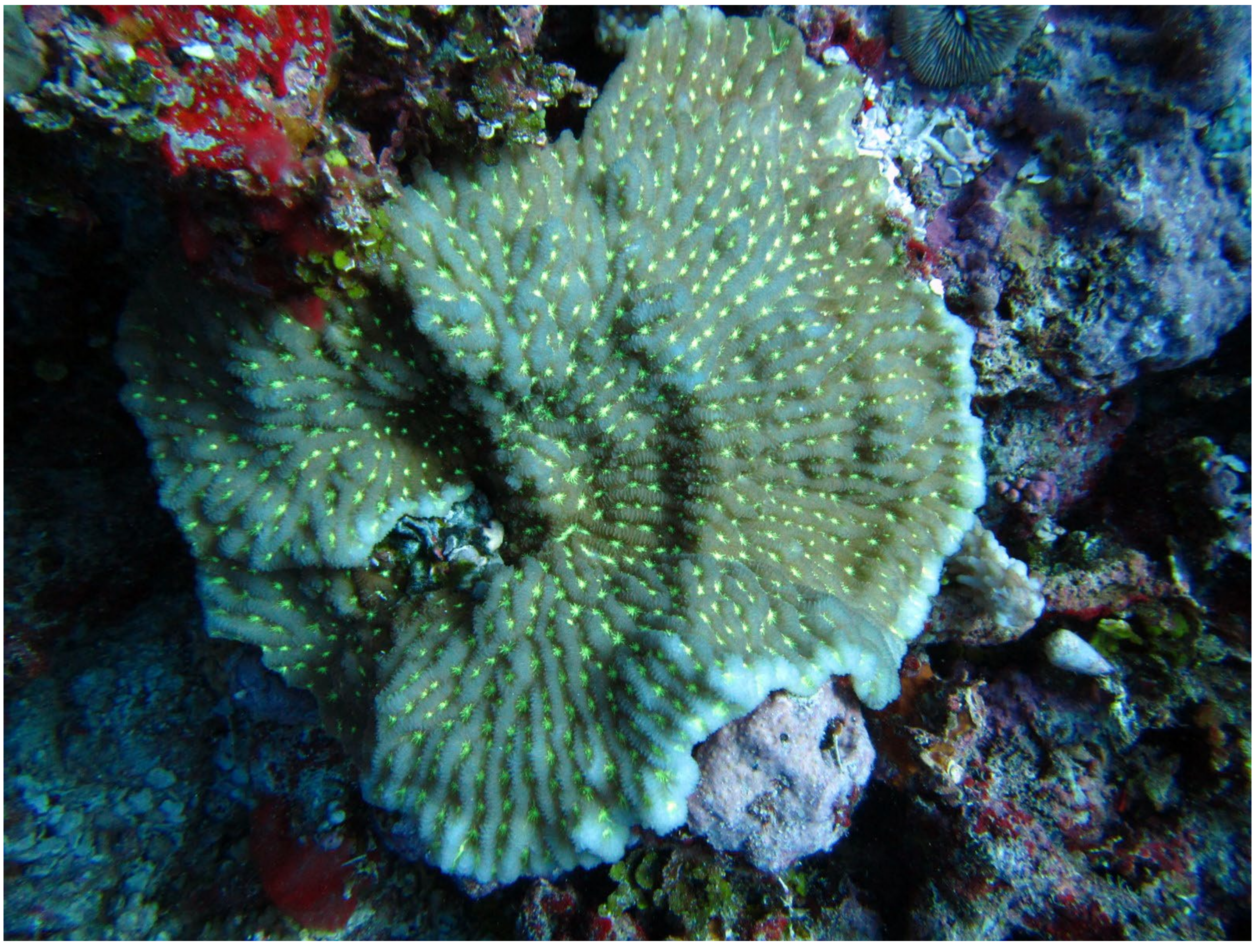
A photo of a small colony of *Mycedium elephantotus* with widely spaced corallites.

Merulina

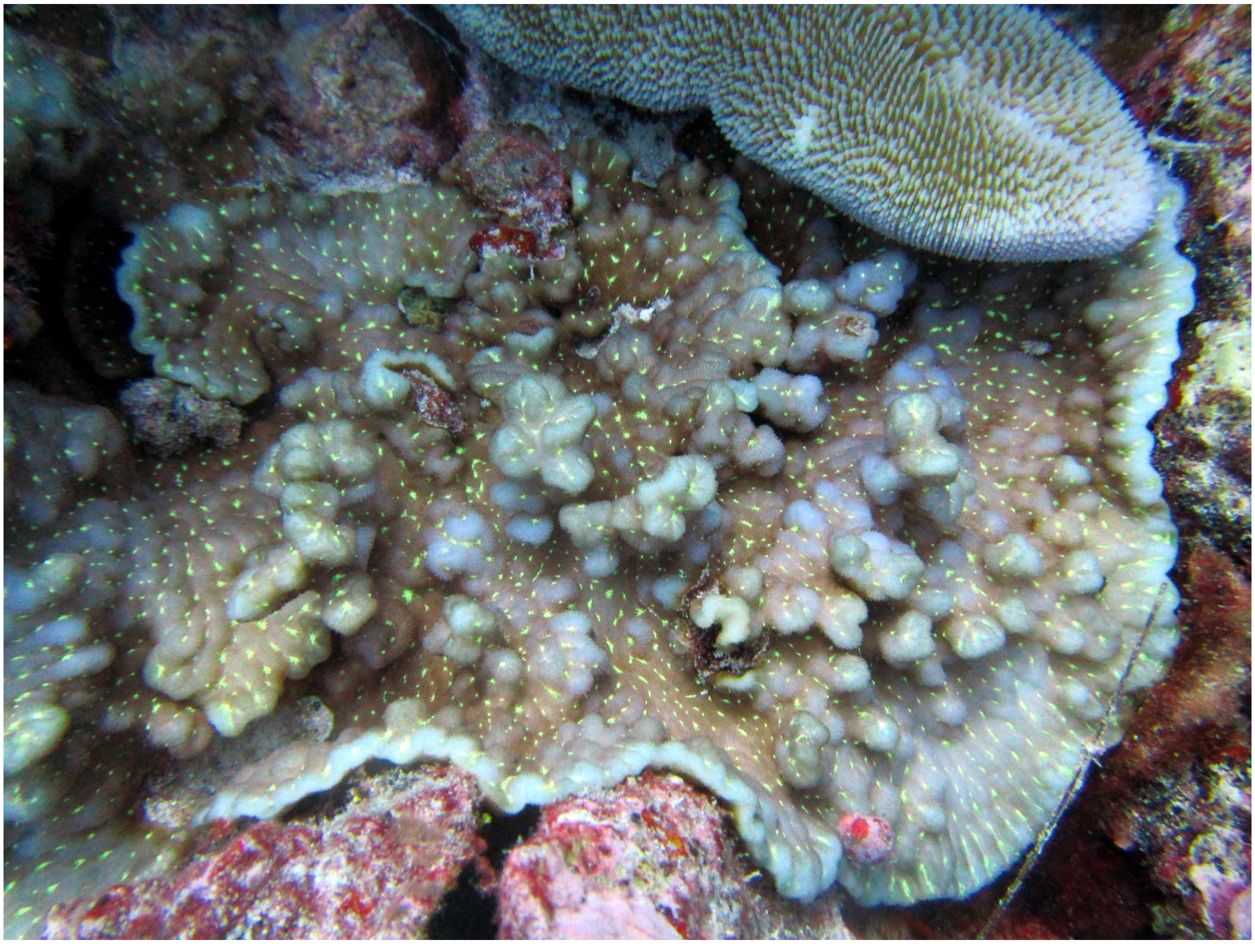
Colonies are thin plates that are often horizontal but can be near vertical or anything in between, or can be encrusting. The upper surfaces are covered with radiating ridges which divide and fuse as they run towards the edge. Colonies can have knobs or columns on their upper surface, which are irregularly shaped in part because they have the ridges running up their sides. The polyp mouths are between the ridges, and tiny septa run up the sides of ridges. *Scapophyllia* is similar but has rouned lumps or thick columns.

Merulina ampliata

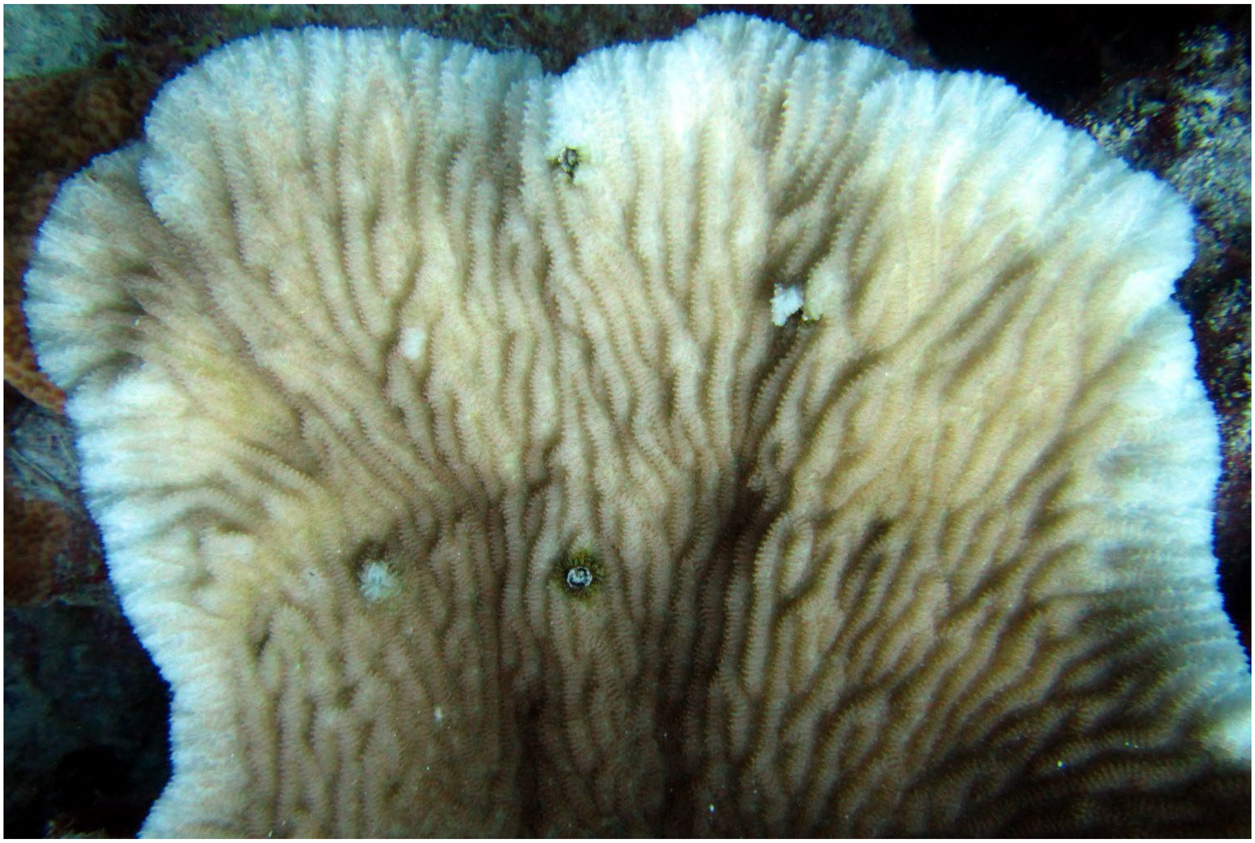
Colonies have rounded ridges, about 3-4 mm wide. *Merulina scabricula* has narrower ridges. *Scapolphyllia cylindrica* has thick cylindrical columns.



A photo of *Merulina ampliata* with bright green polyp centers.



A photo of *Merulina ampliata* with knobs.

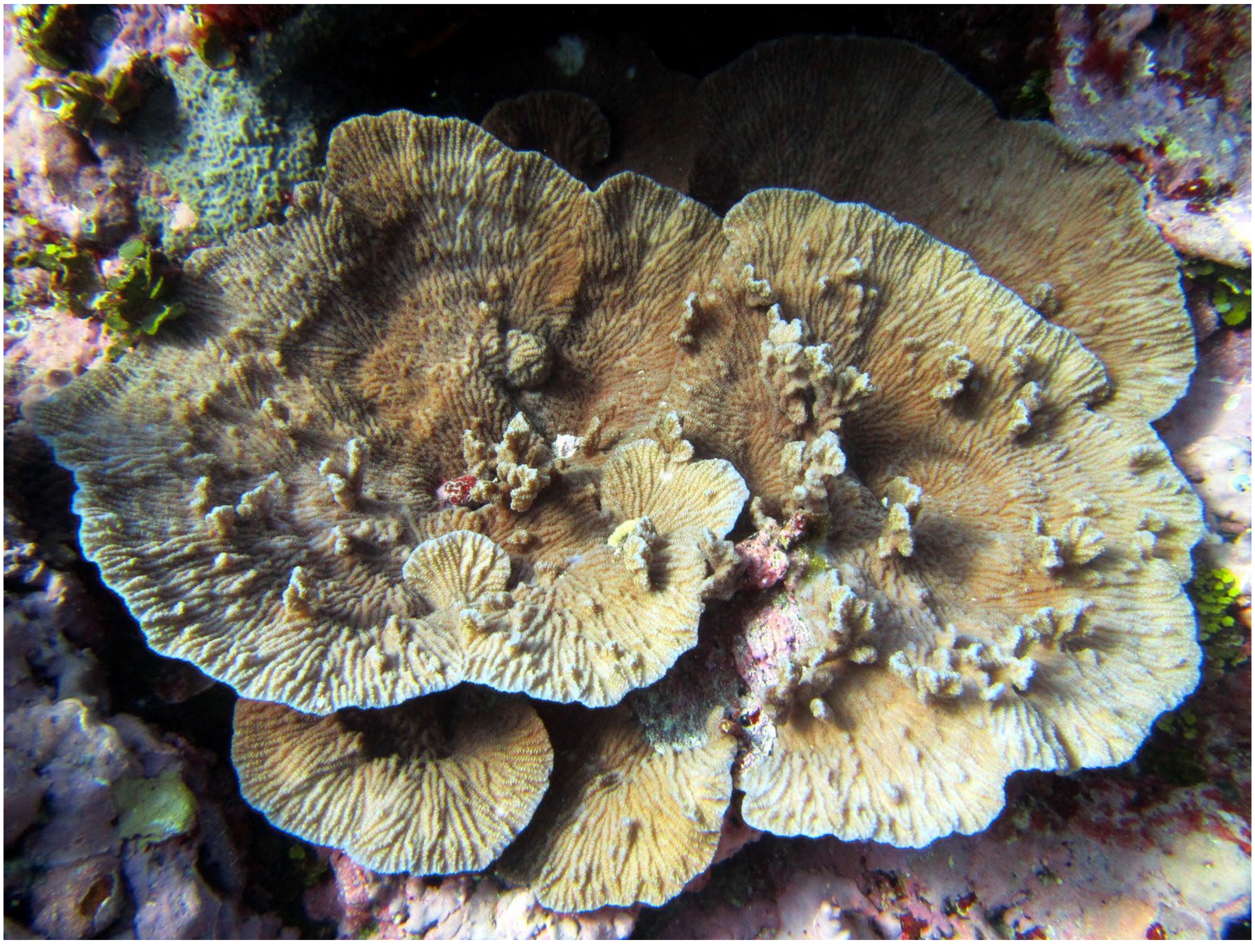


A close photo of *Merulina ampliata*.

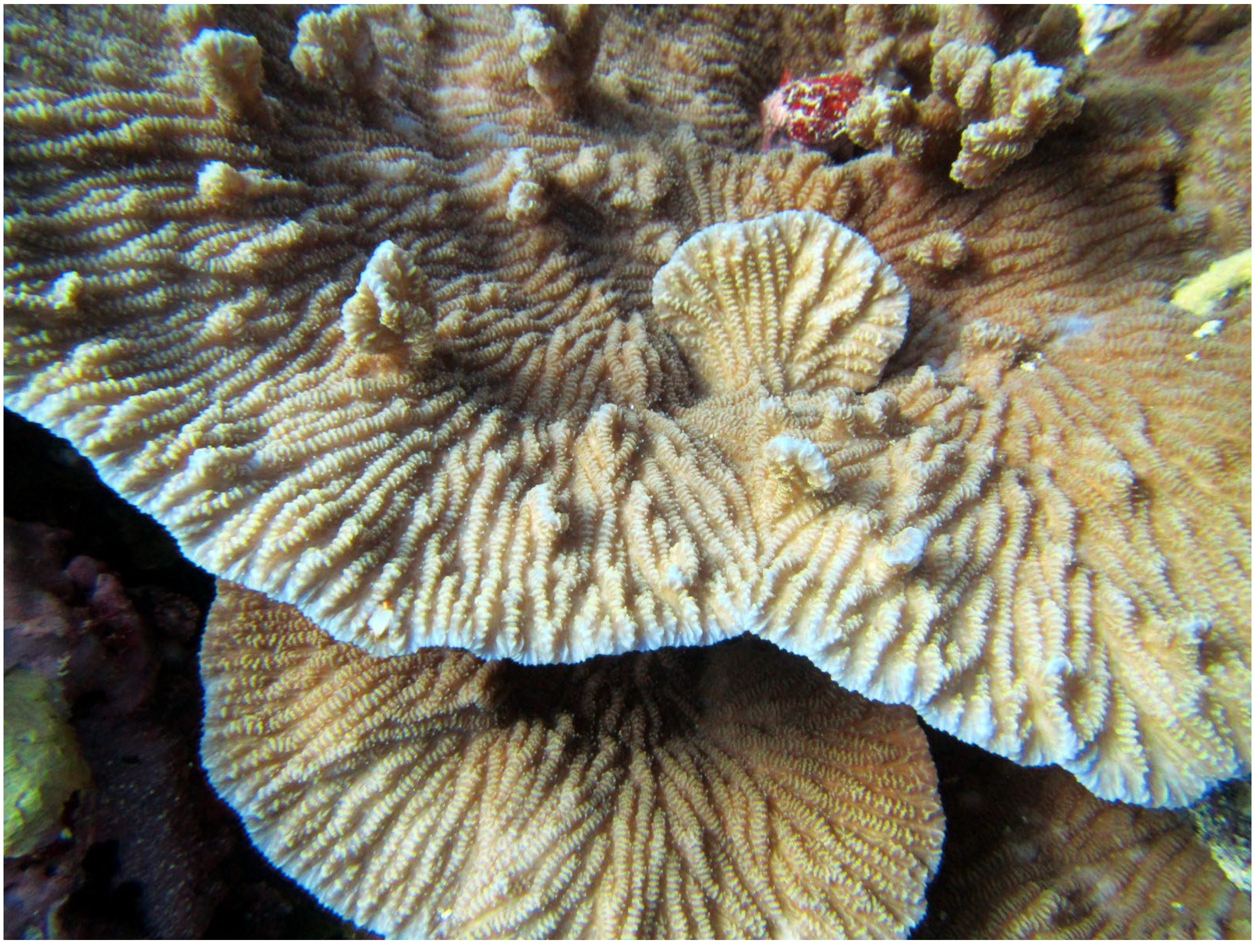
A close-up photo of *Merulina ampliata*.

Merulina speciosa (formerly called Merulina scabricula)

Colonies have narrower radiating ridges about 2 mm wide. The ridges are more narrow than on *Merulina ampliata*. They type specimen of *Merulina scabricula* is a piece of *Merulina ampliata*, while the type of *Merulina speciosa* is this species.



A photo of *Merulina speciosa*.



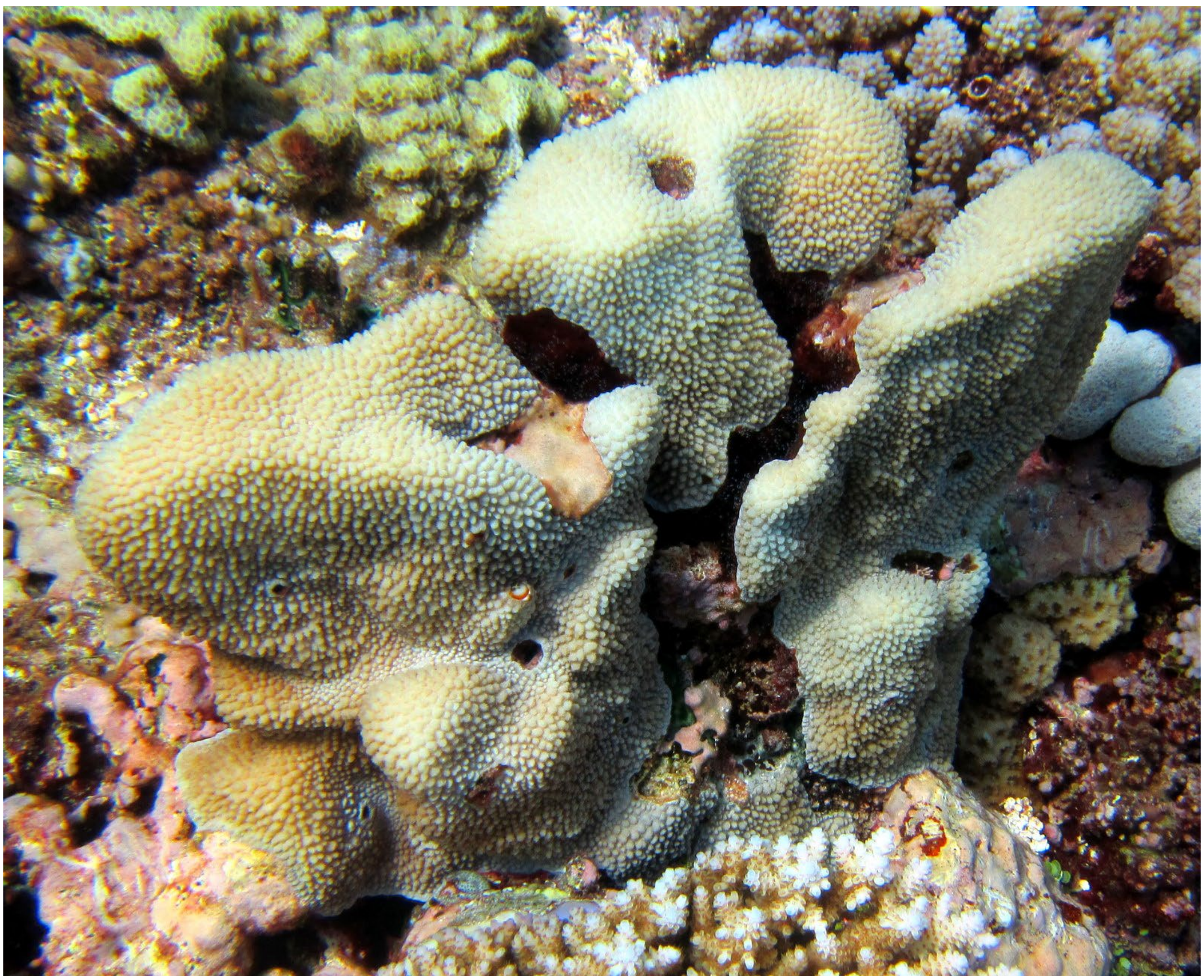
A closeup photo of *Merulina speciosa*.

Hydnophora

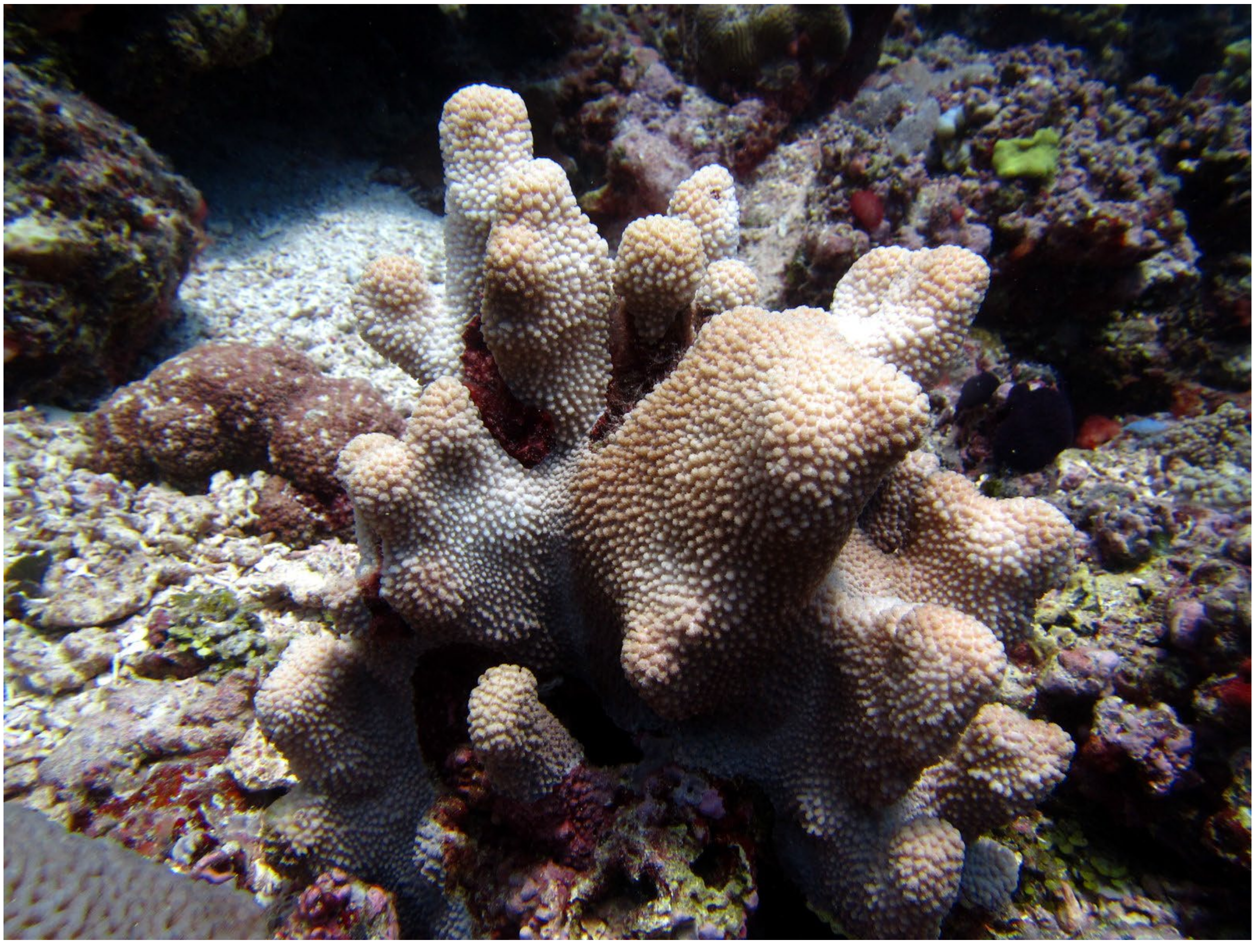
Colonies are encrusting, plates, branching, massive, or combinations of these. Colonies have small ridges or bumps called "hydnophores" between corallites, with septa running up the sides of the hydnophores. Hydnophores are surrounded by corallites. *Pocillopora* is always branching and the bumps (verrucae) have corallites all over them. When **Montipora** has bumps they are either smooth or larger and irregular with corallites on them.

Hydnophora microconos

Colonies are massive, columnar, or branching with thick rounded branches. The hydnophores are quite small and circular. Hydnophores on other species are larger and elongated, and no other species is massive. Most other species also have tiny tentacles that are visible while this species does not. Most colonies of this species in Tonga seem to be columnar or branching, but all colonies most other places are massive.



A photo of a colony of *Hydnophora microconos* with massive flattened lobes.

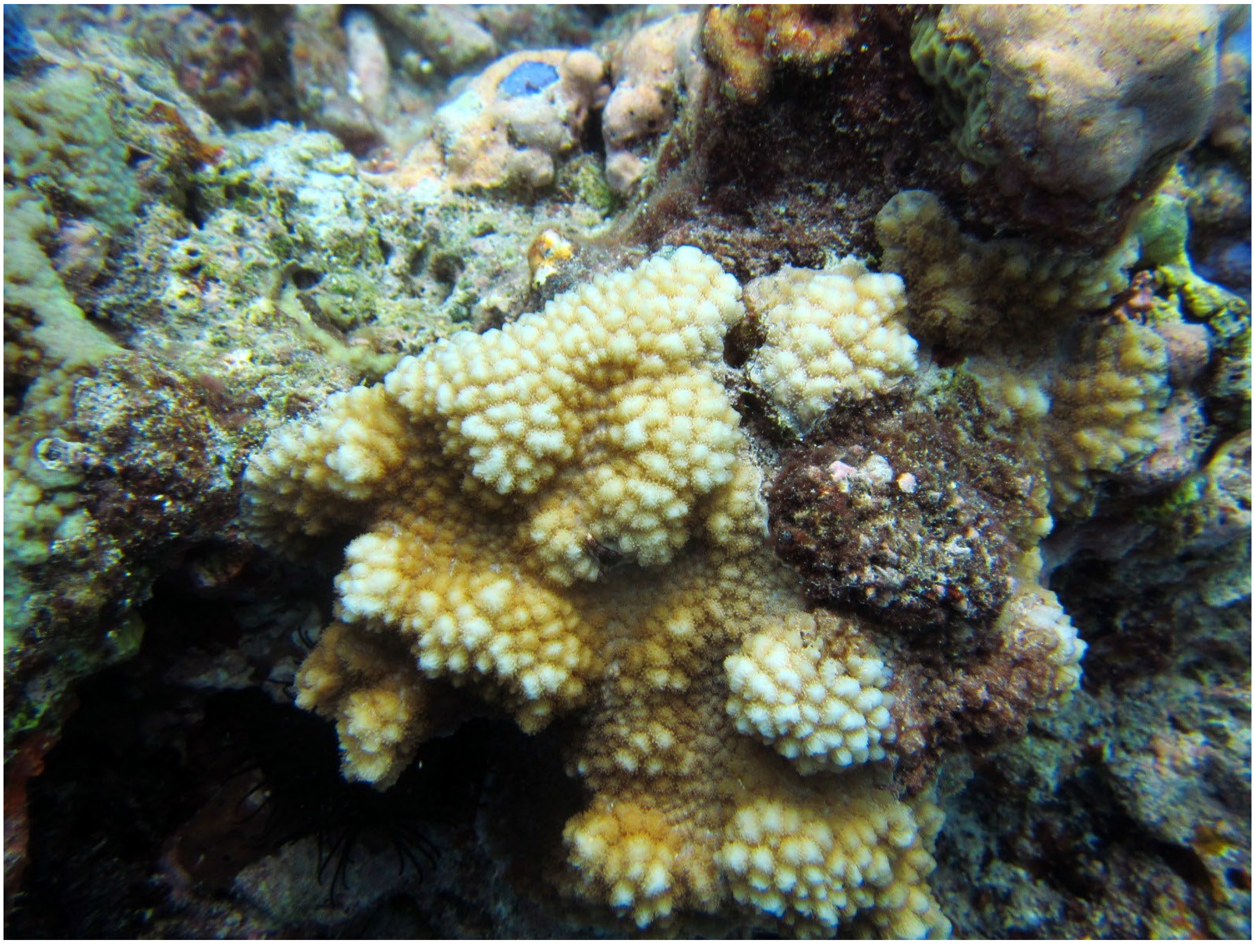


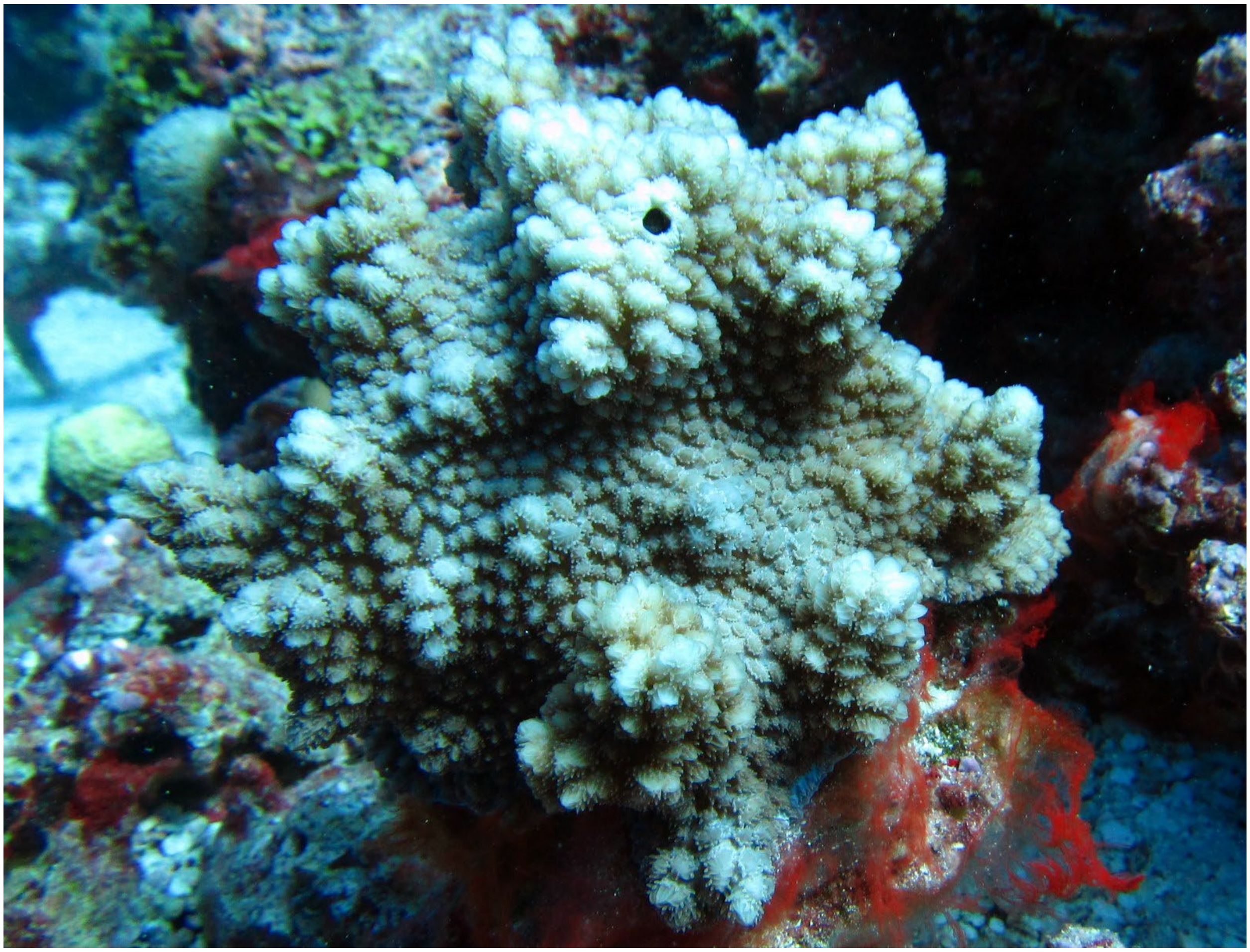
A photo of a colony of *Hydnophora microconos* with various size columns or cylindrical lobes.

A close-up photo of *Hydnophora microconos* showing the hydnophores.

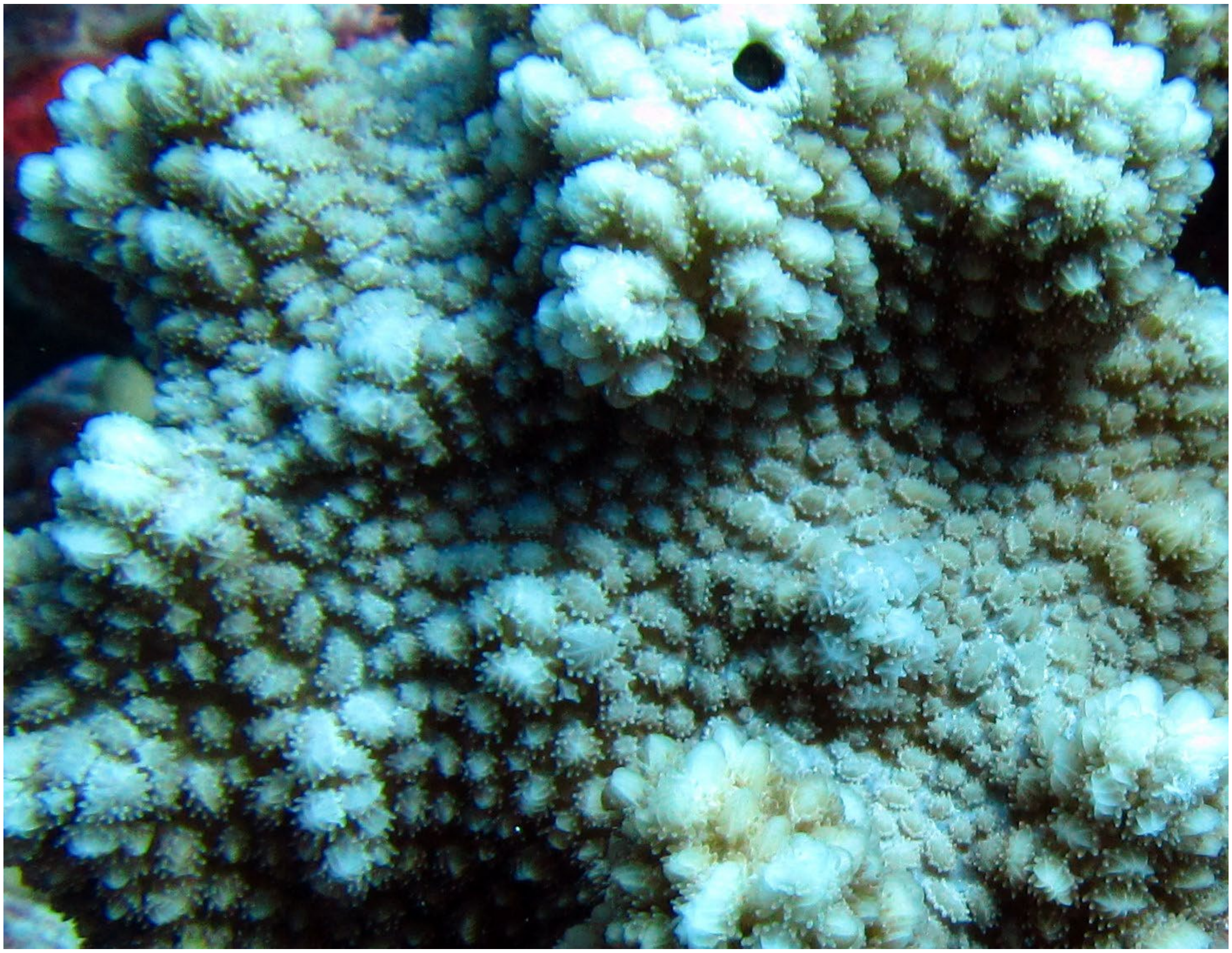
Hydnophora exesa

Colonies have encrusting or plate bases and usually have stubby, thick irregular branches on them. Hydnophores are thick and usually at least slightly oval, and can vary in size. In other places, tentacles are often extended partway, forming rings around hydnophores or a continuous mat between them. But in Tonga tentacles seem to be short.





A photo of *Hydnophora exesa*.



A close-up photo of *Hydnophora exesa*. The white dots are tentacle tips. Septa can also be seen around some hydnophores.

Hydnophora rigida

Colonies are branching with relatively thin branches. Tentacles may be extended obscuring the hydnophores, or not. Hydnophores become more elongated and narrow near branch tips, and septa on the sides of the hydnophores are slanted towards the branch tips.

A photo of *Hydnophora rigida* with extended tentacles.

A photo of *Hydnophora rigida* with tentacles mostly retracted.

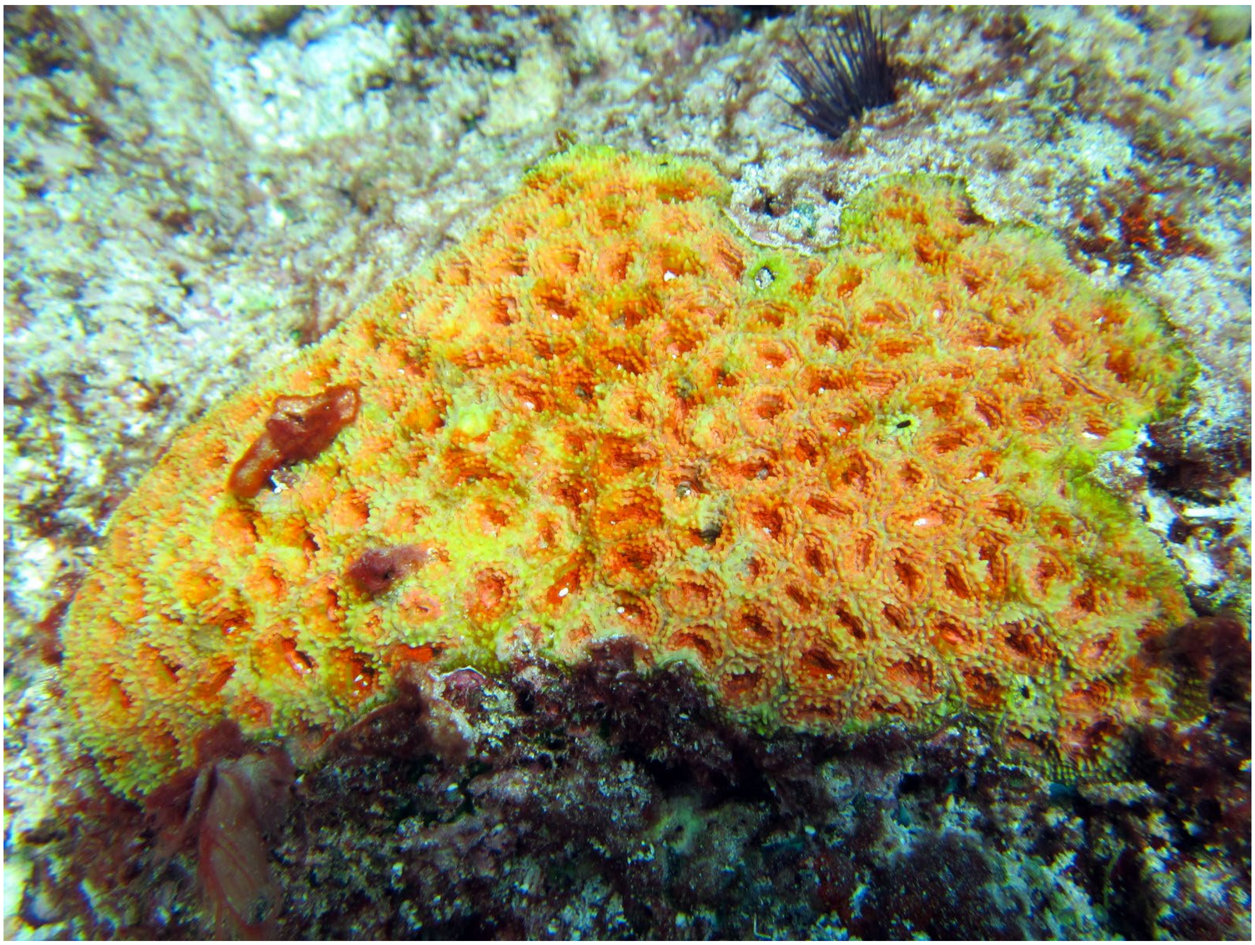
A close-up photo of *Hydnophora rigida*.

