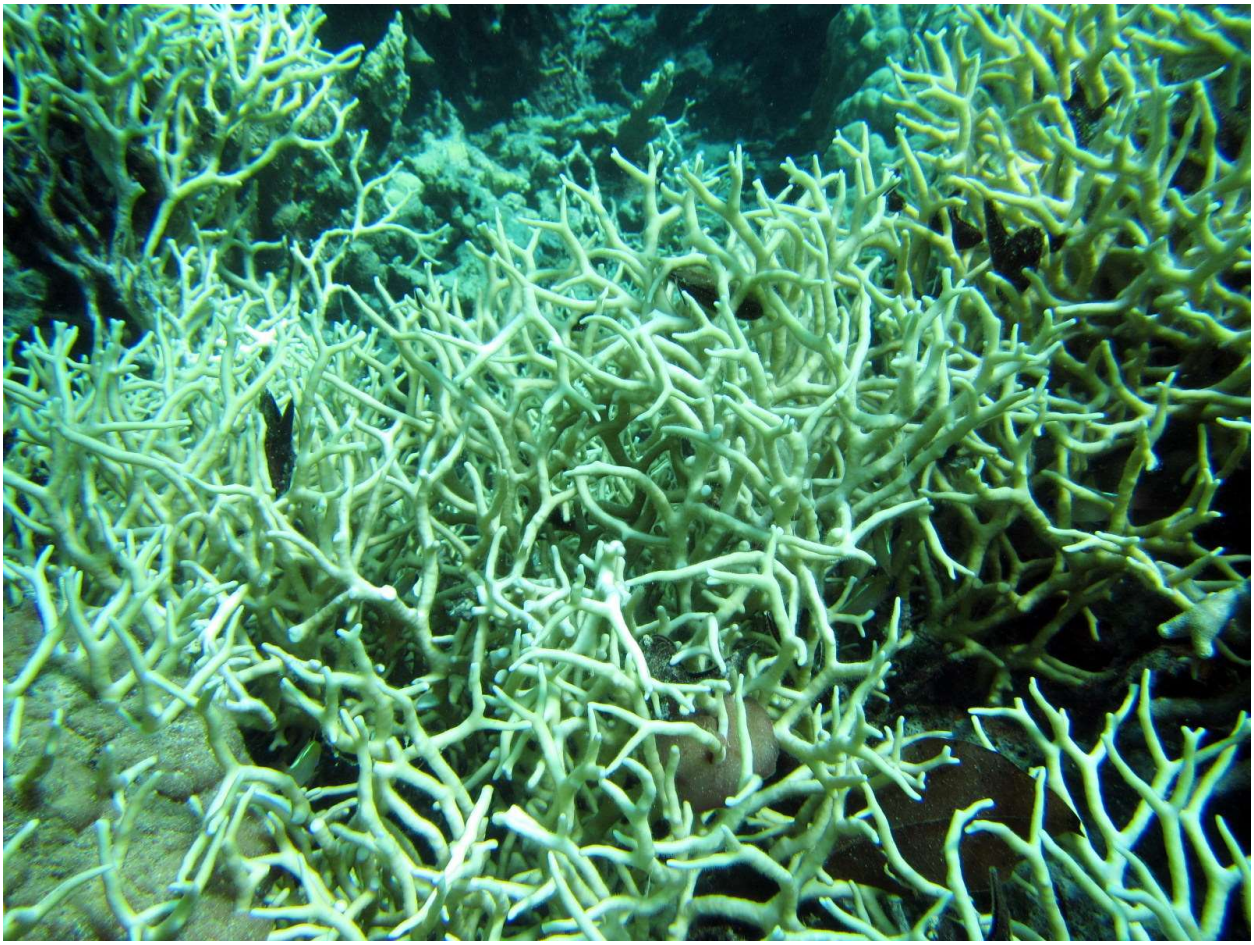
Threatened corals of the Pacific

Douglas Fenner, Ph.D. 2018

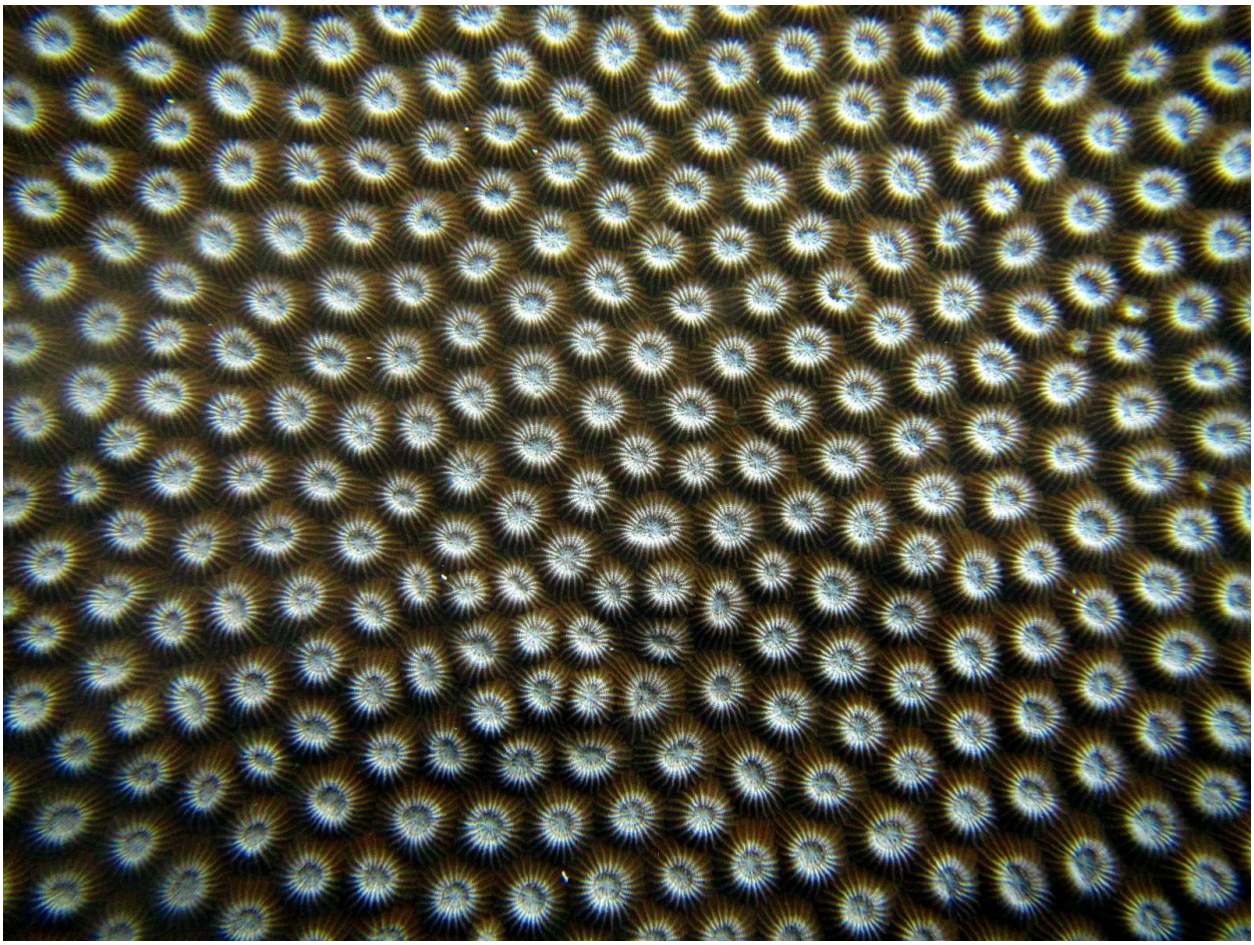
This presentation will look at each of the corals that have been listed as "threatened" under the U.S. Endangered Species Act, and other species that look very similar to the listed species, and how to tell them apart. The first few listed species we will consider are some of the most common of the threatened species and have quite a few similar-looking species and so will take many slides to get through, but the later species have few look-alikes and so will go faster. The process of trying to figure these coral species out is one of gradual progress. Many of the listed species were not well known and the variation within and between species has not been well documented so far. So this is a work in progress. There are enough species here for you to get quite an introduction into coral species.

This coral, *Ctenella chagius*, is only found in the Chagos Archipelgo in the middle of the Indian Ocean. It was once one of the most common 25 corals there, but the El Nino bleaching event in 1998 which killed about 90% of all corals there, plus the 2016 El Nino bleaching event, killed nearly every colony, a decline of about 1000 to 1, the largest population decline known of any coral species. The next mass bleaching event there may well drive it to global extinction. All documented by Sheppard, Sheppard, and Fenner, in press.