Acanthastrea

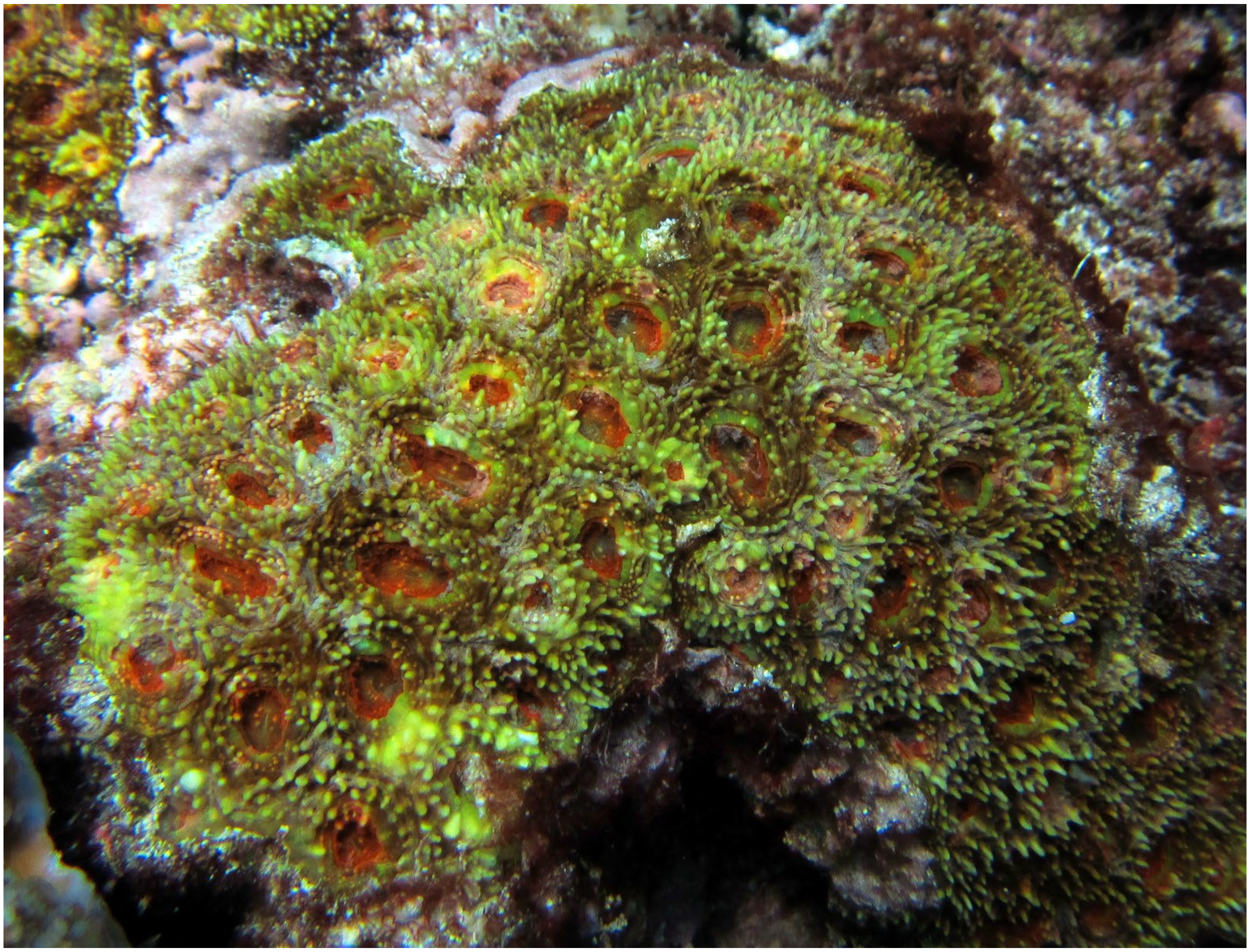
Colonies are encrusting in all species except one that is massive. Corallites are often circular but can be other shapes. Corallites are raised in only a few species. Corallites are typically thumb or finger size. Corallites are spiny.

Acanthastrea echinata

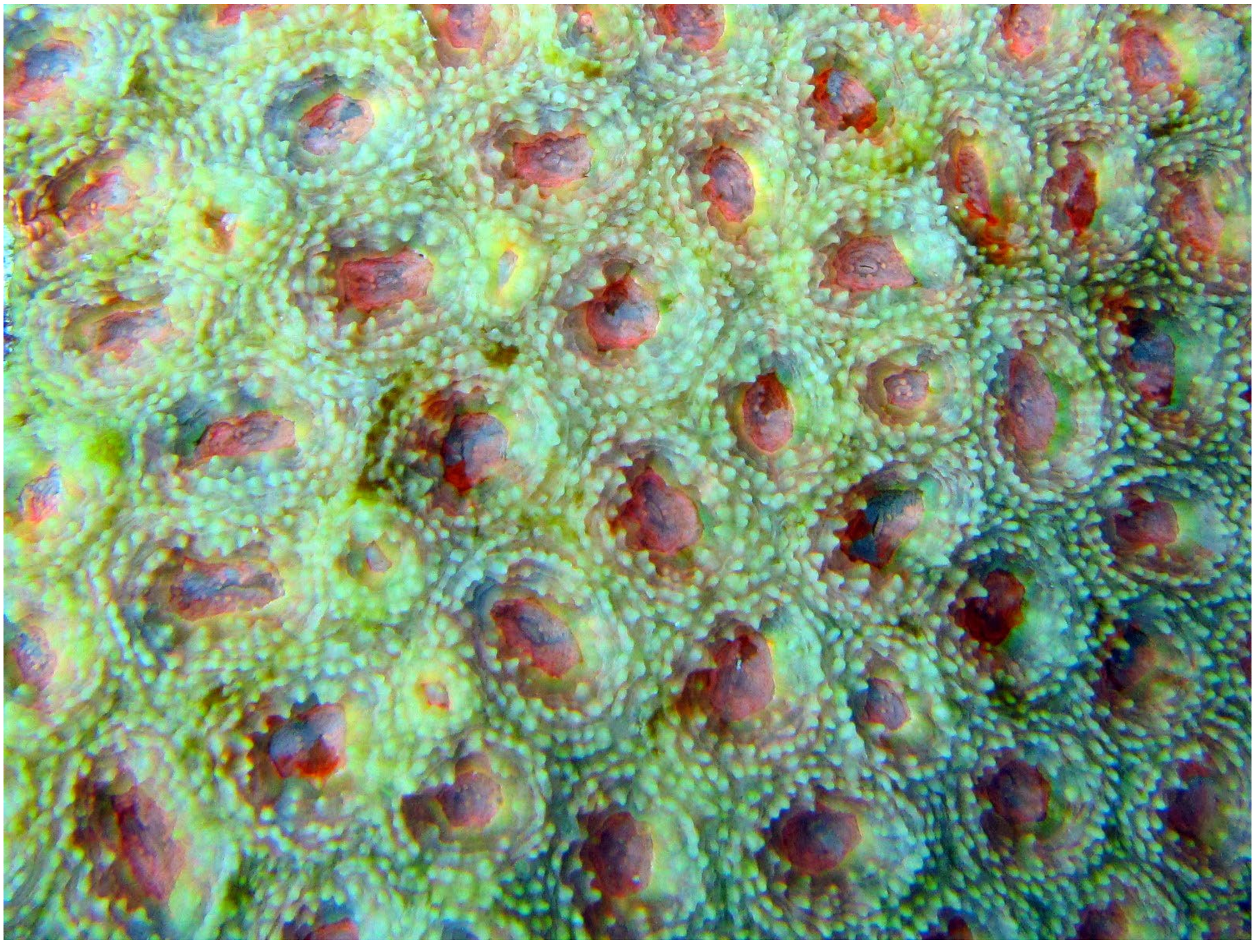
Colonies are encrusting, corallites are circular and the corallite center is depressed. The space between corallites is not wide, but it is also not a narrow ridge. Polyp flesh can be seen in tiny concentric folds. Corallites have thinner walls between them on *Acanthastrea hemprichii*, and corallites are pinched on *Acanthastrea ishigakiensis*, which is also massive. This is the only species that has concentric tissue folds.



A photo of *Acanthastrea echinata*.



A closer photo of *Acanthastrea echinata*.



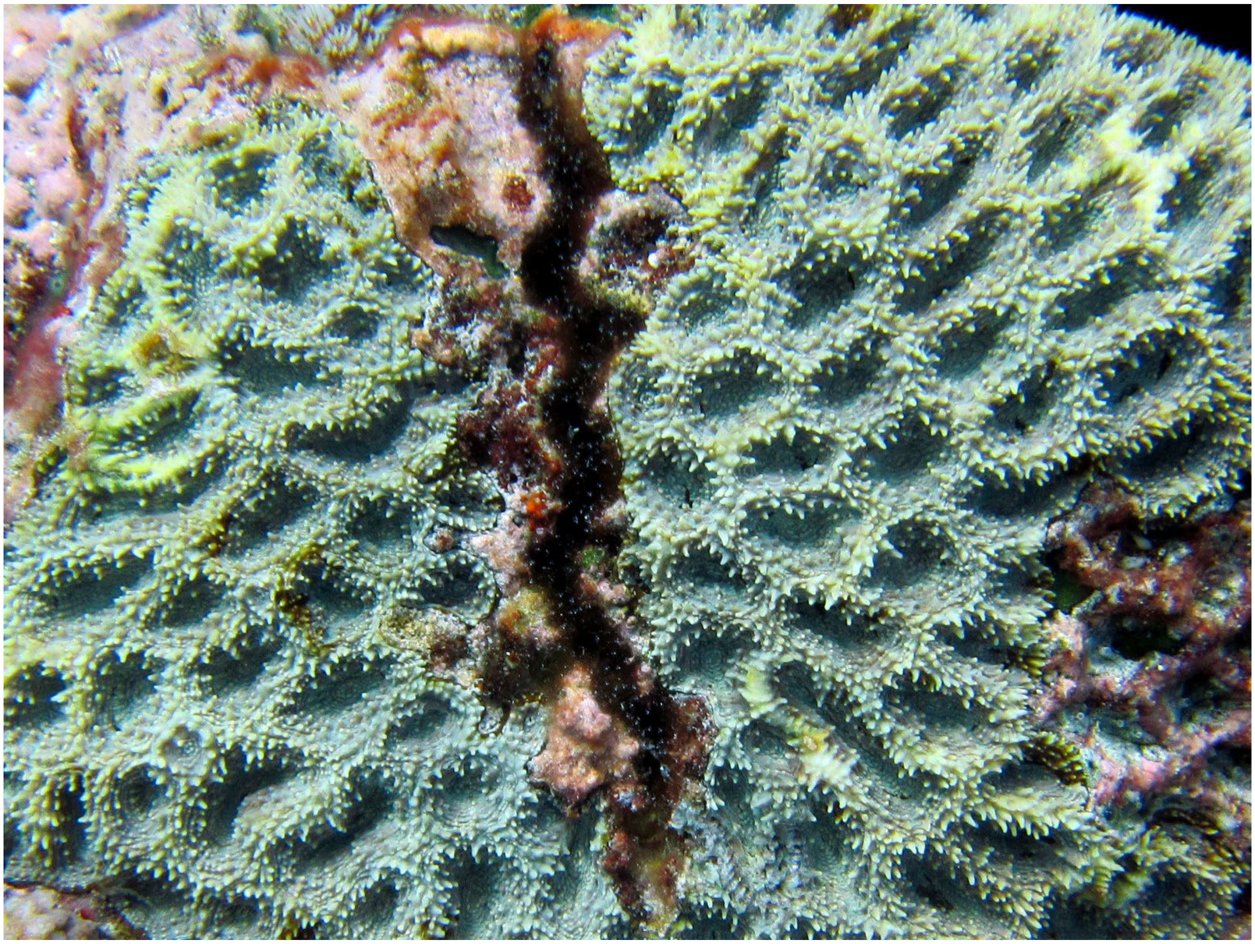
A close-up photo of *Acanthastrea echinata*.

Acanthastrea hemprichii

Colonies are encrusting with round or narrow corallites. Walls between corallites are narrow and concentric tissue rings are not visible. Walls are thicker on *Acanthastrea echinata*, corallites are always circular, and tiny tissue folds can be seen. *Acanthastrea ishigakiensis* is massive, corallites are larger, walls are thicker, and corallites are irregularly pinched in various shapes.

A photo of *Acanthastrea hemprichii*.

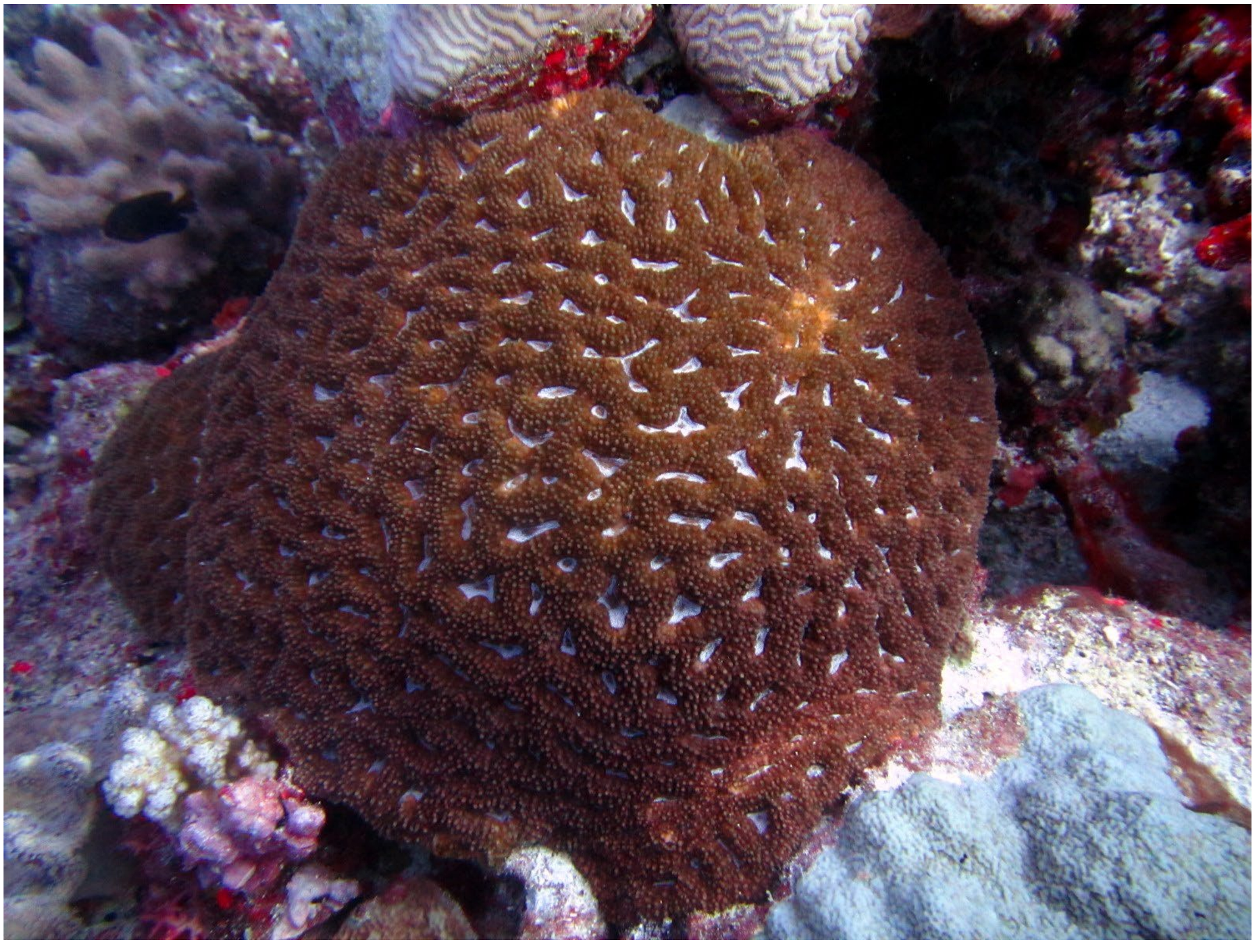
A photo of *Acanthastrea hemprichii*.



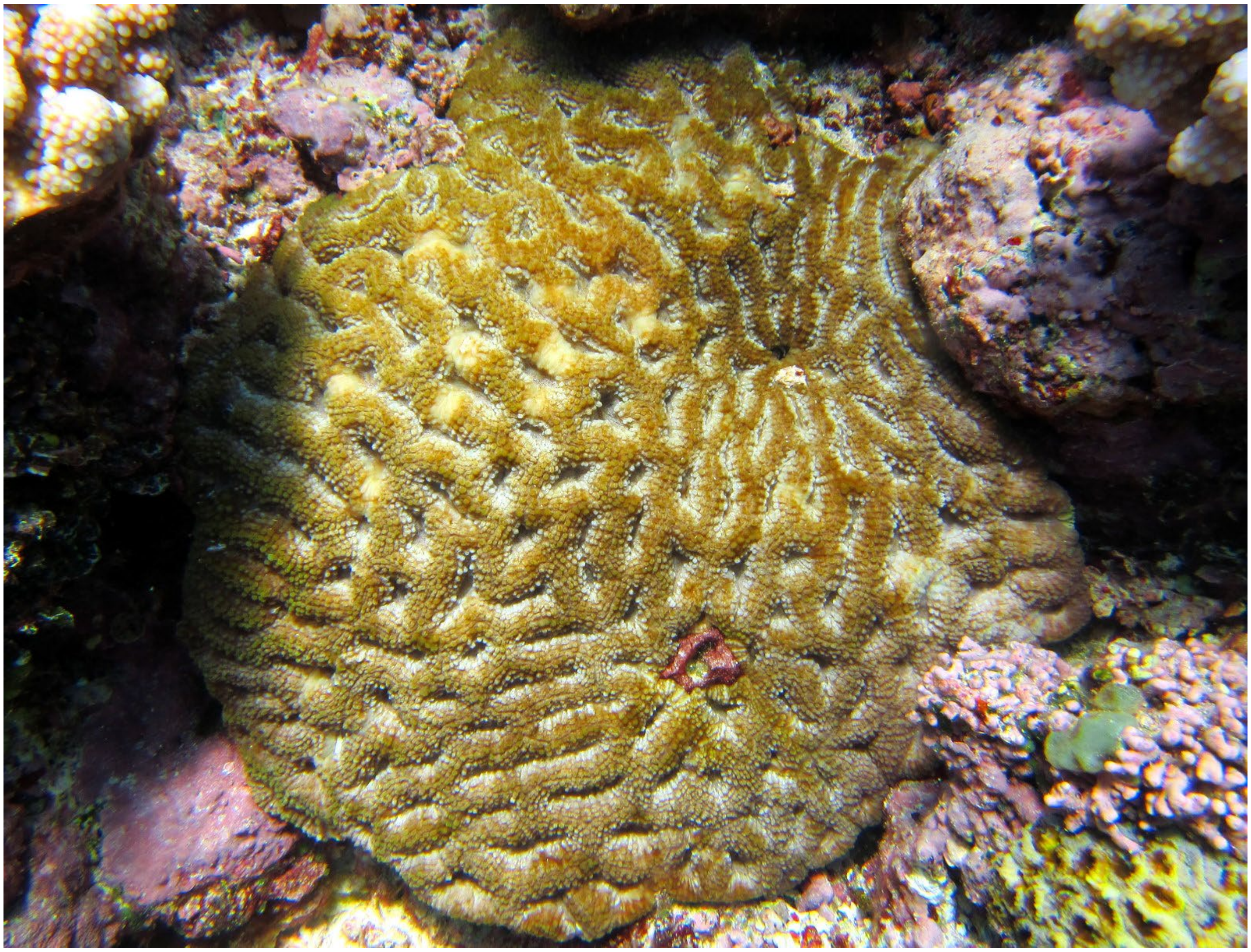
A closer photo of *Acanthastrea hemprichii*.

Acanthastrea ishigakiensis

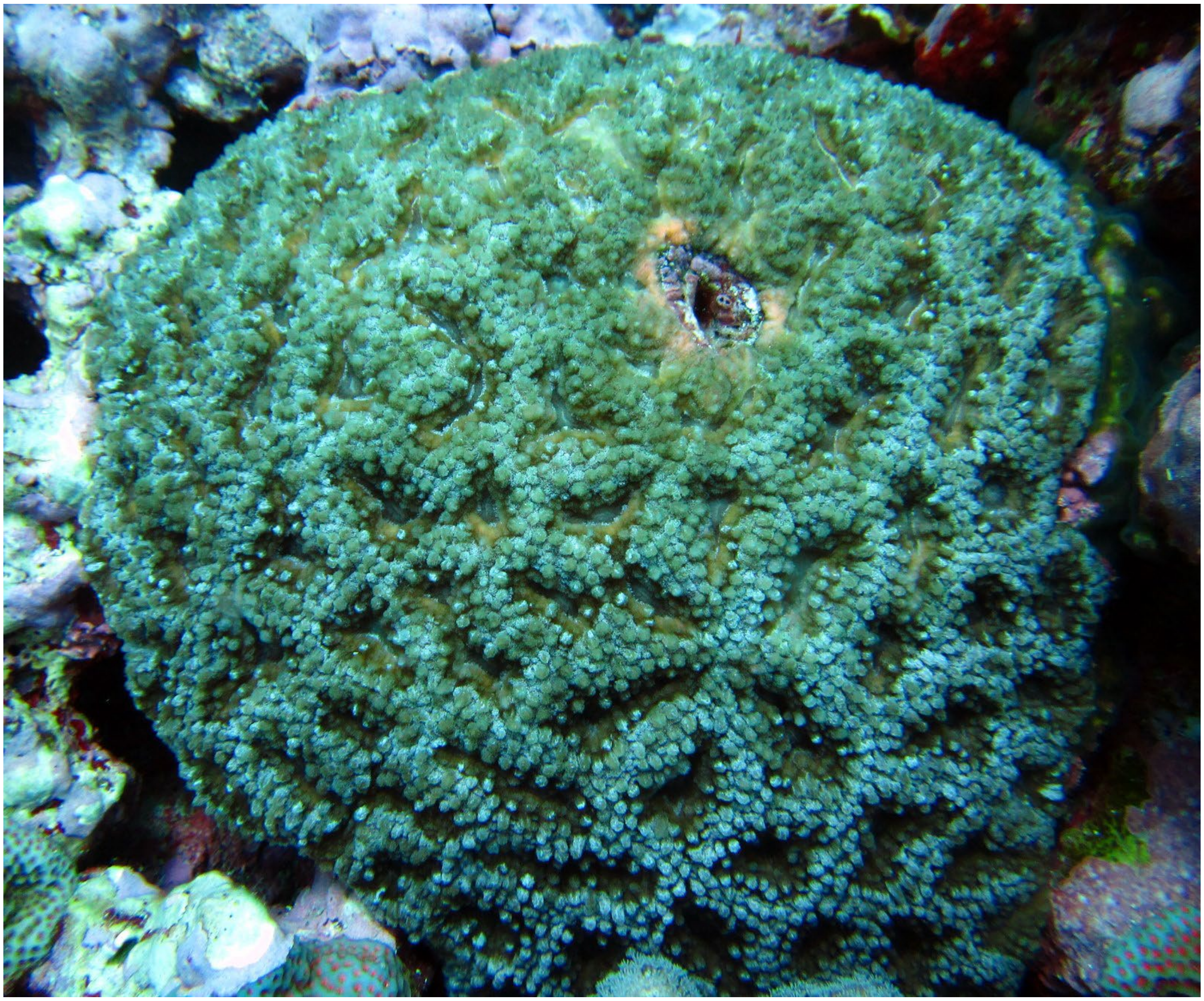
Colonies are massive when large but encrusting when they are starting out and small. Corallites are larger than on most other species in the genus and are pinched in various ways. The walls between corallites are rounded and not narrow. Spines are short and uniform. There is considerable color variation.



A photo of a massive colony of *Acanthastrea ishigakiensis*.



A photo of *Acanthastrea ishigakiensis*.



A close photo of *Acanthastrea ishigakiensis*.

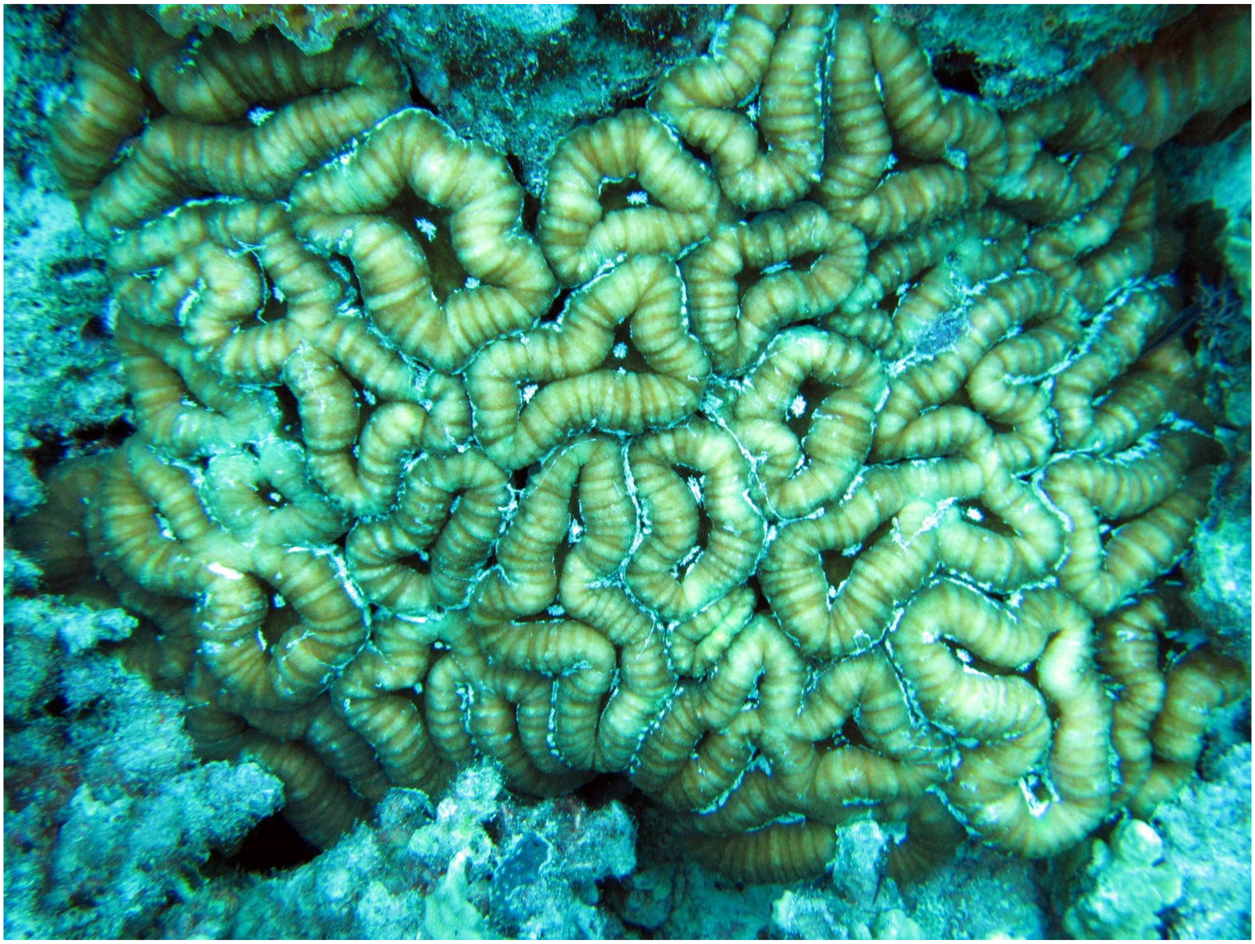
A close photo of *Acanthastrea ishigakiensis*.

Lobophyllia

Colonies can have either of two different shapes. Species that have long been called "*Lobophyllia*" are submassive and look like they are massive but are actually branching with branches very close together. Coloniies can reach several meters in diameter. Sometimes a crack can be seen between the large polyps. Polyps are only on the ends of branches. Polyps vary between about 2-3 cm longest diameter to as much as 30 cm or more, but typically are intermediate in that size range. The centers of polyps are depressed and they have raised rounded edges. Polyps can vary from circular to oval to having lobes around their edges to very elongated. Tissues can be smooth to rough to being covered with short tentacles. *Caulastrea echinulata* looks similar but has smaller corallites than the *Lobophyllia* species wiith the smallest corallites, and in many *Caulastrea* species the corallites are widely spaced. Other colonies, which have long been called "*Symphyllia*" are massive with meandering ridges on the colonies and thus can be called "brain corals" or "meandroid." The tops of ridges can have a tiny, shallow crack but not a deep crack. On the "submassive" colonies with branchs, the raised rounded edges form loops and there are two rounded ridges between polyps. Massive colonies reach sizes up to about a half meter diameter. On massive colonies, there is only one ridge between polyps and the ridges meander but do not form loops. The ridges are larger than other genera that are meandroid like *Platygyra*, *Oulophyllia*, and *Leptoria*. There are three species that are intermediate between these two shapes.

Lobophyllia hemprichii "submassive"

Colonies can grow up to several meters across or more, but have a full range of sizes since they must start out small. Corallites are on the order of 5 cm diameter, with rounded smooth edges. The outlines of polyps can be circular, oval, elongated, or lobed. Colonies consist of several to many polyps. *Lobophyllia hataii* colonies usually have one large polyp with a winding edge and a flat space between the raised edges.



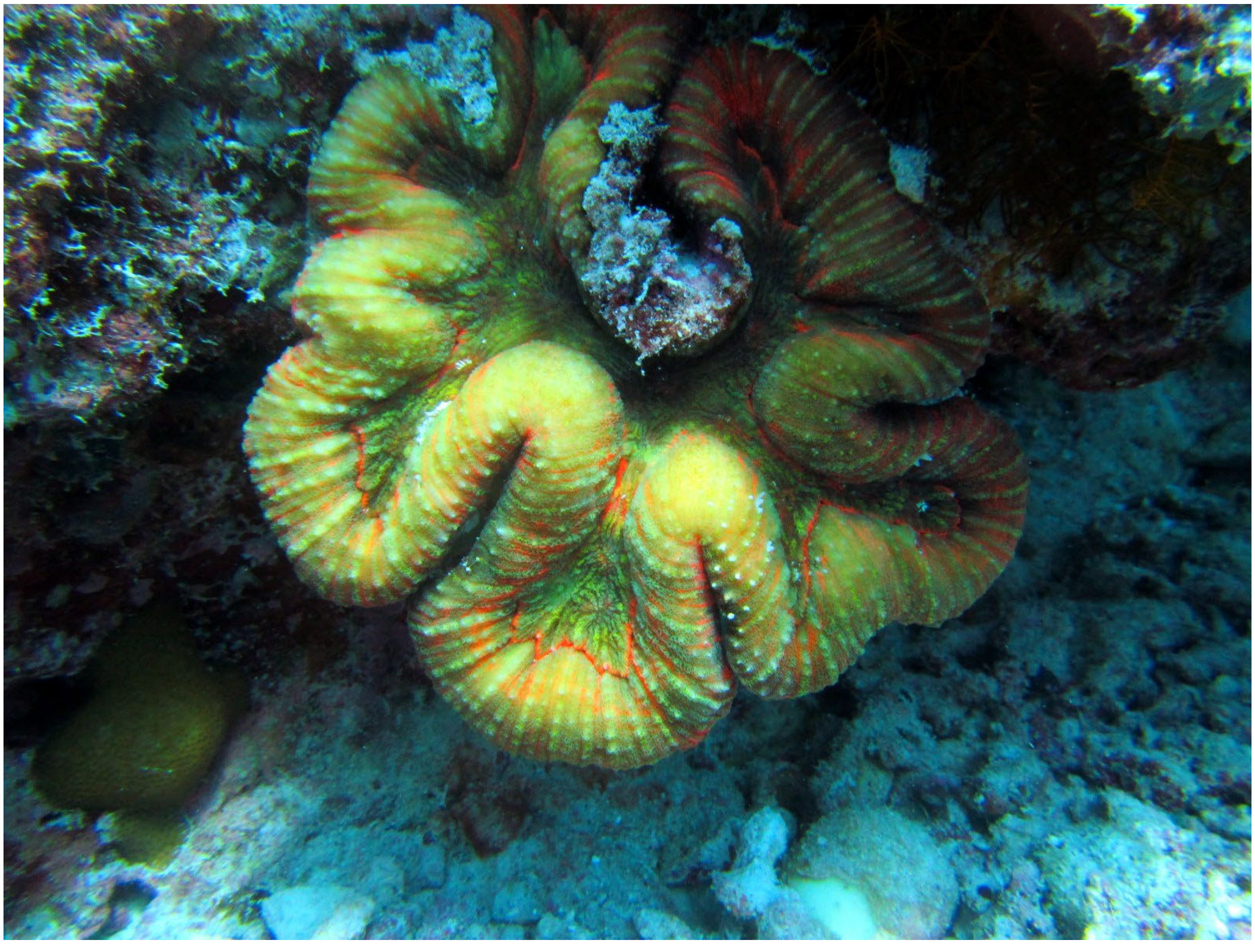
A photo of *Lobphyllia hemprichii*.

A close photo of *Lobophyllia hemprichii*.

Lobophyllia hataii

Colonies are single very large polyps with very lobate edges, or just a few large polyps with lobate edges. Individual polyps are much larger than on *Lobophyllia hemprichii*.

A photo of *Lobophyllia hataii*.



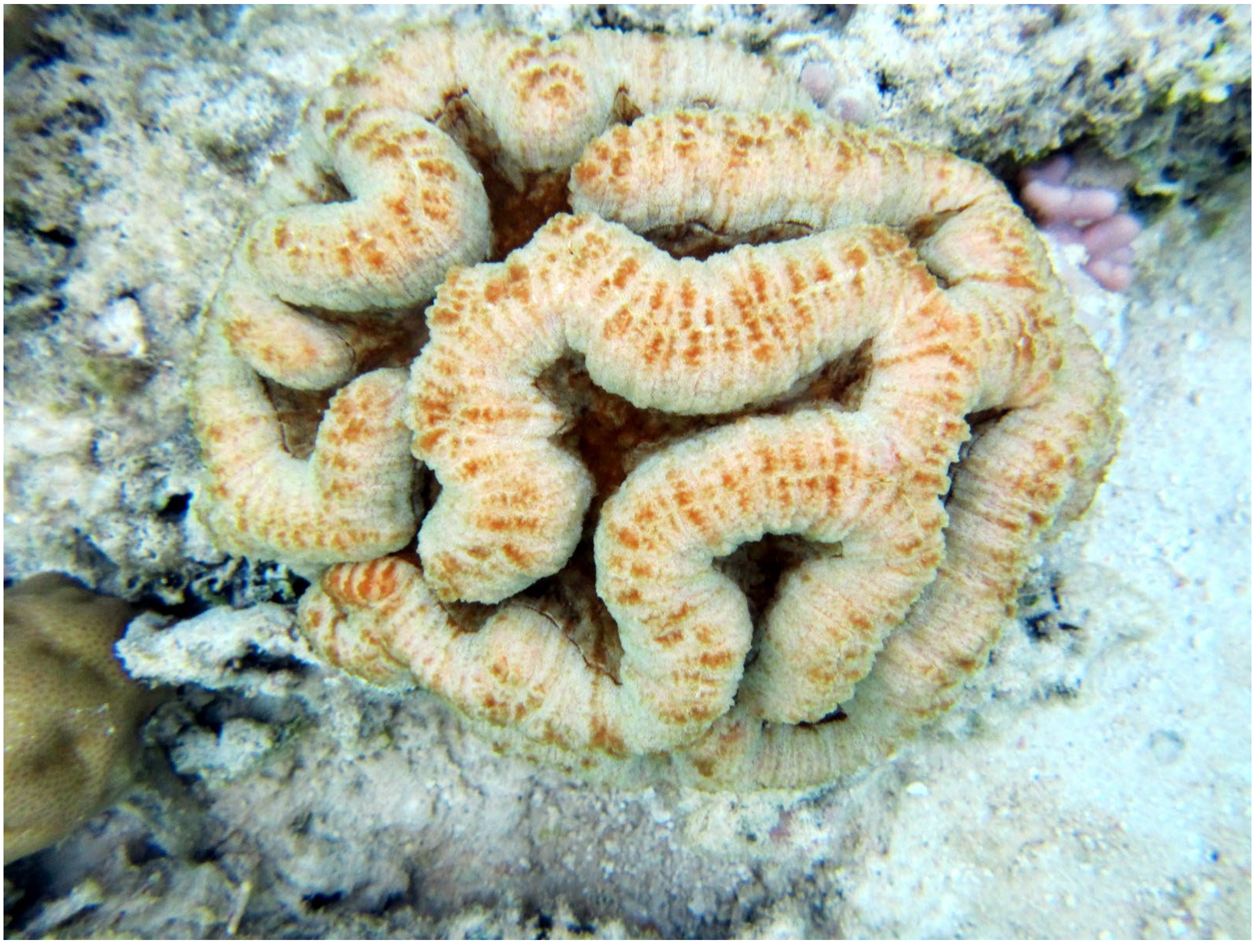
A photo of *Lobophyllia hataii*.

A photo of a colony of *Lobophyllia hataii* with white mouths.

Lobophyllia agaricia "massive" "meandroid" or "brain coral"

Colonies have very large meandering ridges, larger than any other species of *Lobophyllia* or any other meandroid coral.

A photo of *Lobophyllia agaricia*.



A photo of *Lobophyllia agaricia*.

Lobophyllia cf. hassi

Colonies are small, usually 15 cm or less in the longest dimension. Often they consist of one polyp with a very lobate edge. Where the rounded edge extends toward the center of the colony it is usually fused to the adjacent wall and near the center of the colony the wall often becomes thicker and sometimes much thicker. Colonies are smaller than *Lobophyllia hataii* and the wall becomes thicker nearer to the center of the colony.

A photo of *Lobophyllia* cf. *hassi*.

A photo of a small colony of *Lobophyllia* cf. *hassi*.

A photo of a small colony of *Lobophyllia* cf. *hassi*.

Caulastrea

Colonies are branching with small corallites only at the ends of branches that vary in diameter from slightly smaller than a small finger to that of a thumb. The branches may be far enough apart to be obviously branches, or very close together so that the colony is sub-massive and may appear to be massive (though is actually branching). Corallites are smaller than on all *Lobophyllia*, and corallites are only on branch ends unlike other branching species (though live tissue usually extends down the sides of branches).

Caulastrea furcata

Colony branches are about the diameter of a finger and are wide apart. Although tissue covers the branch surfaces, corallites are only on branch ends. Other *Caulastrea* species have corallites much closer together or the branches are smaller.

A photo of *Caulastrea furcata*.

Dipsastrea *This used to be called "Favia."*

Colonies are massive or encrusting. Corallites are near circular and project. There is a crack or space between corallites, they have separate walls. Corallites vary between larger than a thumb to smaller than a small finger. Species are often difficult to distinguish because of high variation within species and small differences between species. *Astrea*, *Phymastrea* and *Plesiastrea* are similar, without defining characteristics that can be seen underwater, so that to distinguish them it is necessary first to identify the species and that tells you what the genus is.

Dipsastrea rotundata

Corallites are round and relatively smooth, with a relatively smooth band around the inside of the edge of the corallite. Corallites are about finger to thumb size. Some other species have rougher outer edges.

A photo of *Dipsastrea rotundata*.

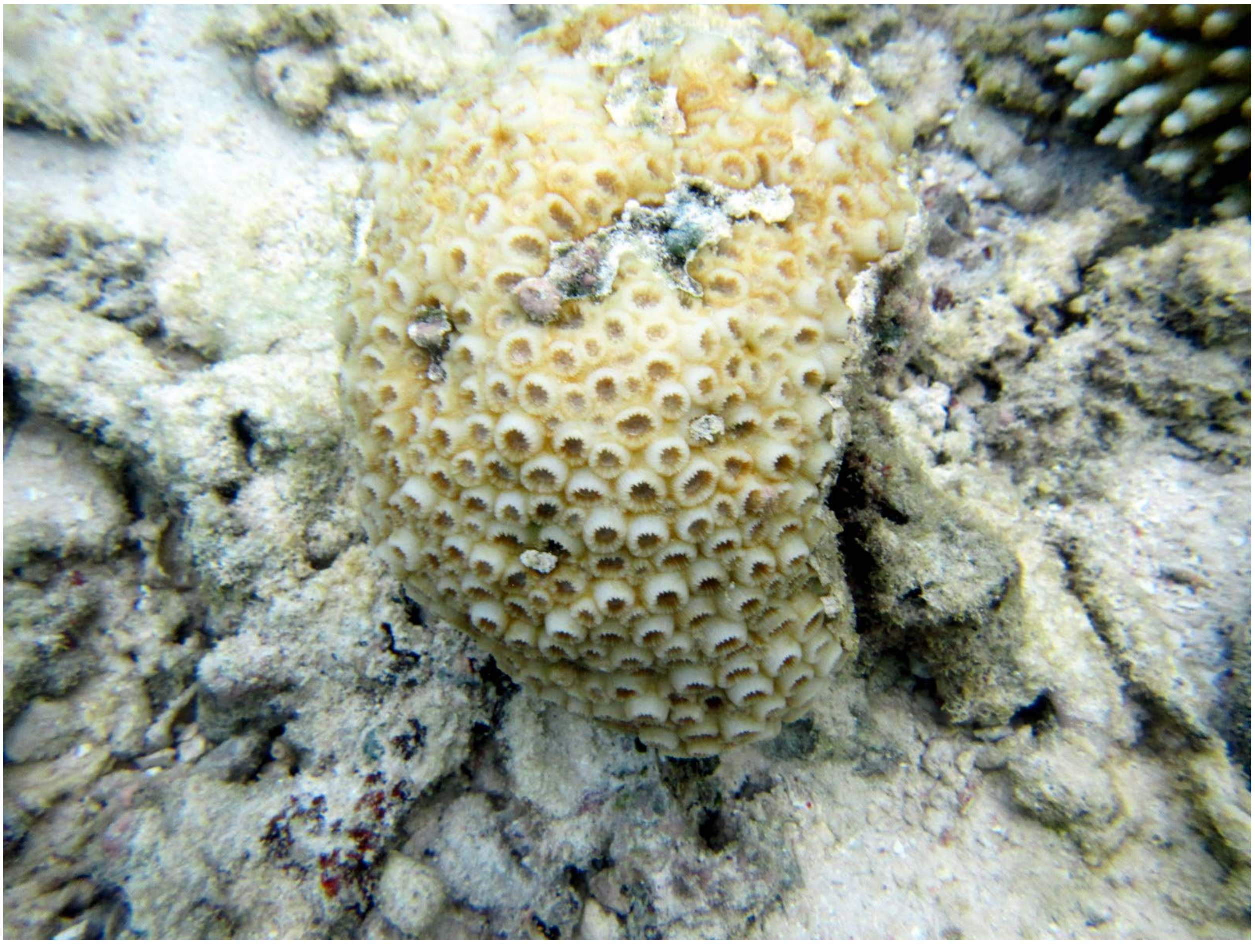
Dipsastrea pallida

Colonies have small corallites about the size of a small finger. The upper edge has septa that extend slightly into the corallite a variable amount. Usually the polyp centers are darker than the space between corallites. Other species don't have the darker centers and inward projecting septa.

A photo of *Dipsastrea pallida*.

Dipsastrea truncata

Colonies are massive. Corallites are usually nearly circular and have a thin rim with small septa. Corallites on the side are downward leaning. This is the only species of *Favia* with downward leaning corallites.



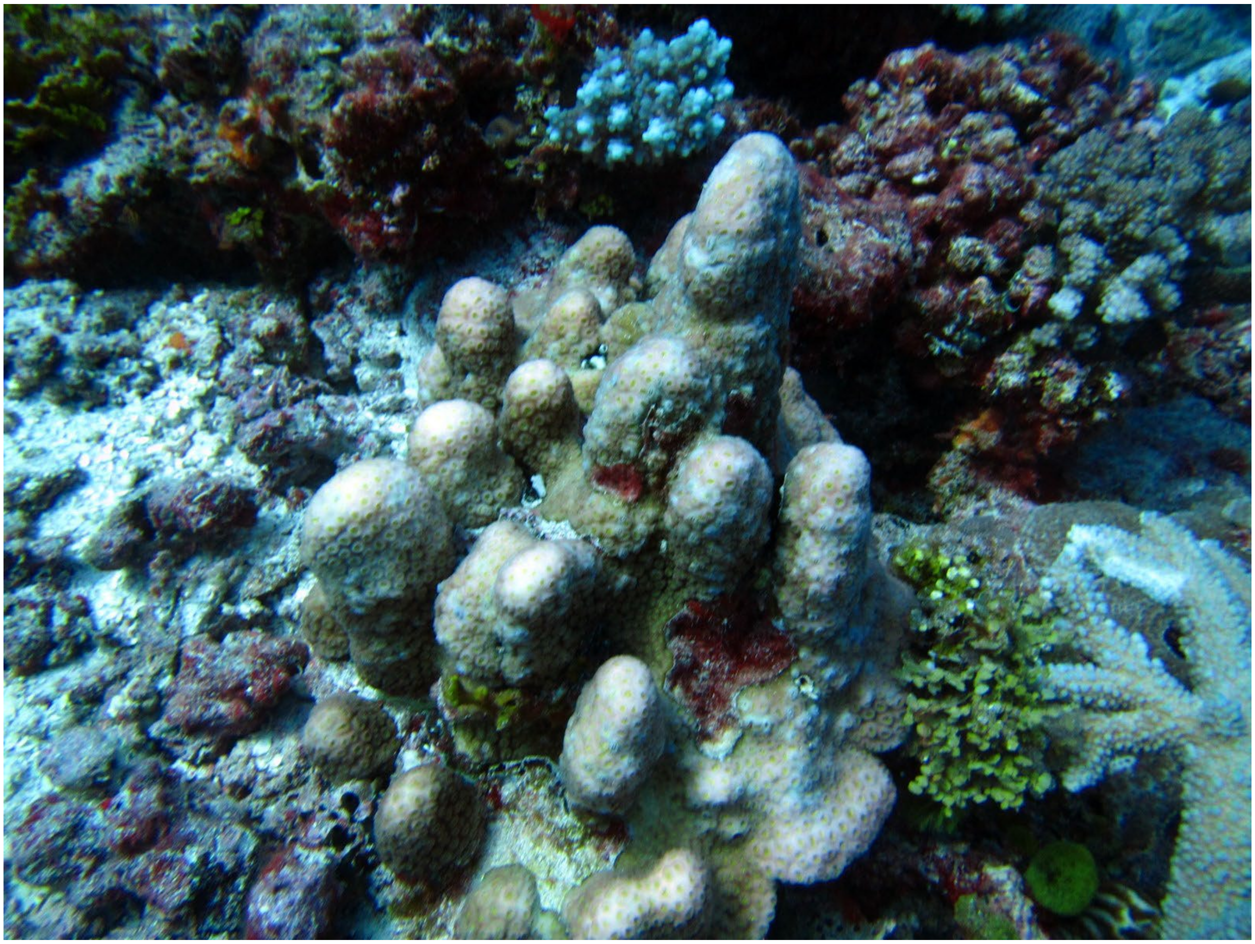
A photo of *Dipsastrea truncata*.