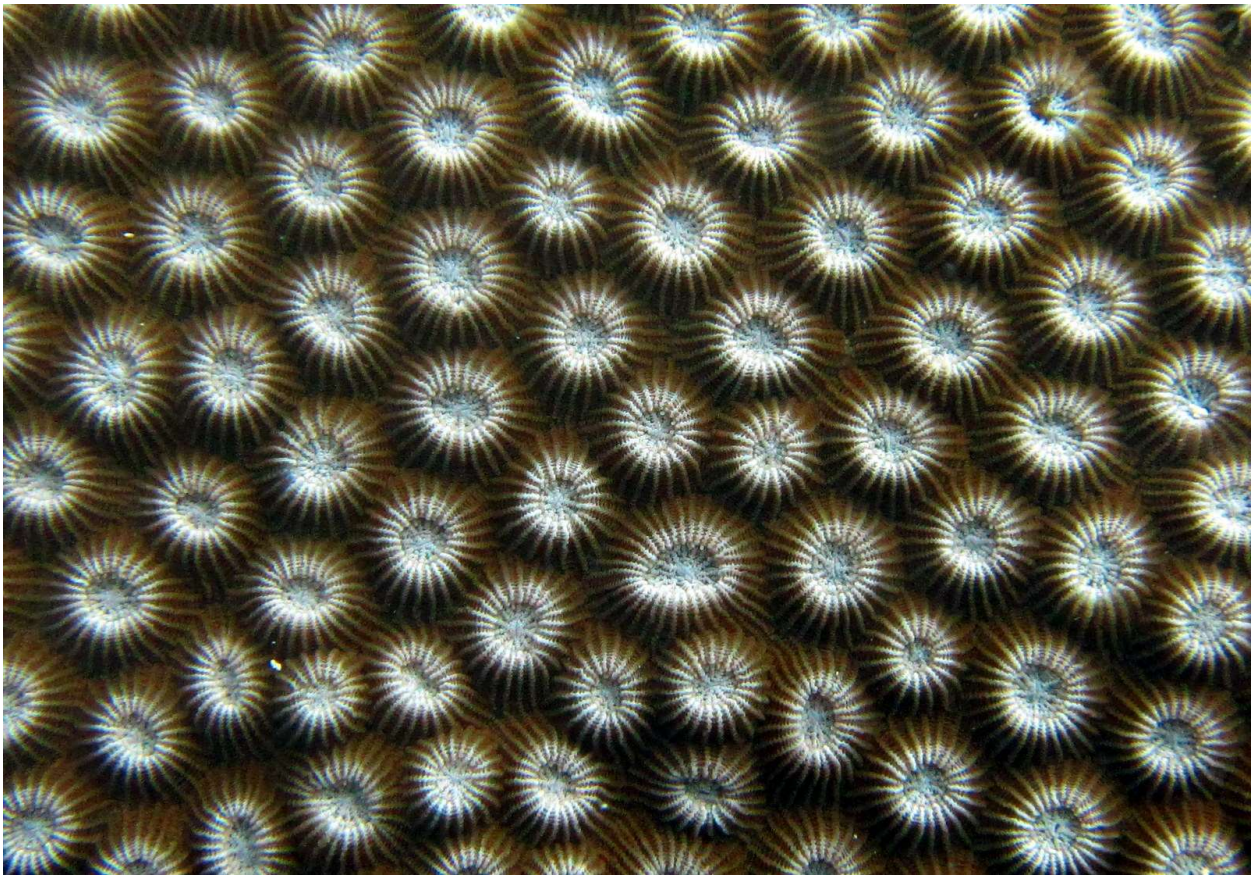
A closeup photo of the same species, which could be called a “brain coral” in common terms. It is the only species in its genus and one of only a few in its family.



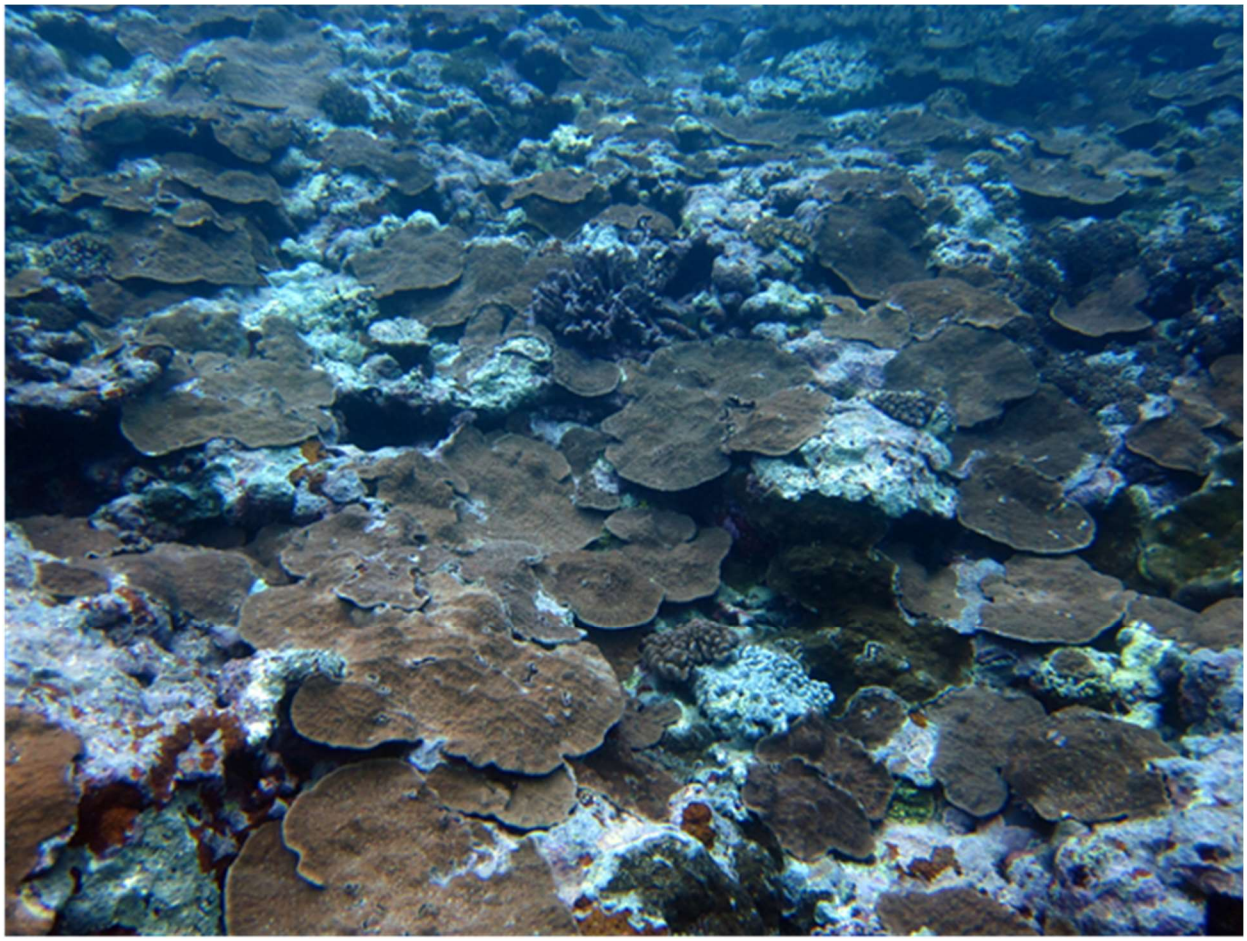
A photo of a fire coral species (*Millepora intricata*) which was known only in the Eastern Pacific from an area in Panama, and was driven to regional extinction by El Nino mass bleaching. It has a wide distribution elsewhere. Although it is not globally endangered, regional extinctions produce



This species was common in Chagos but driven to regional extinction in Chagos by the 1998 El Nino mass bleaching and has not been found there since.



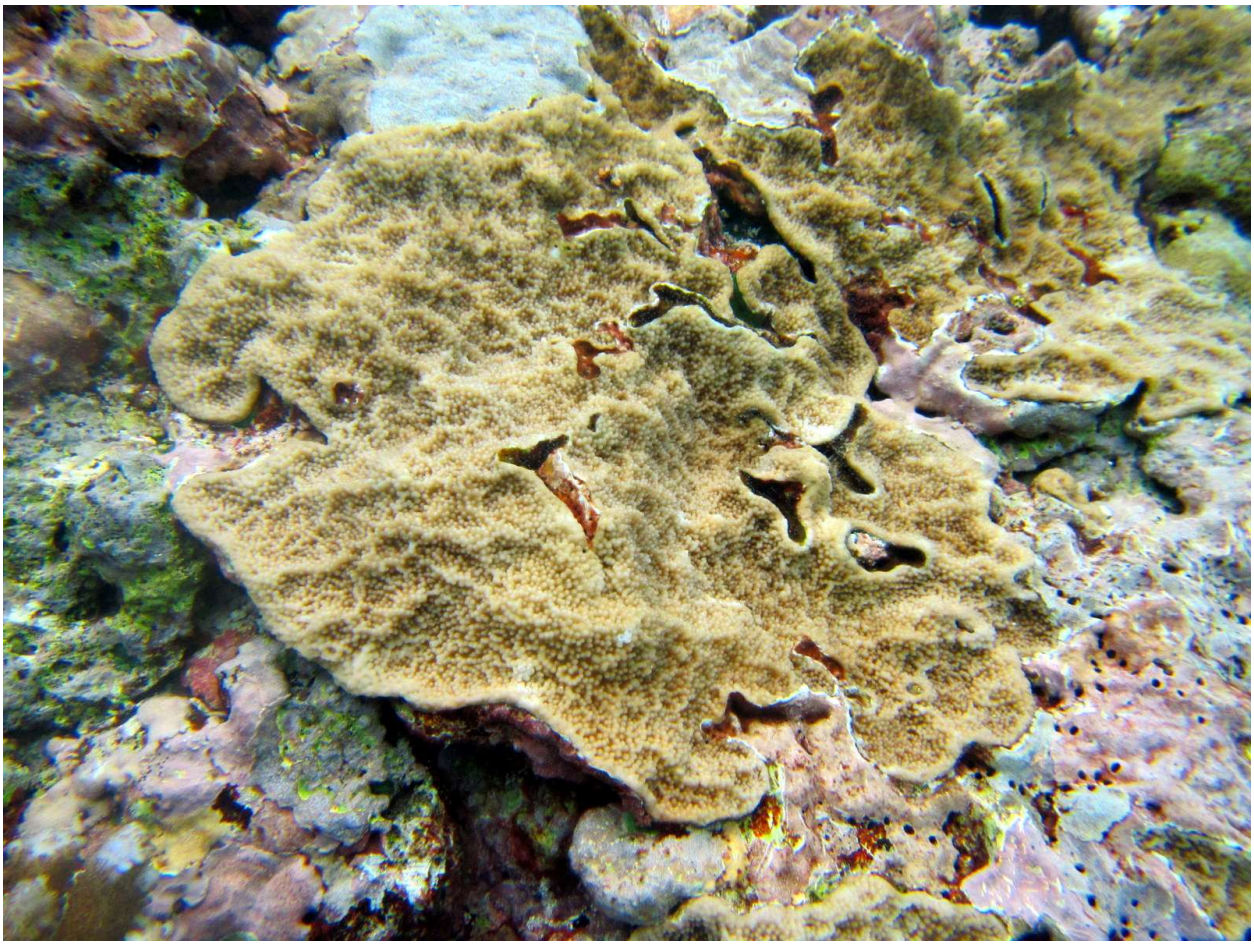
A closeup of the same species, *Diploastrea heliopora*. It has a wide distribution elsewhere. These photos illustrate that local, regional, and even global extinction of corals is now happening, and the main threat appears to be global warming and El Nino-produced mass bleaching.



Isopora crateriformis is our first species to consider that was listed as “threatened” under the U.S. Endangered Species Act. This is a photo from the upper reef slope of SW Tutuila where it dominates at about 15 feet deep. This species is more abundant at that location than any other place in the world that I know of. Most places where it has been found it is uncommon to rare. It is present on reef slopes down to at least 40 feet or more, and can, sometimes, be on reef flats. It doesn’t seem to be in lagoons. It seems to only be in the Pacific.

Overlapping plates of I. *crateriformis*. This species can form encrusting colonies or colonies with raised, plate edges on their lower side on slopes. It is usually rusty brown, but the digital camera incorrectly recorded green in this photo.

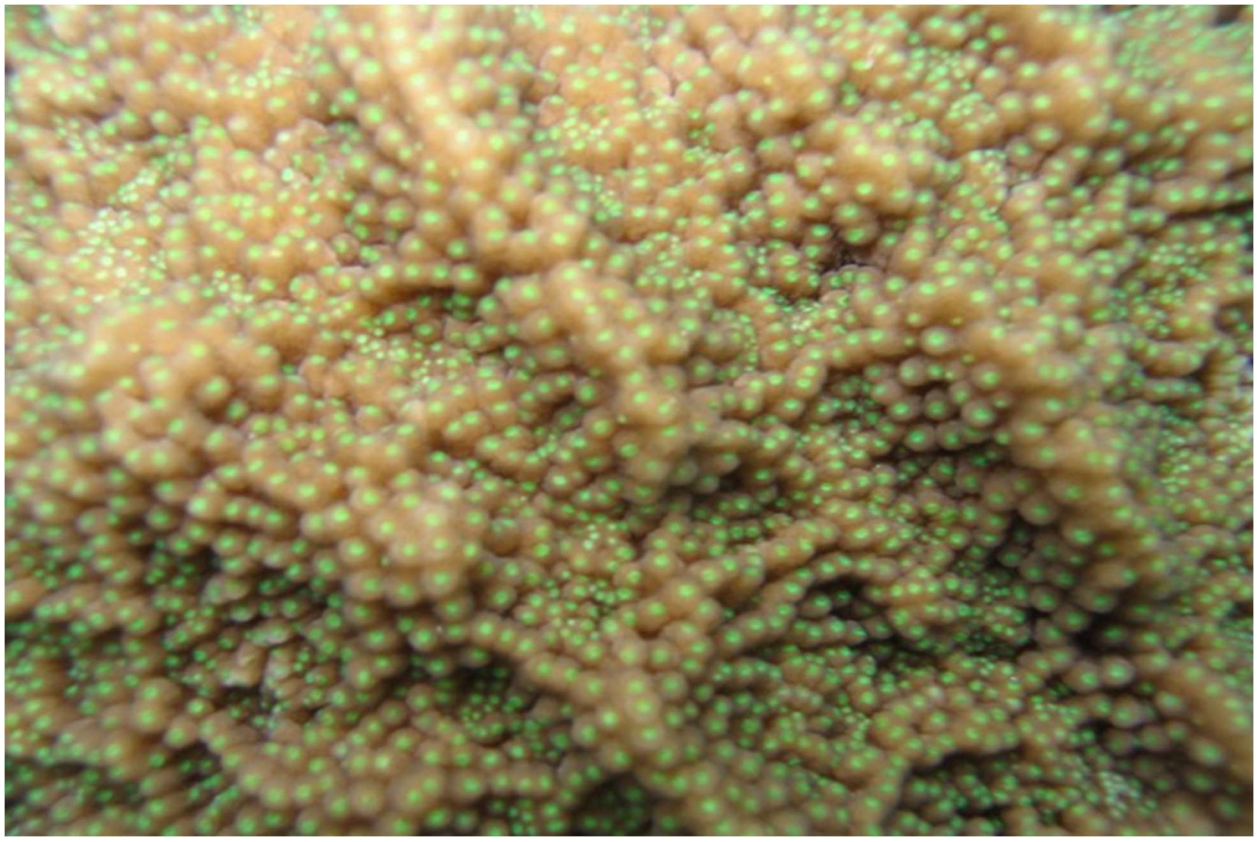
A photo of two overlapping, spiraling colonies with raised edges. The color is better in this photo.