A close-up photo of *Dipsastrea truncata*.

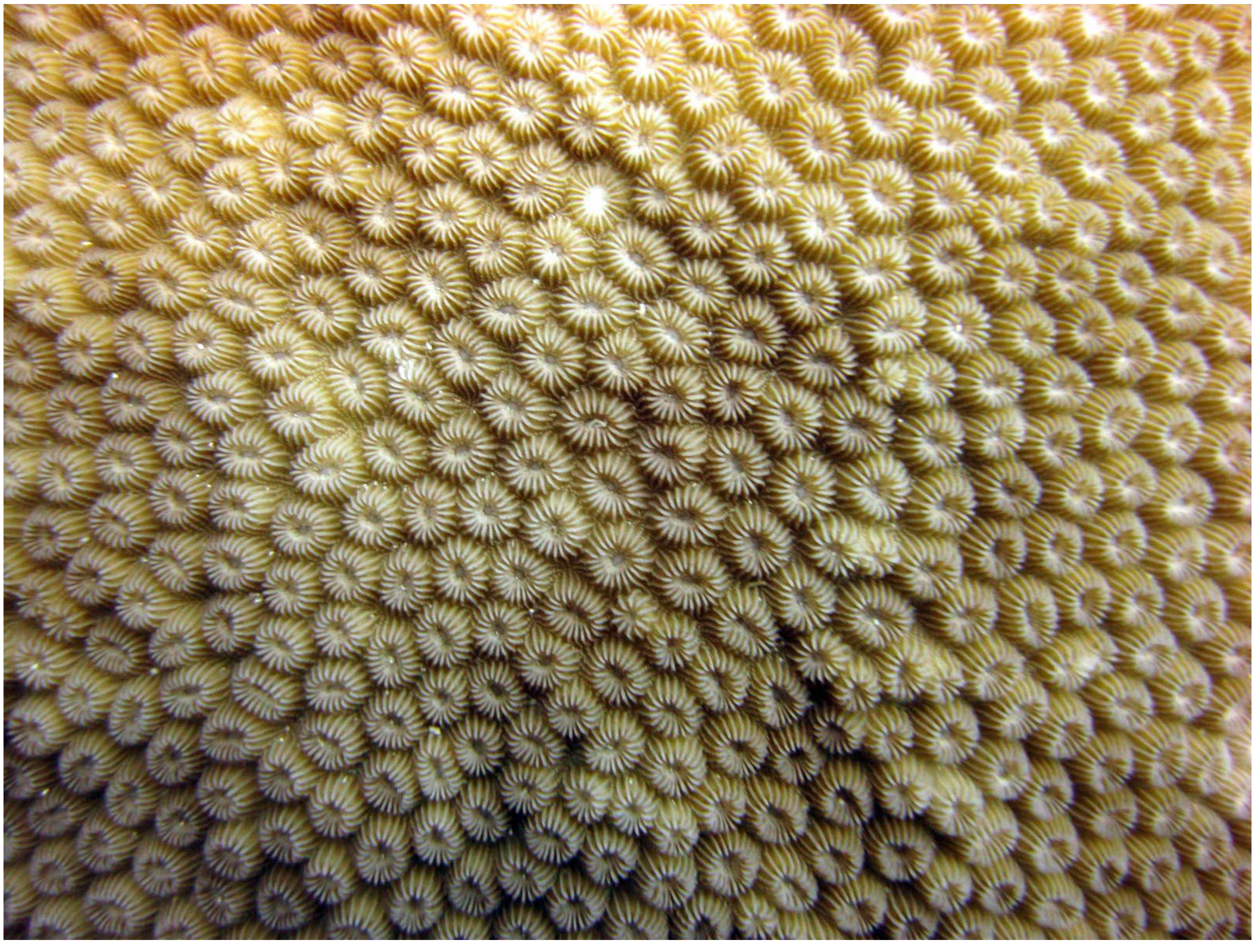
Goniastrea stelligera

This used to be in Favia.

Colonies are usually columnar, some columns may be oval in cross section. Occasionally a colony will be a thick flattened lobe like a pork chop on edge. Corallites are small, about 3-4 mm diameter. This species has corallites that look more like *Dipsastrea* than *Goniastrea*, which is why it was placed here. It has smaller corallites than any *Dipsastrea* species. *Plesiastrea versipora* has similar size corallites, but is massive and often has tissue extended.



A photo of *Goniastrea stelligera*.



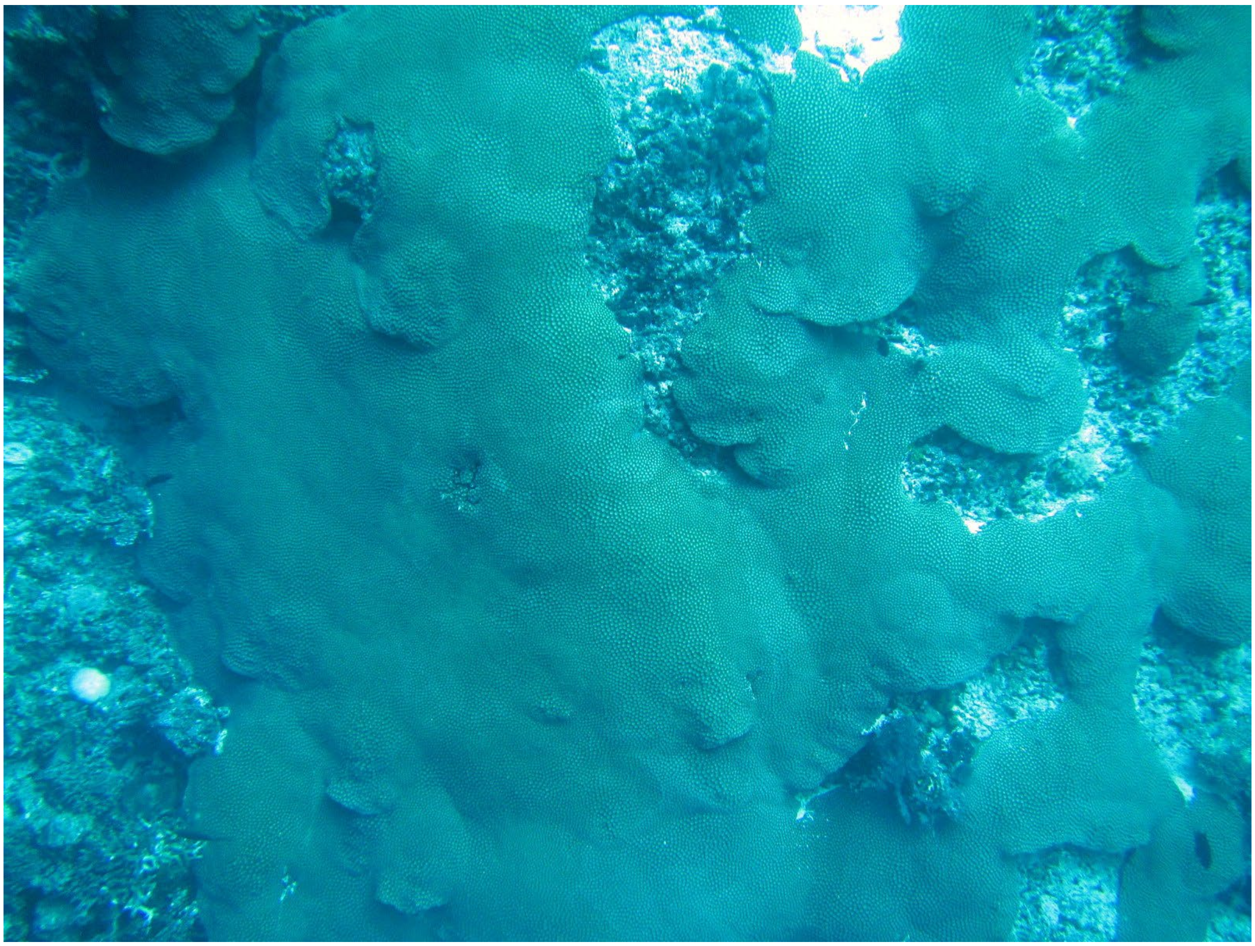
A close-up photo of *Goniastrea stelligera* in American Samoa.

Diploastrea

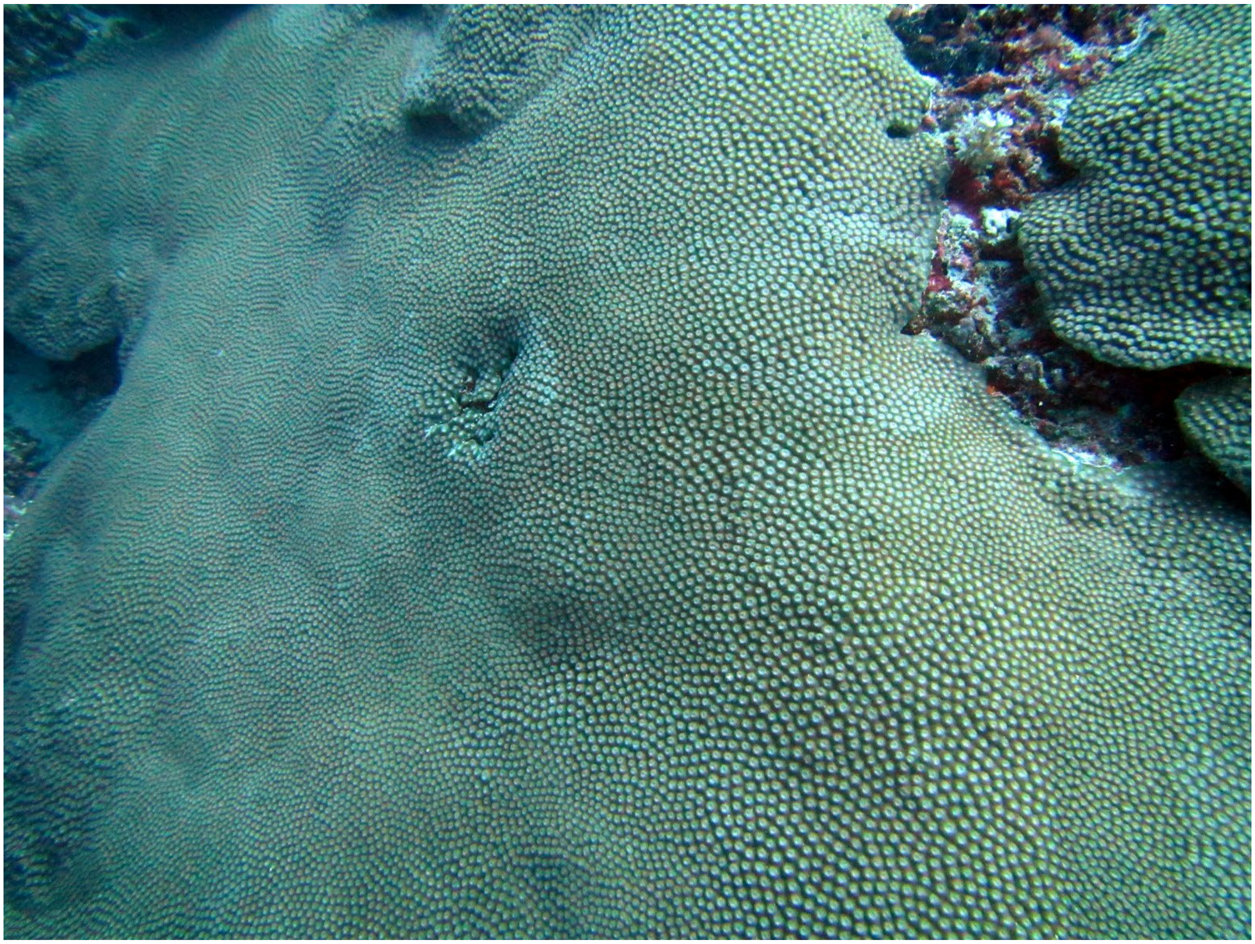
This genus has only one species, the properties of the genus are those of the species.

Diploastrea heliopora

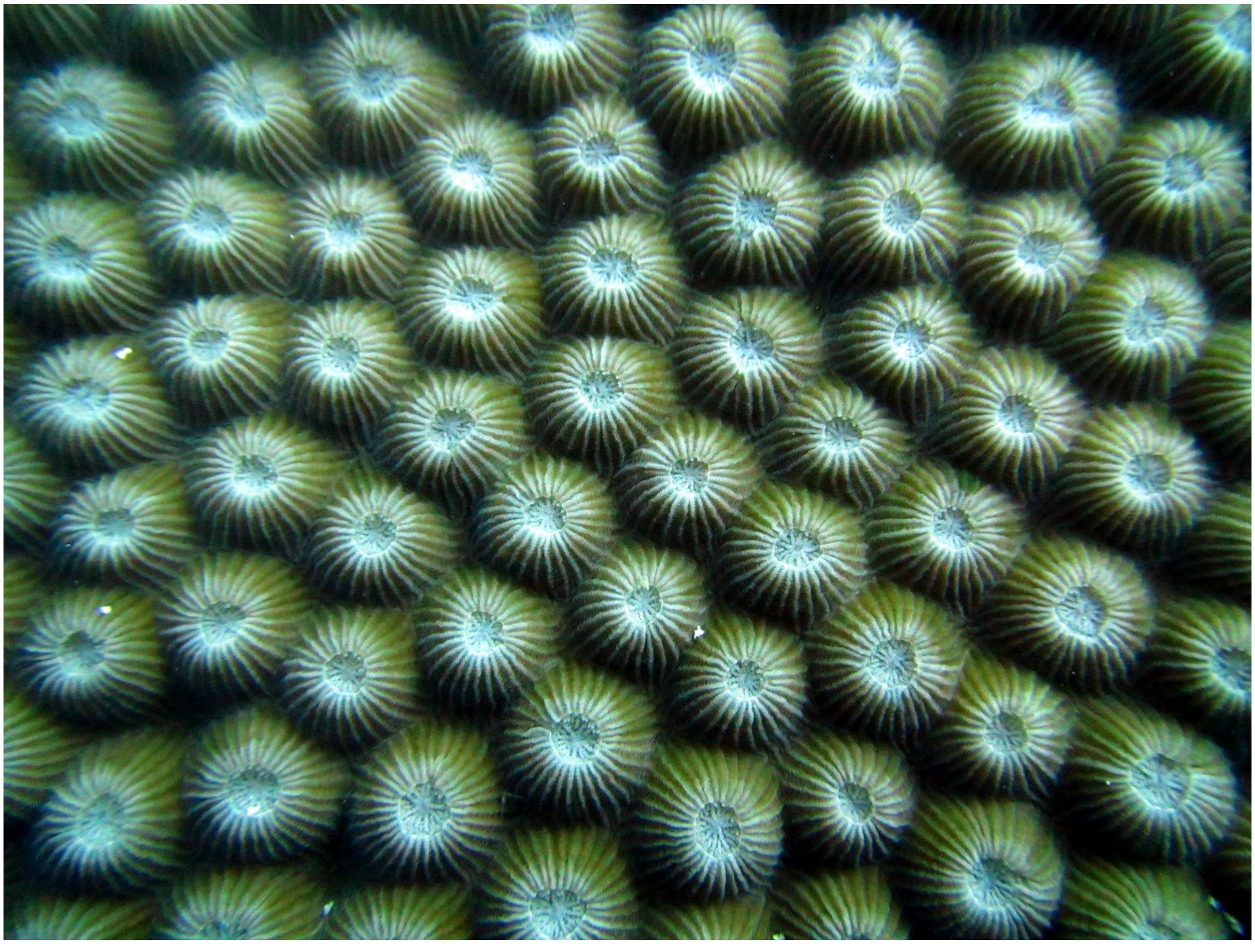
Colonies can be encrusting or massive. They often seem to form encrusting colonies on slopes and massive colonies on more level surfaces. Colonies on slopes often have lifted lower edges. Colonies can get quite large, many meters across. The corallites are about the size of a fingertip. Corallites are volcano-shaped with tapering sides and a depressed center. The outer sides have costae, which are tiny ridges running down the side. Colonies are usually green but may be brown, corallite centers are usually white. This is one of the most distinctive and easy to identify corals in the Indo-Pacific.



A photo of a large colony of *Diploastrea heliopora*.



A closer photo of a colony of *Diploastrea heliopora*.



A close-up photo of *Diploastrea heliopora*.

Astrea *This genus used to be part of what was called "Montastrea."*

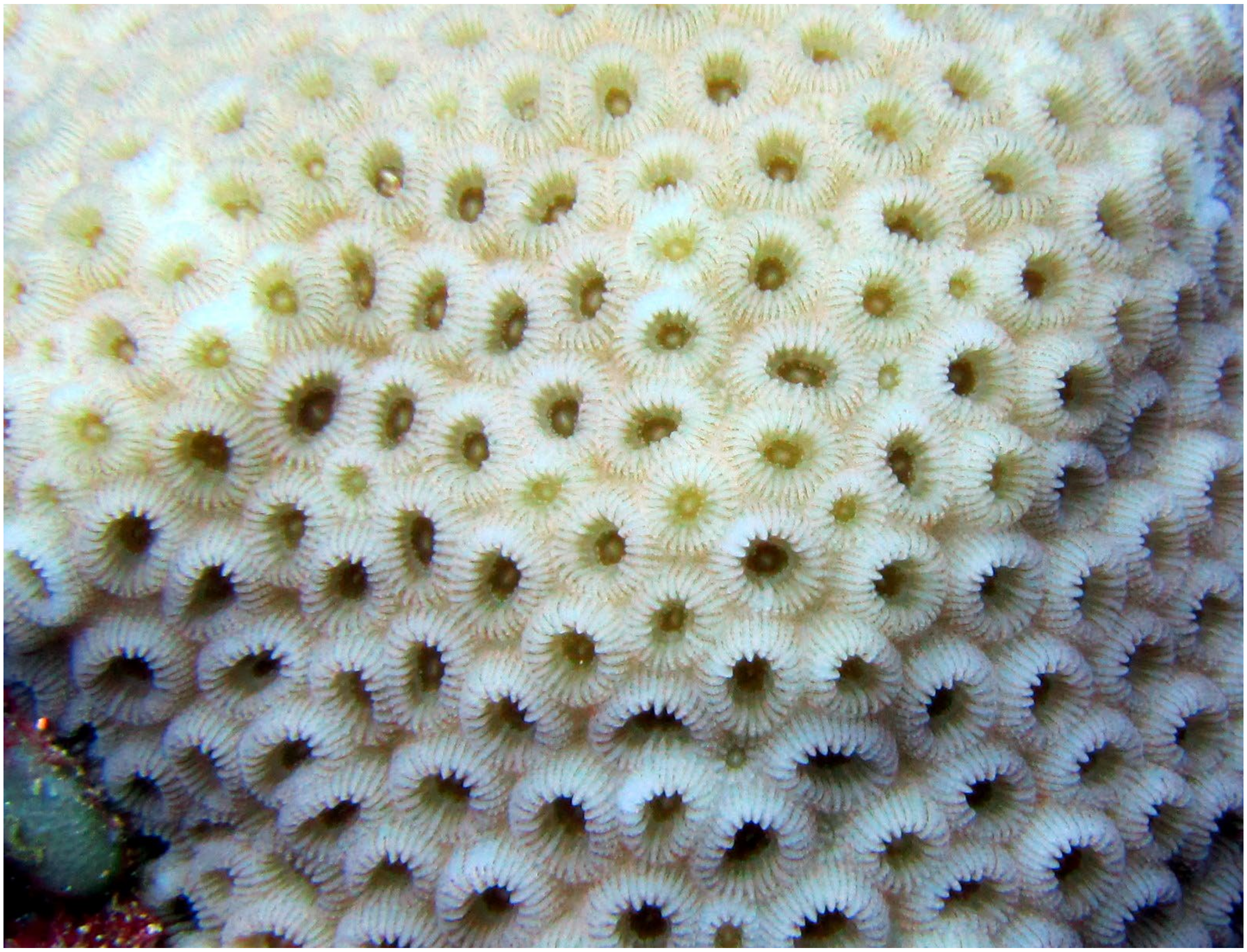
Colonies are massive or encrusting and usually are 30 cm or less in diameter. Corallites project as thick circular rings with a crack between adjacent corallites. Corallites are about the size of a pea. There are no features visible in the water to distinguish this genus from *Favia* other than the features of the species, so the species tells you which genus it is in.

Astrea curta

Colonies are massive and usually cream colored. The septa are uniform. *Astrea annuligera* is encrusting, is brown or green, and has some septa that extend farther into the center of the corallite than others. *Favia truncatus* can look similar, but corallites are more obviously inclined and the rim of the corallite is thinner.

A photo of an *Astrea curta* colony that is unusual in that it is yellow.

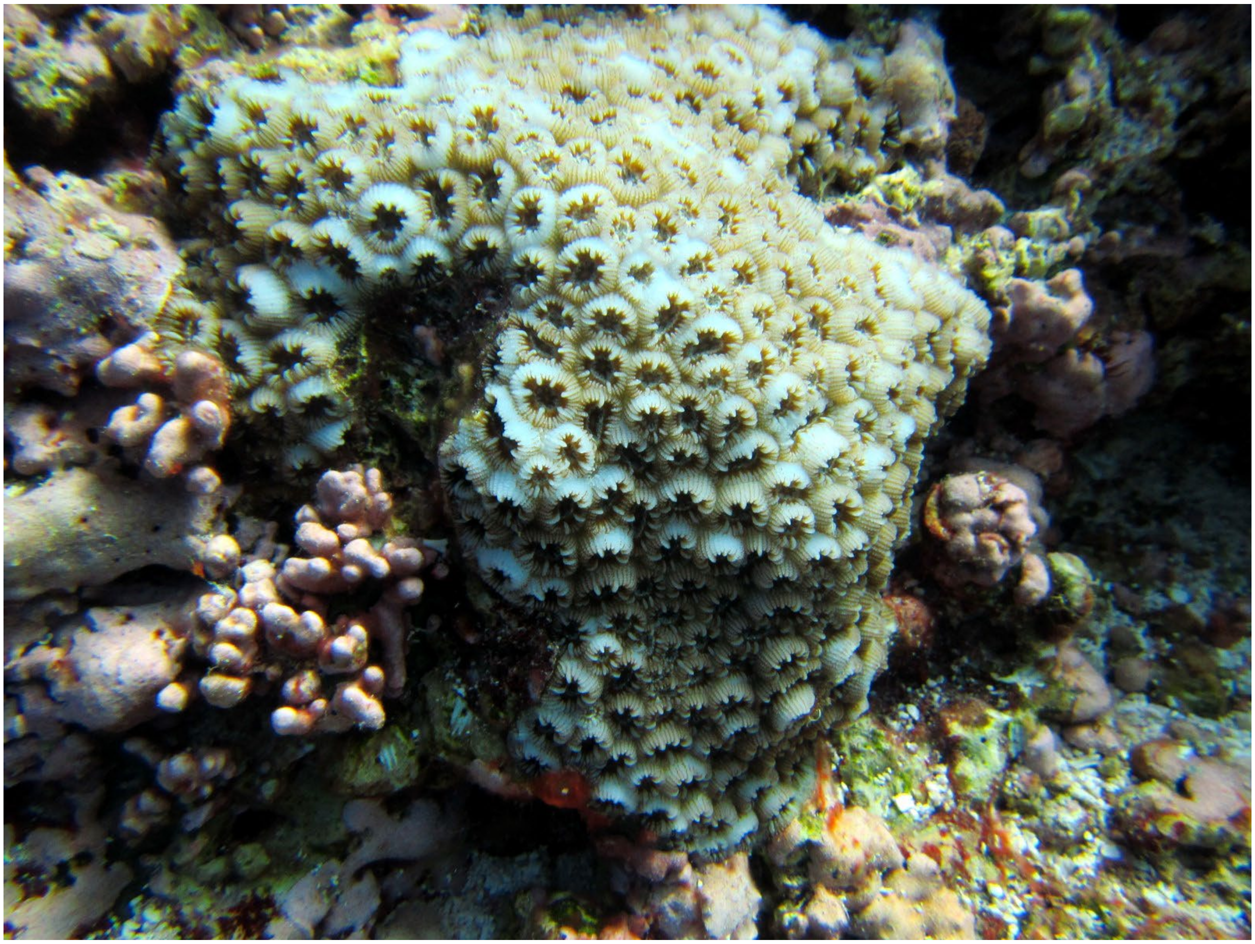
A photo of a typical colony of *Astrea curta*.



A close-up photo of *Astrea curta*.

Astrea annuligera

Colonies are encrusting, brown or green, and have a few septa that project farther into the corallites than other septa. *Astrea curta* is massive, cream colored, and has uniform septa.



A colony of *Astrea annuligera*.

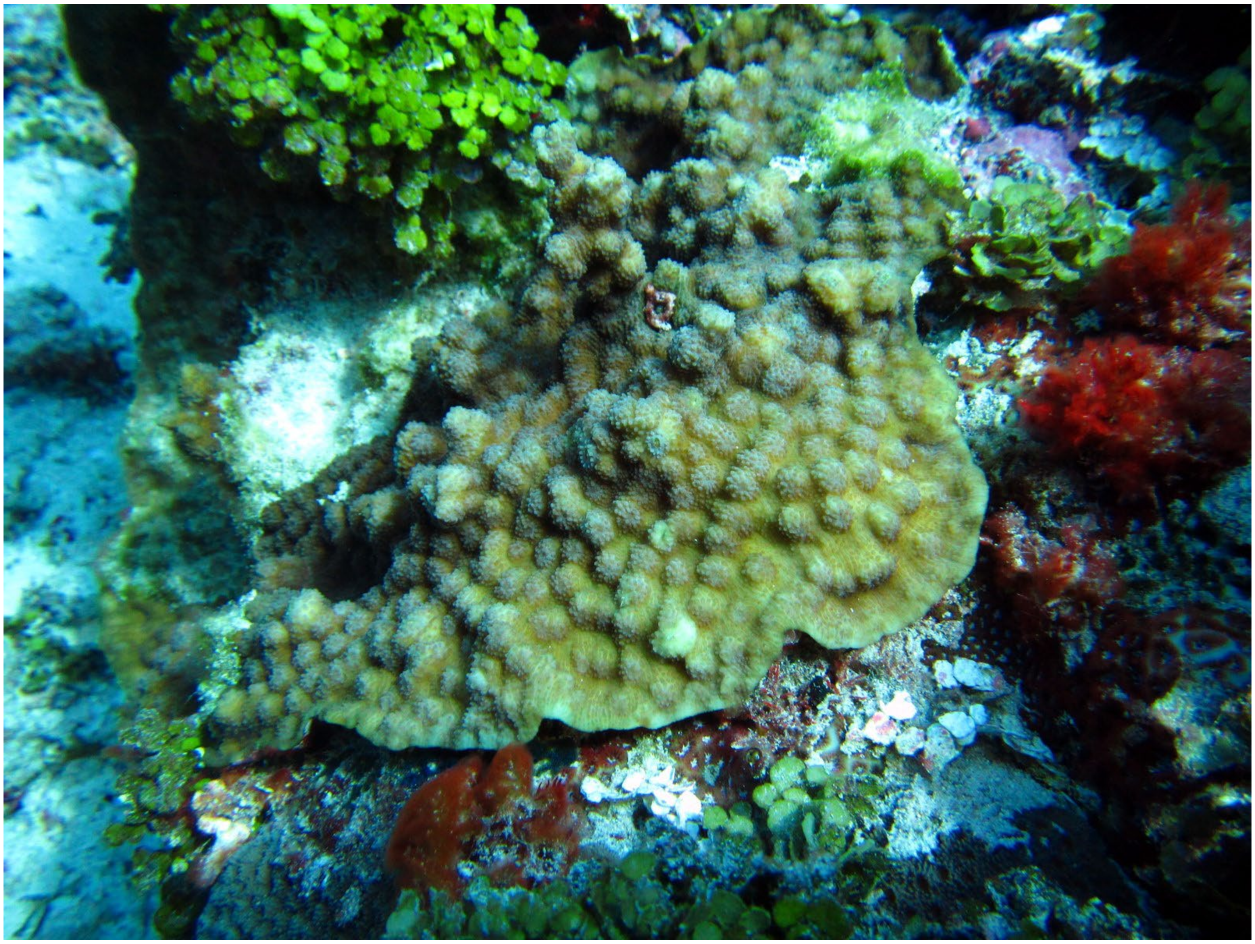
A close-up photo of *Astrea annuligera*.

Echinopora

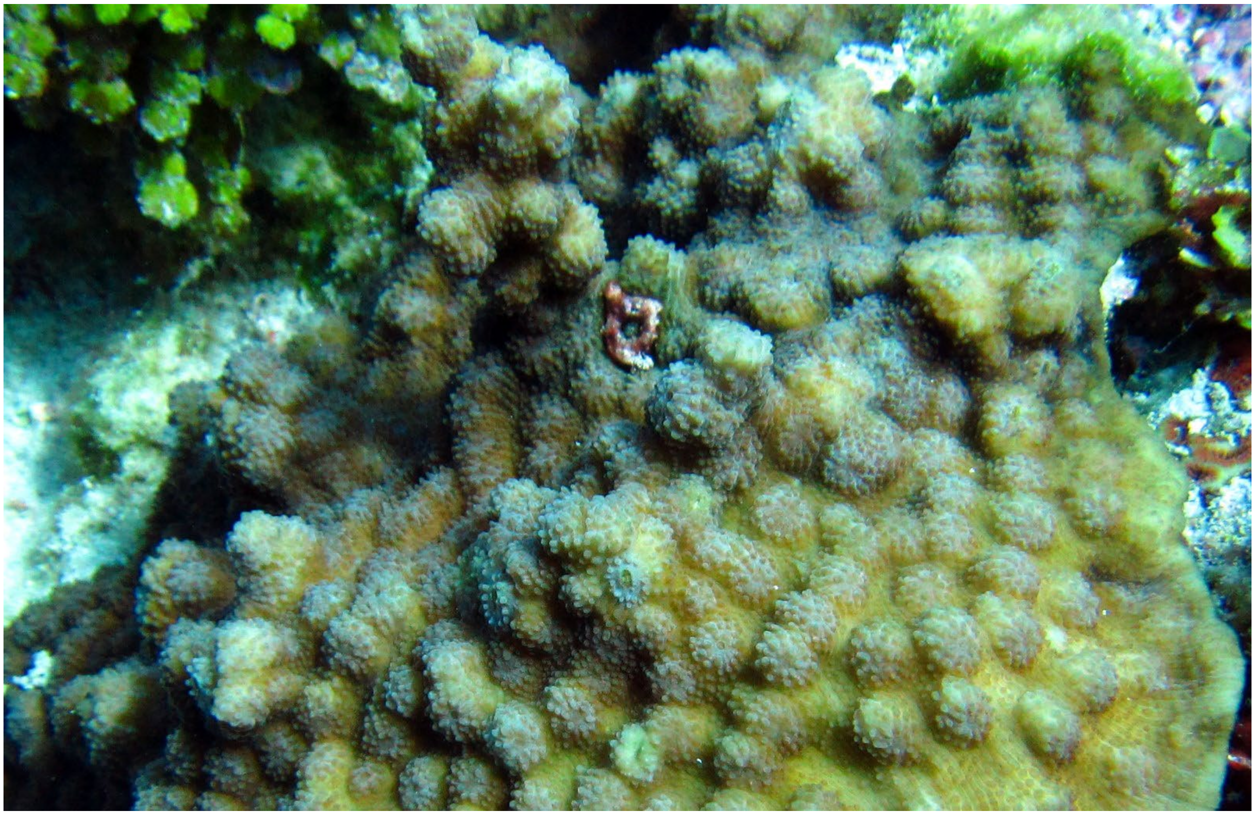
Colonies are encrusting, thin plates or branching, or branches on top of plates. Corallites are small, between about 3 and 5 mm diameter. Corallites usually project. Corallites are usually finely spiny, and the colony surface may be spiny. The corallites are smaller than on most *Favia* species and the septa are not obvious.

Echinopora cf. hirsutissima

Colonies are encrusting, often with knobby, irregular columns or short branches. Colony edges are often raised as short plates. Corallites are rounded and spiny. *Echinopora gemmacea* and *Echinopora lamellosa* are plates without columns. *Echinopora horrida* is completely branching and has thinner branches than the columns in this species and smaller corallites.



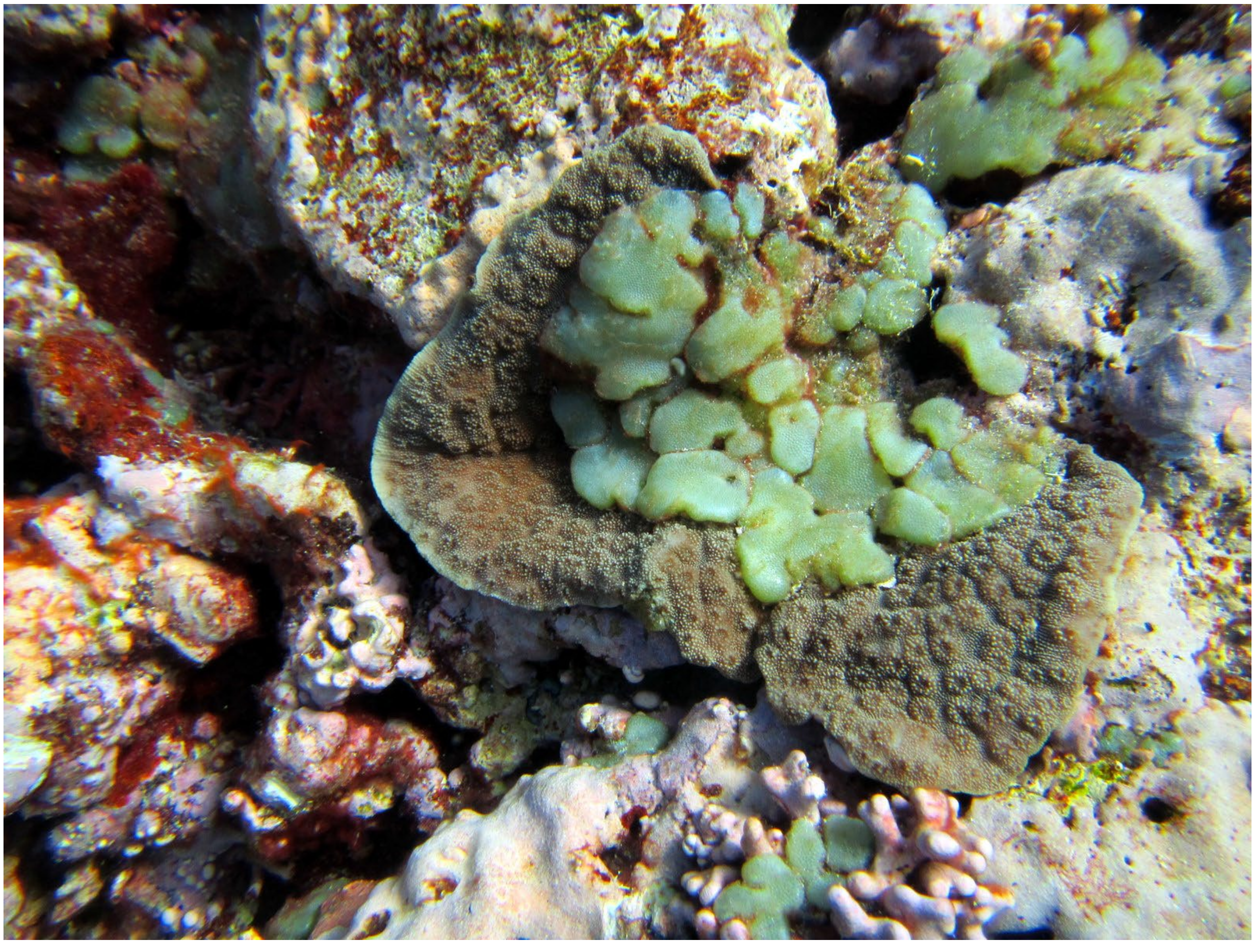
A photo of a colony of *Echinopora* cf. *hirsutissima*



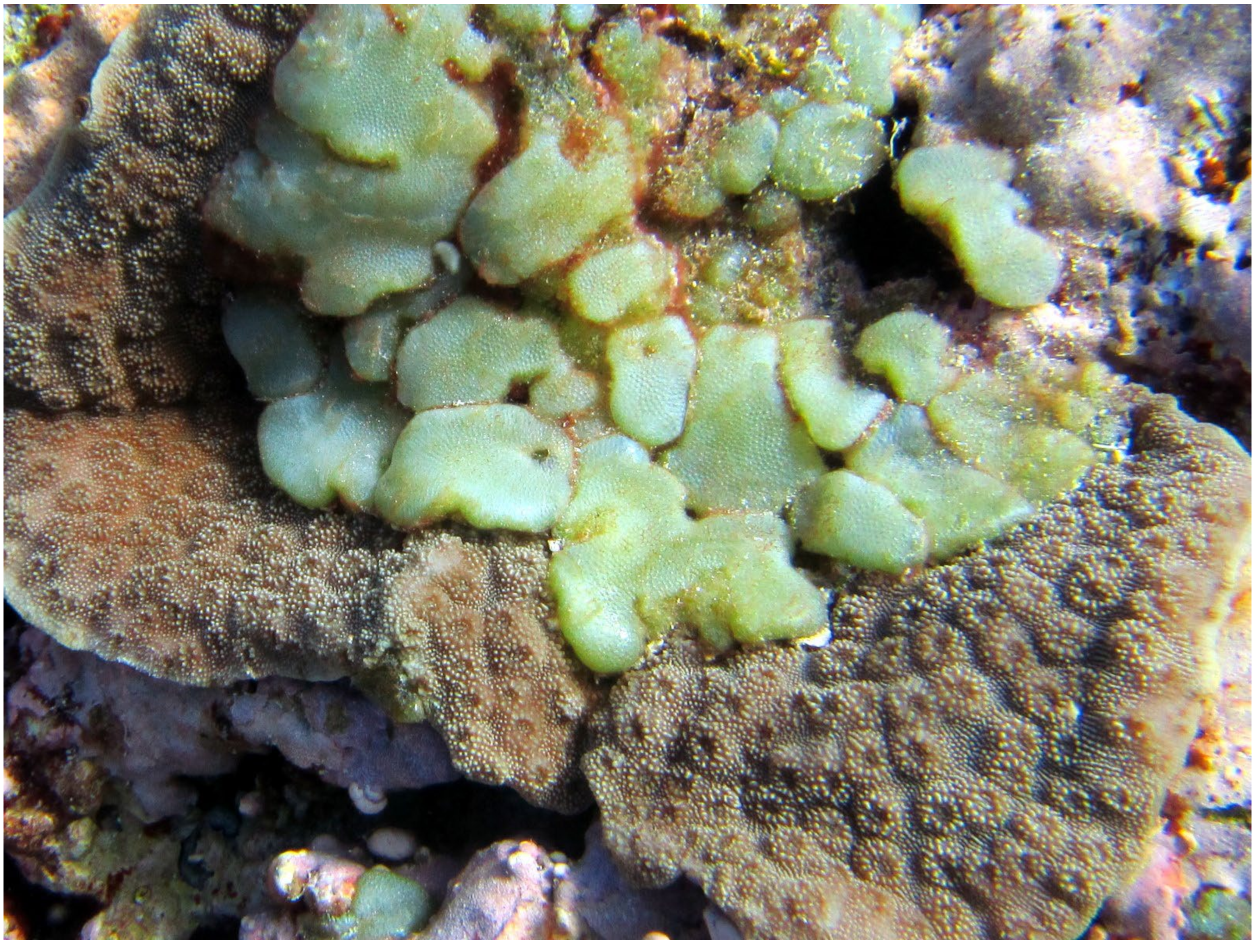
A close-up photo of *Echinopora* cf. *hirsutissima*.

Echinopora gemmacea

Colonies are thin plates or encrusting. Corallites are flat-topped, and often the calices can be seen on corallites. The corallites are larger and spinier than on *Echinopora lamellosa*, though it may be necessary to see the two side by side to be sure which is which. Colonies do not form columns or branches and corallites are less rounded than on *Echinopora* cf. *hirsutissima*.



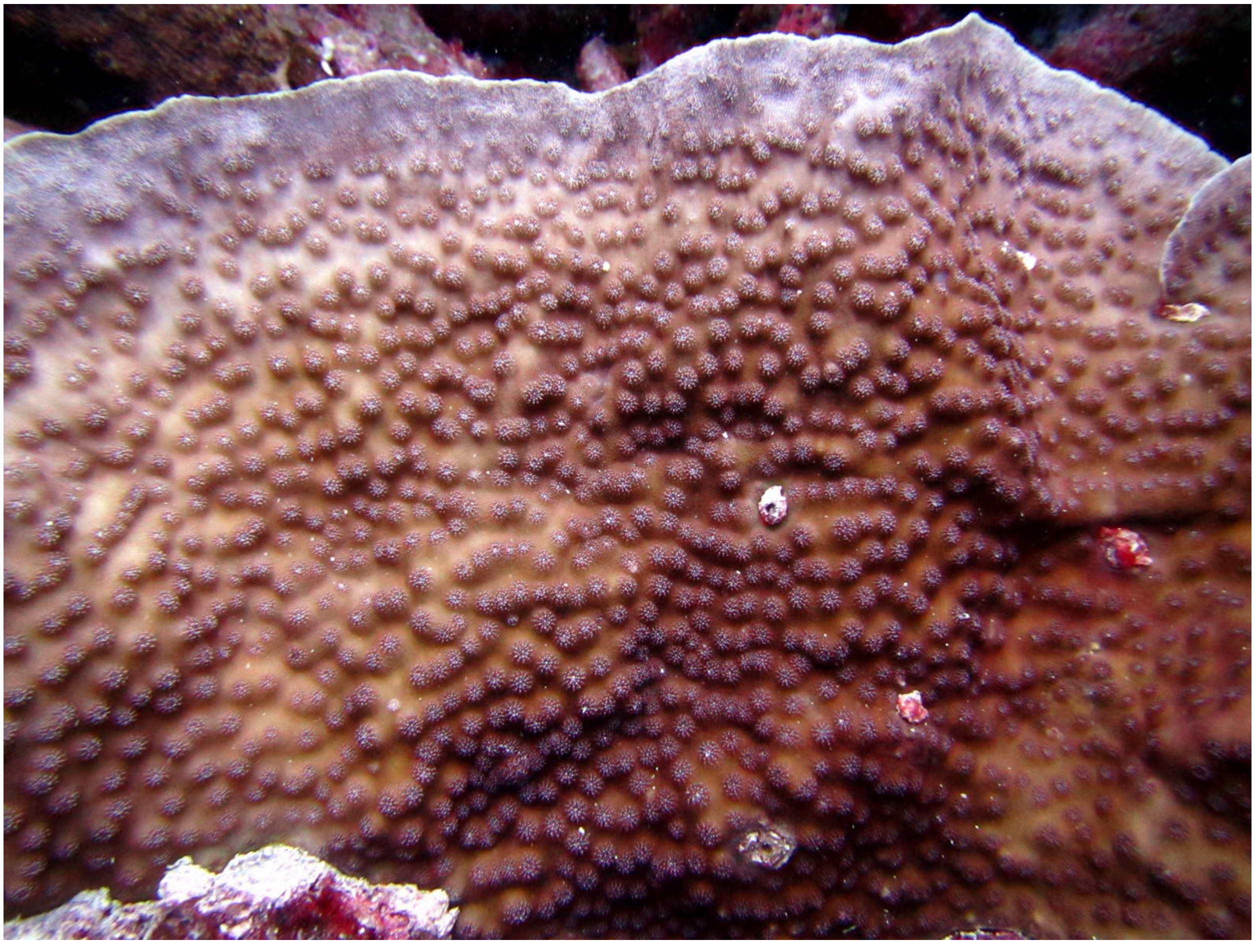
A photo of *Echinopora gemmacea*.