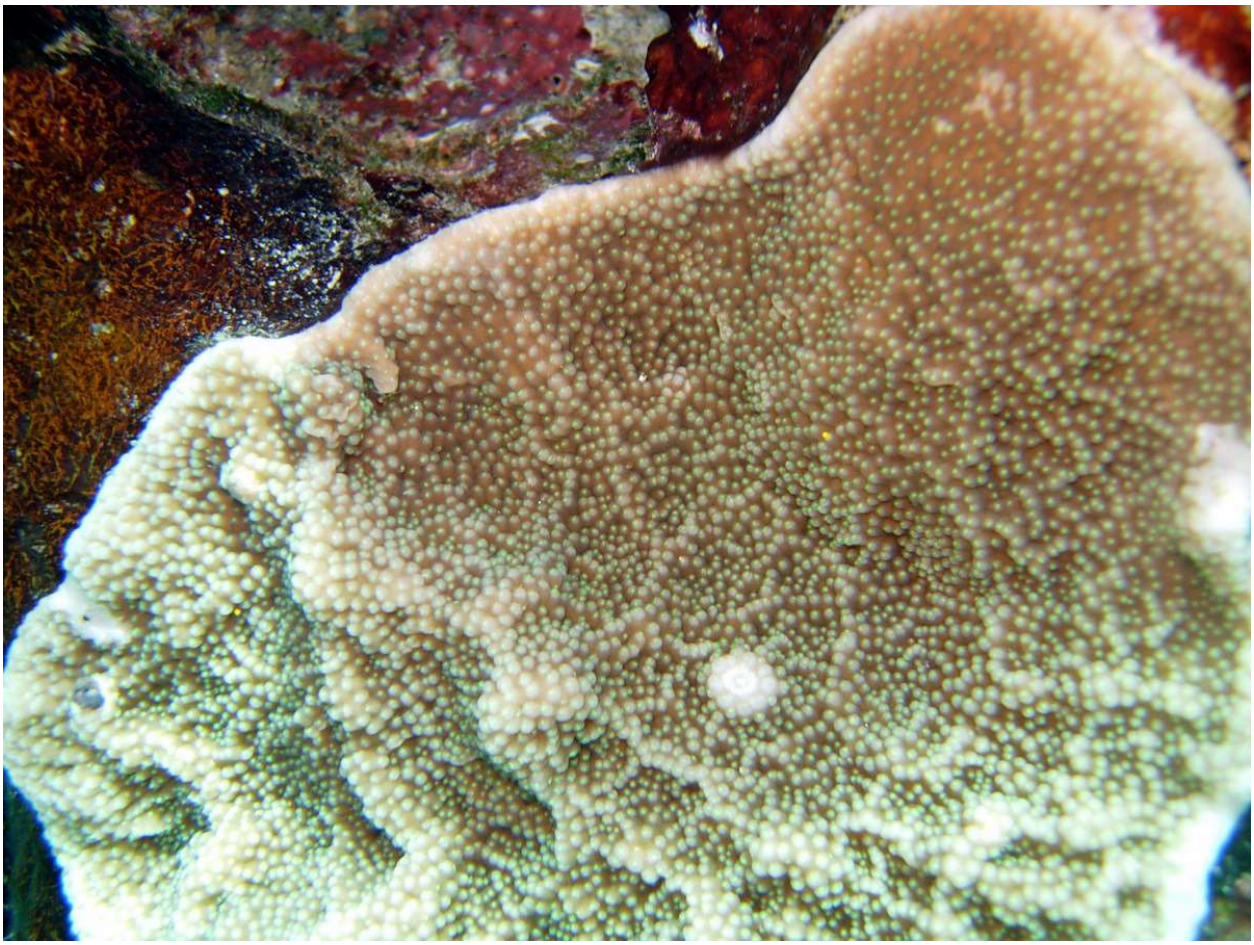
As we get closer to the colonies, this colony has ripples or ridges on its surface which is a common feature. Also, it is almost entirely encrusting.

This colony also has the ripples or ridges and is encrusting.

Getting closer, we can now begin to see the tiny tubular corallites where the polyps are.

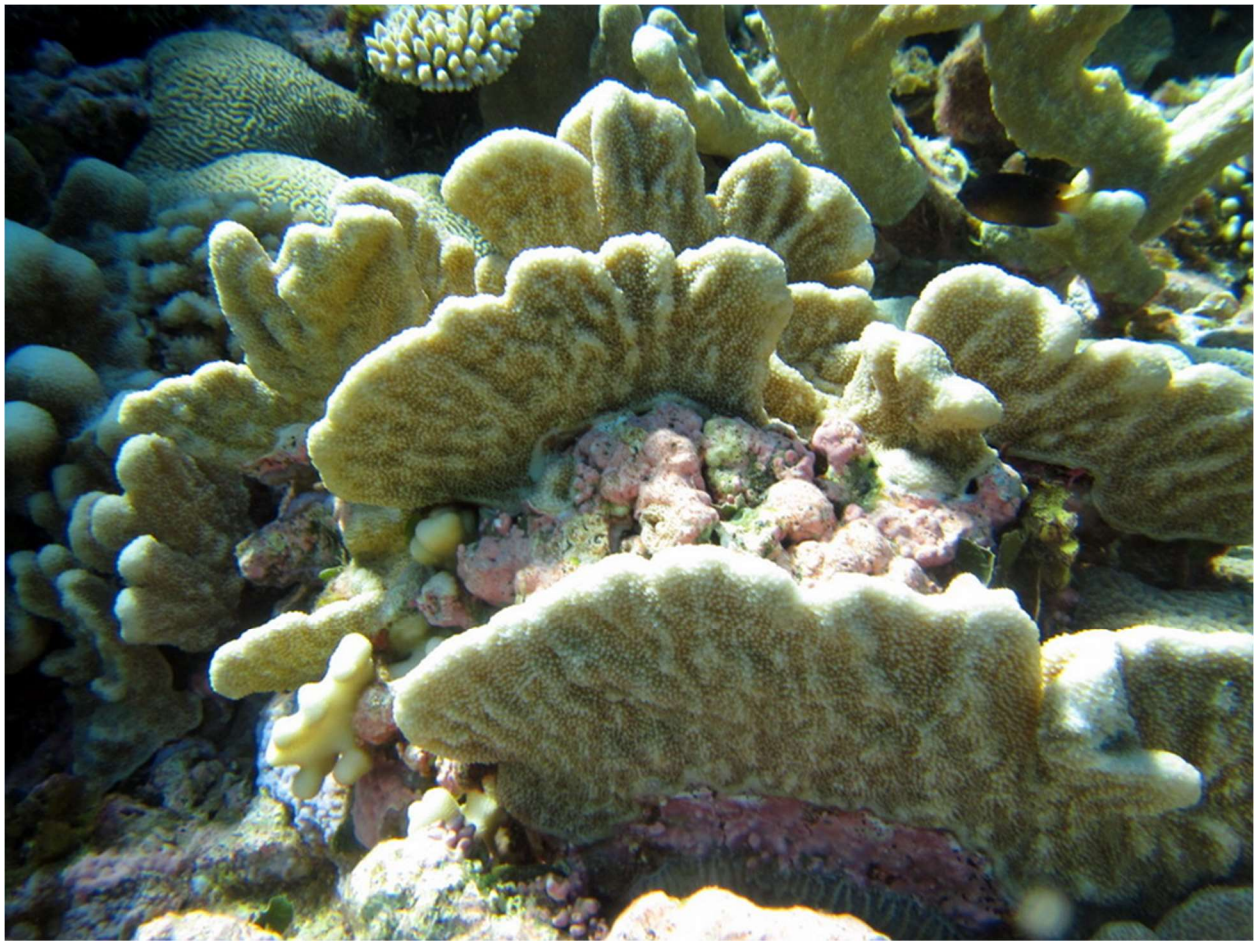


Here is an extreme closeup where we can see the tubular corallites. The polyps are retracted and are the green spot in the center of the corallite. Note that corallites in ridges are larger than between. The corallites in this photo appear much larger than they are in reality. They are only about 2 mm diameter, so they look tiny in the water. Colonies with green polyps are uncommon to rare and from a distance can look light greenish. This species is really easy to ID in American Samoa, because it is always encrusting or plates without any branches. There is a second species in American Samoa that is all branches with no encrusting or plate colonies. So super easy to distinguish. I'll show you that other species in a few slides.