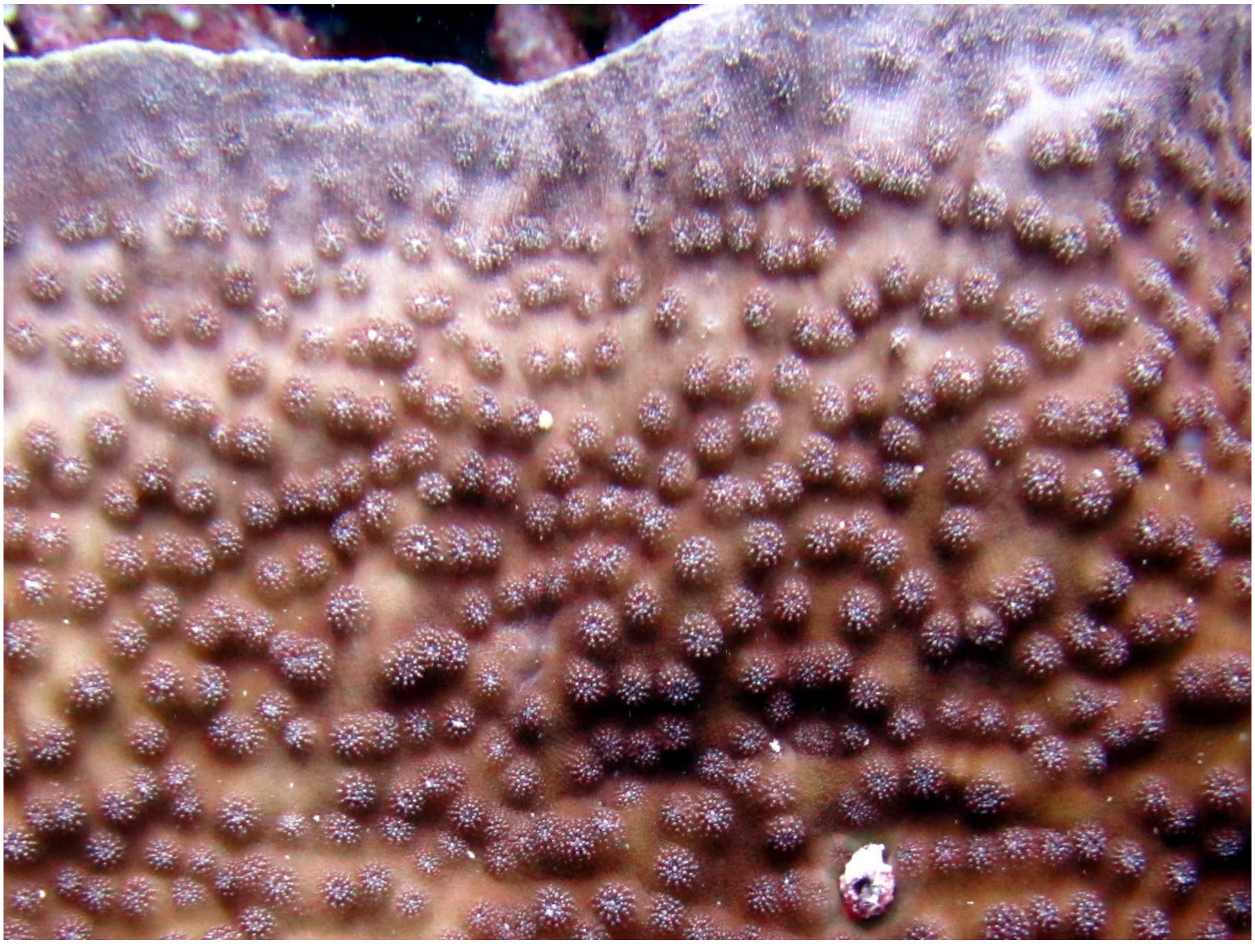
A close-up photo of *Echinopora gemmacea*.

Echinopora lamellosa

Colonies are thin plates. Corallites are small, about 3-4 mm diameter. Corallites are smaller and may have smaller spines than on other species. It does not have columns like *Echinopora hirsutissima.*



A photo of a colony of *Echinopora lamellosa*.



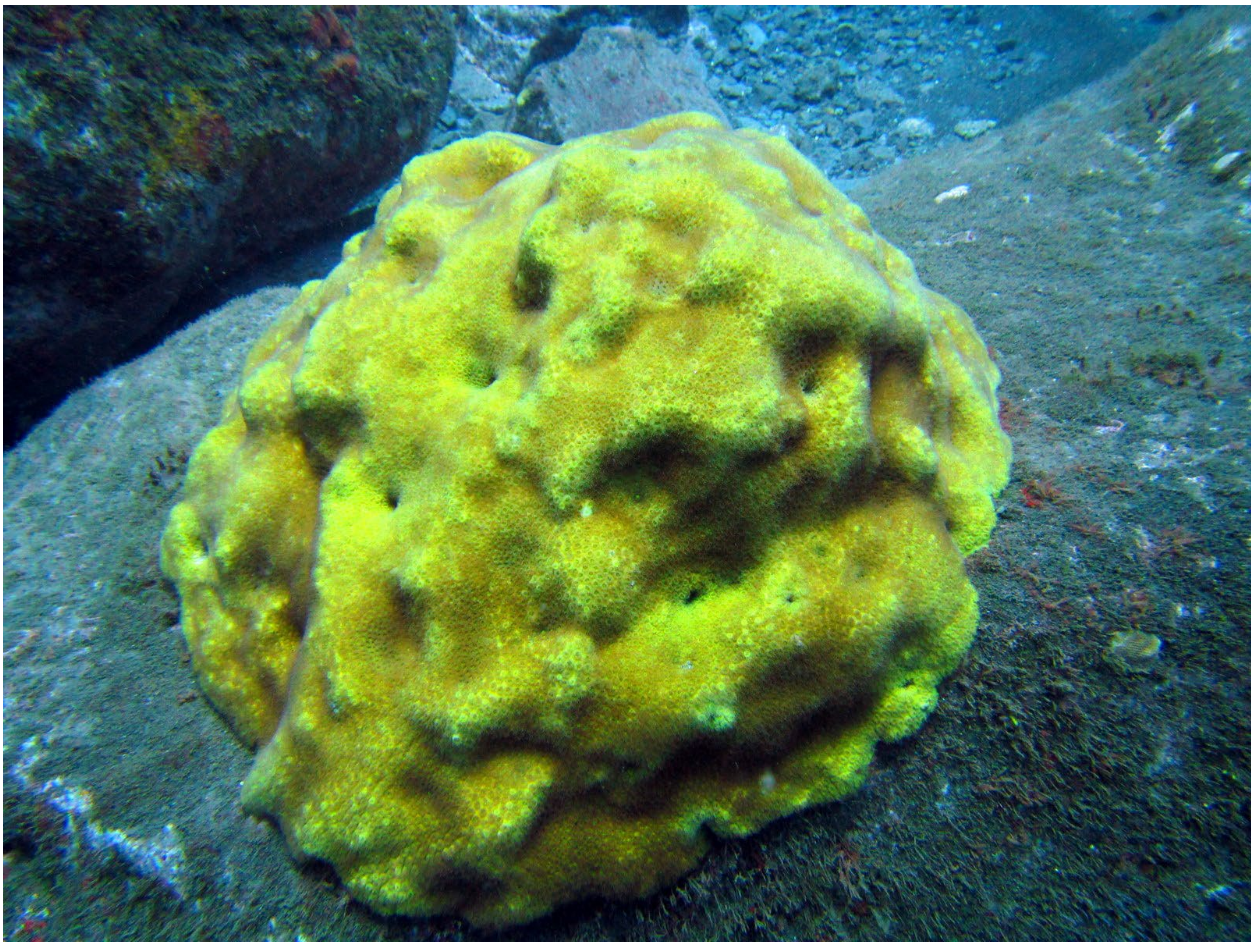
A close-up photo of *Echinopora lamellosa*.

Plesiastrea

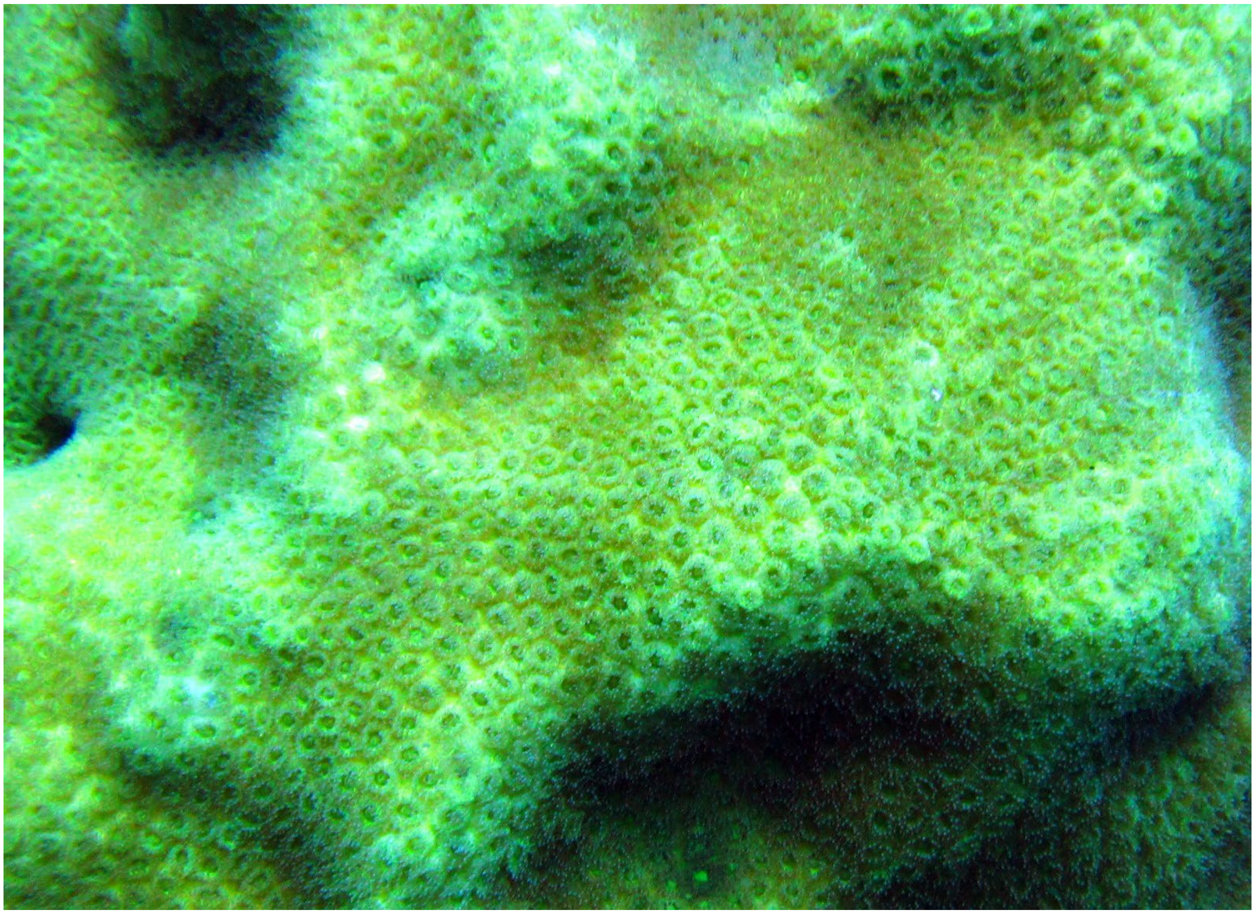
Colonies are massive and have small, projecting corallites, about 3-4 mm diameter. *Echinopora* forms thin plates or branches, and *Cyphastrea* has smaller corallites.

Plesiastrea versipora

Colonies may be lumpy or smooth. Colonies can look quite different depending on whether polyps are extended or contracted, and extent of polyp extension. Polyps are usually extended and may be in the form of short tubes or rings of tentacles. When polyps are contracted the corallites are small low mounds with radiating costae. Colonies can also be a variety of colors. Colonies don't form columns like *Favia stelligera*, which doesn't have polyps or tissue extended.



A photo of *Plesiastrea versipora*.



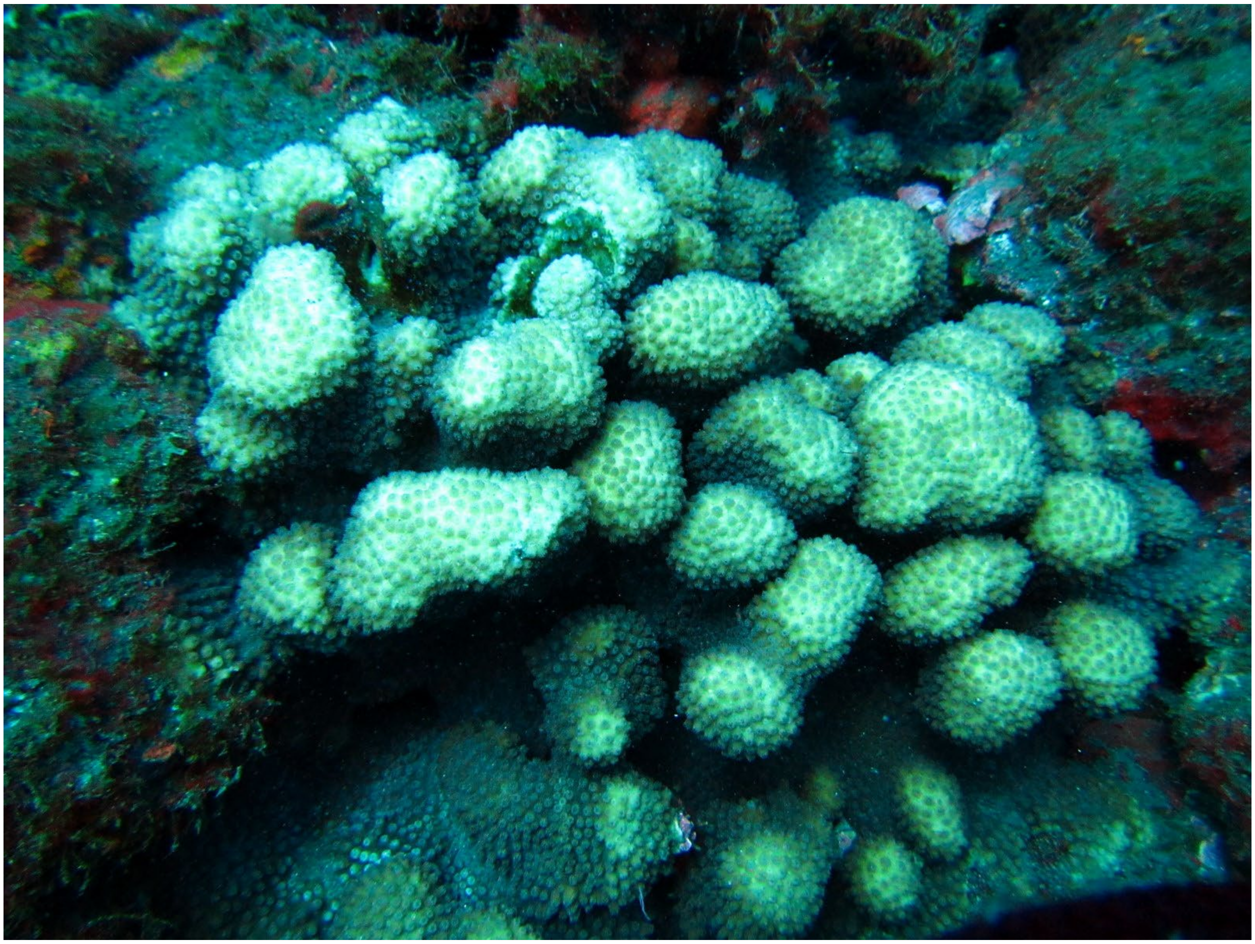
A close-up photo of *Plesiastrea versipora*.

Cyphastrea

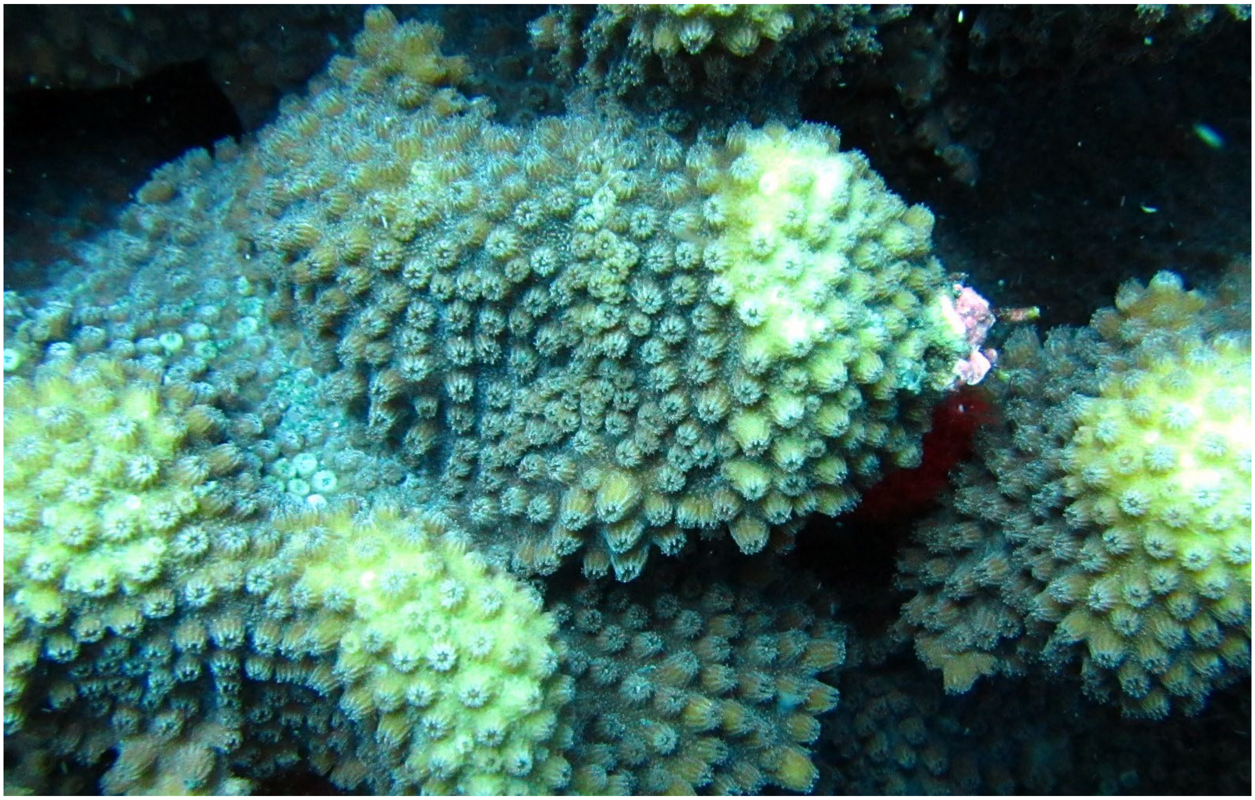
Colonies are encrusting, massive, or sometimes branching. Corallites project and are tiny, about 2 mm diameter. Corallites are smaller than on *Plesiastrea* or *Echinopora*. Branching colonies can look like *Pavona maldivensis* but have less obvious costae (ridges) radiating from corallites. The features like septa and costae are so small that most species are very difficult to identify without magnification.

Cyphastrea spp.

A close photo of encrusting *Cyphastrea*.



A photo of nodular or columnar *Cyphastrea* spp.

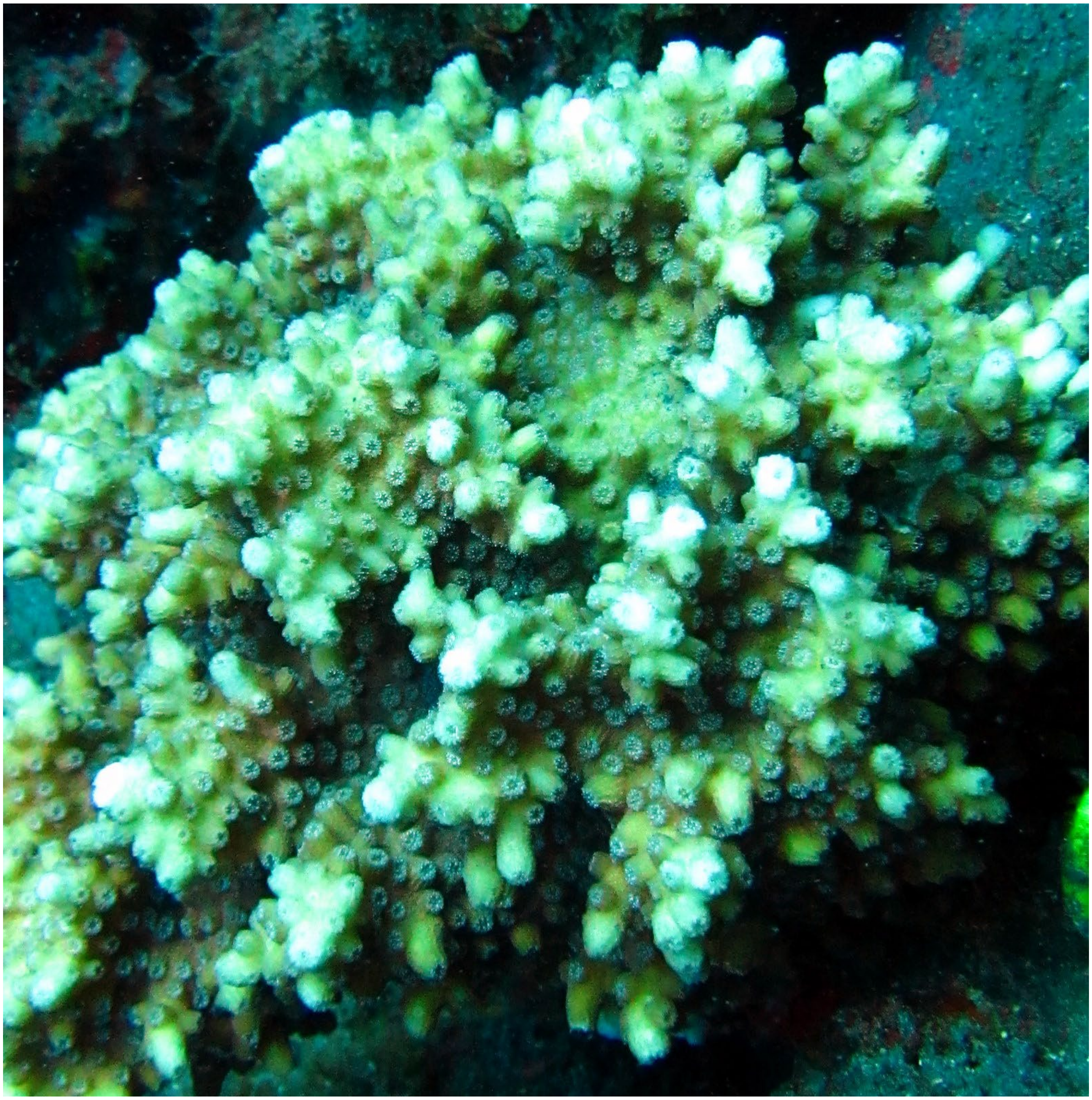


A close-up photo of encrusting *Cyphastrea* sp. showing costae.

Cyphastrea decadea

Colonies are branching, and there is one corallite on the end of a branch, much like *Acropora*, but the septa and costae show it is *Cyphastrea* not *Acropora*.

A photo of *Cyphastrea decadea*. In other places, branches are longer than this.



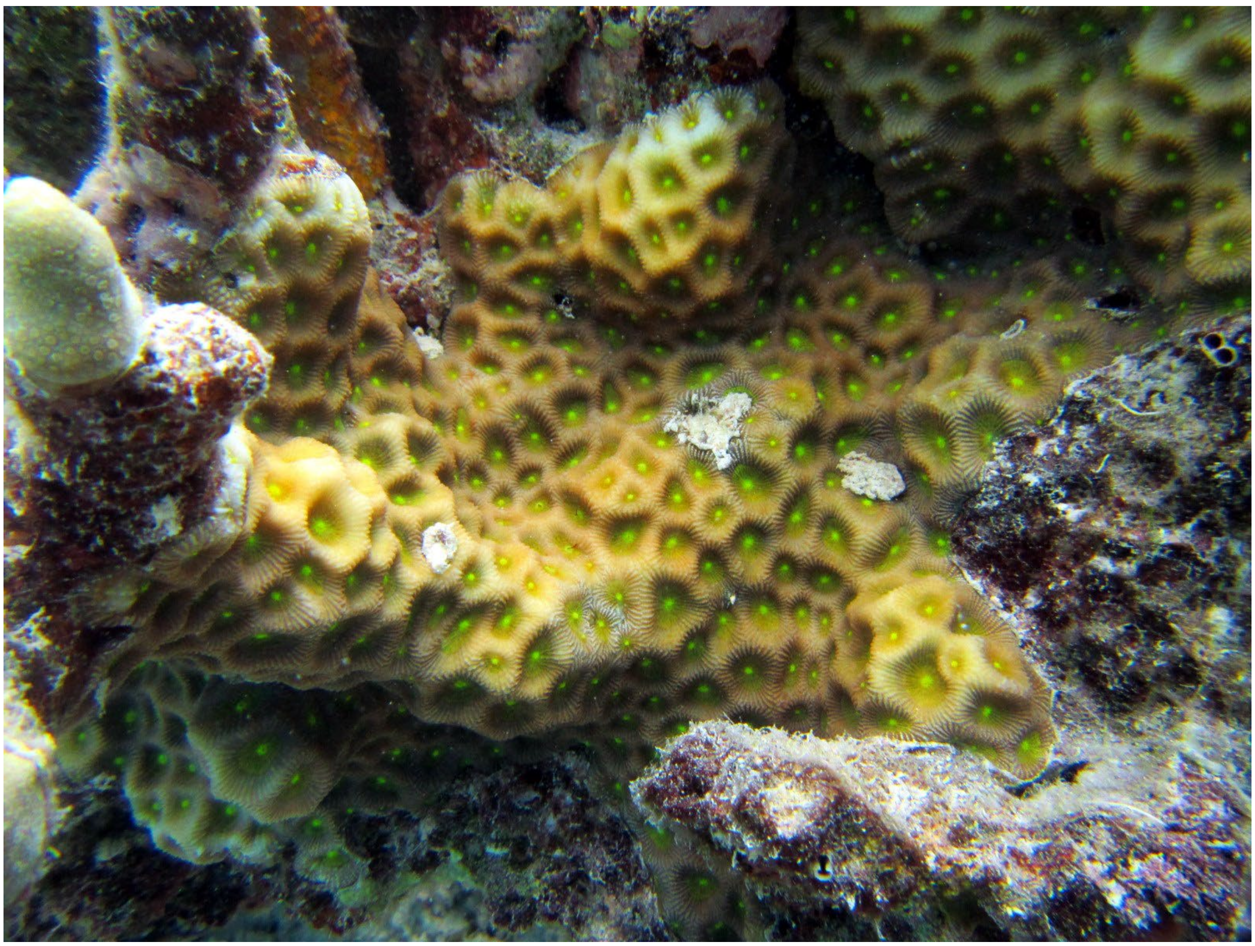
A close-up photo of *Cyphastrea decadea*.

Favites

Colonies are encrusting or massive. Corallites vary in size from smaller than a little finger to at least as large as a thumb. Corallites are not separate, they share common walls. There is no groove separating corallites. *Favia* has separate corallites which do not share walls. *Goniastrea* is very similar to *Favites*, with no single reliable rule that can distinguish living colonies. It may be necessary to identify species first and that tells you what genus they are in. Species of *Favites* are difficult to identify reliably.

Favites abdita

Colonies are encrusting or massive or a combination. Corallites are about finger diameter. The shared walls are fairly sharp at the top. Colonies are often golden and may have green polyp mouths or calice floors.



A photo of *Favites abdita*.

A photo of *Favites abdita*.

A photo of *Favites abdita*.

Favites sp.

There are several *Favites* in Tonga that do not appear to be easily identifiable to species yet. Here are three.

A photo of *Favites* sp.

A photo of *Favites* sp.

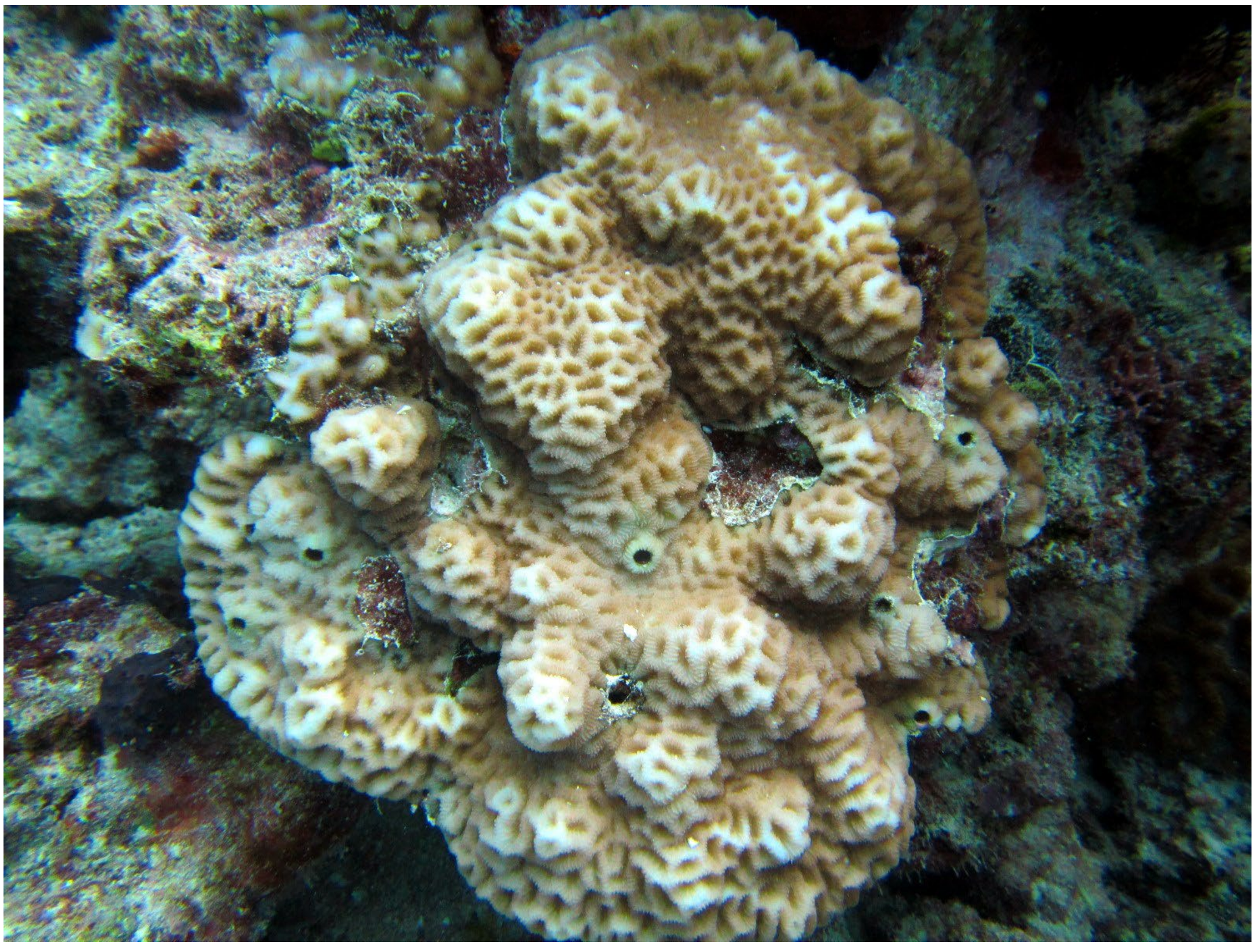
A photo of *Favites* sp.

Goniastrea

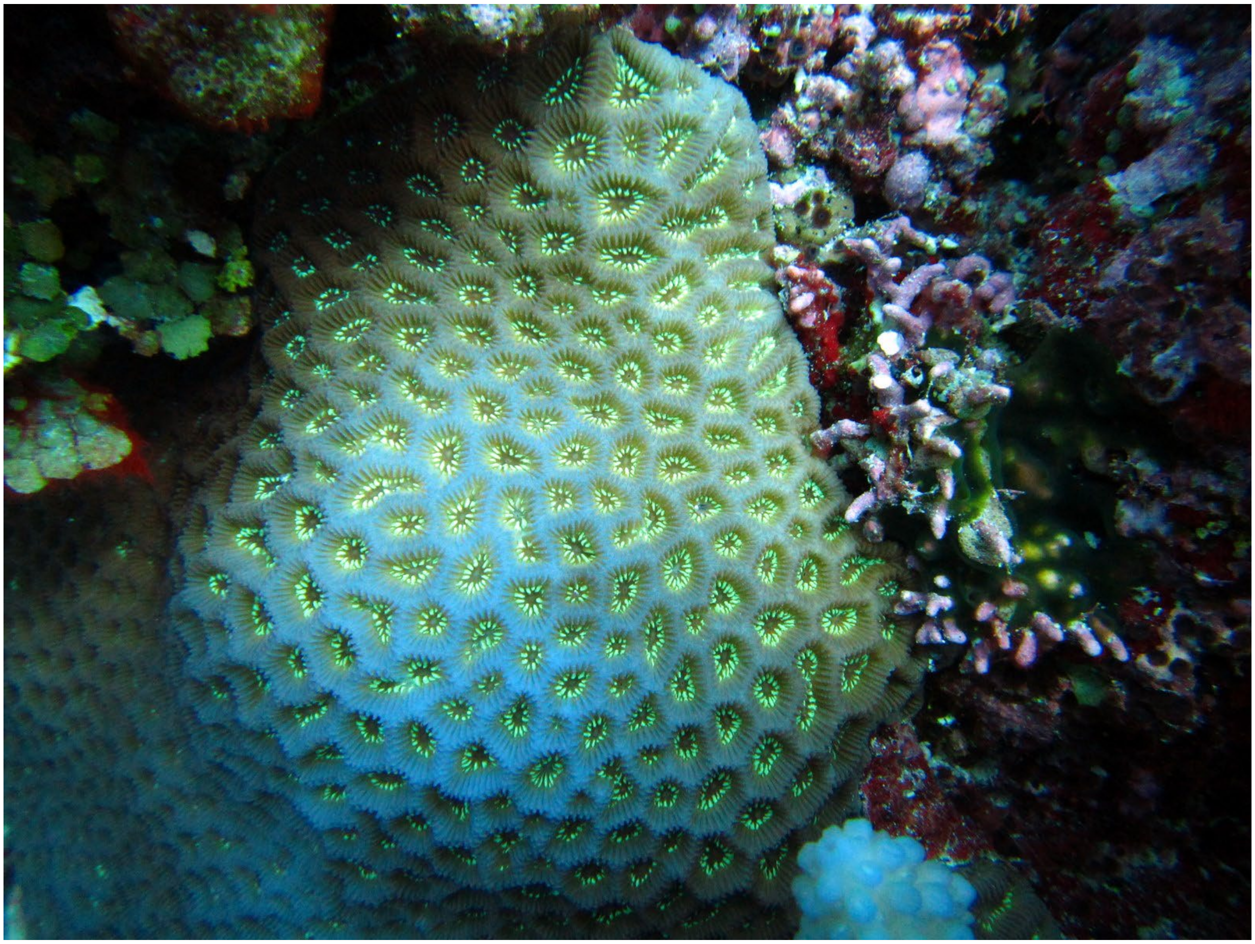
Colonies are massive or encrusting. Corallites share walls and vary from about finger size to about 2-3 mm diameter. The walls between corallites are often thin and narrow, but not always. No single rule can separate living colonies of *Goniastrea* from *Favites*, often one must identify species first and that tells you what the genus is. A fair number of species can be pinkish-orange.

Goniastrea pectinata

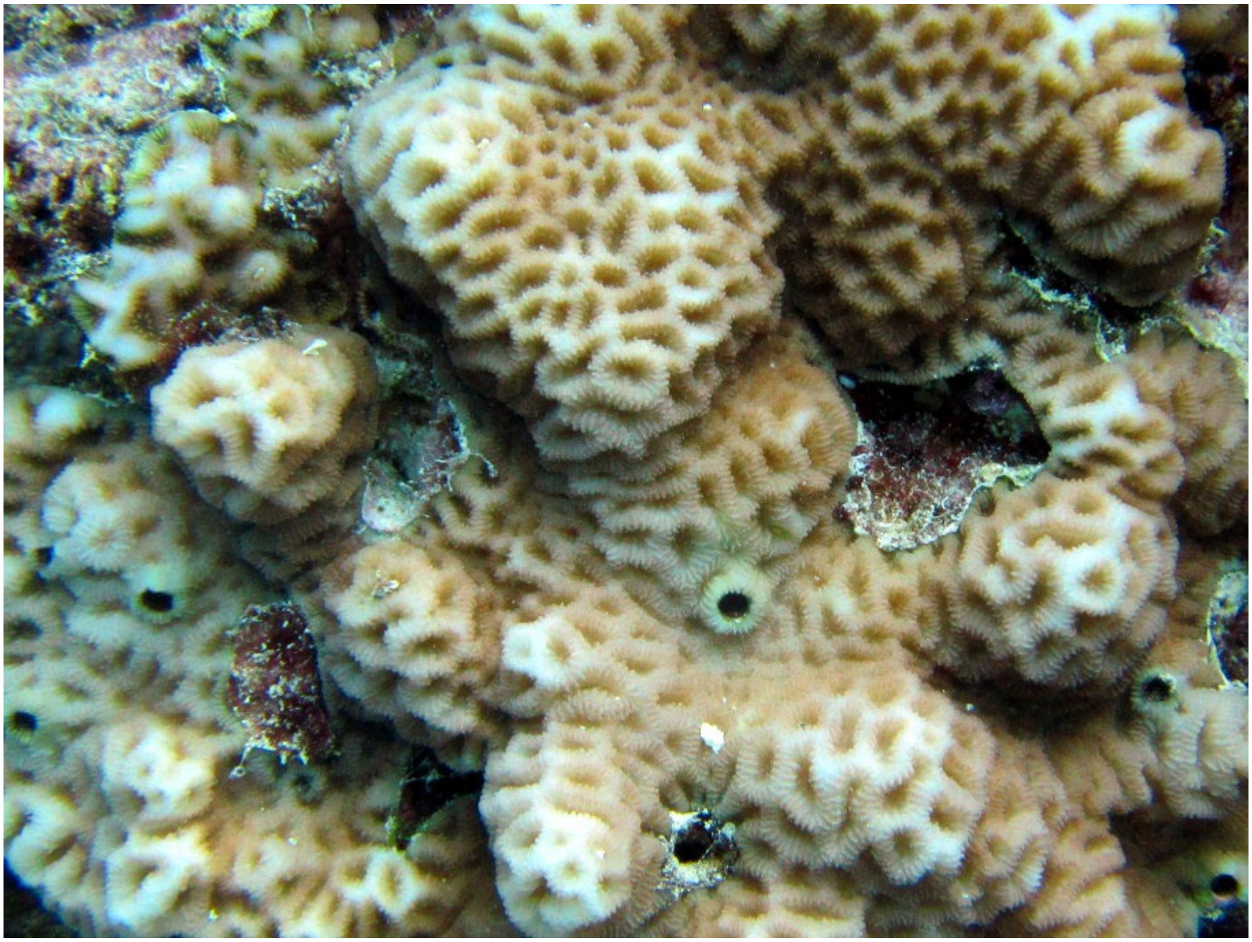
Colonies are usually irregularly lumpy. Corallites are a bit smaller than a small finger, and some corallites are elongated enough to have more than one mouth. The walls between corallites are usually wedge-shaped, sharp at the top but wider at the bottom.



A photo of a typical colony of *Goniastrea pectinata*.



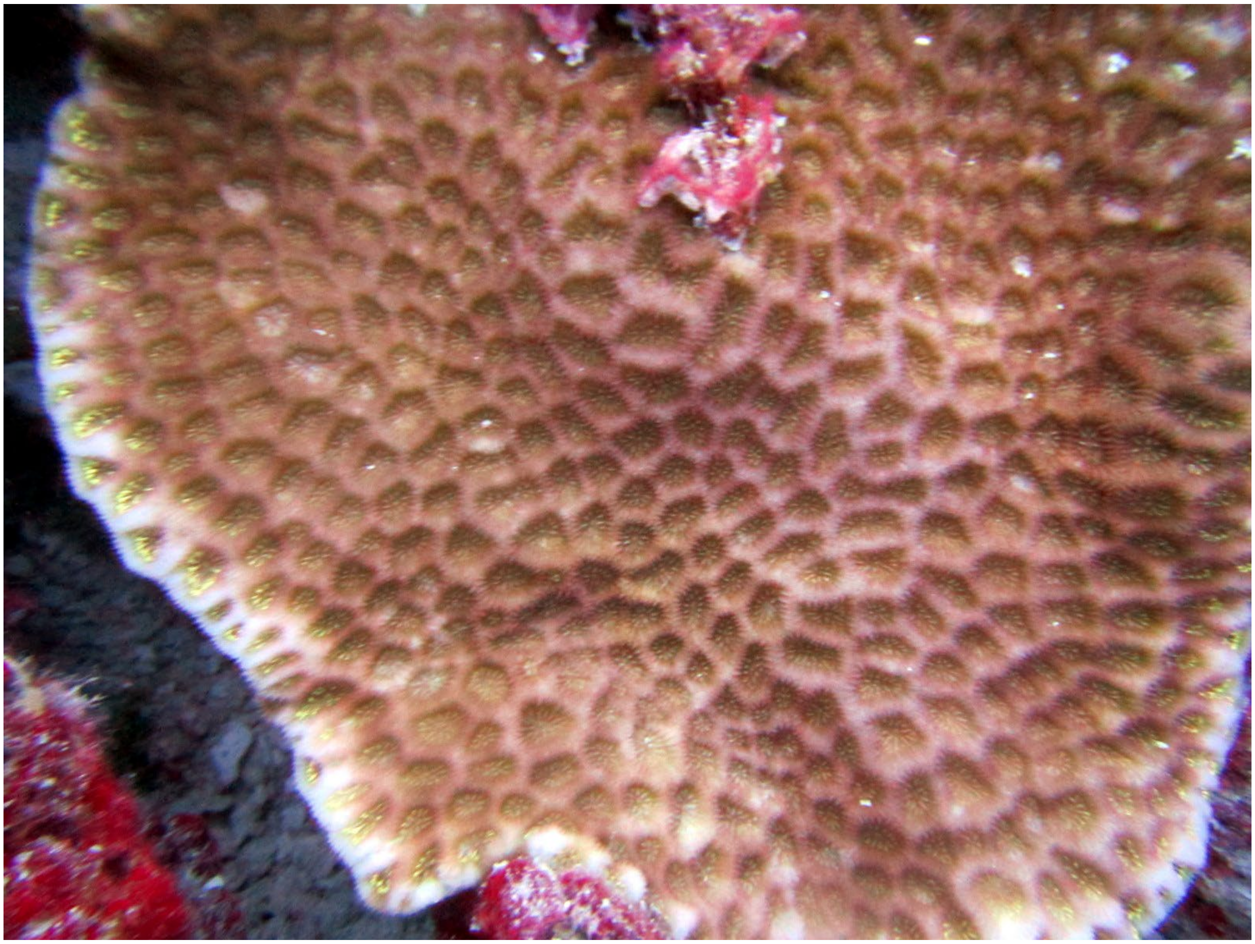
A photo of *Goniastrea pectinata* with fluorescent green pali inside the corallites. This is an uncommon color pattern.



A close-up photo of *Goniastrea pectinata*.

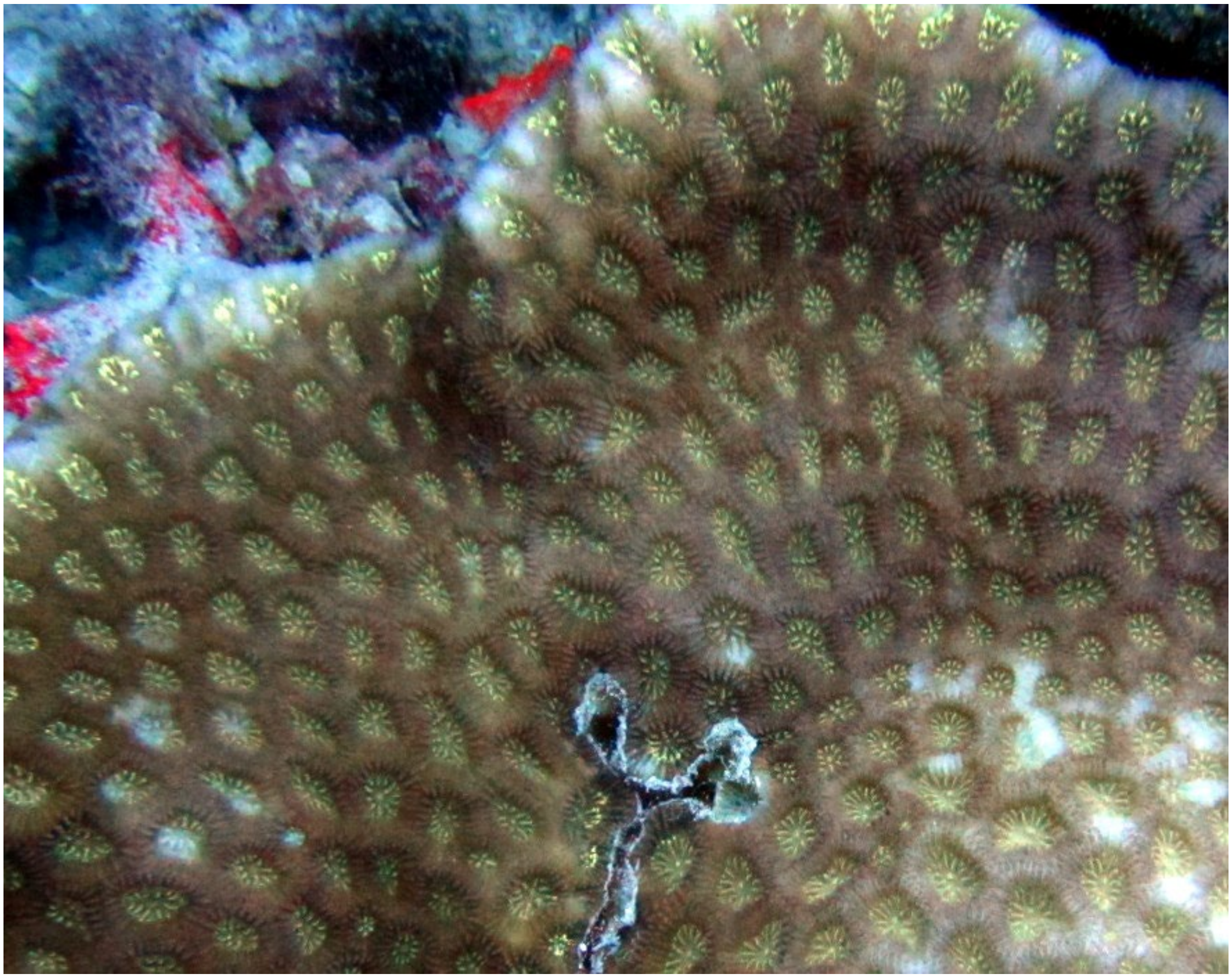
Goniastrea favulus

Colonies are usually encrusting. Corallites are about finger diameter. Corallite walls are short and corallites are shallow with flat floors. Corallites are often polygonal but can be elongated. Encrusting instead of lumpy like *Goniastrea pectinata*, with thinner walls and shallow, flat floors. Corallites larger than *Goniastrea minuta*.



A photo of *Goniastrea favulus*.

A photo of *Goniastrea favulus*.

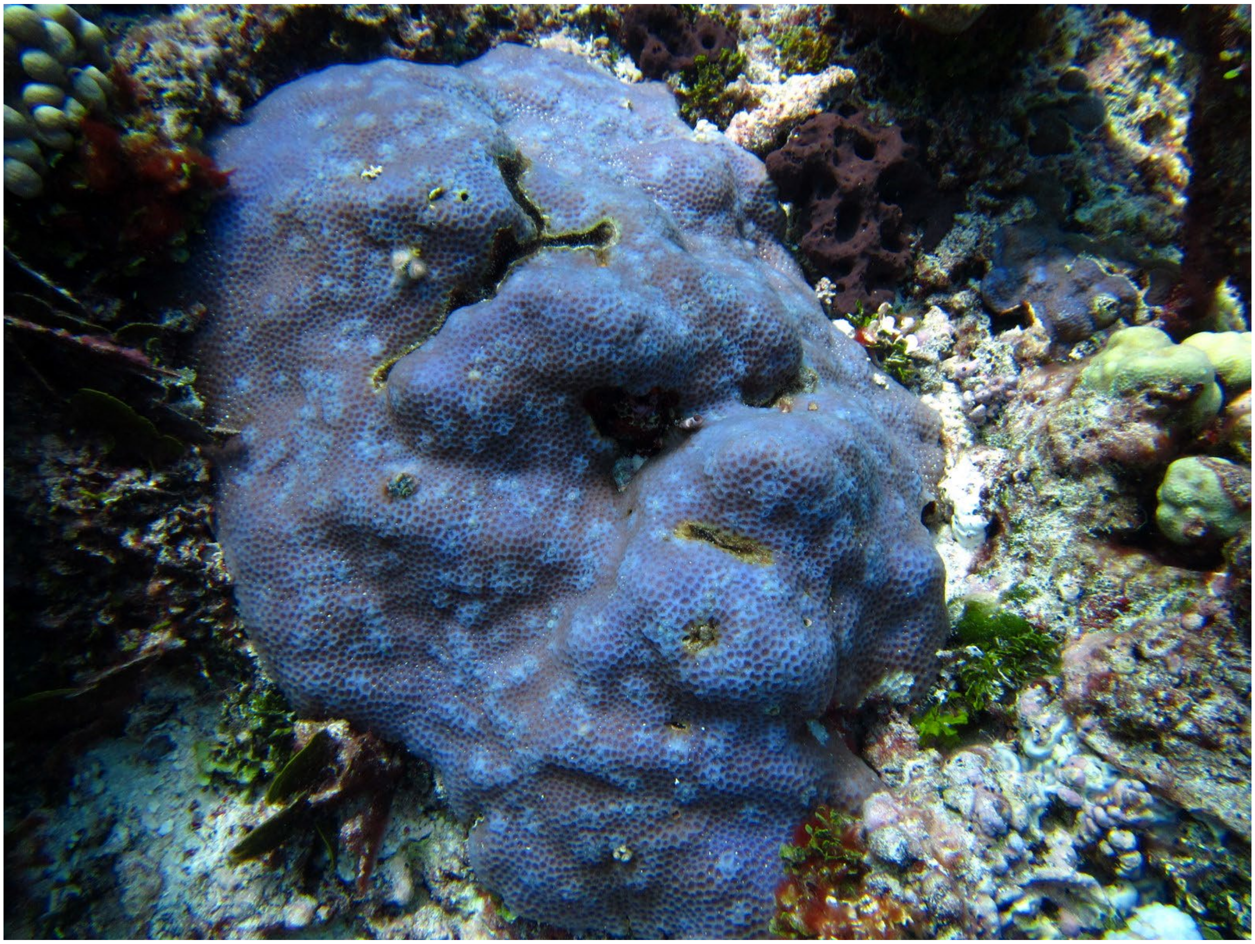


A close-up photo of *Goniastrea favulus*.

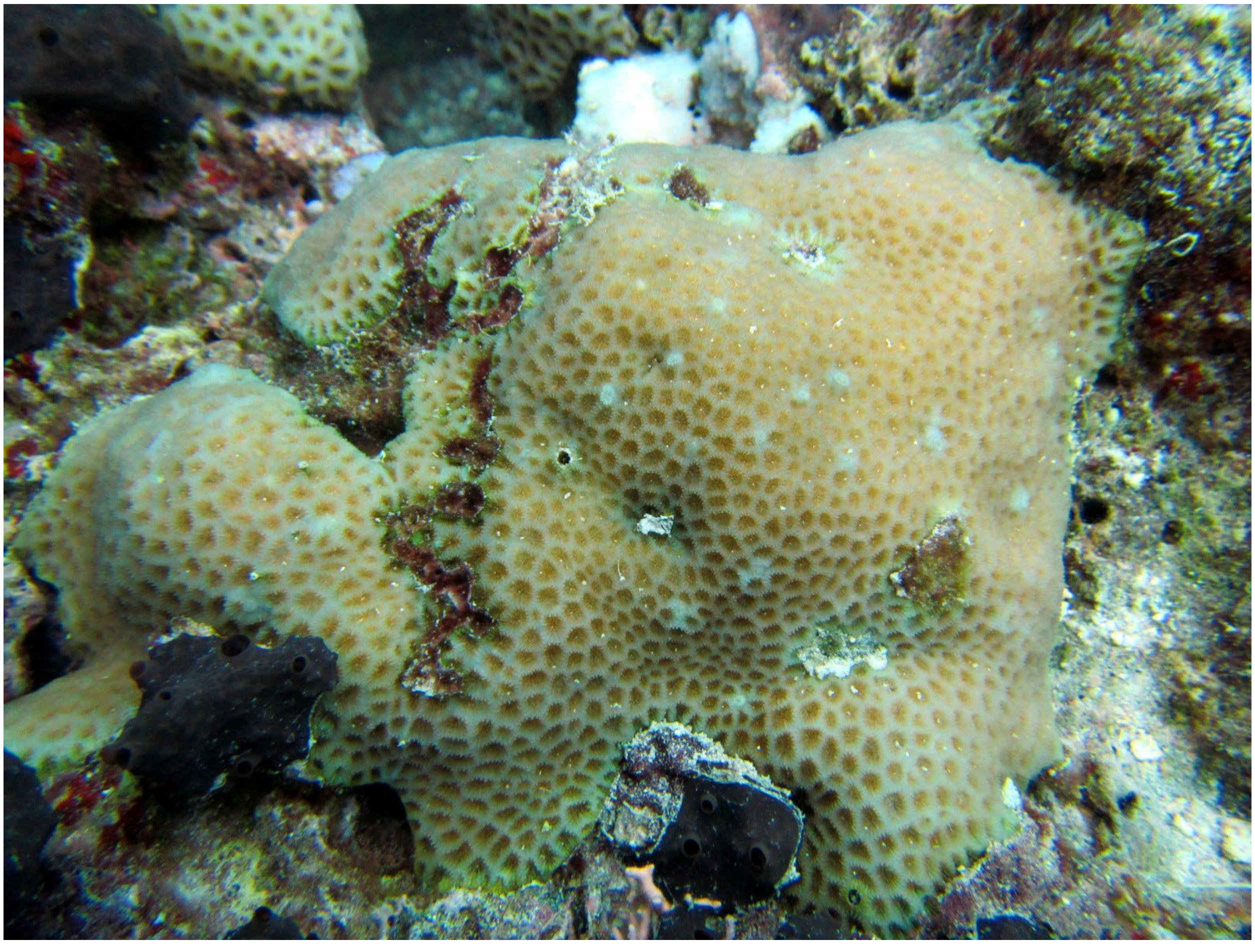
Goniastrea minuta

Colonies are usually encrusting but may have rounded mounds on them or be somewhat raised as a low massive colony. Corallites are small, about 2-3 mm diameter, with thin walls and shallow floors. Colonies often have white spots which are barnacles. Colonies are usually light brown or rust colored, but a few colonies are purple. Colonies have smaller corallites than most species of *Goniastrea*, shallower corallites than another species that have small corallites, and often barnacles which other species lack.

A photo of *Goniastrea minuta* with white spots that are barnacles.



A photo of a purple colony of *Goniastrea minuta* with barnacles.



A close-up photo of *Goniastrea minuta* with barnacles.

Goniastrea australiensis

Colonies have meandering thick, rounded ridges and relatively wide valleys. The edges of the flat valley floors have tiny bumps which are pali. Colonies are very different from other *Goniastrea* but quite similar to *Platygyra lamellina*. The latter has more narrow valley floors without the tiny bumps along the edge of the valley. The ridges are lower and more rounded and septa more uniform than on *Oulophyllia*, and mouths are often not obvious. The ridges are smaller than on *Symphyllia*. Ridges larger than most *Platygyra*.

A photo of a colony of *Goniastrea australiensis*.

A close-up photo of *Goniastrea australiensis*.

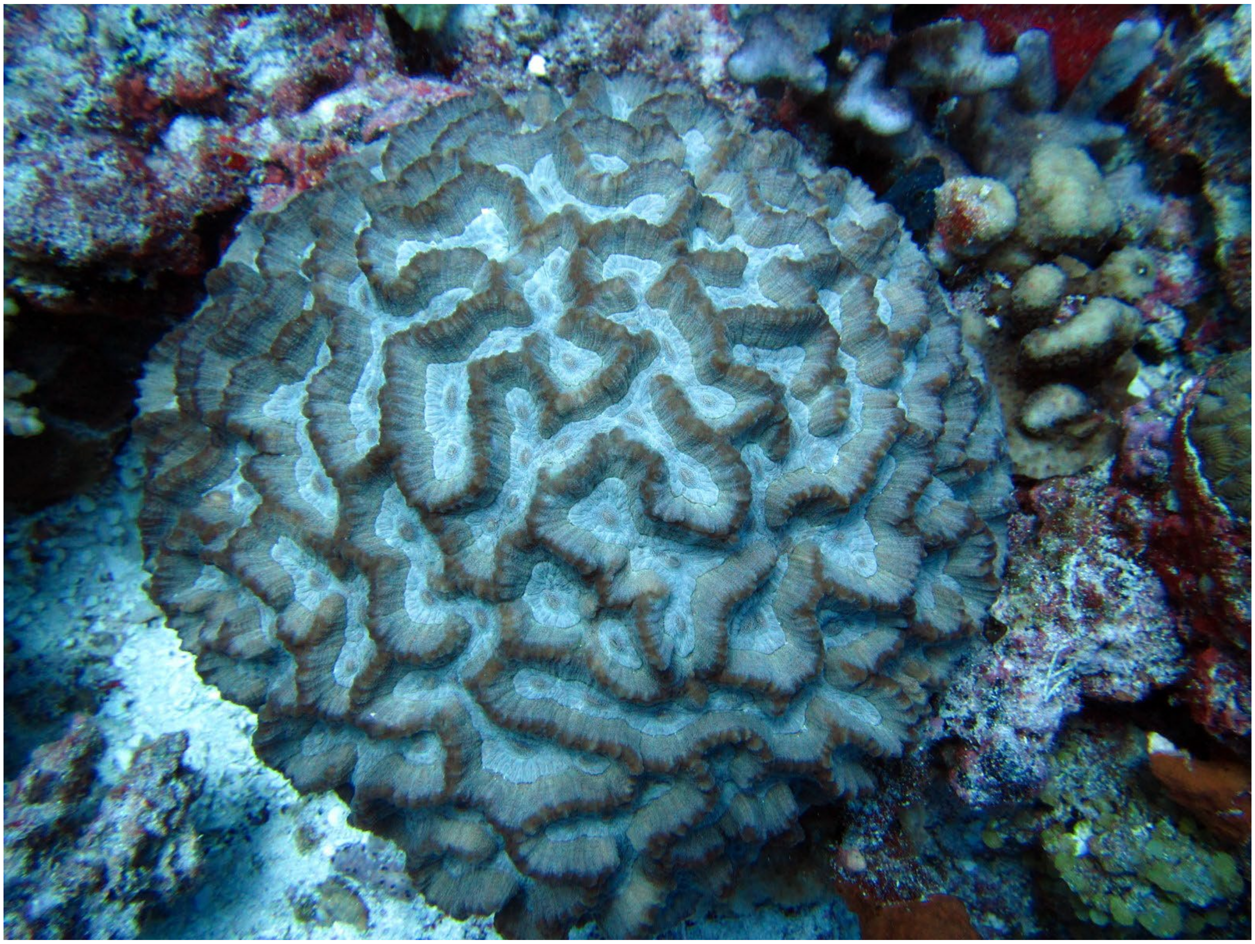
Oulophyllia

Colonies are usually massive. Colonies have wide flat corallite floors in between narrow walls that are usually tall for their width and the size of the corallites. The tops of walls are often nearly flat with small bumps. Corallites range from near circular with one mouth to oval with two or three mouths, to long and winding, with meandering ridges between them. Mouths often project and are visible. Corallites are finger to thumb width. Similar to *Goniastrea* and *Favites* but the corallite floors are usually wider and the walls higher and thinner.

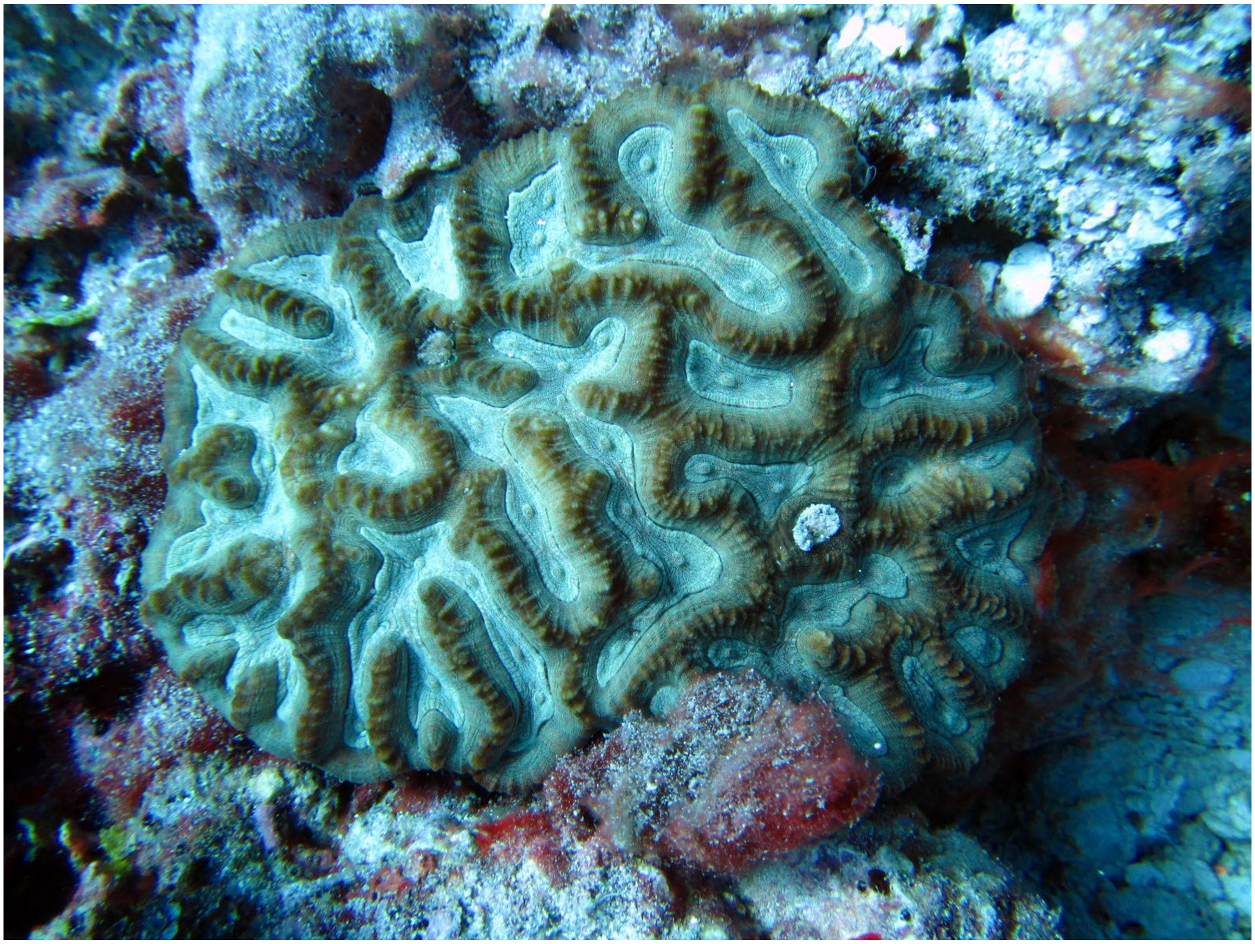
Oulophyllia crispa

Colonies have long meandering ridges and valleys. *Oulophyllia bennettae* has corallites that vary from round to oval and have only 1-3 mouths.

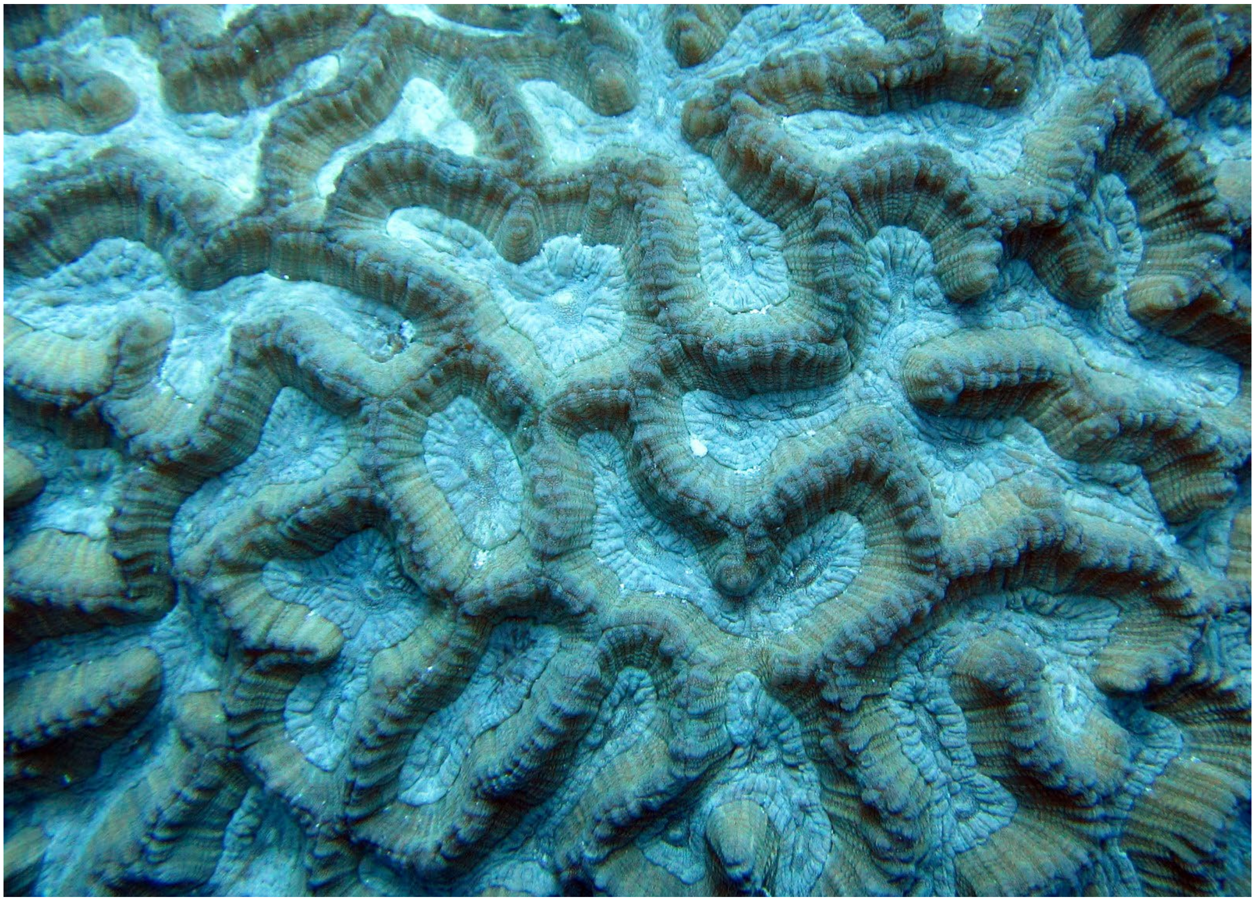
A photo of a colony of *Oulophyllia crispa*.



A photo of *Oulophyllia crispa*.



A photo of *Oulophyllia crispa*.



A close-up photo of *Oulophyllia crispa*.

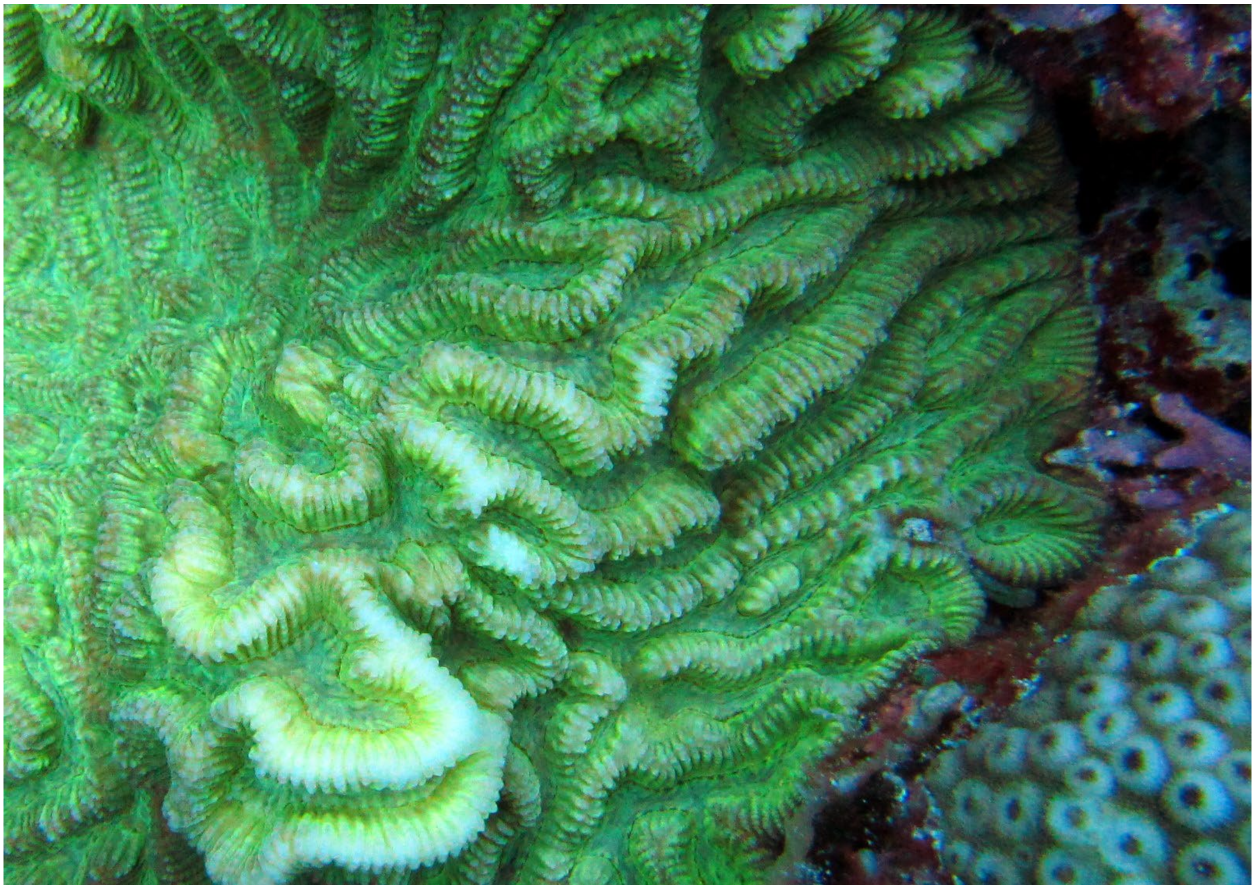
Platygyra

Colonies are massive or encrusting. Colonies vary from meandroid with long meandering ridges, to ridges enclosing just one or two polyps. Ridges vary from about 5 mm wide to about 3 mm wide. *Symphyllia* has far larger ridges, *Oulophyllia* usually has taller ridges and has wider valleys, *Goniastrea australiensis* has wider ridges than most species of *Platygyra* and usually wider valleys. *Platygyra* species that have enclosed polyps usually have more irregular shape corallites than *Favites*. High variation within species and small differences between species make *Platygyra* species difficult to identify and uncertain.

Platygyra lamellina

Colonies have relatively wide, rounded, smooth ridges. Ridges are wider than on *Platygyra daedalea/sinensis*. Valleys are more narrow than on *Goniastrea australiensis* and there is no line of tiny bumps along the edge of the valley floors. *Oulophyllia* has flatter ridge tops and usually taller ridges.

A photo that is probably of *Platygyra lamellina*.

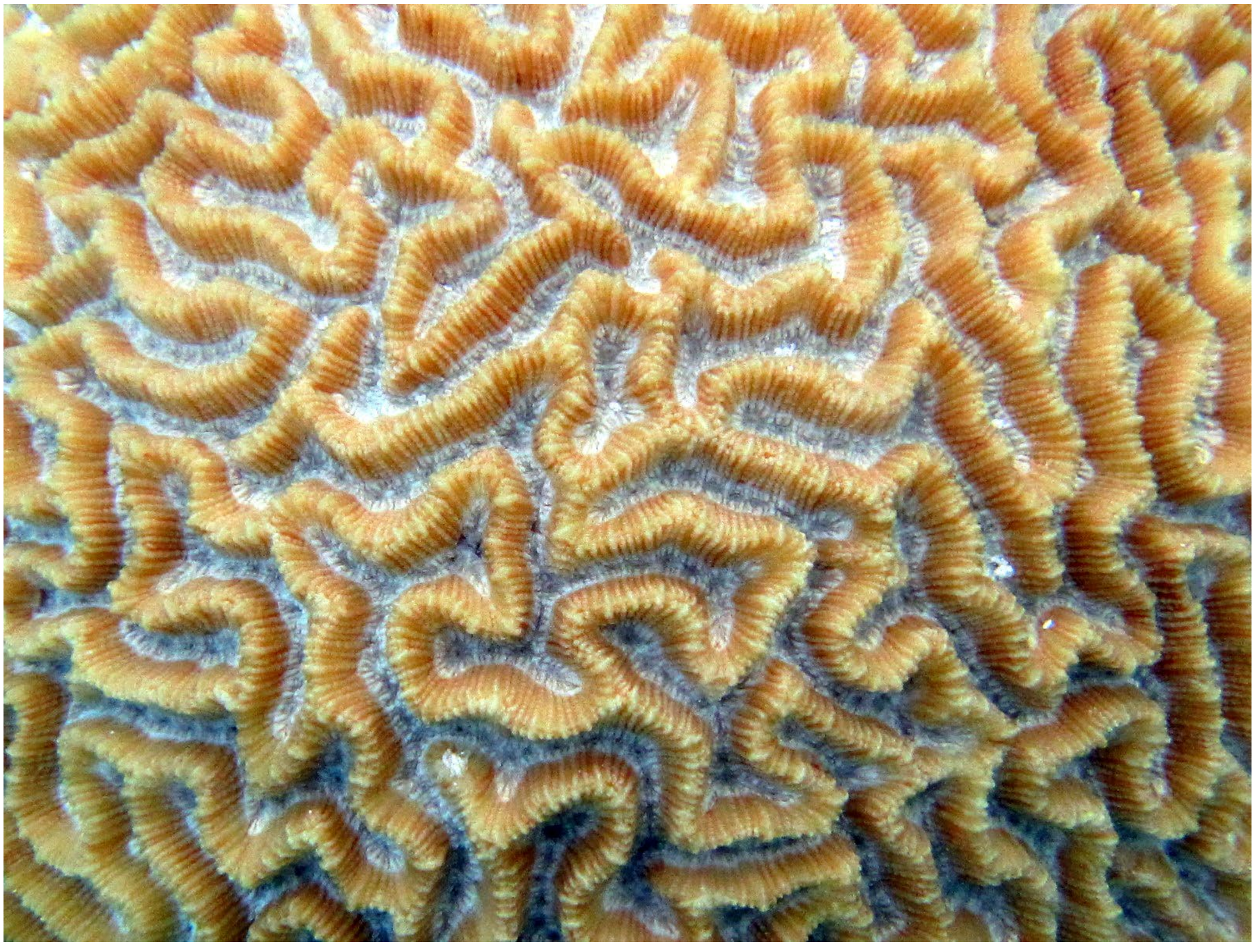


A close-up photo that probably is of *Platygyra lamellina*.

Platygyra daedalea or Platygyra sinensis

Ridges are relatively thin, rounded on top, and have somewhat variable septa sizes.

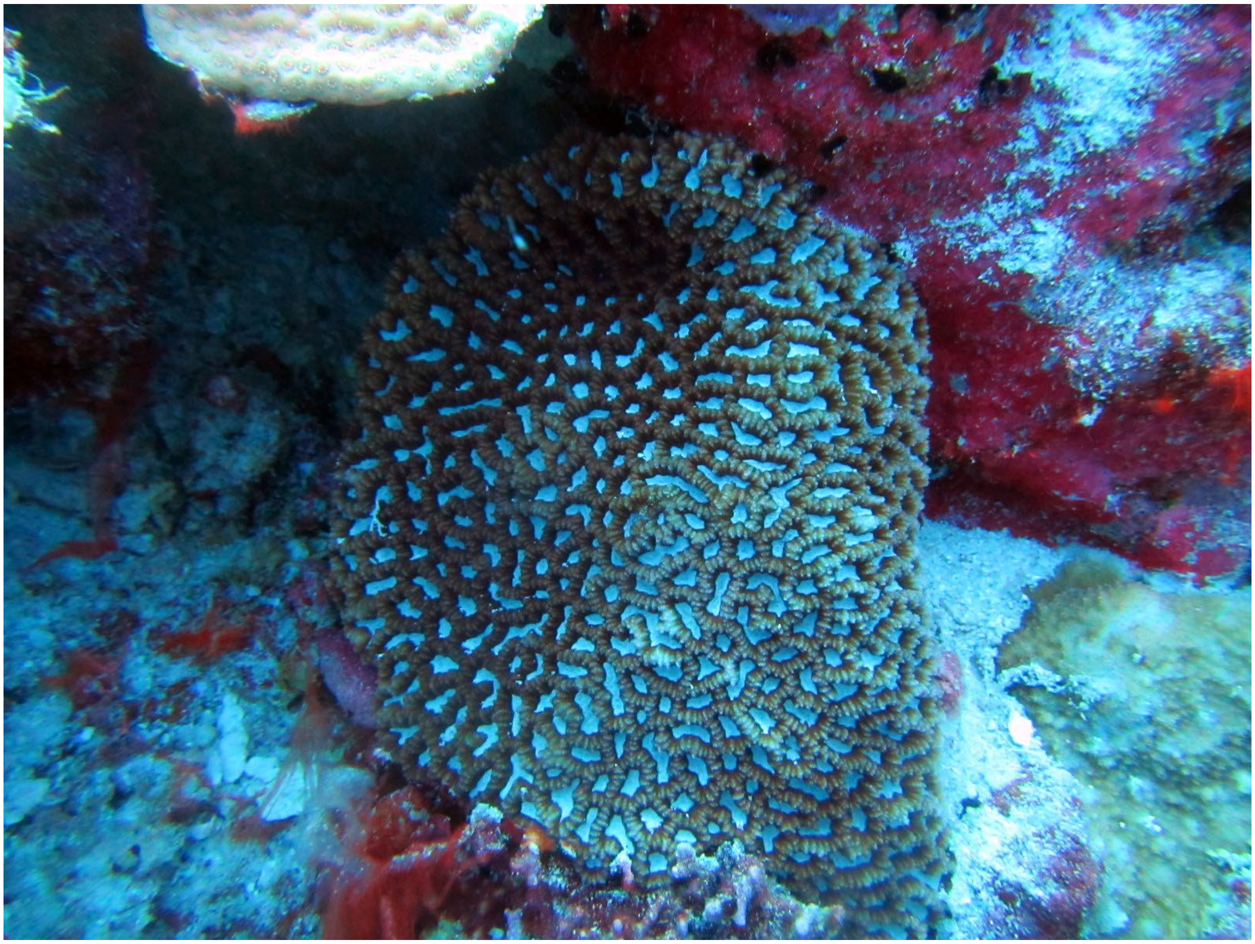
A photo of *Platygyra daedalea* or *sinensis*



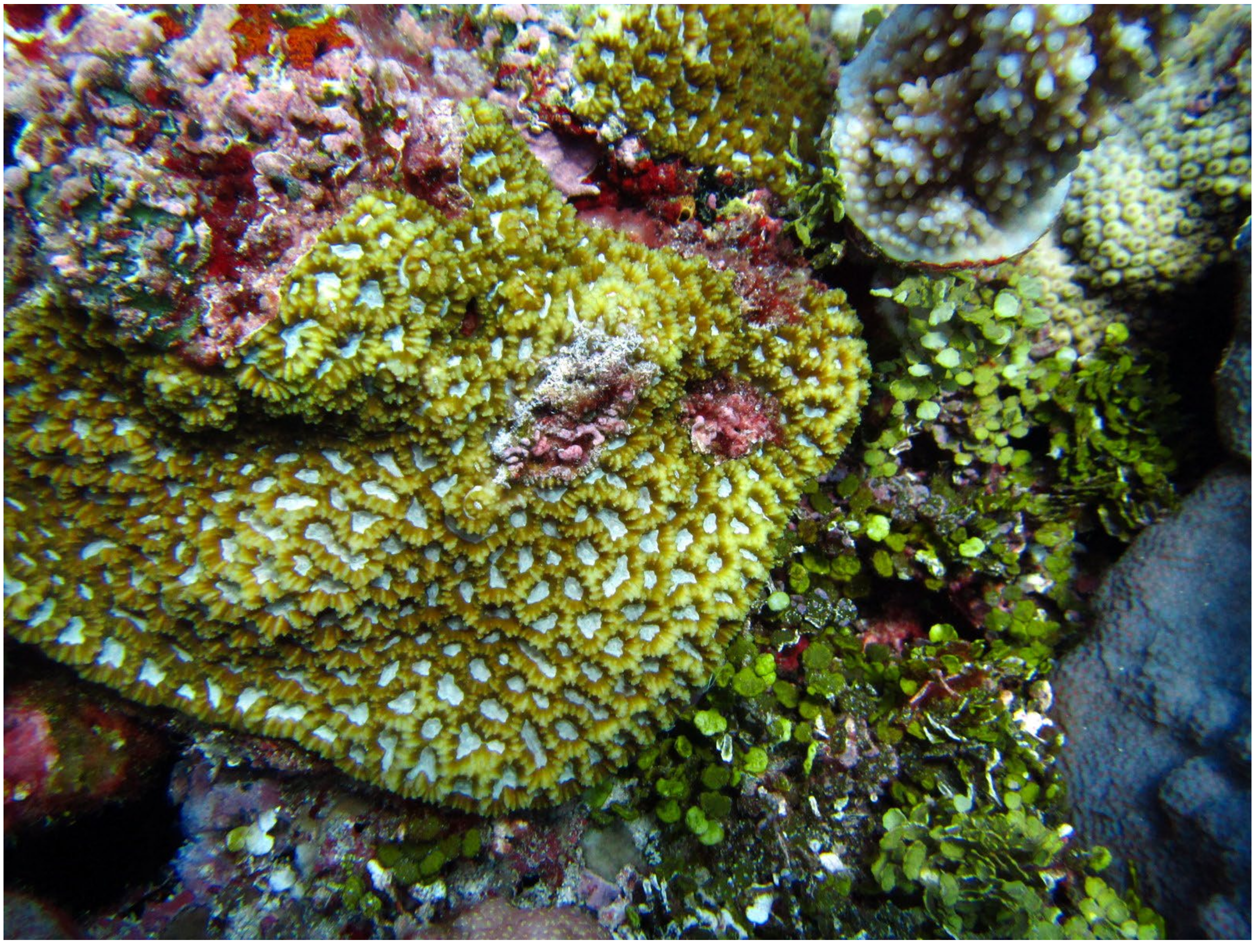
A close-up photo of *Platygyra daedalea* or *sinensis*.

Platygyra pini

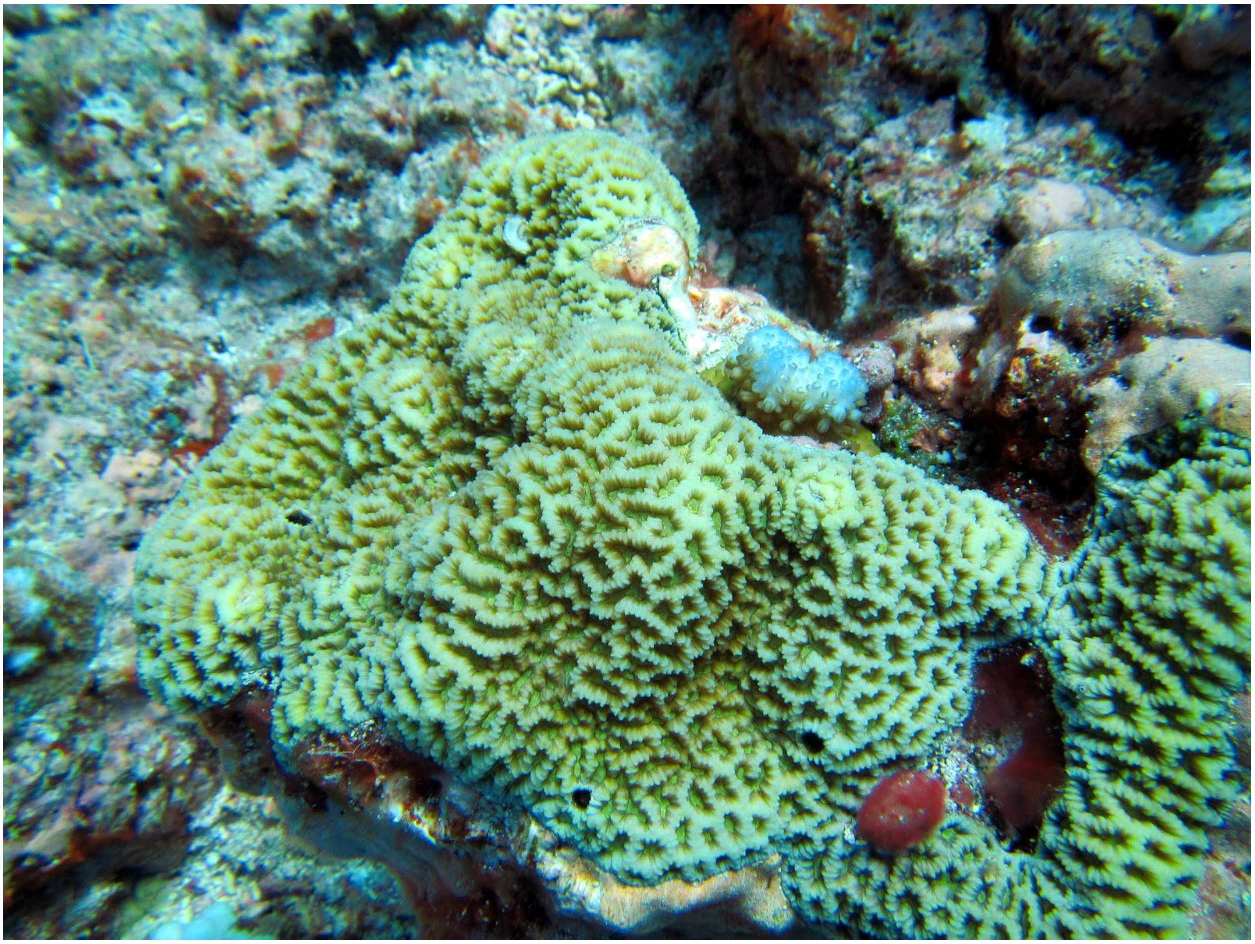
Colonies have ridges that enclose small valley segments in irregularly shaped corallites. The ridges are relatively rounded and smooth. Colonies are not meandroid like some *Platygyra* species, nor flat topped and irregular like *Platygyra contorta*.



A photo of *Platygyra pini*.



A photo of *Platygyra pini*.