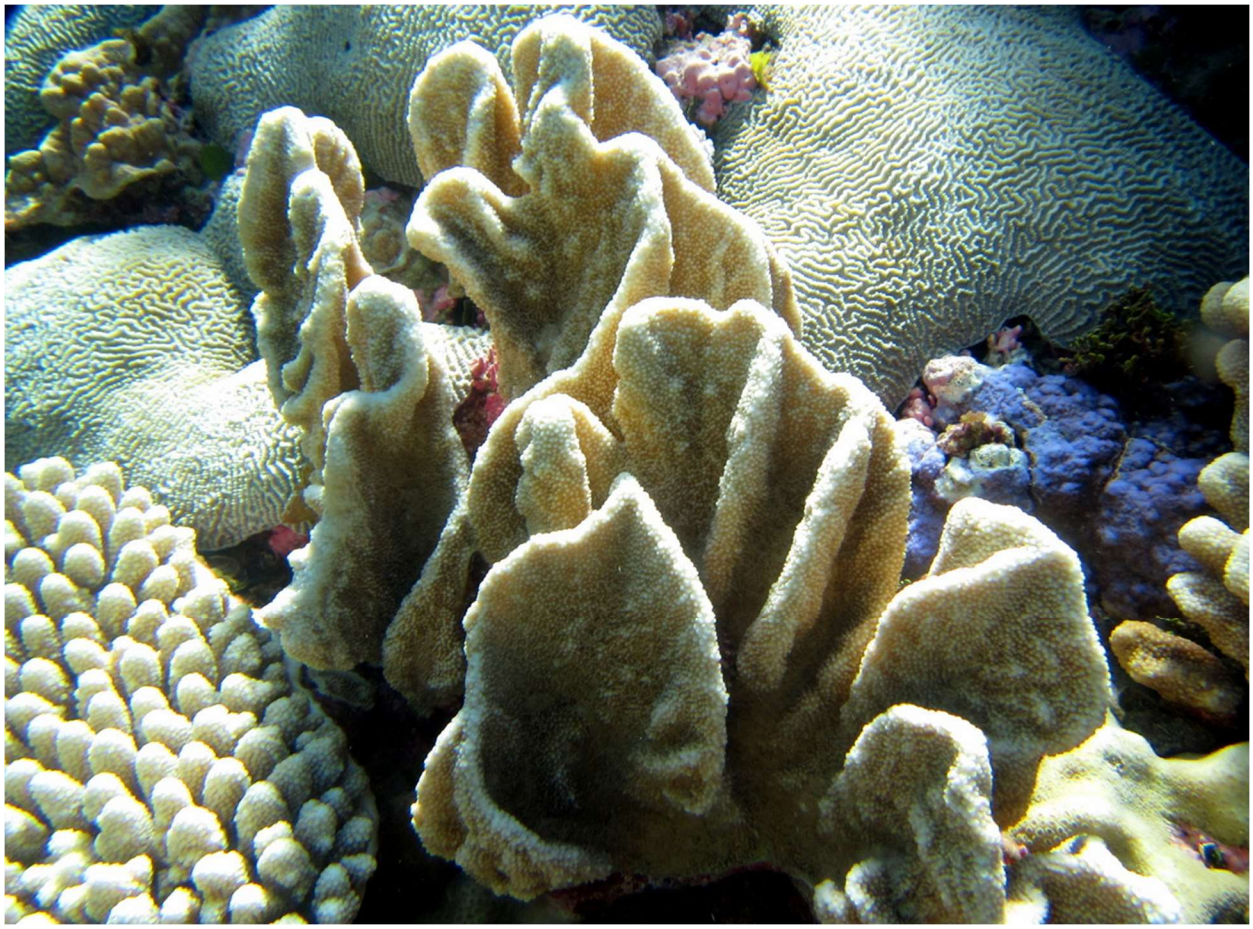


A slightly different looking colony from New Caledonia.

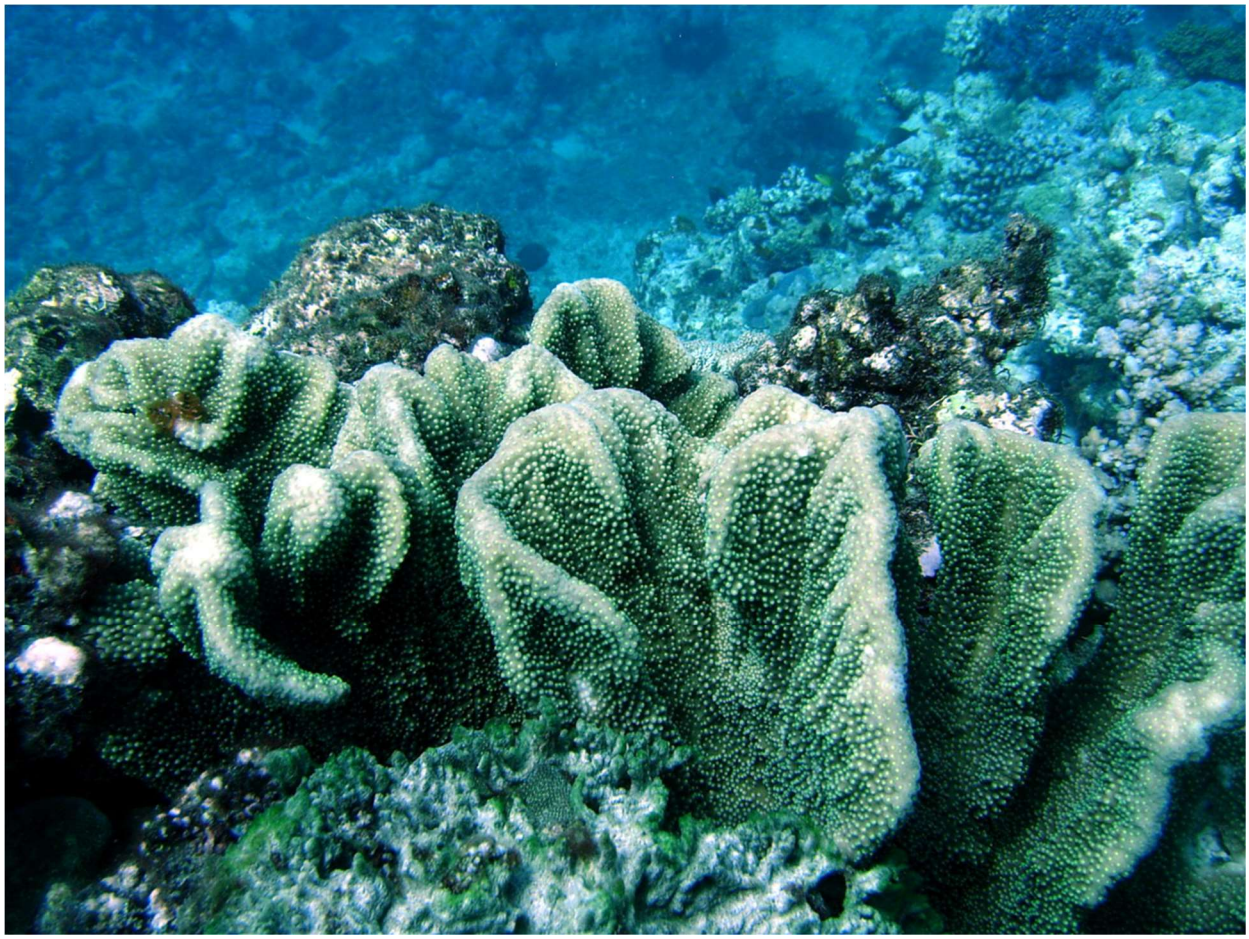
Another colony from New Caledonia, this with rounded bumps on it. Most coral species have significant variation between colonies, making it harder to identify them. The color in this photo is too blue.



Isopora cuneata is a species that is similar to I*. crateriformis*. *I. cuneata* was not listed as threatened. The word “cuneate” refers to the vertical wall shape seen in this photo, which is most common in heavy wave surge near reef crests.



A variation on the vertical wall shape where *I. cuneata* has vertical walls which intersect.



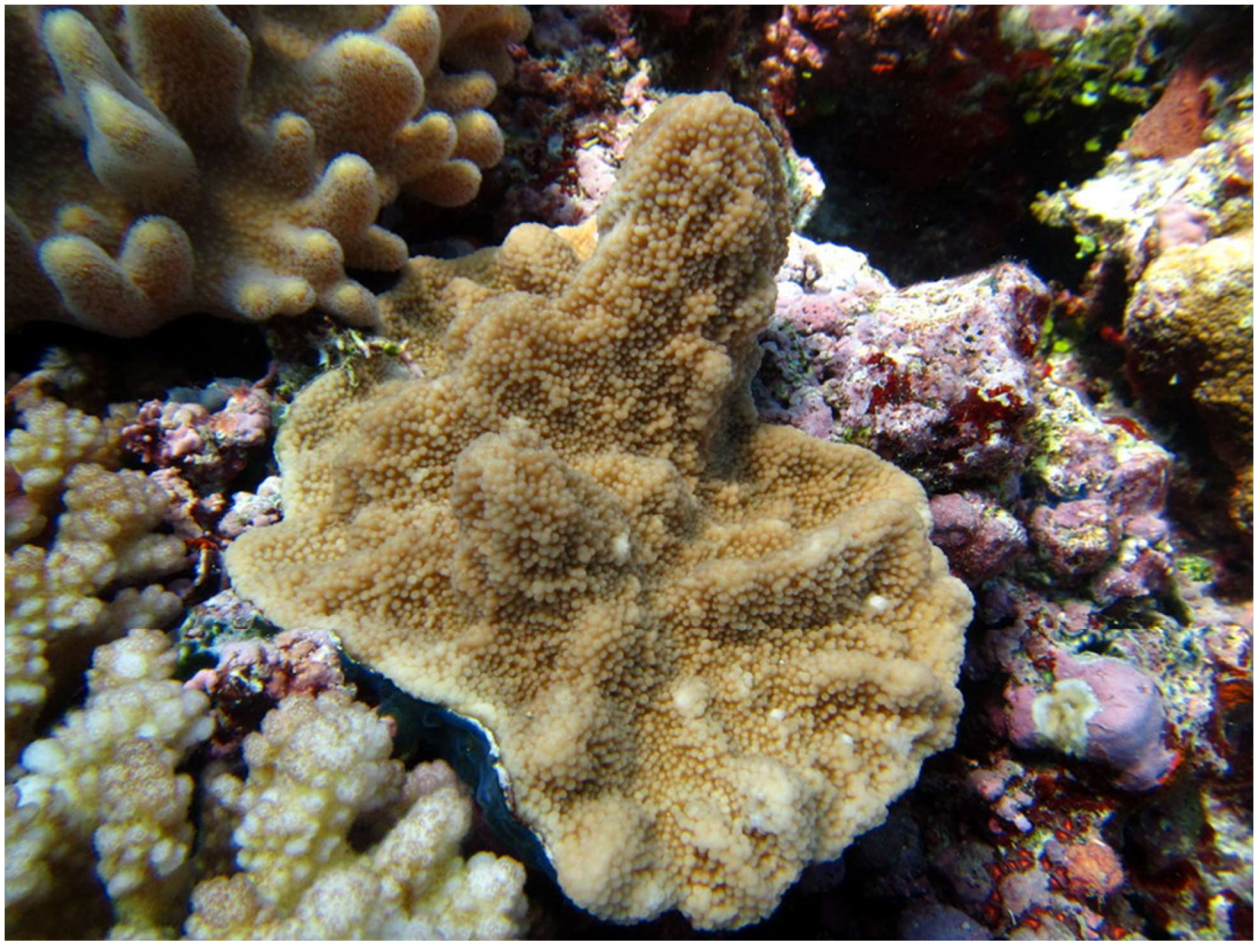
A similar photo from New Caledonia. Note the green tint and green polyp dots in the corallites. I have not seen that color pattern in any other corals other than these two species. It is rare in both.