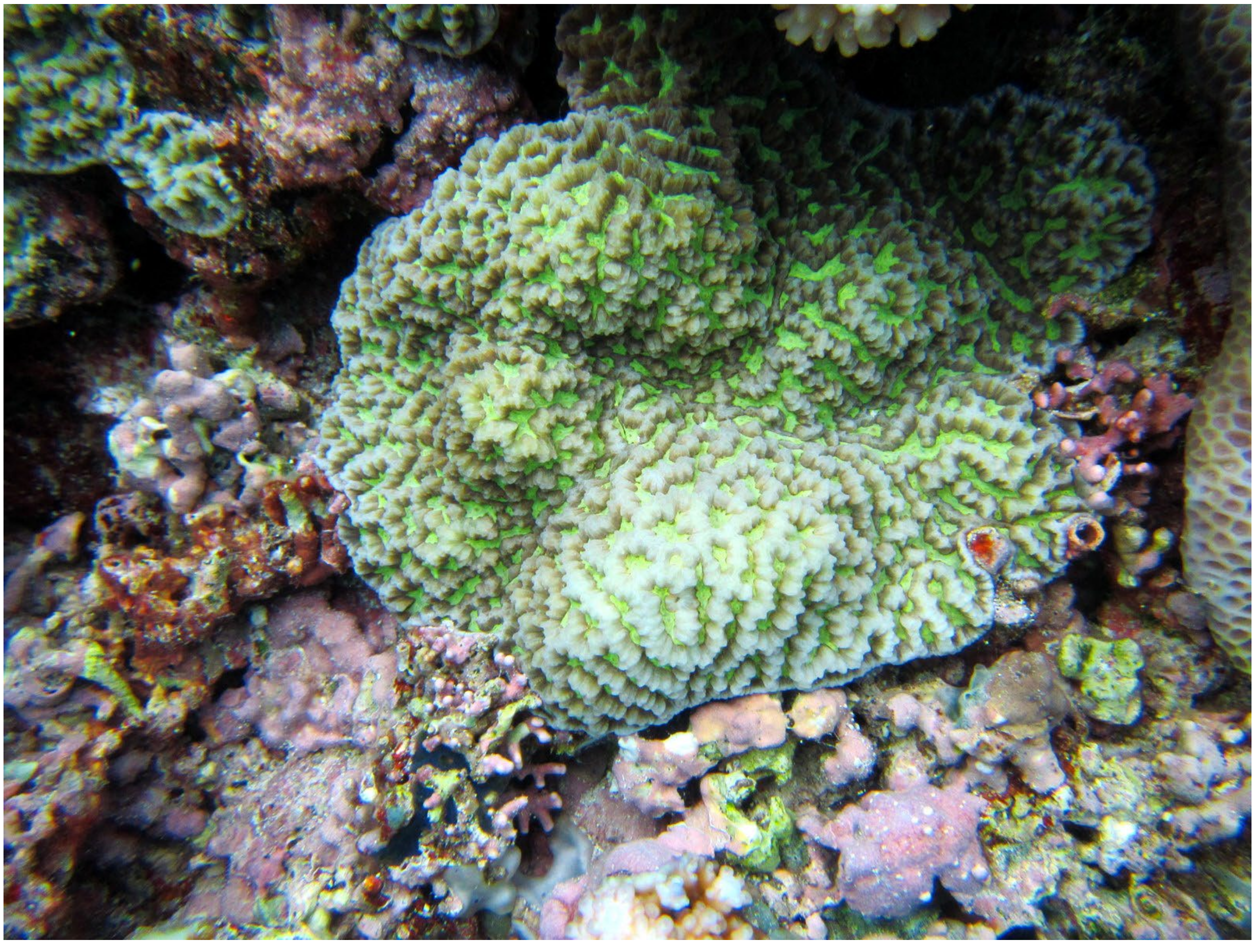


A photo of *Platygyra pini*.

A close-up photo of *Platygyra pini*.

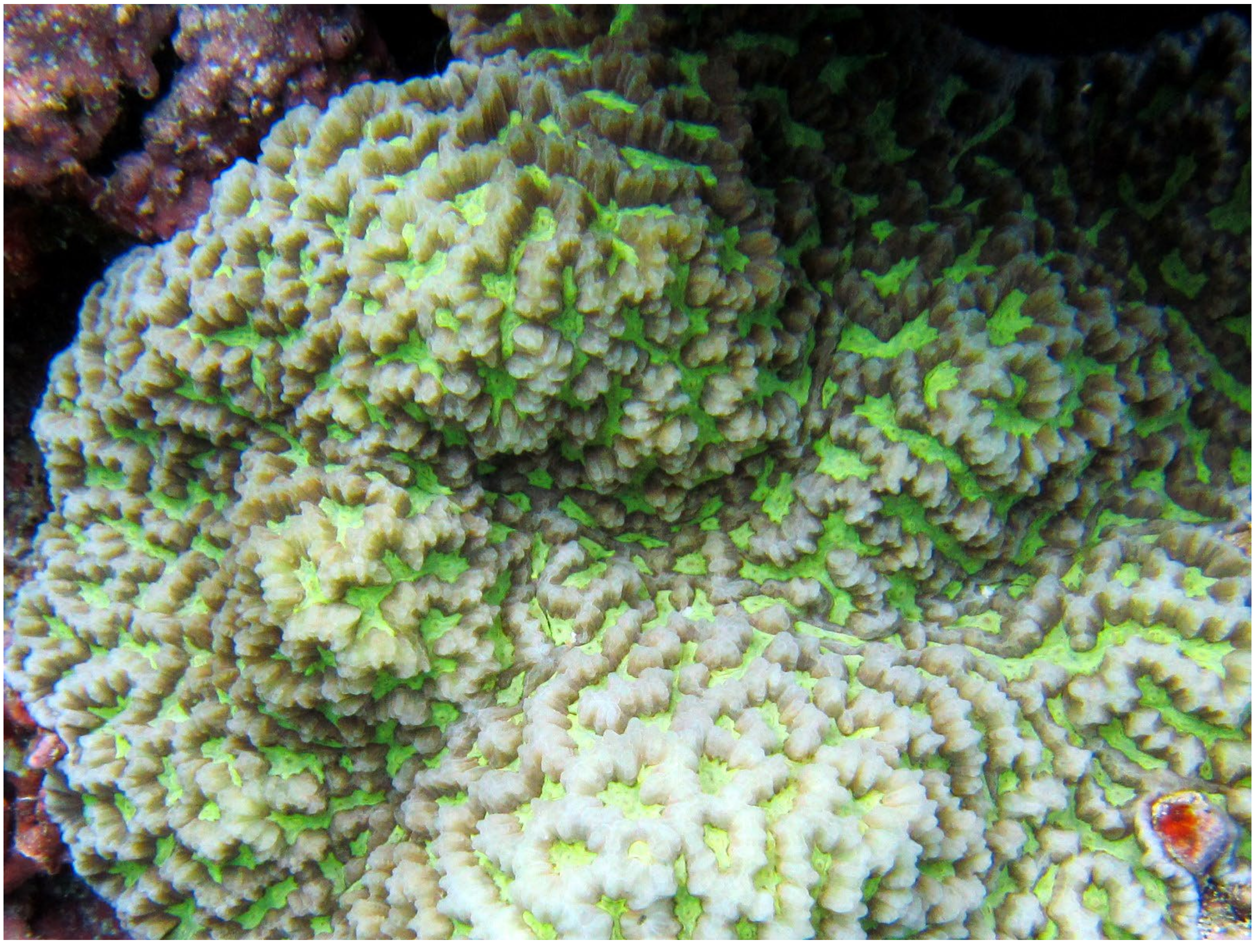
Platygyra contorta

Colonies have ridges that are thin, and have septa in irregular sizes so some project from ridge sides more than others. Septa are more irregular than in most other *Platygyra* species.



A photo of *Platygyra contorta*.

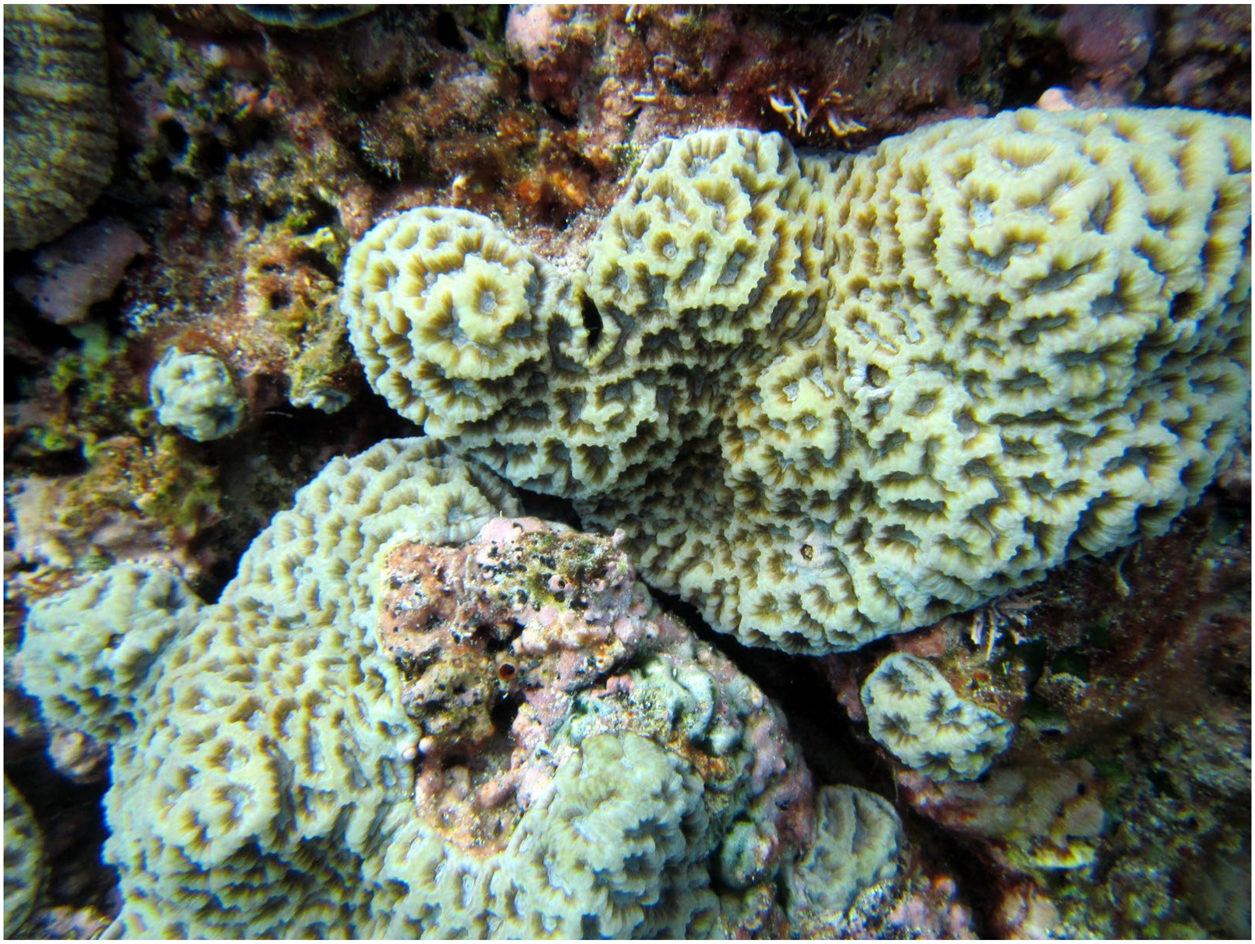
A photo of *Platygyra contorta*.



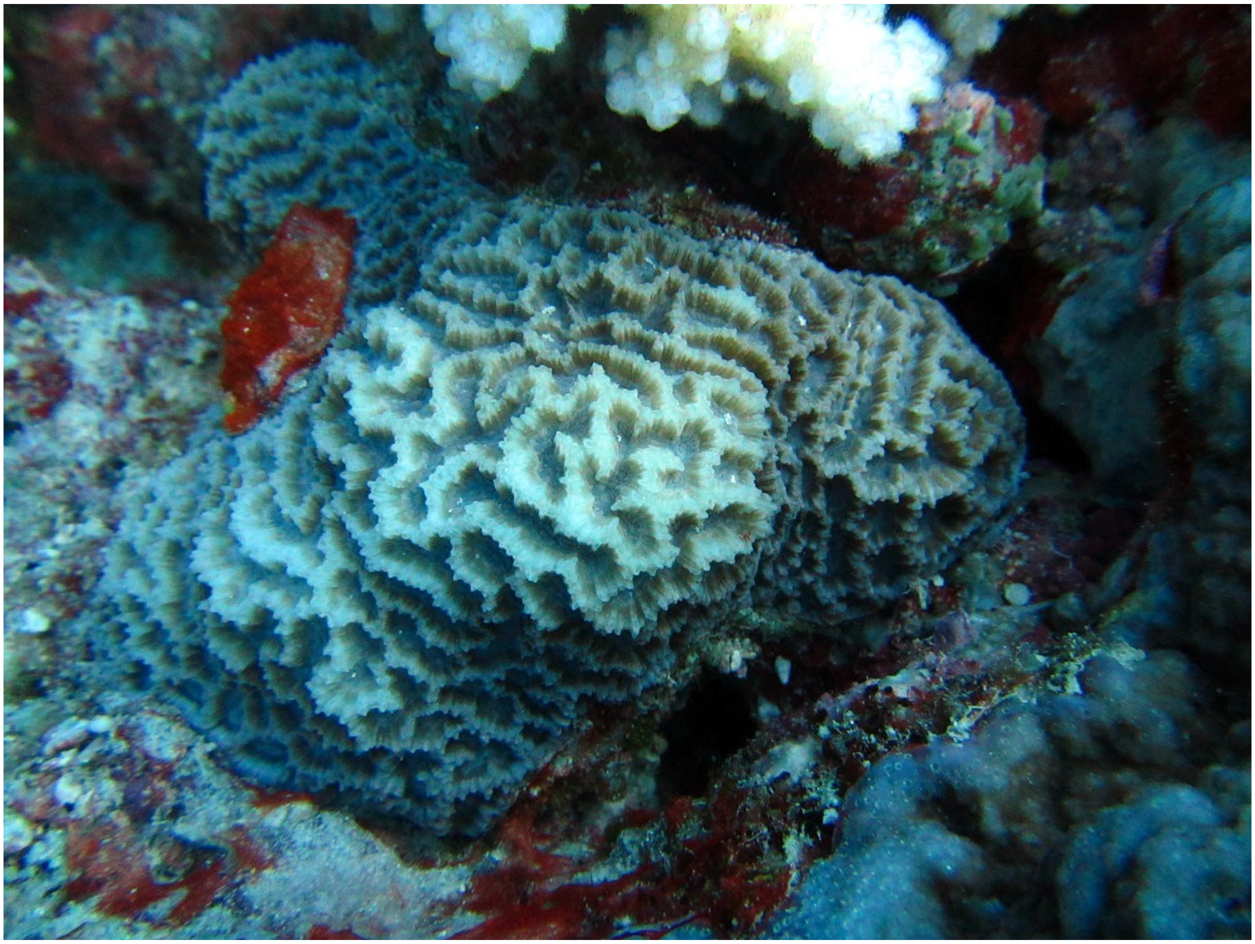
A close-up photo of *Platygyra contorta*.

Platygyra carnosus or Platygyra contorta

Colonies are encrusting or lumpy. The ridges enclose rounded or elliptical or irregularly shaped valleys, but not long valleys, it is not meandroid. Ridges are fleshy often with flat tops. *Platygyra contorta* is not fleshy and may have even more irregular septa.



A colony of *Platygyra carnosis or contorta*.



A photo of *Platygyra carnosus* or *contorta*.

Leptoria

Colonies are usually massive but can be low and nearly flat. Colonies are covered with very small meandering ridges. The ridges are only about 2 mm wide and tall, and may be close together. All other meandroid species have larger ridges.

Leptoria phrygia

Colonies have relatively smooth, uniform ridges.

A photo of two colonies of *Leptoria phrygia*. A few colonies have fluorescent green valleys, but most do not.

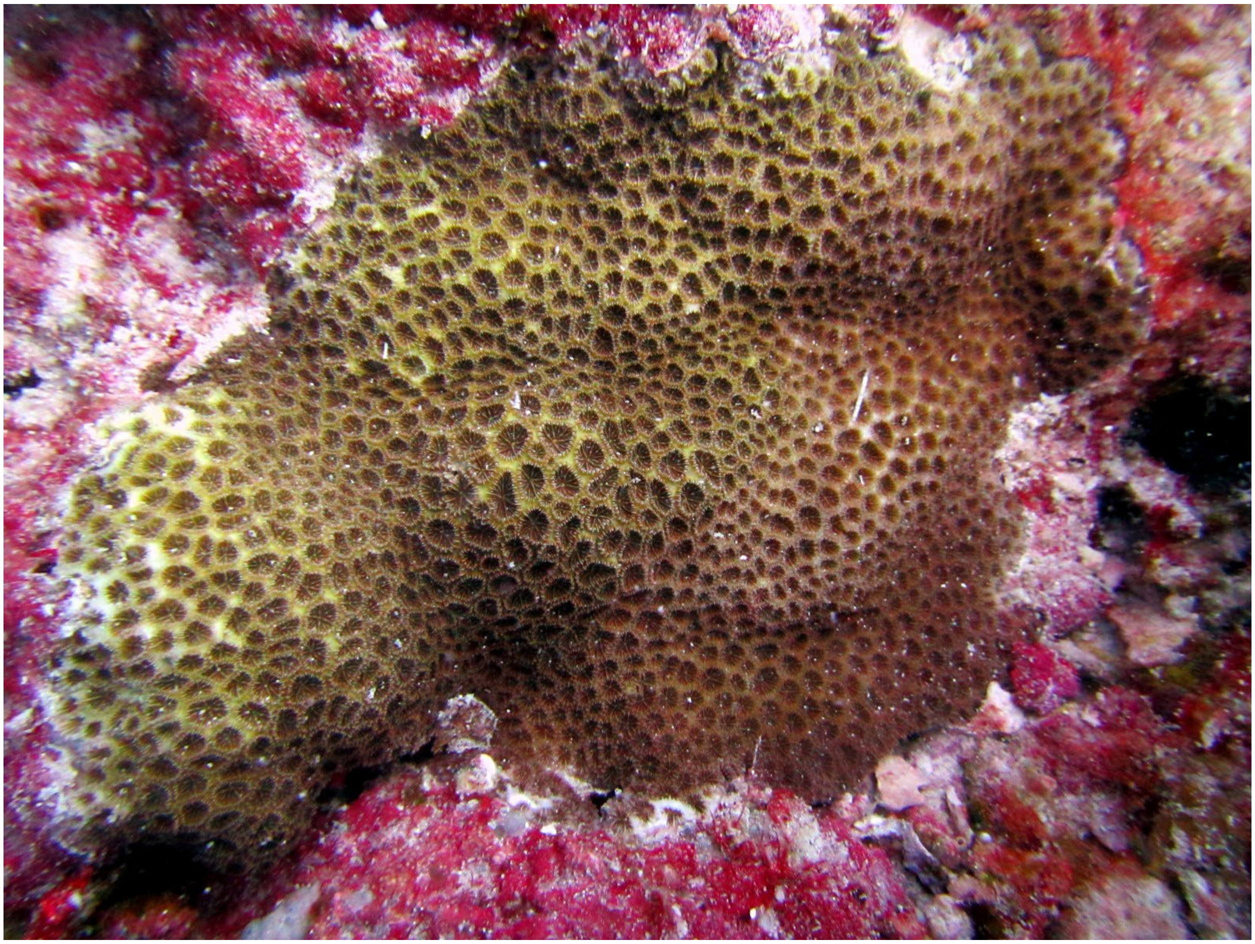
A close-up photo of *Leptoria phrygia*.

Leptastrea

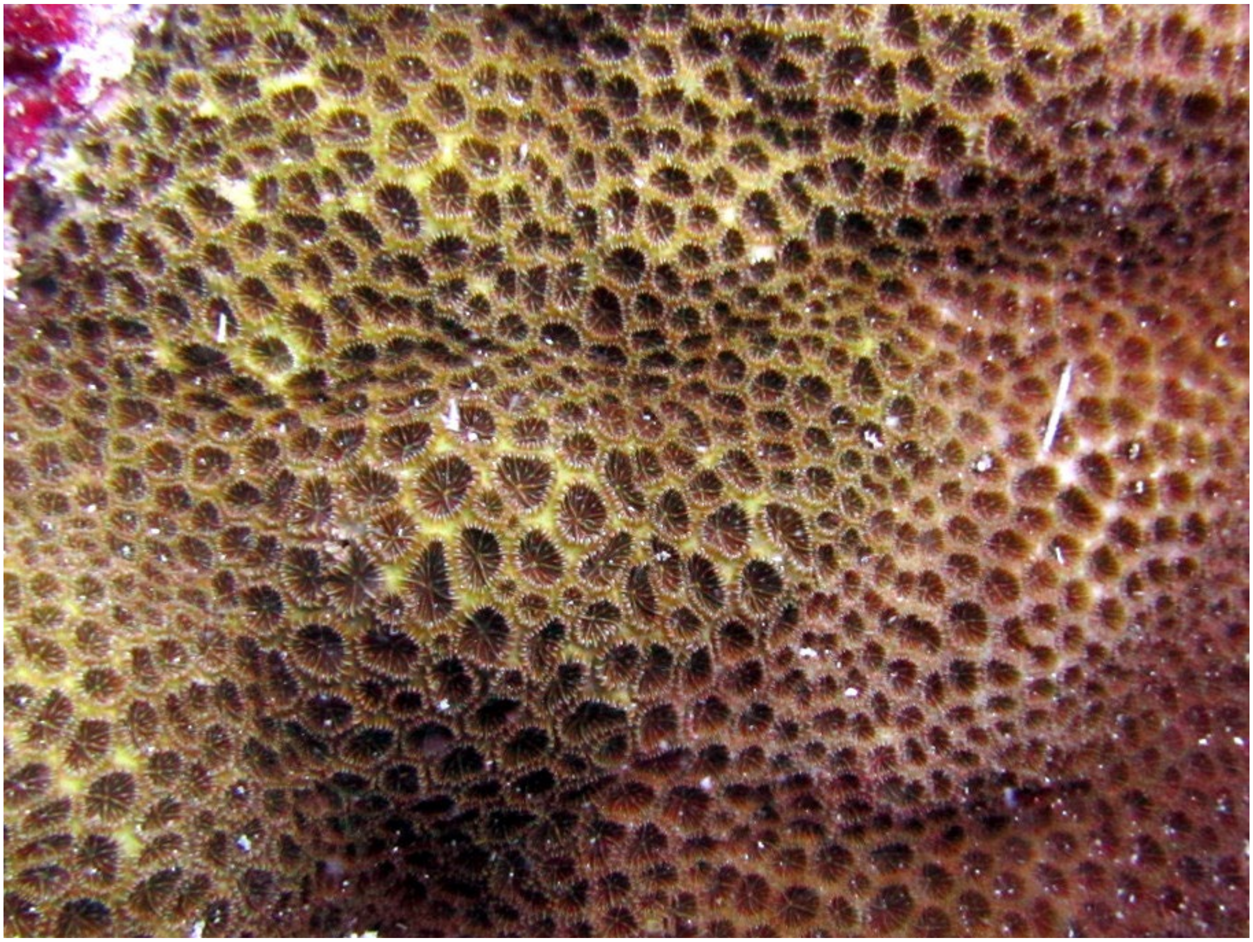
Colonies have small corallites that share common walls. Corallites can vary from about 3 mm diameter to at least 7 mm diameter. In some colonies corallites are close together with just a thin wall between them, and in others there is more space between them. Corallites are smaller than on *Favites*.

Leptastrea transversa

Colonies are encrusting and can be up to at least 50 cm diameter. Corallites are small, about 3-4 mm diameter, and relatively uniform in size. In most colonies, septa project slightly as tiny spines at the corallite rim. It looks like there is a groove between corallites, but it is just the lower space between the two rings to projecting septa edges that look like spines. Other species of *Leptastrea* do not have the apparent groove between corallites.



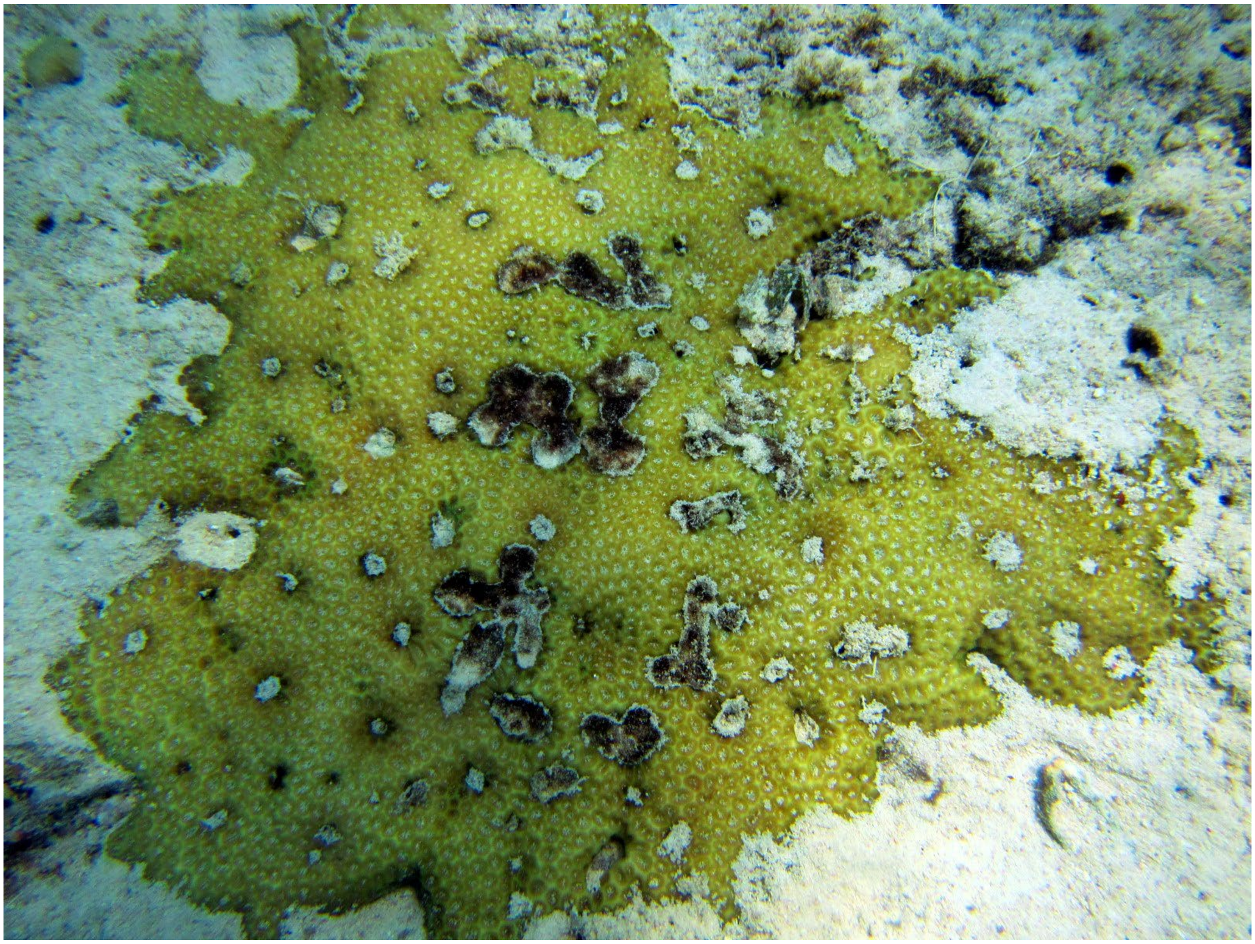
A photo of *Leptastrea transversa*.



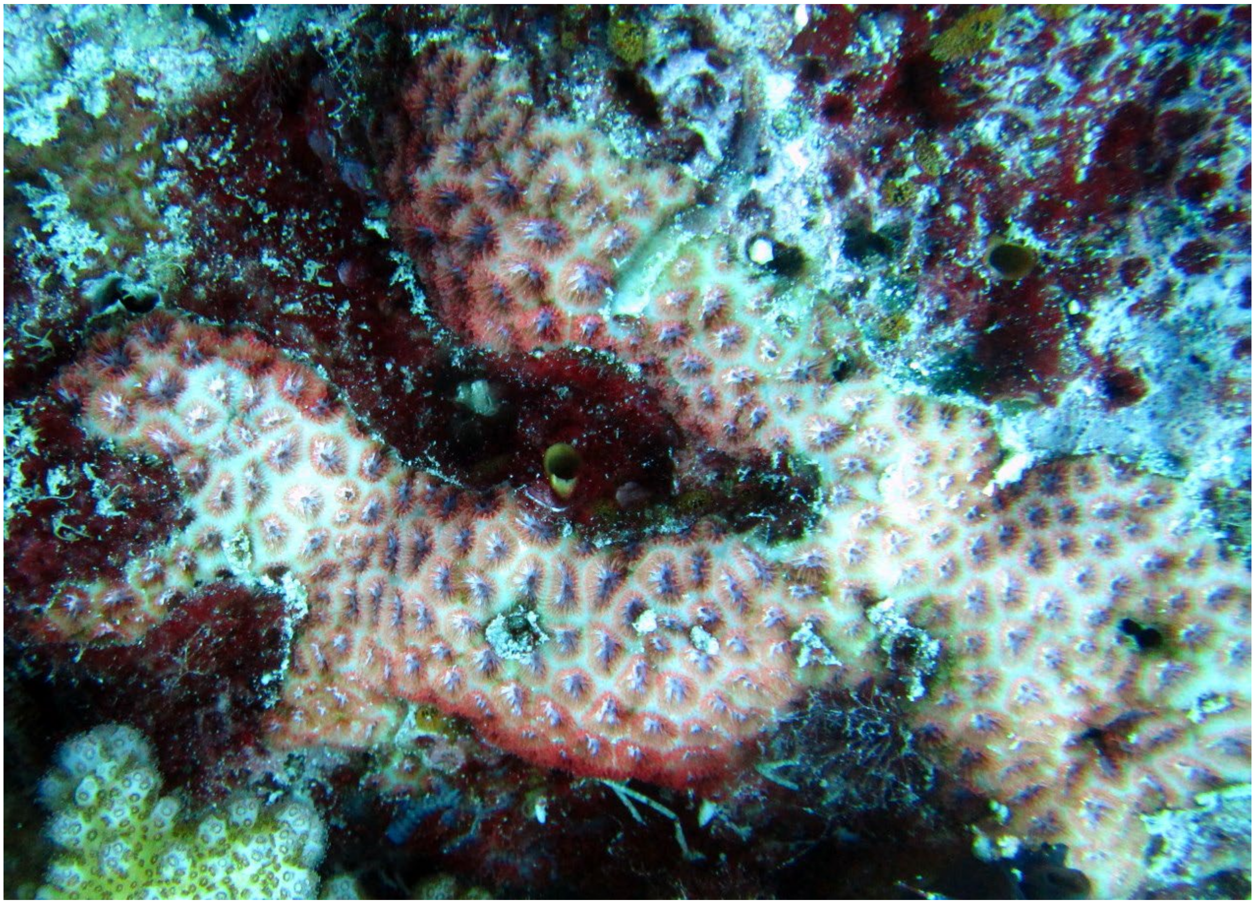
A close-up photo of *Leptastrea transversa*.

Leptastrea pruinosa

Colonies are encrusting, and while usually small they can get up to at least 30 or 40 cm diameter. The floors of the corallites of the corallites are usually a different color from outside the corallites, and they can be quite colorful. They are fleshier than other species but it is hard to see the flesh. Other species of *Leptastrea* usually do not have bright contrasting colors.



A photo of an unusually large colony of *Leptastrea pruinosa*.



A close-up photo of *Leptastrea pruinosa*.

A close-up photo of *Leptastrea pruinosa*.

Galaxea

Colonies are encrusting, massive, lumpy, or branching. Colonies have separate corallites that extend from the colony. The top ends of the septa extend as blades upwards from the inside edge of the corallites, often making colonies look very spiny. Corallites range in size from the size of a little finger down to about 2 mm diameter. *Favia* and similar genera do not have septa projecting as spines.

Galaxea fascicularis

Colonies are usually encrusting and up to about 10-15 cm diameter. Corallites are about the diameter of a little finger and often oval. The septa extending as blades make colonies look spiny. The corallites are larger than on most other species of encrusting *Galaxea*.

A photo of *Galaxea fascicularis*.

A photo of *Galaxea fascicularis*.

Galaxea paucisepta

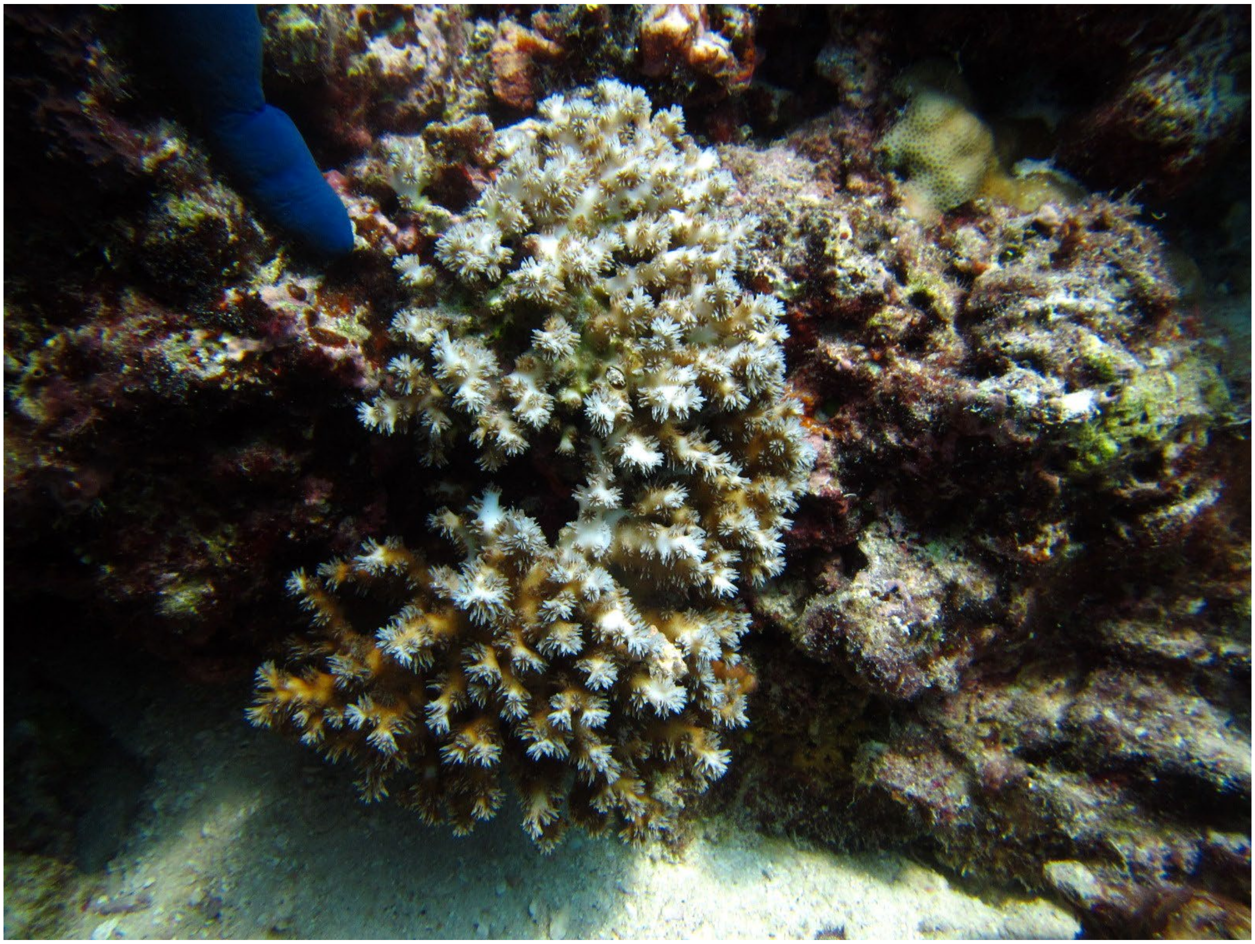
Colonies have very small corallites, only about 2 mm in diameter. The corallites have fewer septa than species with larger corallites, and the septa do not extend as far, making them look less spiny. This species has the smallest corallites of all *Galaxea* species.

A close photo of *Galaxea paucisepta*.

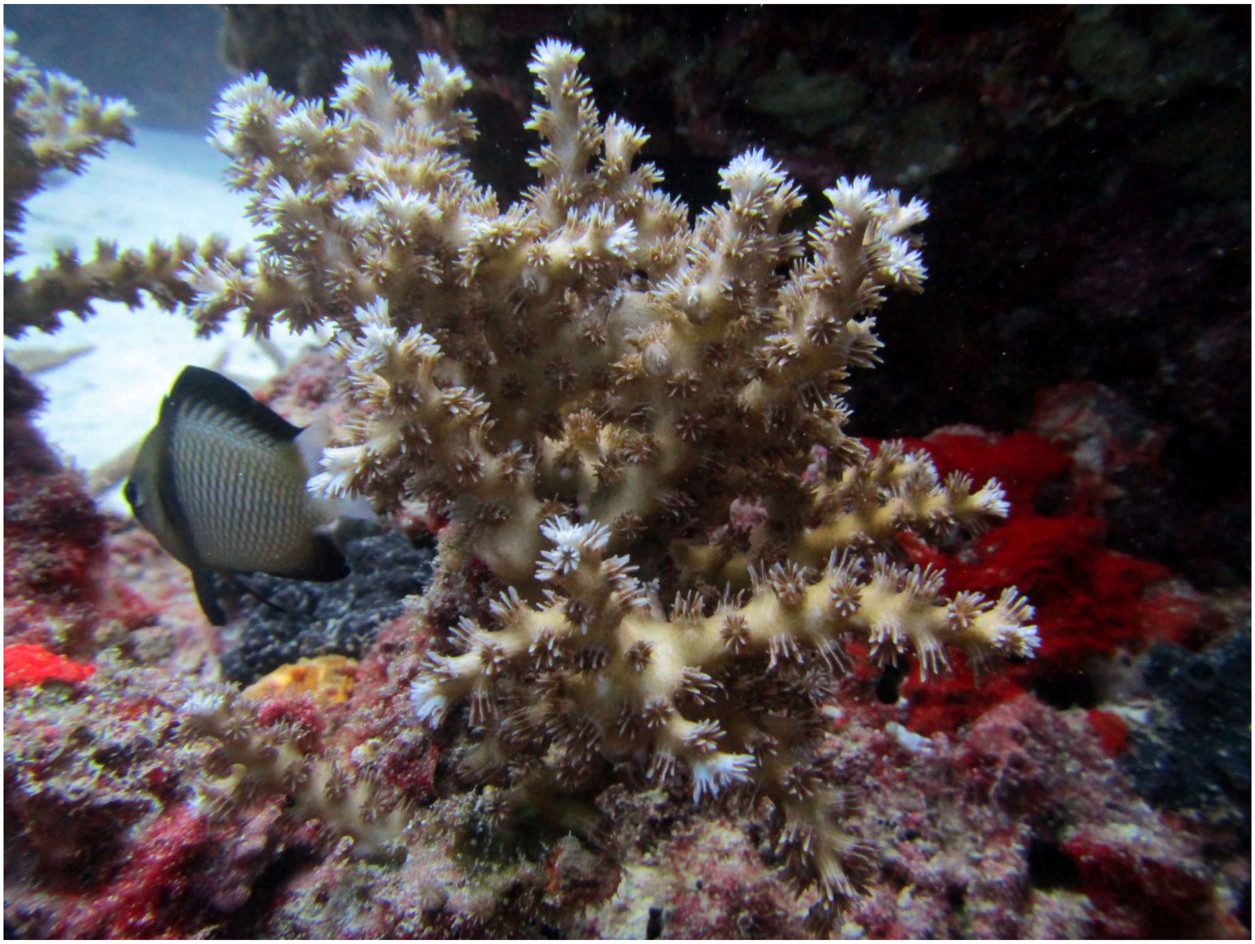
Galaxea horrescens

This species used to be called Acrhelia horrescens

Colonies are branching. Corallites may have space between them on branches. Corallites are moderate size, about 4 mm diameter. Colonies look very spiny even though the septa are only about as long as on *Galaxea fascicularis*. This is the only fully branching species of *Galaxea*.



A photo of *Galaxea horrescens*.



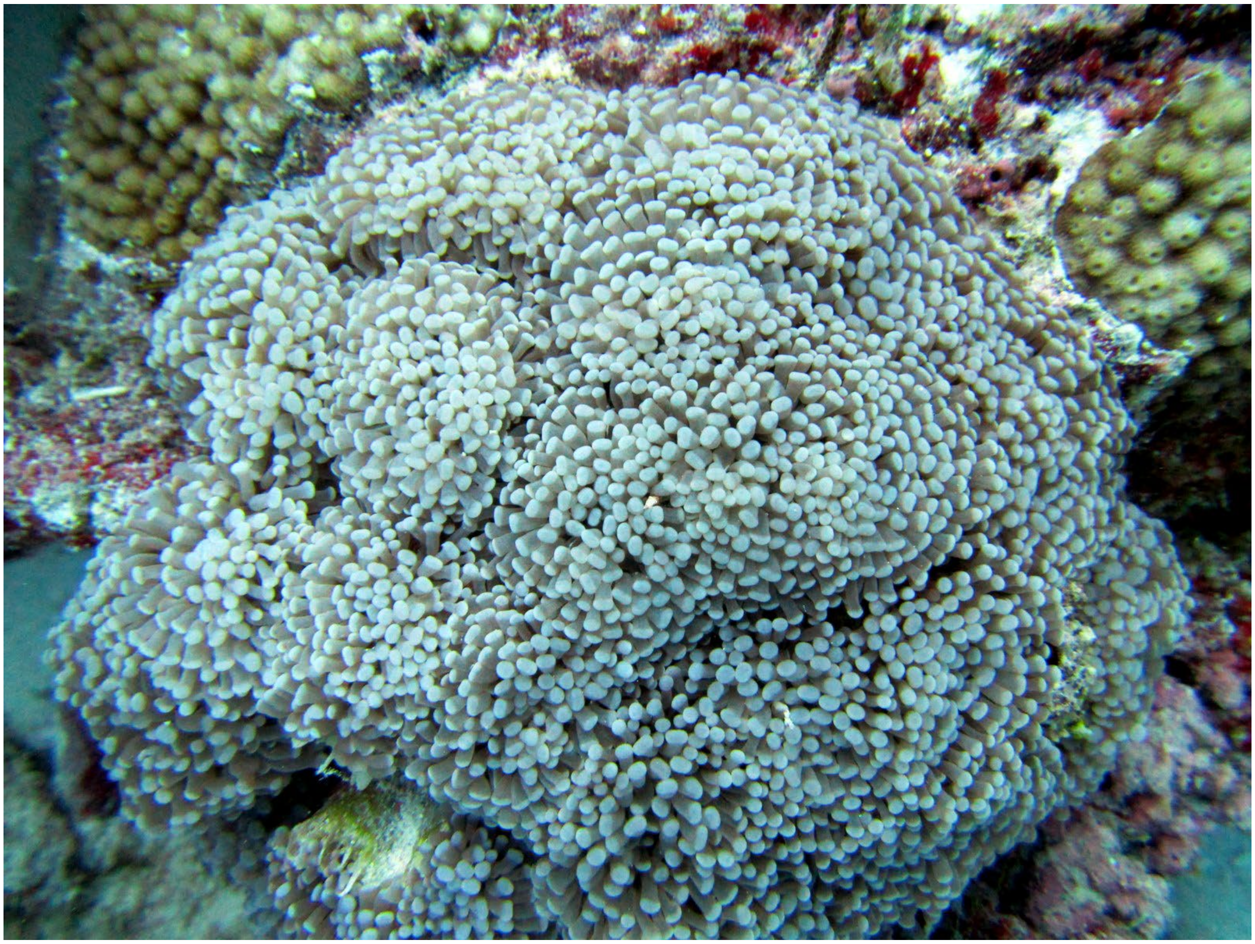
A photo of *Galaxea horrescens*.