A photo from Tonga, appears to be *I. cuneata*.

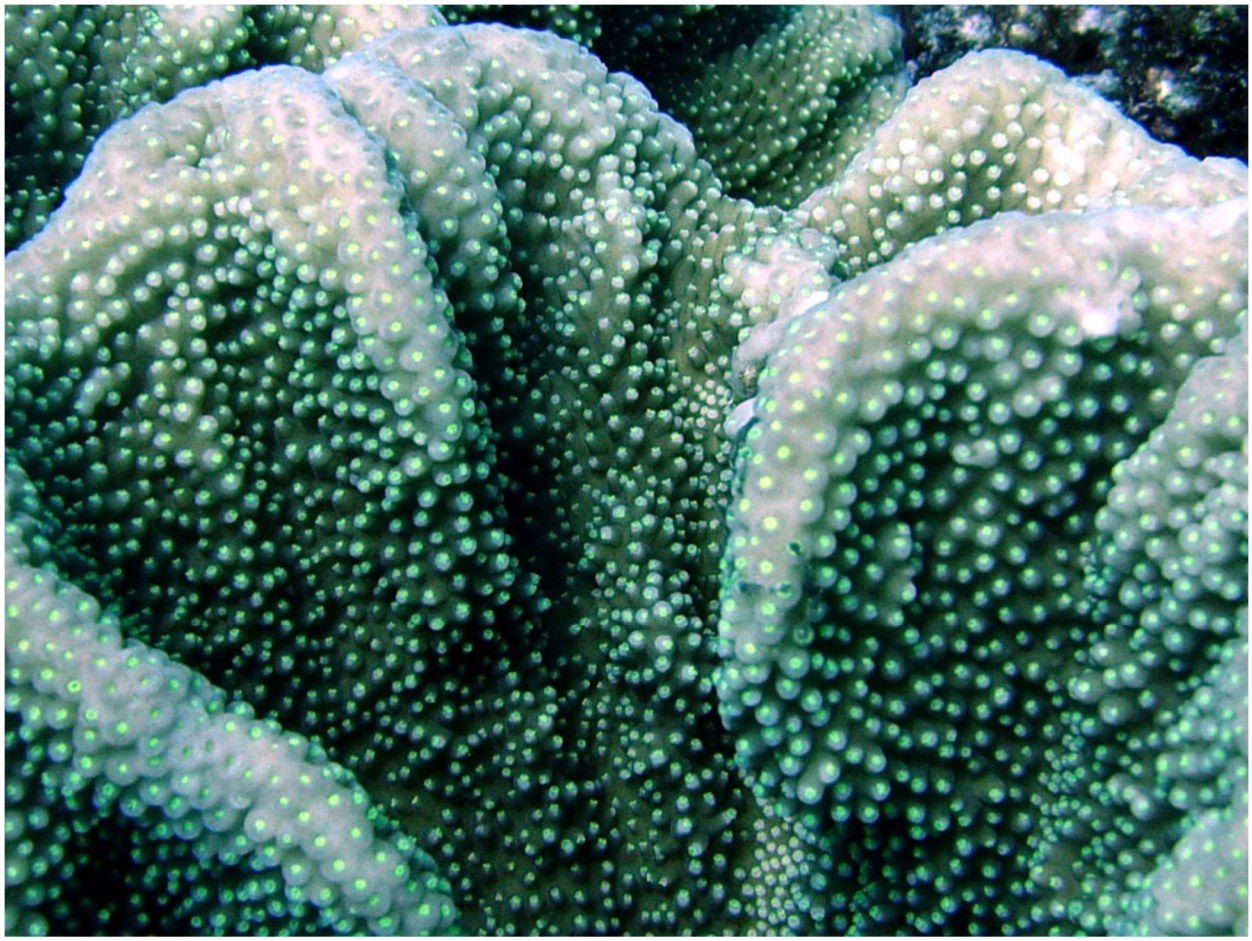
Another photo from Tonga, with branch development but no encrustation or plates. So far, easy to tell from *I. crateriformis*.

More branches, somewhat flattened, and bumpy.

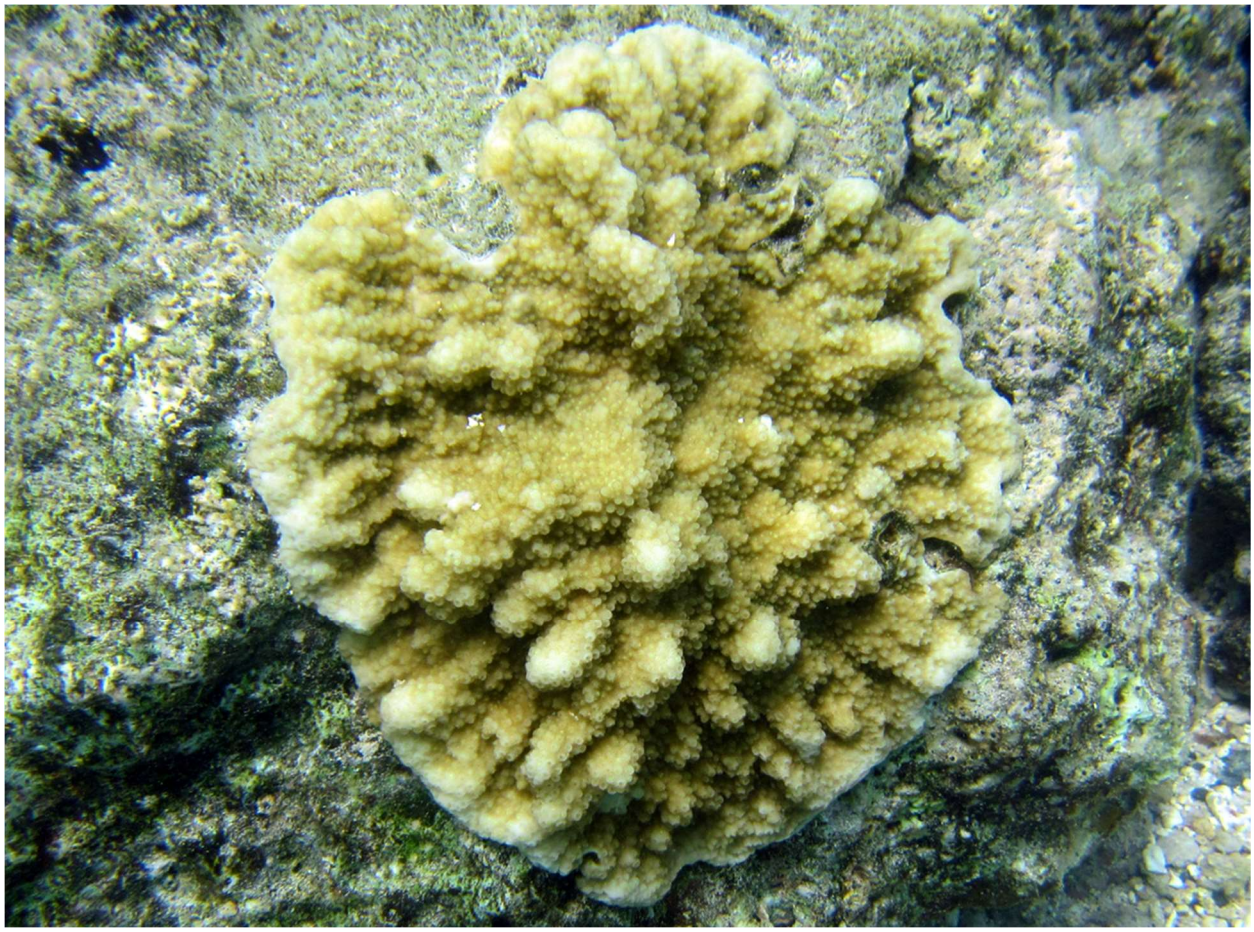
Uh-oh, a colony that is part encrusting base and part stubby branches. Bad news, this one is half way between *I. crateriformis* and *I. cuneata*. Up to now, colonies have been fairly easy to distinguish. Also, the corallites in these two species are said by Wallace (1999) to be the same. Veron (2000) says that I. *cuneata* has smaller corallites. But the size ranges given by Wallace (1999) almost entirely overlap. If there are intermediate colony shapes, maybe they aren't two separate species. Wallace acknowledges that possibility. Tonga has intermediates, I haven't seen them elsewhere.