Euphyllia

Colonies can be branching or “flabello-meandroid.” The latter shape is a thick, meandering wall, with polyps only on the upper edge of the wall. Colonies have very fleshy polyps, often with large tentacles extended. Polyps are only on the ends of branches or on the top edge of meandering walls. When the polyps are extended, the tissue covers the skeleton, making colonies look massive. Thus they could be said to be “sub-massive.” Often there is only living tissue on the ends of the branches not on the sides of branches. This is the only genus in which species distinctions are made based on both skeleton and tissue shapes. Species differ in the shapes of their tentacles. Some species look more like sea anemones than corals. *Heliopora* looks similar but the tentacles are larger, unbranched, and there is only one polyp. It is a fungiid that is not attached.

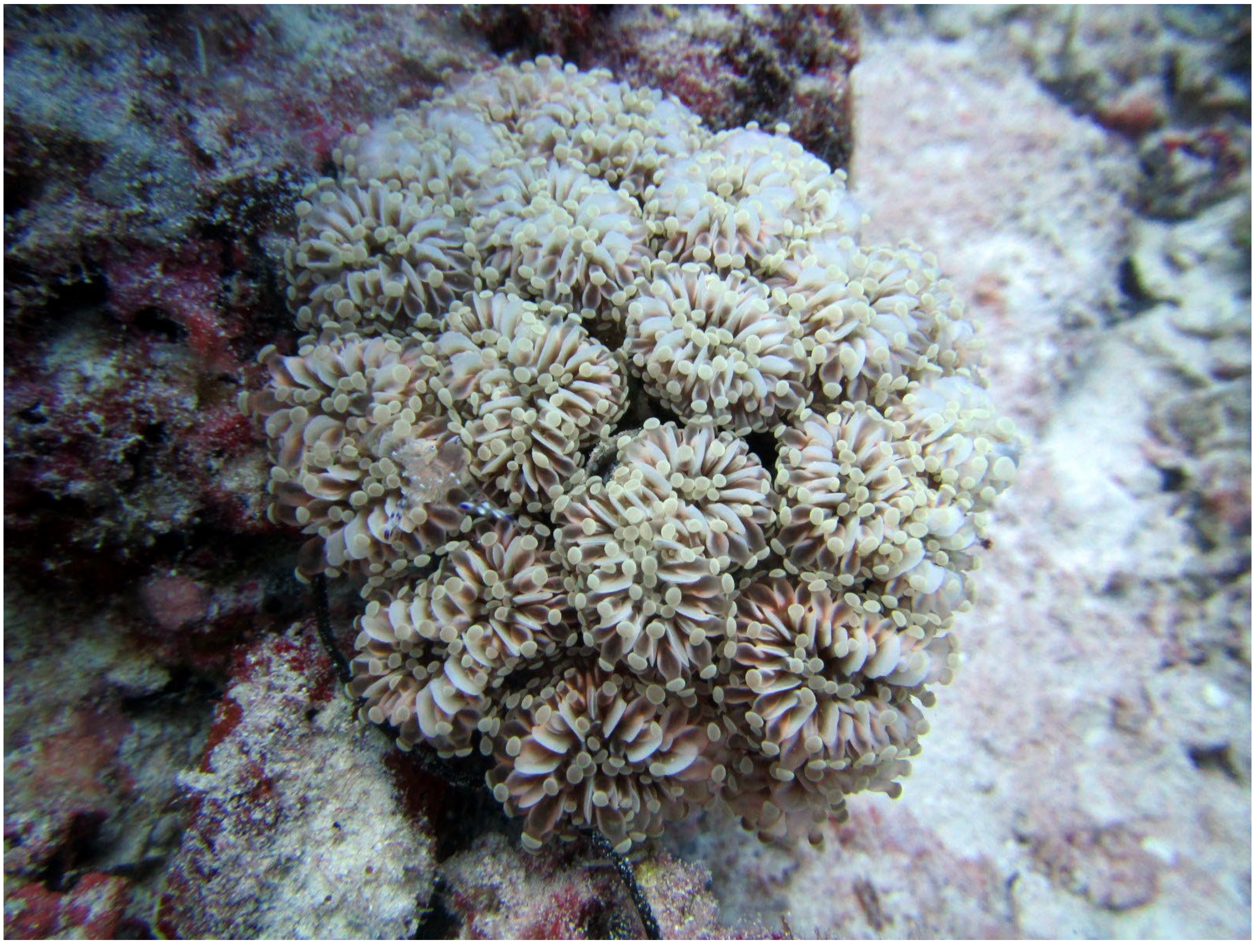
Euphyllia cristata

Colonies are small, usually less than 20 cm diameter, and branches are small, about 2 cm diameter. Branches are cylindrical and close enough together that a small finger usually does not fit between them. Tentacles can be extended enough that the colony shape looks massive, or retracted enough that the individual branch ends can be seen. When they are at least part way retracted, septa can be seen between them as the septa project slightly from the corallites. Branches can sometimes be detected by the arrangement of the tentacles. Tentacles do not branch or have semicircle ends; they look like simple anemone tentacles. Each tentacle has a tip that is colored white or another color. Branches, polyps, and tentacles are smaller than *Euphyllia glabrescens*, but the same shape. Branches, polyps and tentacles are larger than on *Euphyllia baliensis*. All other species of *Euphyllia* have different shapes of tentacles and/or skeleton. This species is rare most places and colonies are quite small. In Tonga they are the most abundant the author has ever seen, and many colonies are larger than elsewhere.



A photo of a relatively large colony of *Euphyllia cristata*. The arrangement of the tentacles provides hints to where the branches are.

A photo of a colony of *Euphyllia cristata* with tentacles retracted far enough so that septa can be seen.



A photo of *Euphyllia cristata* with tentacles retracted even farther, so that the corallites as well as septa can be seen.

A photo of *Euphyllia cristata* with orange tentacle tips.

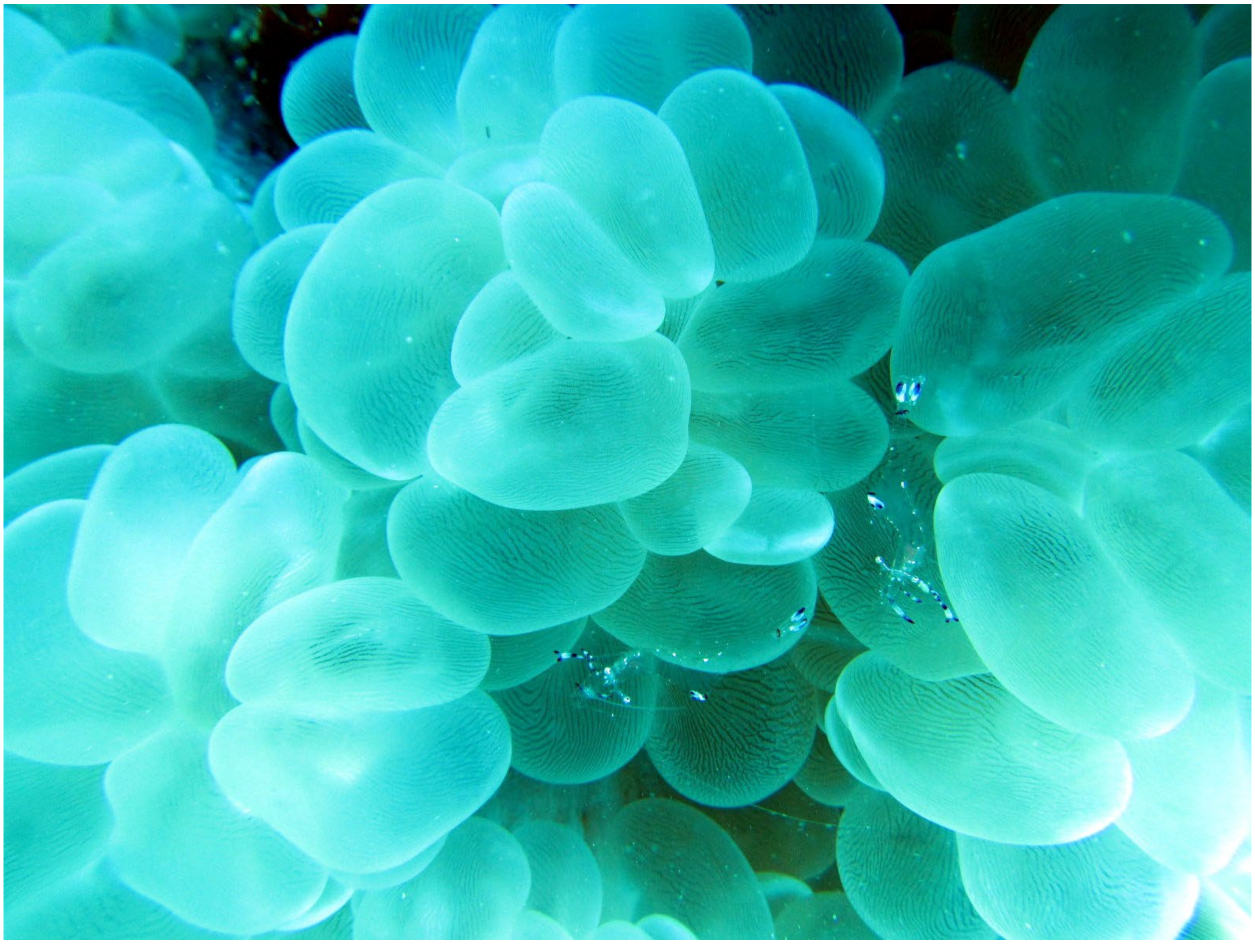
Plerogyra

Colonies are covered with large “bubbles” of expanded body wall, filled with water. The bubbles are the size of large grapes and often are oval. The bubbles are white. The skeleton cannot be seen but can be either massive or branching. When it is branching, there is tissue (bubbles) only on branch ends. *Physogyra* has much smaller bubbles.

Plerogyra sinuosa

Colonies are usually small but in some other places can reach at least a meter diameter. The bubbles form a continuous mass that covers all of the skeleton. *Plerogyra simplex* has branches and the bubbles are only on the ends of branches.

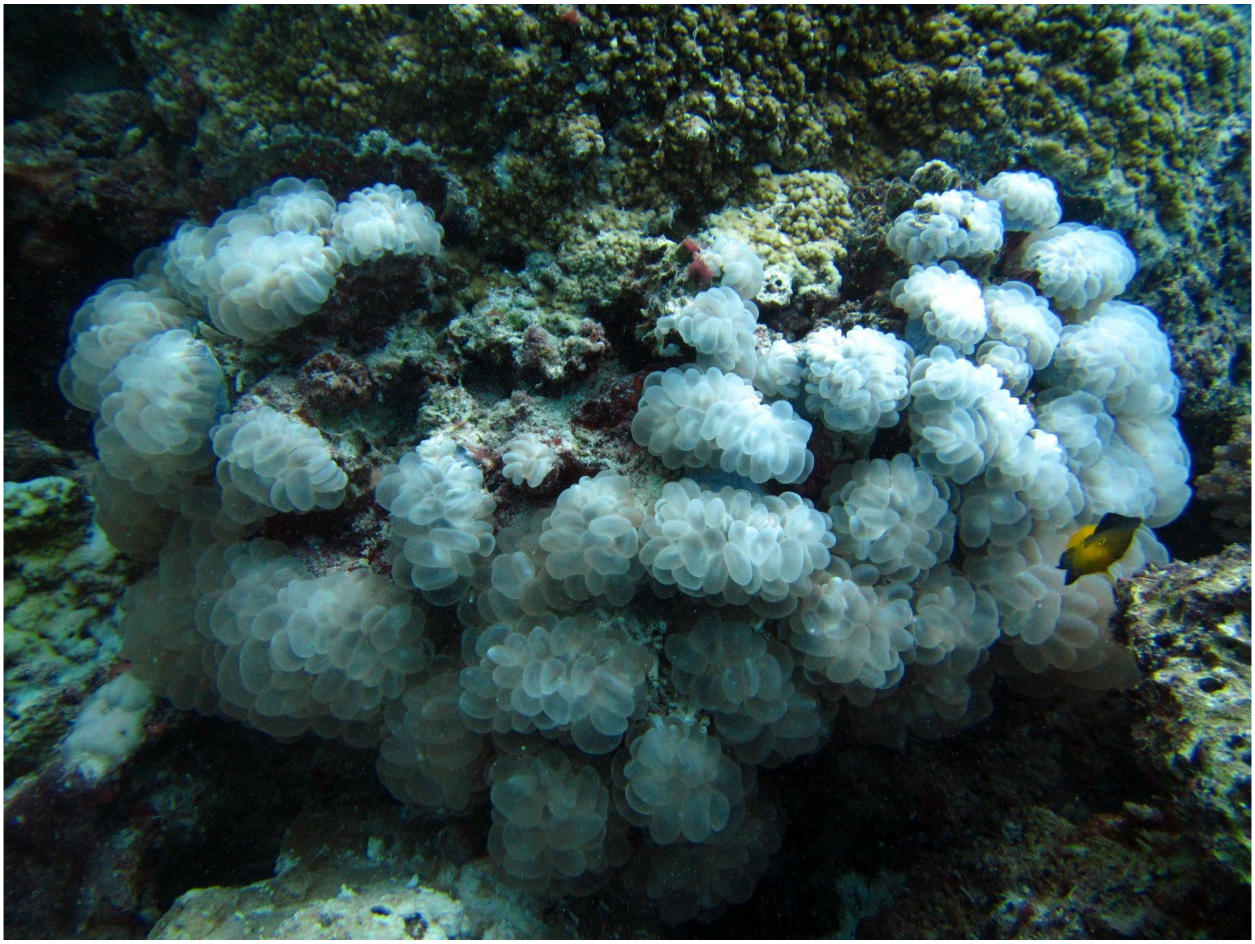
A photo of *Plerogyra sinuosa*.



A close-up photo of *Plerogyra sinuosa* with commensal *Periclimines* shrimp. Shrimp are rare on this coral, these are the first the author has seen.

Plerogyra simplex

Colonies are branching, with tissue only on the ends of the branches. Some colonies have very short branches, others have branches up to about 10 cm long. The white bubbles are usually the same size as on *Plerogyra sinuosa*, or somewhat smaller. *Plerogyra sinuosa* does not have branches and has a single continuous mass of bubbles.



A photo of a colony of *Plerogyra simplex*.

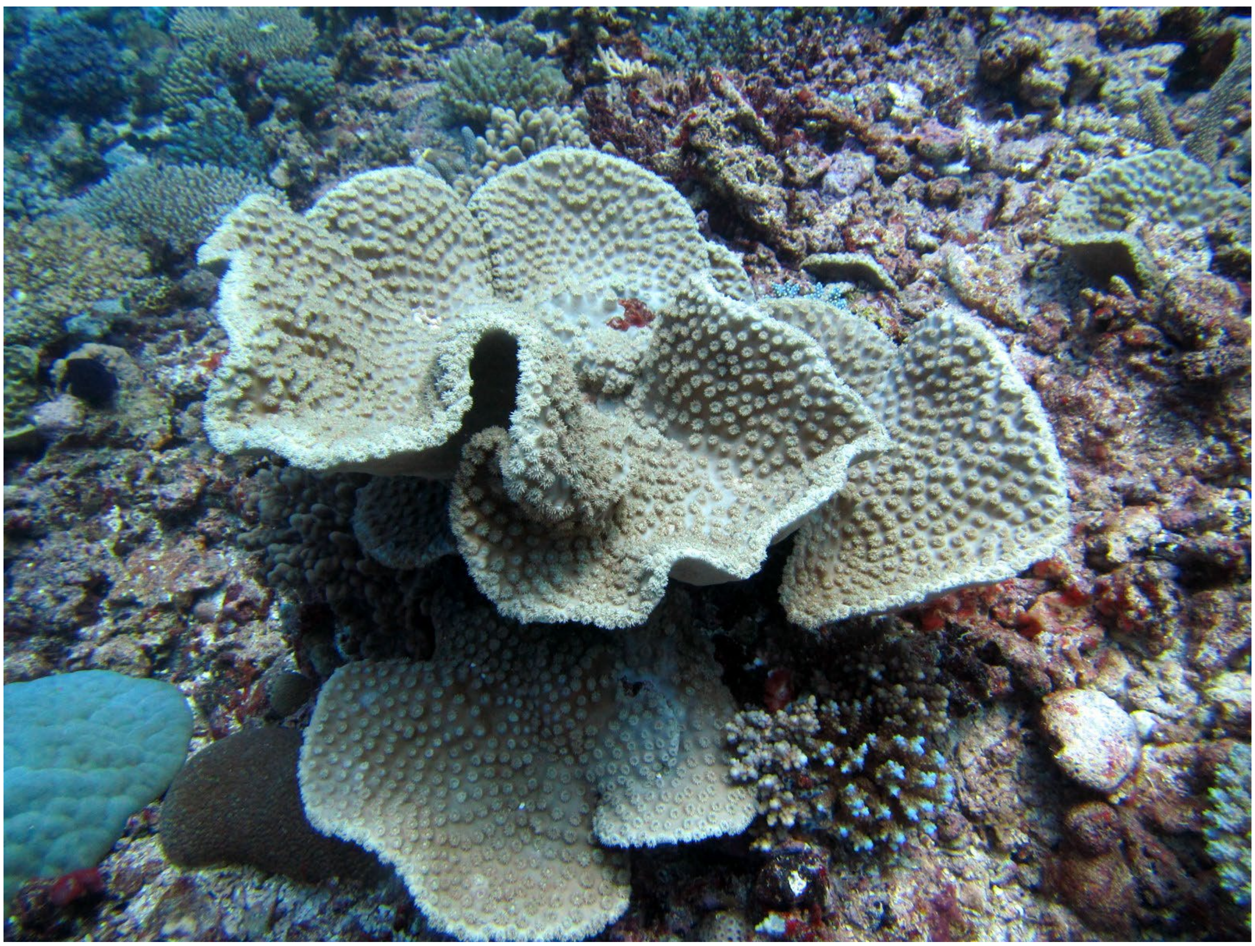
A close-up photo of *Plerogyra simplex*.

Turbinaria

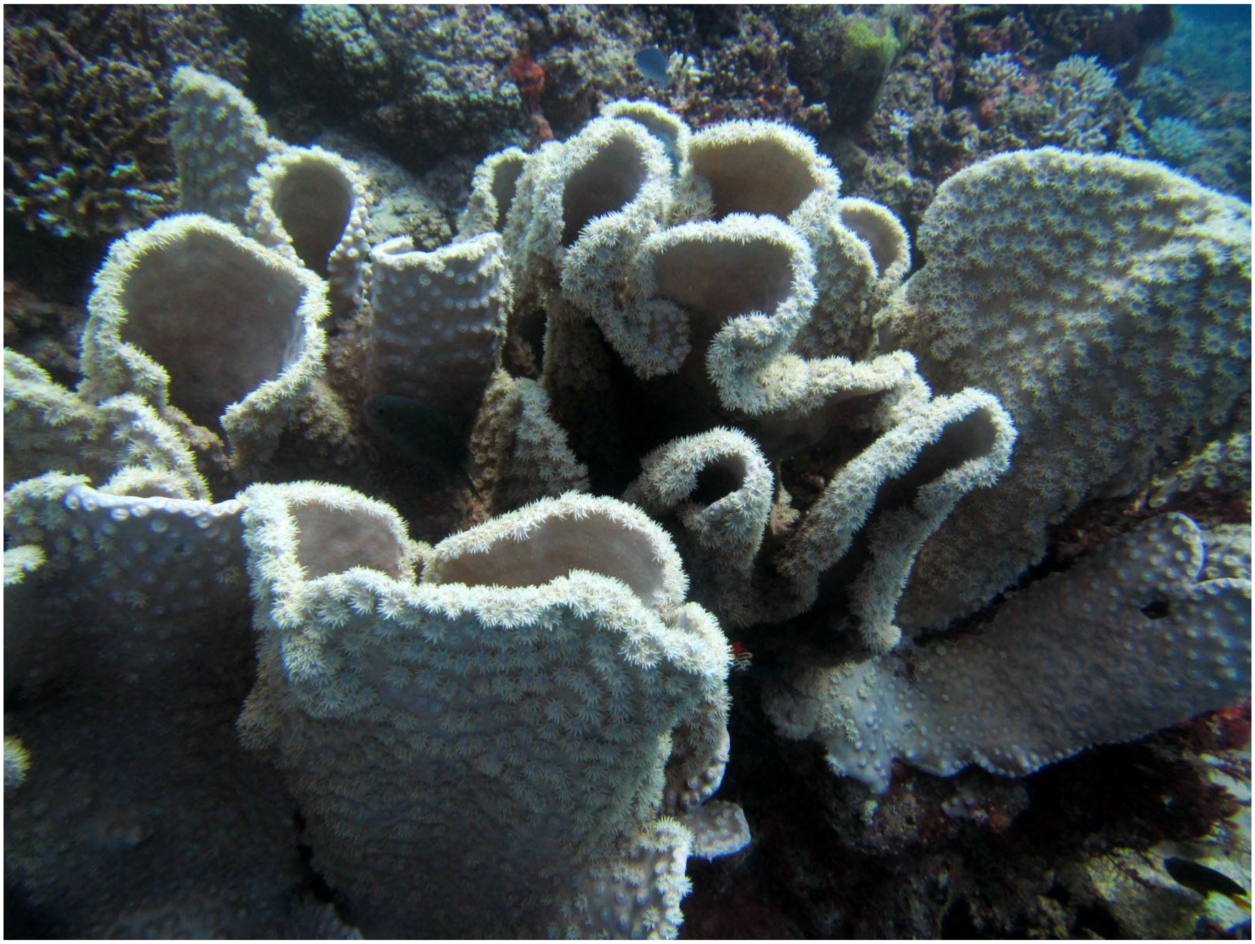
Colonies usually form plates but one species is encrusting and another is branching. Plates are usually thin, but are about 1 cm thick in one species. Corallites are on only one side of plates in most species, but on both sides of vertical plates in a couple species. Corallites vary in size between species, ranging from 3-4 mm in diameter in several species up to 1 cm diameter in one species. Corallites project in all but one species. The outer surfaces of corallites and the colony between corallites appear smooth. Tentacles are often extended, but not always. *Echinopora* is spinier and coralliites may be closer together.

Turbinaria peltata

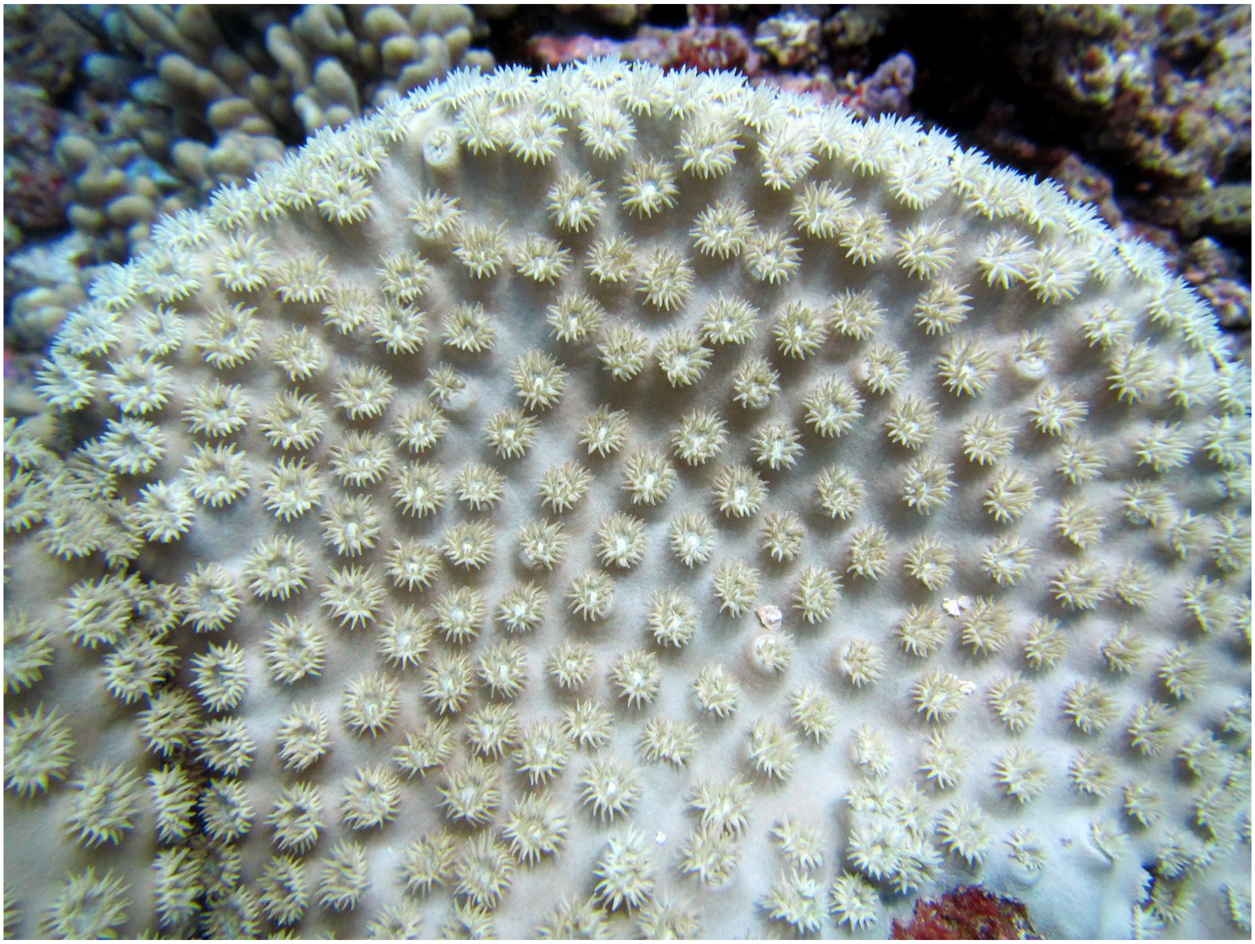
Colonies form thick plates that are often in a vase shape, but can be more folded. The plates are about 1 cm thick. Corallites are about 1 cm diameter and usually have their tentacles extended. Corallites have space between them and the surface of the coral appears smooth. Corallites are on only one side of the plates, the upper side. Plates are thicker and polyps larger than on any other *Turbinaria*.



A photo of a colony of *Turbinaria peltata*.



A photo of folded vertical plates of *Turbinaria peltata*.

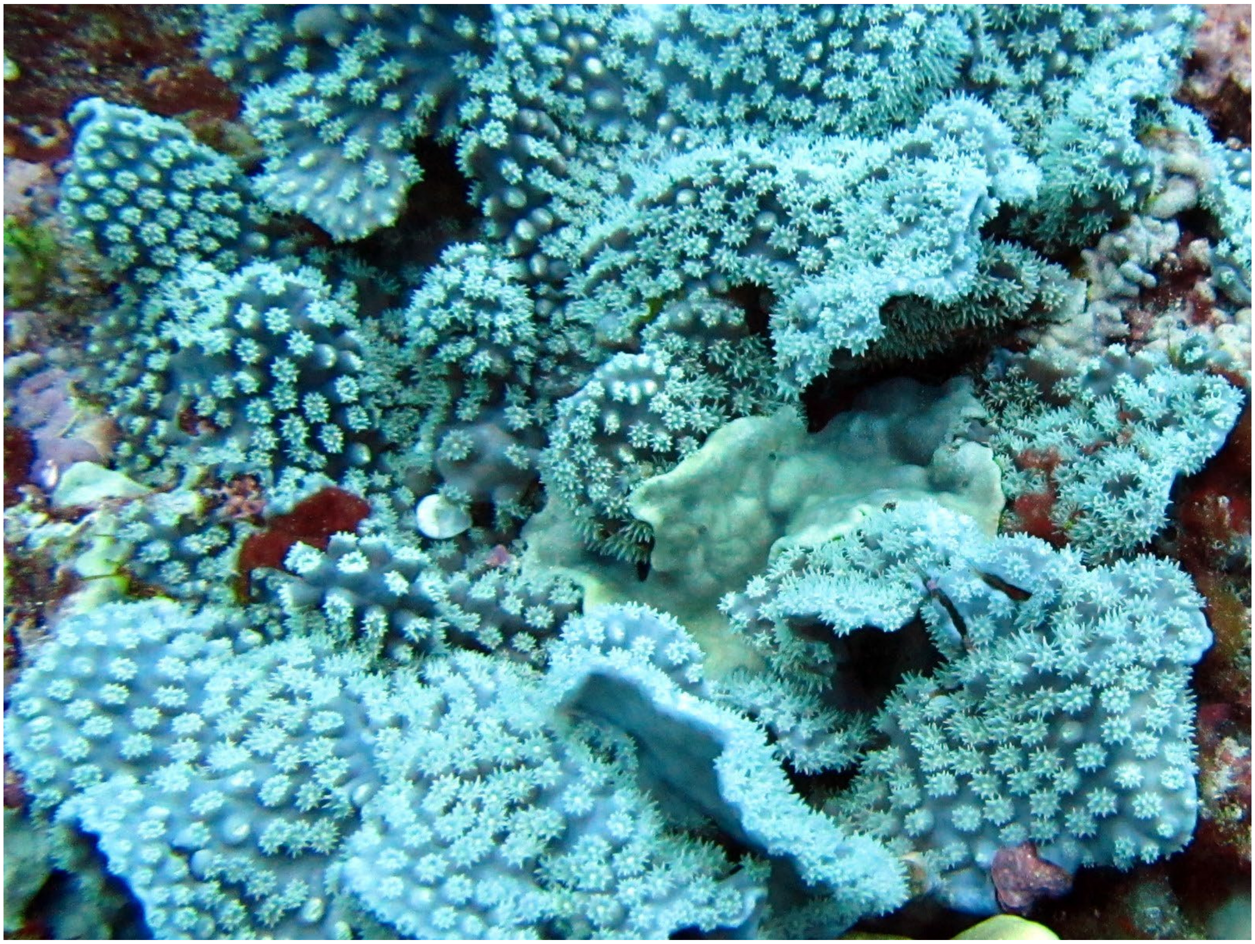


A close photo of *Turbinaria peltata* with polyps extended.

Turbinaria mesenterina

Colonies form thin plates that can be horizontal, vertical, or any angle in between. Plates are commonly large but can be small. Corallites are small, about 3 mm diameter, and project slightly. Tentacles are usually extended, but not always. The plates are thinner and the corallites much smaller than on *Turbinaria peltata*. *Turbinaria reniformis* is similar but always has some yellow coloration.

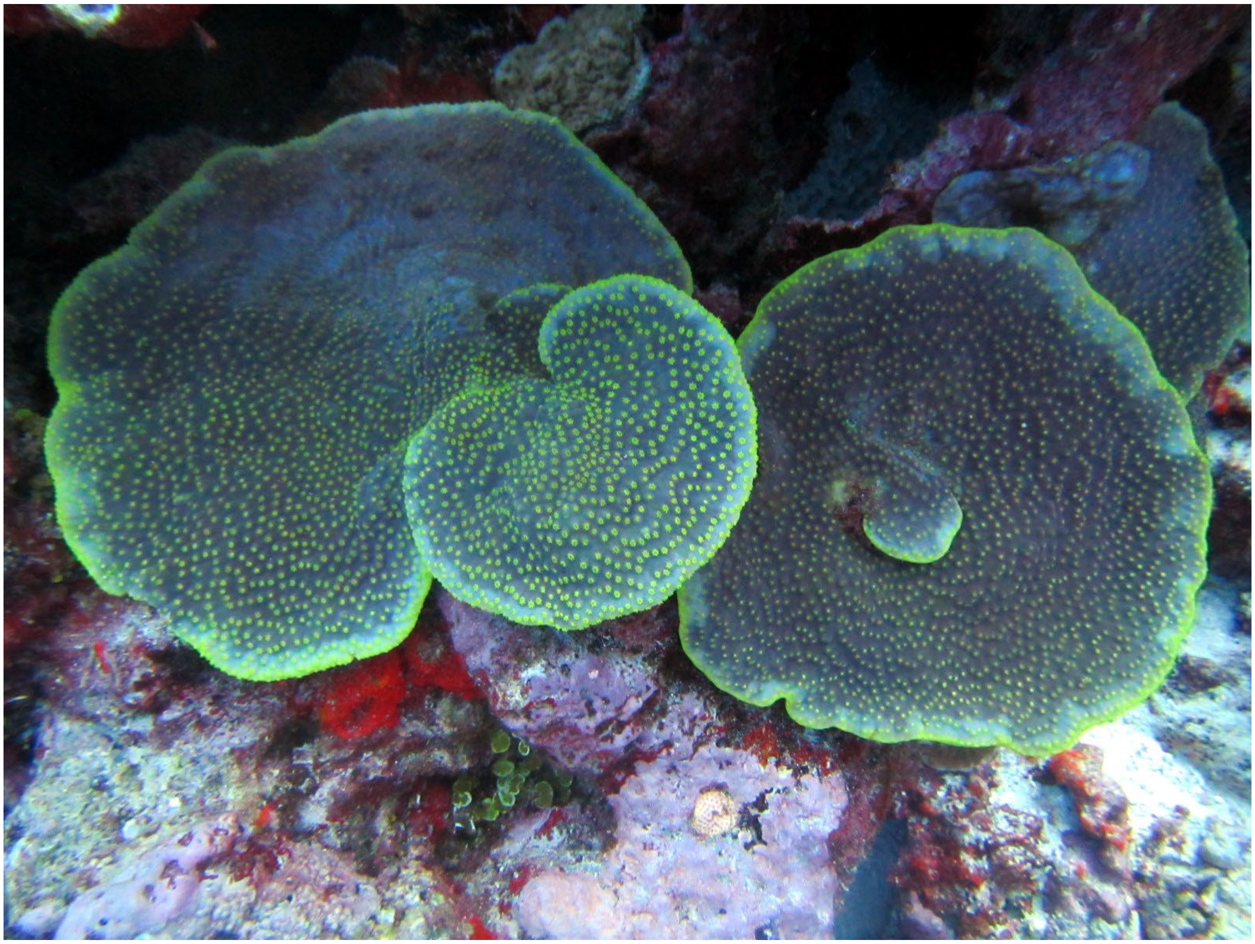
A photo of a colony of *Turbinaria mesenterina* with polyps extended. They yellow digitate colony at the bottom is a soft coral, *Lobophyton*.



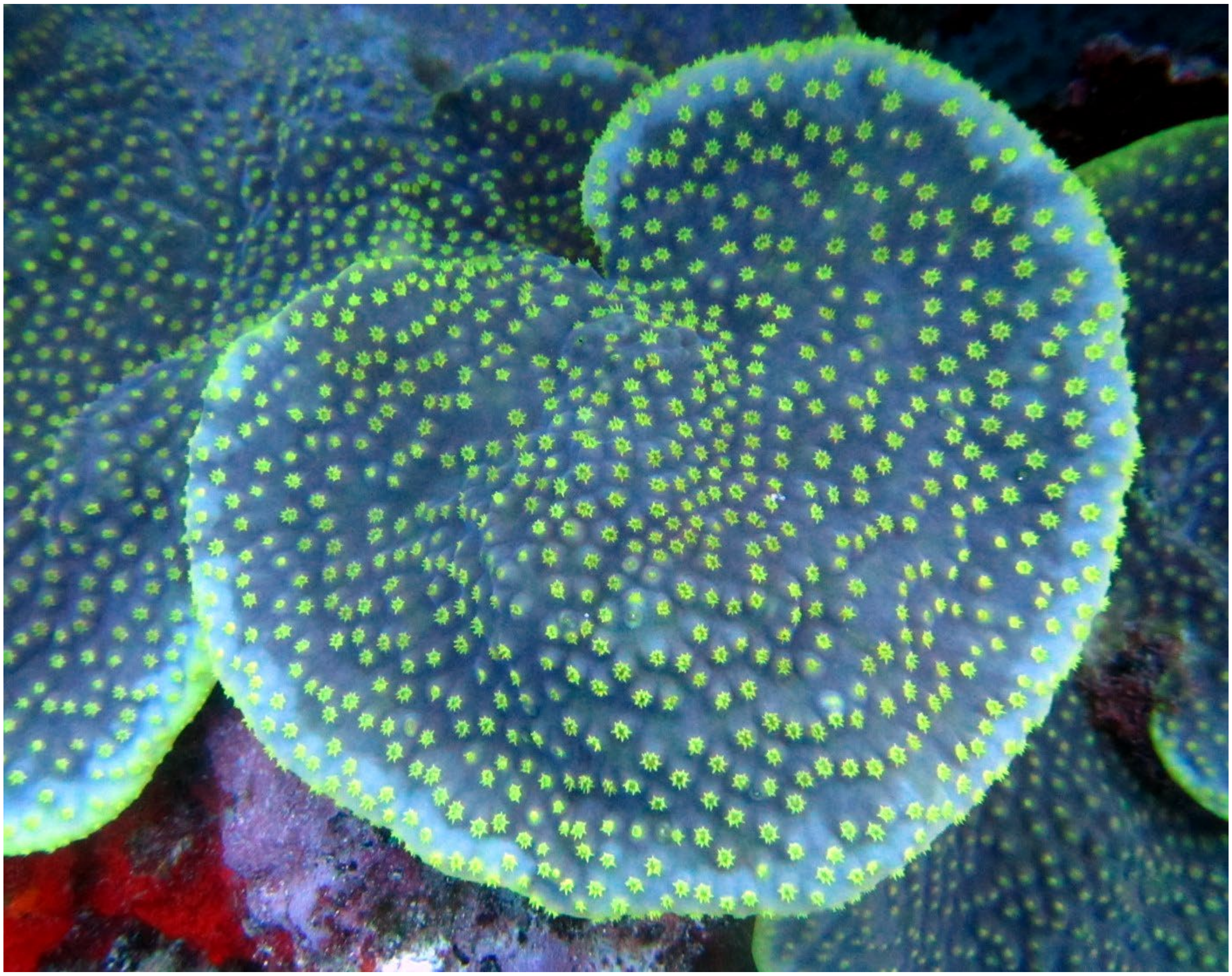
A close-up photo of *Turbinaria mesenterina*.

Turbinaria reniformis

Colonies form thin plates, with little corallites on only one side. Plates can be anywhere from horizontal to vertical and anything in between, commonly near 45 degree angles in whorls. Colonies can be solid yellow or just have yellow corallites and edges. *Turbinaria mesenterina* is almost identical, except it does not have yellow coloration.



A photo of *Turbinaria reniformis*, with yellow corallites and edges.



A close-up photo of *Turbinaria reniformis*.

Subclass Octocorallia or Alcyonaria

Octocorals have exactly eight tentacles, and each tentacle has small regular side branches called "pini". Some, called "soft corals," are very fleshy and can form at least some external skeleton below them that is solid, without corallites. Some (gorgonians) do not form calcium skeletons. The octocorals include all of the soft corals, gorgonians, and sea pens, plus a couple of hard corals, *Heliopora* and *Tubipora*. Both of these have the zooxanthellae single-cell algae in their cells just like the Scleractinia. Many soft corals and gorgonia also have zooxanthellae, but many others do not. *Heliopora* and *Tubipora* do form skeletons of calcium carbonate (aragonite) with a thin tissue layer over them, much like Scleractinia. Soft corals are much fleshier than Scleractinia, but some do produce hard calcium underneath their tissues. They produce tiny knobs of calcium carbonate (aragonite) called "sclerites" in their tissues and move them down slowly and then extrude them beneath them and glue them to what is already there. Many species thus build an undulating smooth platform beneath them, which is as hard as the skeleton of Scleractinia. One species of *Sinularia* builds it in the shape of thick branches that can be up to at least 2 meters tall, and there are a few places in reefs where the reef is made more of this material (called "spiculite") than skeletons of Scleractinia. Most gorgonians are branching and have a flexible rod in the center of the branch under the thin layer of tissue.

Order Alcyonacea

Soft corals, gorgonians, and organ pipe coral

The Stolonifera Group

Family Tubiporidae

This family has only one genus:

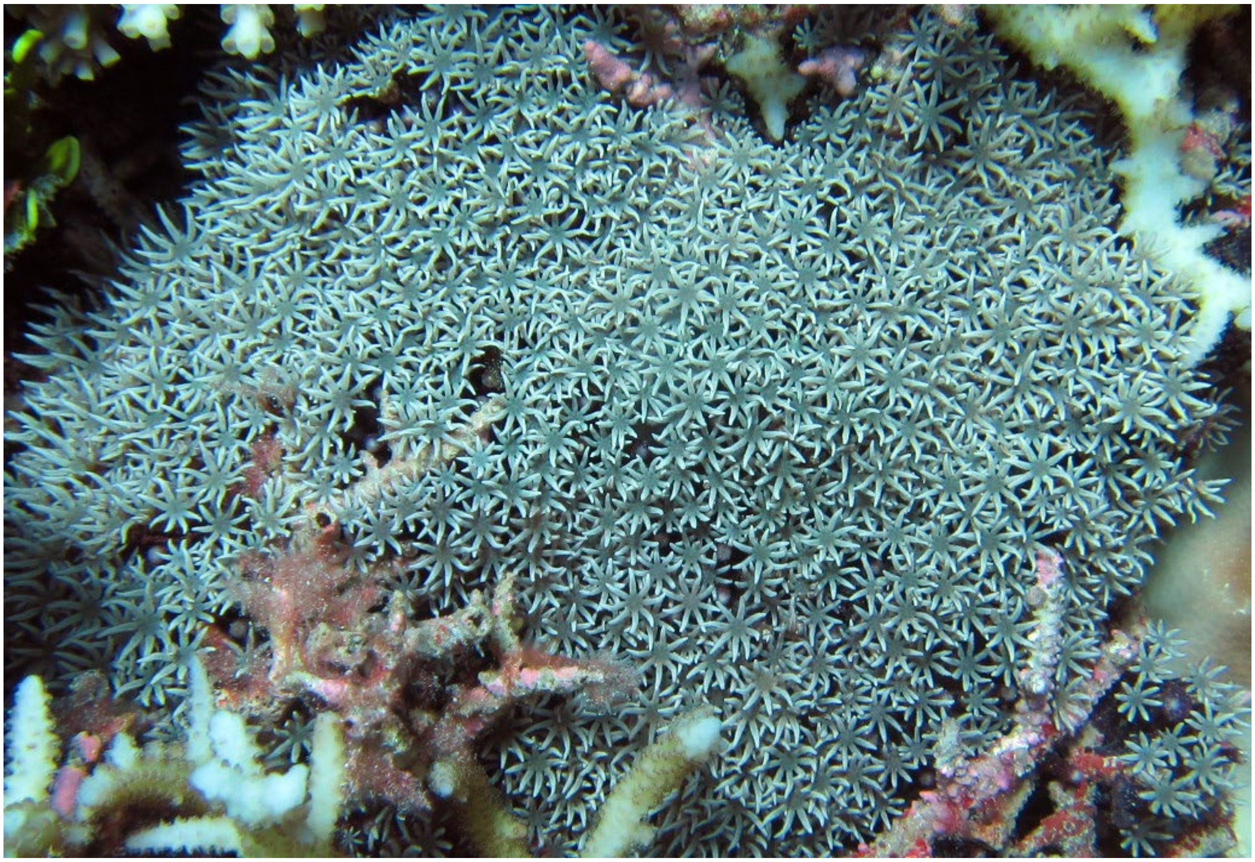
Tubipora

"Organ Pipe Coral"

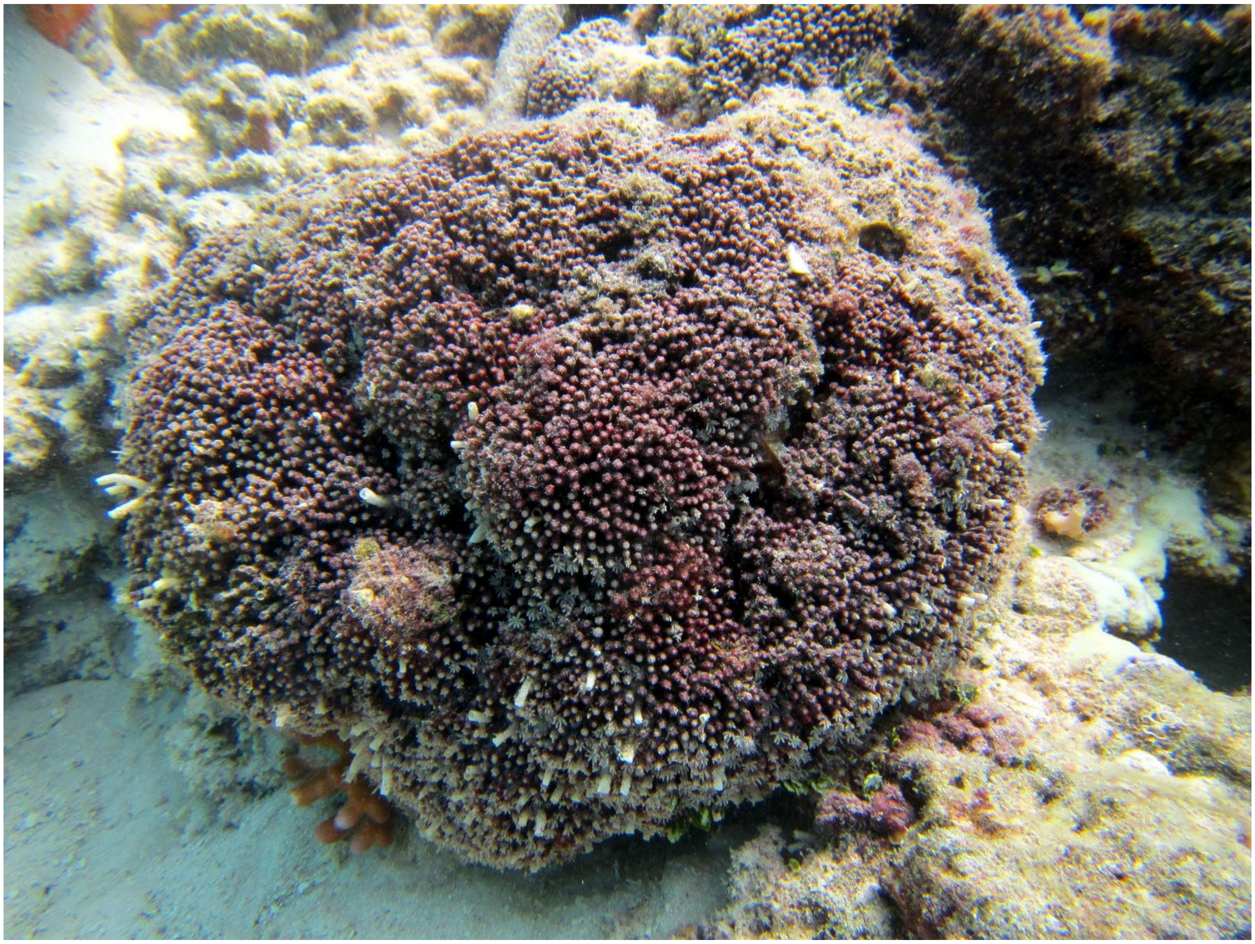
Only one species is known in this genus, so the properties of the genus are those of the species. *Clavularia* has somewhat similar looking polyps, but they are larger and it does not have a hard skeleton.

Tubipora musica

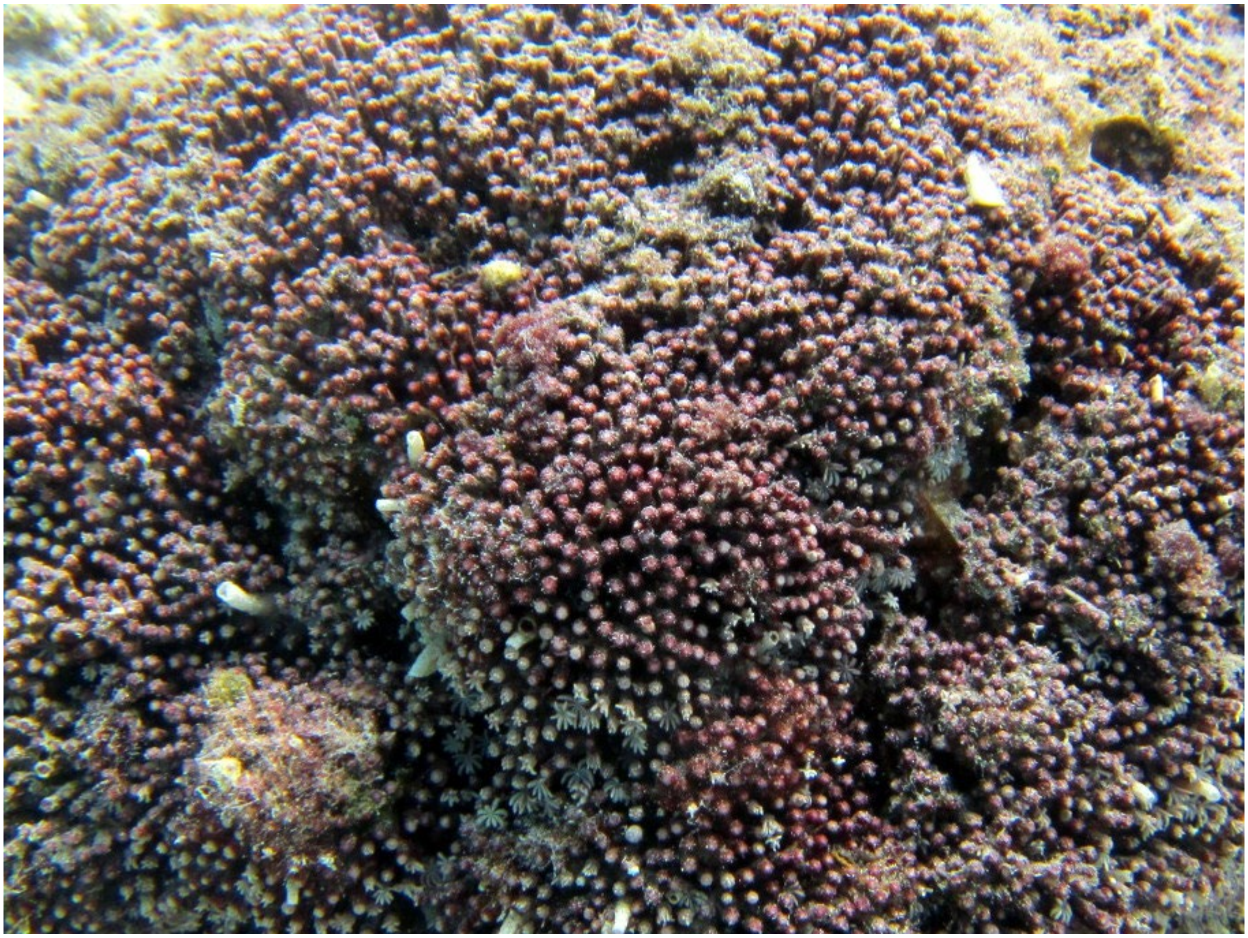
Colonies have an external calcium skeleton which is built by the tissue secreting tiny calcium “sclerites” in their tissue, then moving the sclerites down and adding them to the external skeleton. The skeleton is a deep red and consists of small vertical tubes each one of which has one polyp in the top end, and thin horizontal plates that connect the tubes together. The polyps are usually extended during the day, though they can be contracted. The tentacles are small and have tiny side branches. When contracted, each polyp is a small smooth round bump at the top of its tube.



A close-up photo of *Tubipora musica* with the polyps extended. Photo from the Marshall Is.



A photo of *Tubipora musica* with its tentacles retracted.



A close-up photo of a colony of *Tubipora musica* with its polyps contracted. In the lower center of the photo a few polyps are extended aa little sets of light green tentacles.

Subphylum Medusozoa

These have alternating polyps and medusae**.**

Class Hydrozoa

Class Hydrozoa contains hydroids, some small jellyfish, and several genera that produce hard skeletons, including the last three genera. All hydrozoans alternate generations between small polyps which asexually produce medusa (jellyfish), which in turn produce eggs and sperm which when fertilized grow into polyps. In some hydrozoa the polyp stage is obvious and the medusa stage less so and in others it is the other way around. The stage that produces the skeletons we see in the next three genera are all colonial polyp stages and produce tiny medusa (about 1 mm diameter or less) that then release eggs and sperm.

Order Hydrocorallina "hydrocorals"

This order contains the colonial polyp colonies that produce calcium carbonate (aragonite) skeletons, suborders Milleporina and Stylasterina. One genus (*Millepora*) is zooxanthellate and a common contributor to coral reefs, and several genera are azooxanthellate, only two of which are on coral reefs (*Distichopora* and *Stylaster*).

Suborder Milleporina

This suborder has only one family:

Family Milleporidae "Fire Corals"

This family has only one genus:

Millepora *"Fire corals"*

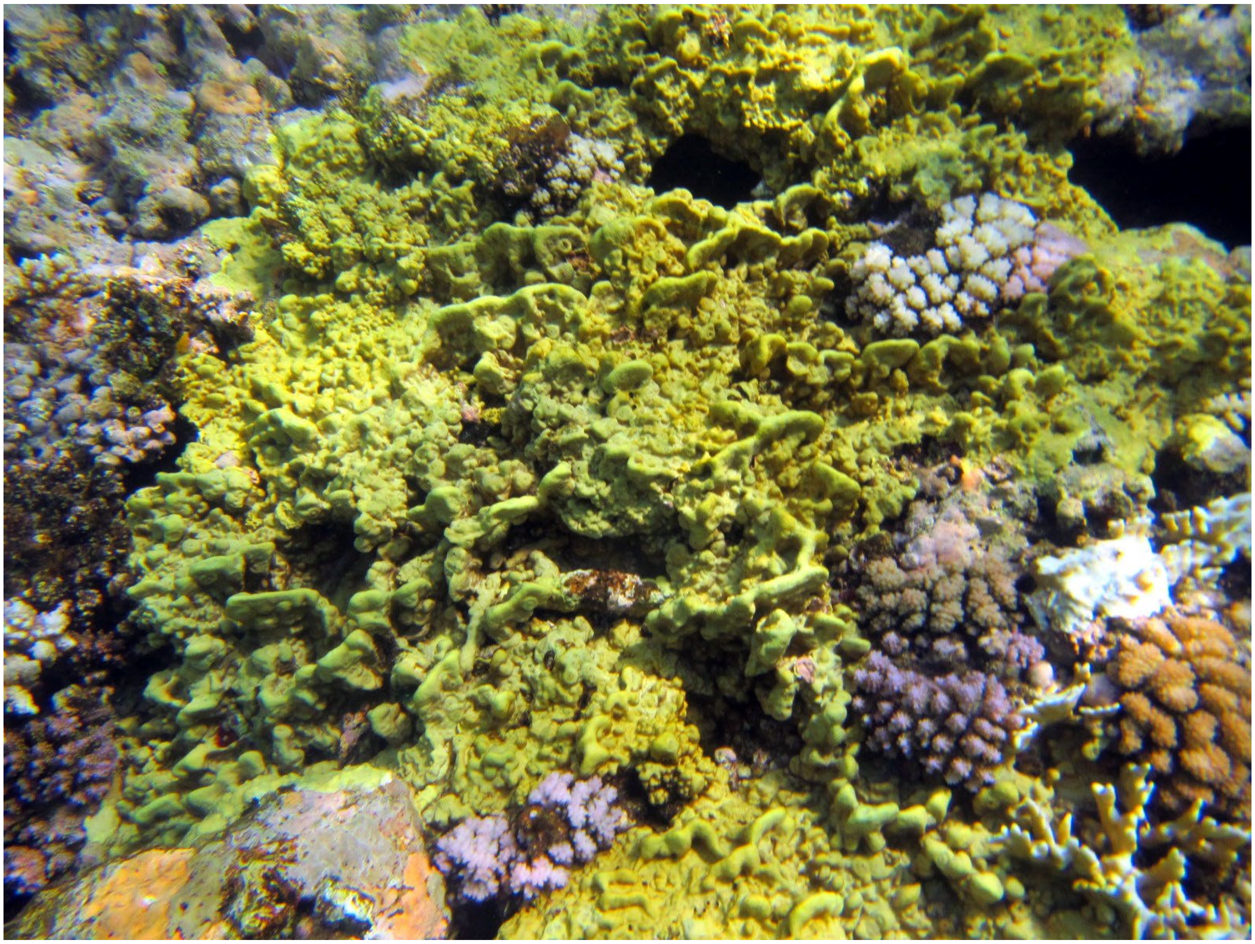
This genus produces a hard skeleton. The living tissue forms tiny, hair-like polyps that sit in tiny pores in the skeleton. The word "millepora" means "thousands of pores" in Latin, which is what the skeleton has, one for each polyp. There are long thin polyps with no mouths for stinging, and short thicker polyps with tiny mouths for eating. *Millepora* species all have the zooxanthellae single-cell algae in their cells and they are found in the light. They evolved the symbiotic relationship with the algae independently of the Scleractinia.

Millepora species are fairly fast growing. Branching species are also some of the most sensitive to mass coral bleaching.

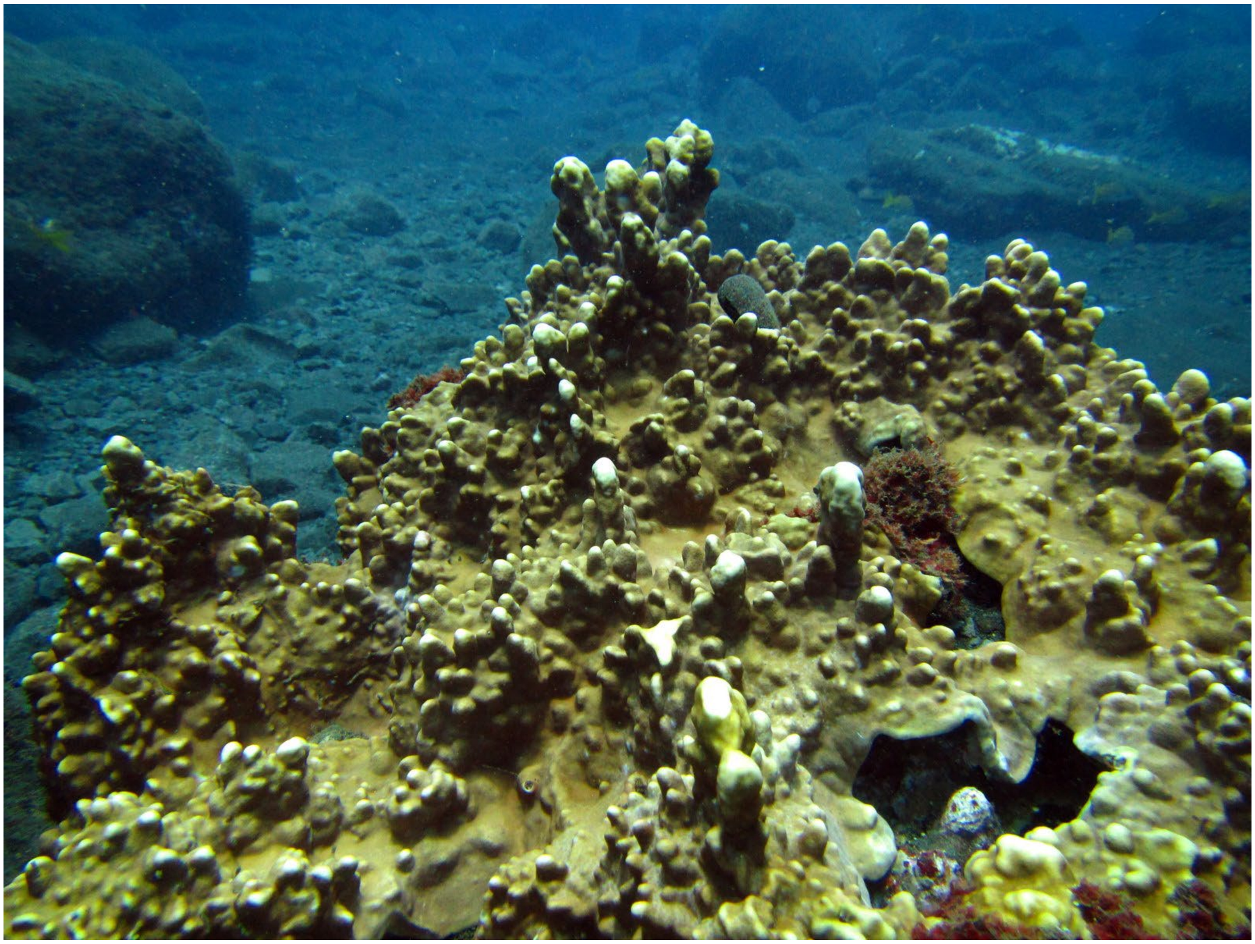
Millepora can be encrusting, encrusting base with vertical paddles, or branching. Surfaces may be smooth or bumpy. Colony shapes are highly variable. It is most often yellow or brown, but can be light green, pink, or dark reddish-purple. They have zooxanthellae and are found in light. Touching it with anything but your finger tips will likely give a sting, and it is the only coral that can sting humans. The stings are a brief burning sensation but not serious. They are called "fire corals" because of their sting. Other hydrozoans like the feathery hydroids can sting as well, but they do not have skeleton. The smooth yellow-brown colonies are distinct, and no other hard coral can sting humans.

Millepora platyphylla

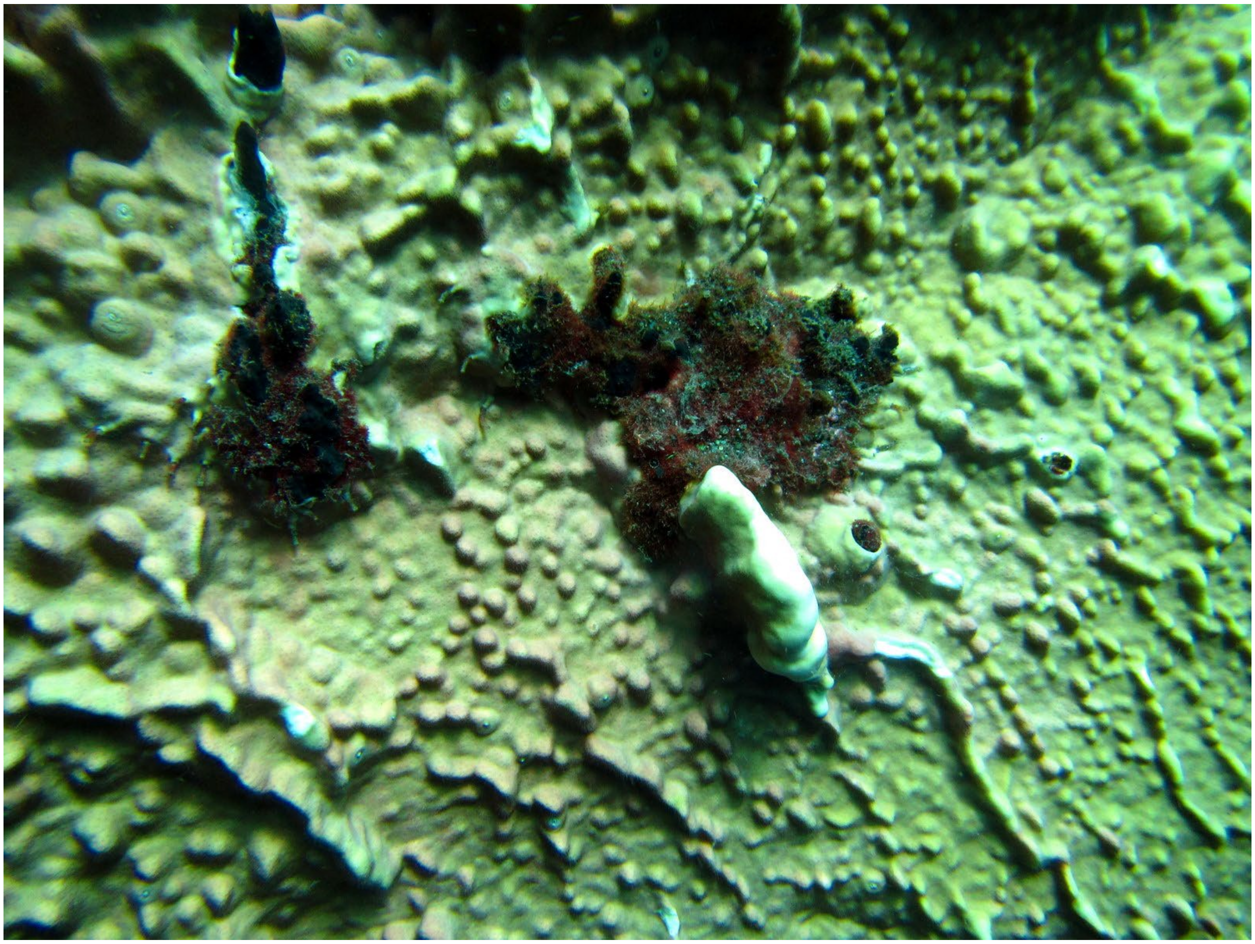
Colonies form encrusting sheets which commonly have ridges, plates, paddles or rarely columns growing up from them. Surfaces can have small rounded bumps. *Millepora exaesa* is encrusting and has bumps but no larger structures projecting. It also usually has small colonies and often encrusts rubble. *Millepora tuberosa* is encrusting but purple.



A photo of *Millepora platyphylla*, showing an encrusting base with some flattened upgrowths.



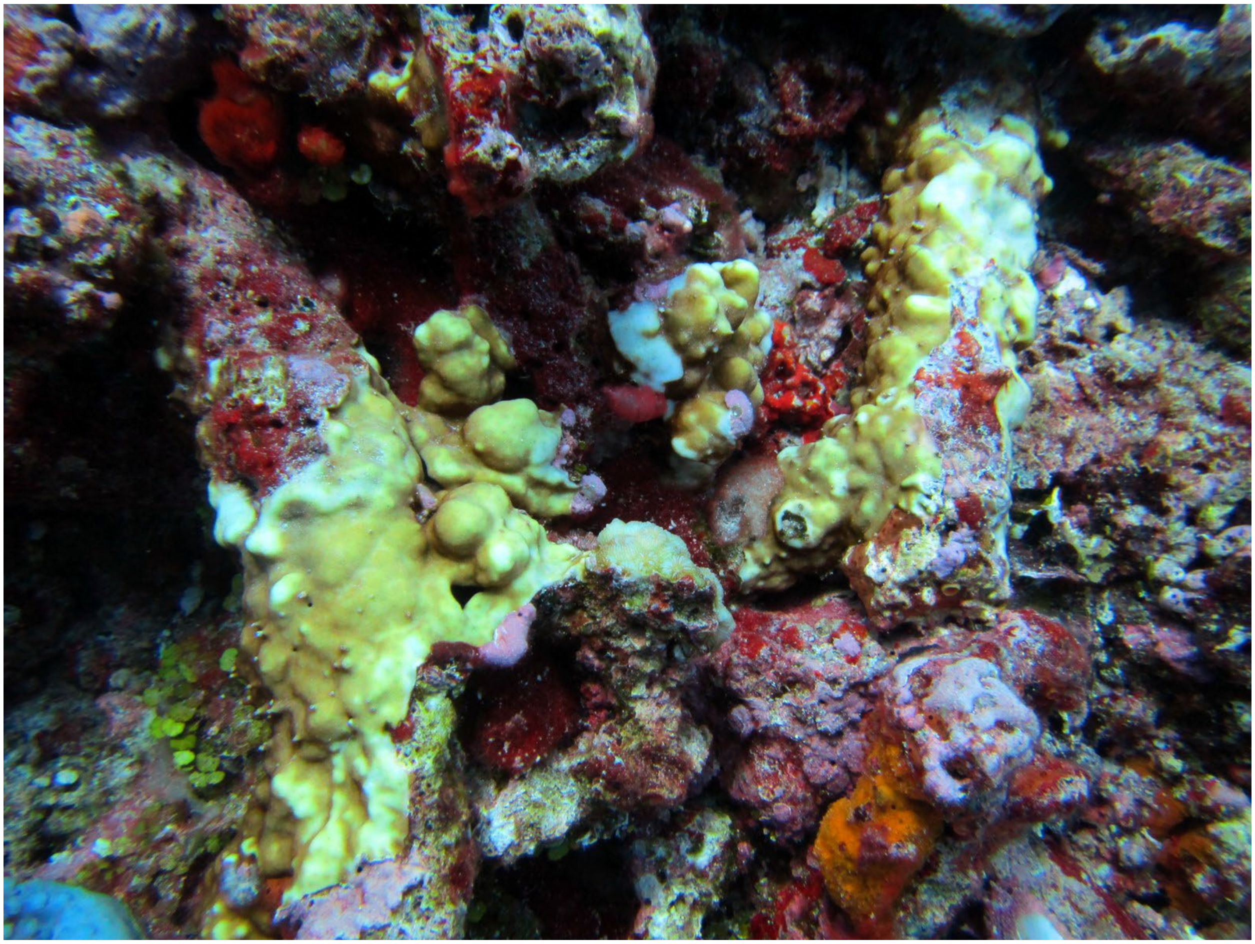
A photo of *Millepora platyphylla* with knobby upgrowths.



A closer photo of *Millepora platyphylla* showing rows of bumps and one short paddle.

Millepora exaesa

Colonies are relatively small and encrusting, often with knobs on them. Colonies are yellow, may have some spots, and can have tints of pink and/or green on parts of the colony. In some places it mostly encrusts rubble. It is most common in shallow water. *Millepora tuberosa* can grow larger colonies, is purple, has bumps that are usually smaller, does not encrust rubble and is most common on reef slopes. *Millepora platyphylla* often or usually has larger upgrowths.

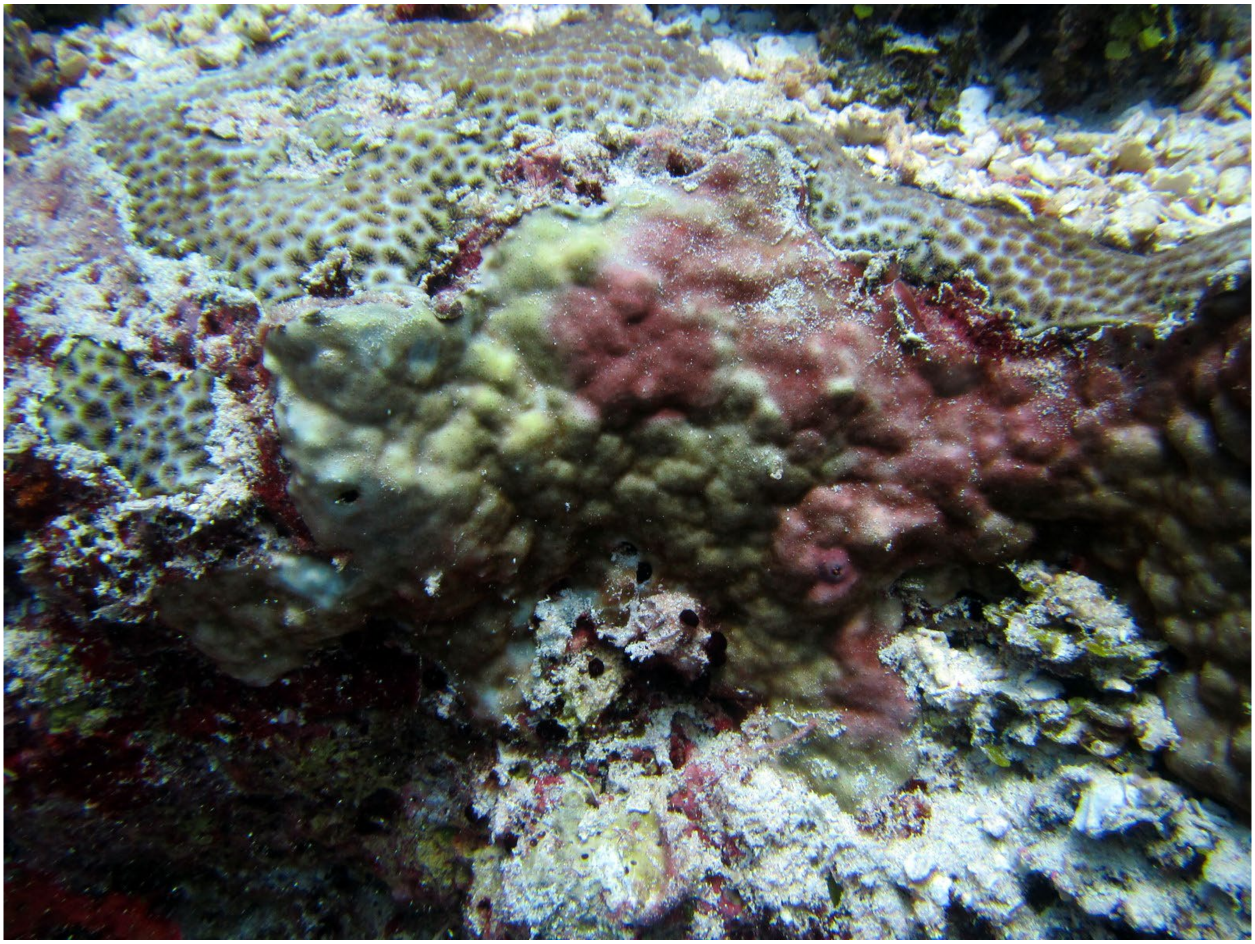


A photo of *Millepora exaesa*.

Millepora tuberosa

Colonies are encrusting, and can be up to at least 50 cm diameter, and are most common on mid depths of fore reef slopes. Colonies often have small bumps, about the diameter of a pea. Colonies are purple, except near edges where it sometimes is light yellow, presumably from a disease. It has a mild sting. It is more easily mistaken for coralline algae than for other species of *Millepora*. Coralline algae has no tiny holes and cannot sting. *Millepora exaesa* has smaller colonies, is most common in shallow protected water, can have larger bumps, and is yellow though can have tinges of pink or green on parts of the colony.

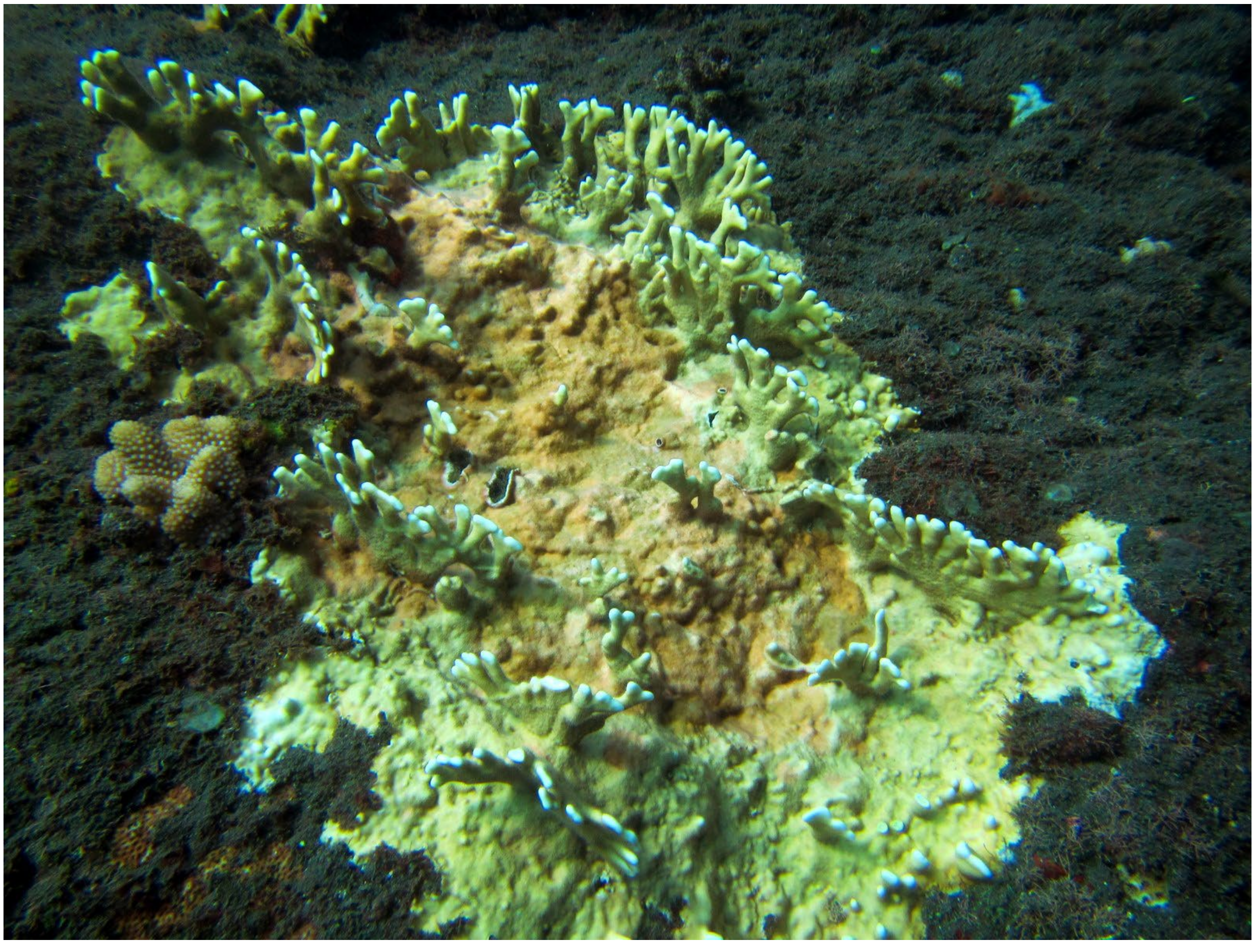
A photo of *Millepora tuberosa*.



A photo of *Millepora tuberosa*. The light areas of the colony are affected by a disease.

Millepora tenera

Colonies have encrusting bases and form rows of vertical branches that divide some. The branches are not long, and some or many end up flattened in the plane of the row of branches. Branches are longer and anastamose in *Millepora dichotoma*. *Millepora intricata* has thinner branches that go in all directions and do not form two dimensional rows or fans, and does not have a visible encrusting base.

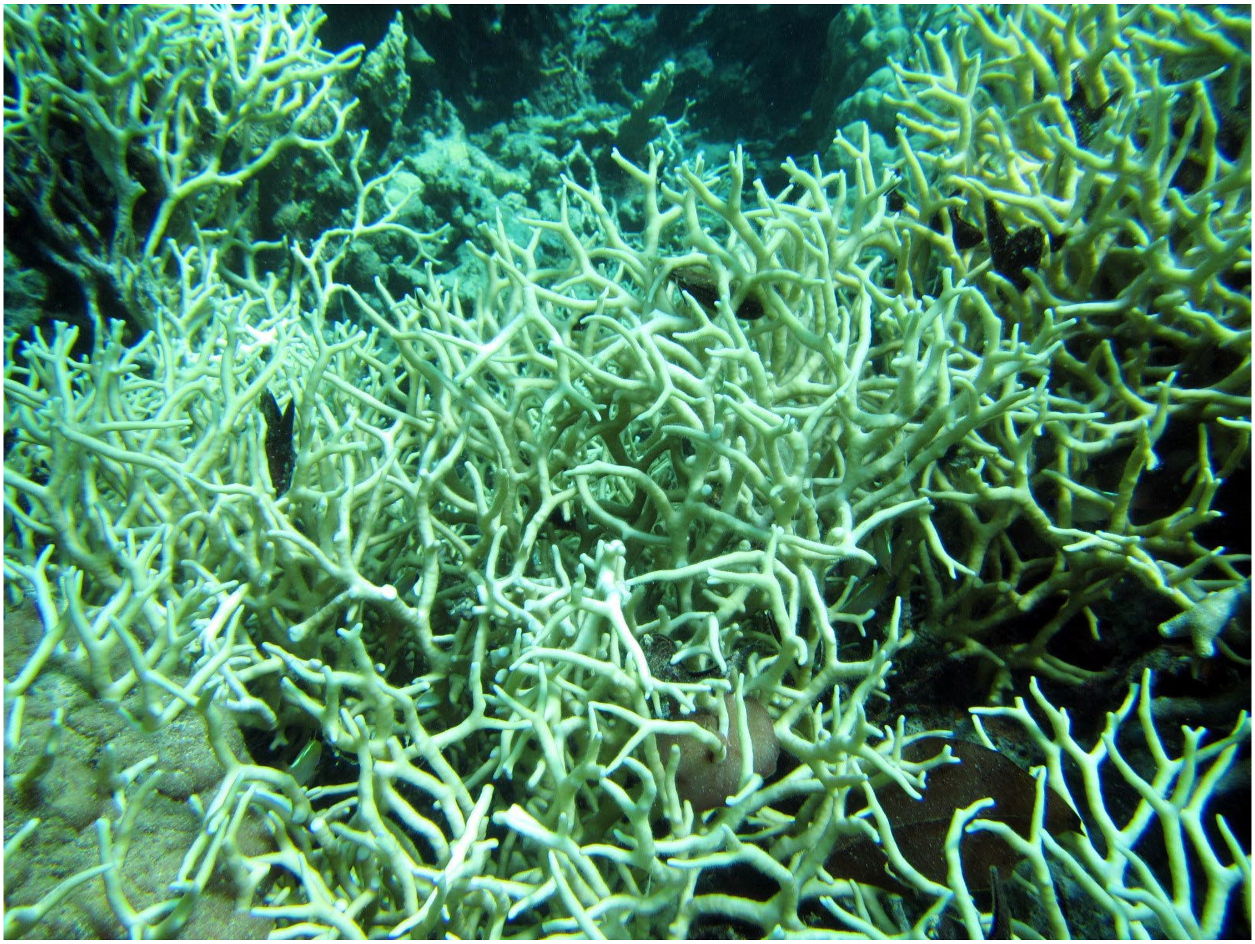


A photo of a colony of *Millepora tenera* with rows of vertical branches on an encrusting base.

A closer photo of *Millepora tenera* showing flattened branch tips.

Millepora intricata

Colonies are composed of thin branches which go in all directions, forming bushy structures but not forming fans. *Millepora dichotoma* has thicker branches which form two dimensional fans.



A photo of *Millepora intricata*.

A close-up photo of *Millepora intricata*, showing the typical color.

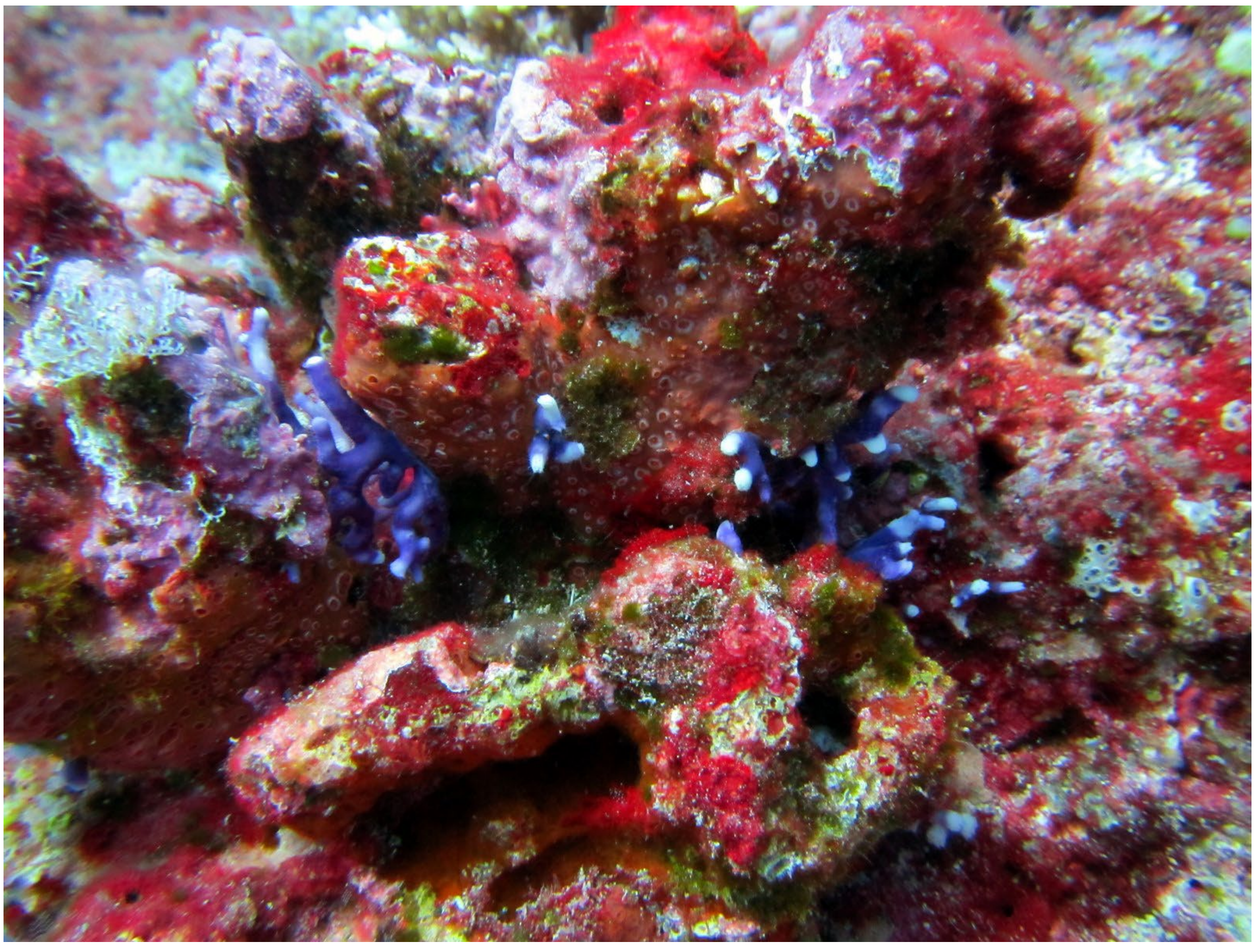
Family Stylasteridae has several genera in it, all of which are azooxanthellate, only two of which have species on coral reefs.

Distichopora

Colonies do not have zooxanthellae, and are typically seen in the shade of overhangs and holes, though sometimes they may be in partial shade. Colonies are branching, with smooth surfaces, and bright colors.

Distichopora violacea

Colonies are often quite small, but have smooth branches that are oval in cross section. Colonies are purple with white tips. The polyps and their corallites are in short rows on the edges of the oval branches. Branches are smoother, thicker, purple, with rounded tips and without zig-zag shapes like *Stylaster*. *Distichopora nitida* can be other colors and colonies may be larger.



Stylaster *"lace coral"*

Colonies are finely branching and have no zooxanthellae, so they are found in shaded locations under overhangs and in holes. Colonies tend to be small, 5 cm tall or less. Colonies have thin branches that taper and tend to zig-zag. Colonies can be pink, orange or white. The species of Indo-Pacific *Stylaster* are not well worked out yet.

Stylaster sp.

A photo of a white colony of *Stylaster* sp. The blue is *Distichopora*.

A close-up photo of *Stylaster* sp. with a light pink color, and showing some of the zig-zag shape. The slight bumps on the branches are where the corallites are. Minute clear tentacles can be seen on upper branches, the first time the author has ever seen them even in a photograph.

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The Author

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Born in Michigan, USA, the author has lived in a variety of places in the states, including Florida during his high school years, which stimulated an interest in tropical marine life. During his years at Reed College in Portland, Oregon, he was introduced to biology, including invertebrate biology, studied sea urchin tube feet and respiration for his thesis and spent two summers in Hawaii studying fish behavior with his professors. Once graduated he attended the summer invertebrate zoology course at the Marine Biological Laboratory at Woods Hole, Massachusetts and then another summer was a course assistant for that course. Snorkeling trips to the Caribbean (including to Jamaica just before Hurricane Allen) during graduate school at the University of Pennsylvania were followed by scuba trips to the Caribbean. His coral reef research and publications began with surveys and description of reefs in the Caribbean, including Cozumel, Roatan, Cayman Brac, Little Cayman, and St. Lucia. It became clear that to do transects you need to know your corals, and existing guides were inadequate, so Caribbean coral identification and taxonomy were next to be studied. By this time the author lived in Seattle, Washington. Then the author began to study corals in Hawaii, which led to his identification book for Hawaiian corals. Following that, he worked in the Philippines for two years, learning many coral species in that area of high diversity. This was followed by six years of working with Dr. “Charlie” J.E.N. Veron at the Australian Institute of Marine Science on the “Coral ID” electronic key to corals of the world. At that time, the author began to be invited to study and record corals during Rapid Assessment Programs to a variety of places around the Indo-Pacific. In November, 2003, the author began work at the Dept. Marine & Wildlife Resources, in American Samoa. He began working on coral reef monitoring there a year later and continued with that, and continued to make trips to study corals around the Indo-Pacific. Currently, the author has studied coral at 14 islands in the Caribbean and 14 areas of the Indo-Pacific, plus southern Italy in the Mediterranean. He is an author of 17 book chapters and 46 peer-reviewed articles in scientific journals. He has worked as a contractor for NOAA NMFS Protected Species on threatened coral species since 2013. That work has taken him around the Pacific each year to study corals and teach people how to identify corals. That effort includes photographing corals, writing field guides and building “practice modules” for teaching coral ID and people to practice with. He also works on describing new species of corals and coral diseases and other coral reef topics. He continues to be based in American Samoa.