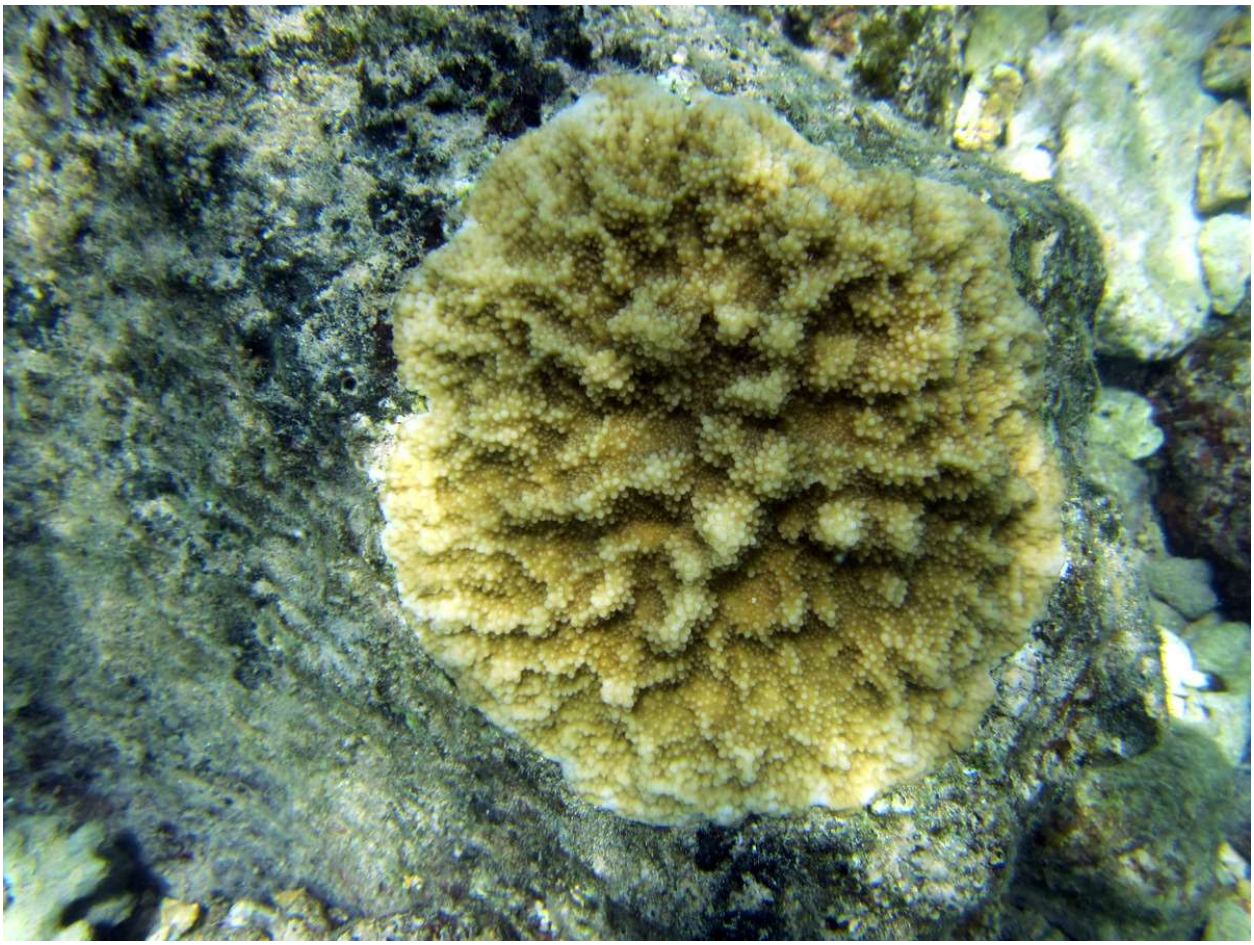
Another colony from Tonga that appears to be intermediate between *I. crateriformis* and I*. cuneata*. Welcome to difficult coral. I never said corals were easy.



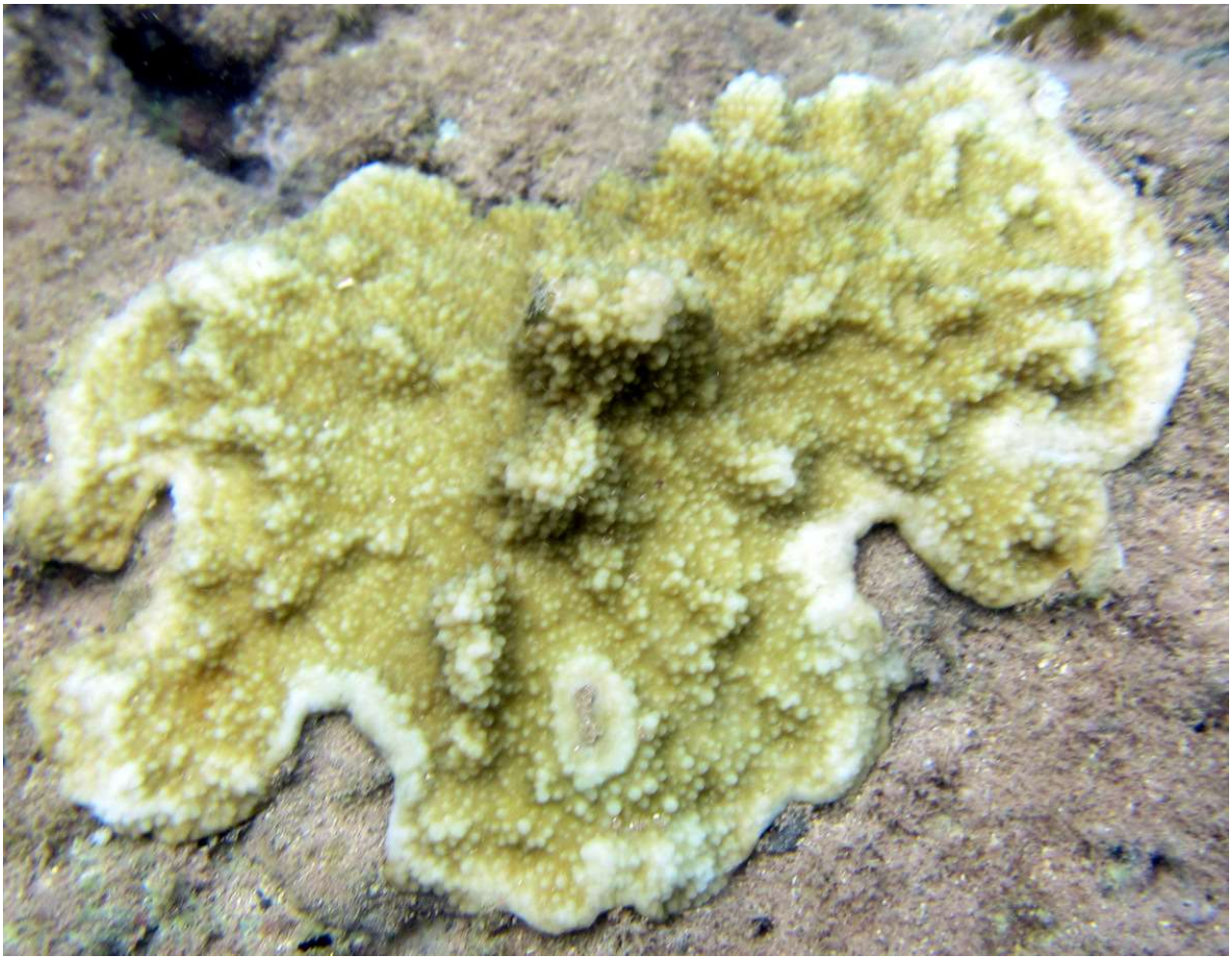
Slide 24: A closeup of the colonies in New Caledonia that have the I. *cuneata* shape but green mouths, the rare color variation that is also in *I. crateriformis*.



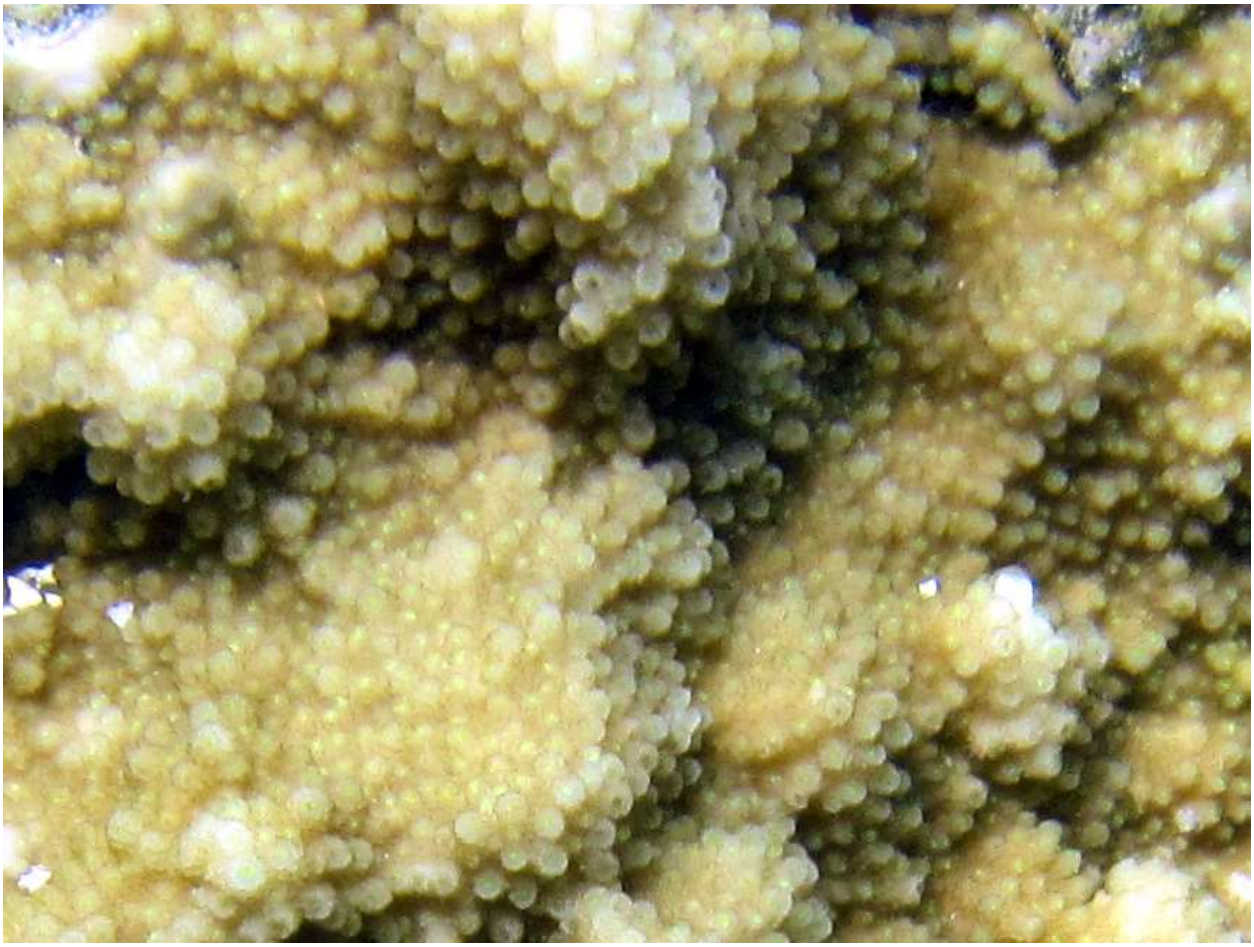
This is a photo of a coral that initially had me puzzled. Looks a bit like a *Montipora* from a distance, but under the microscope is clearly *Isopora*, and appears to be a variation of *I. crateriformis*. It is lumpier than the usual colonies and the corallites seem to be tubular with thinner walls and lest rounded ends. I've only seen it in the Ofu harbor, where it is fairly common.



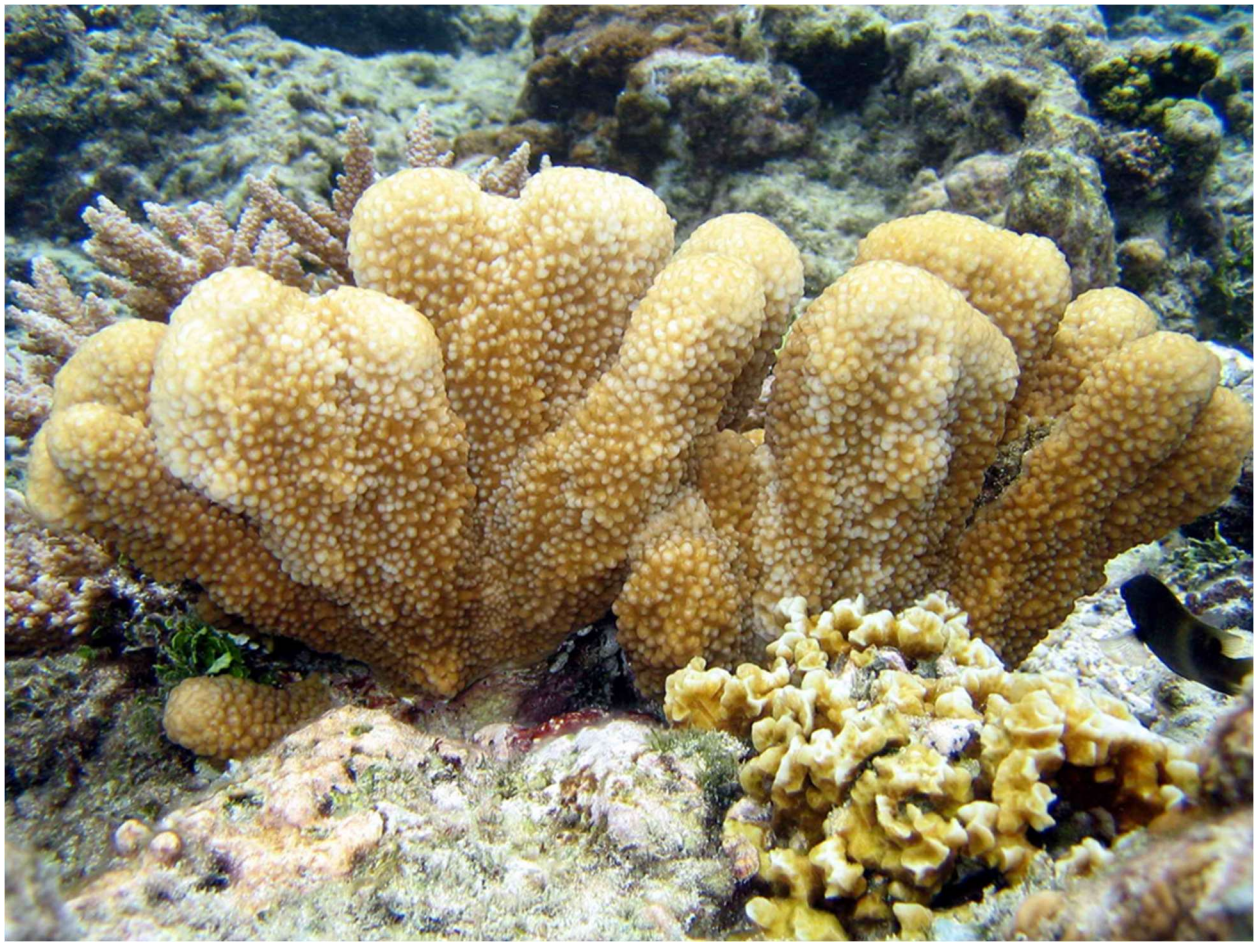
Another colony from Ofu harbor, showing ridges and bumps. The bumps almost become short branches.



Another colony.

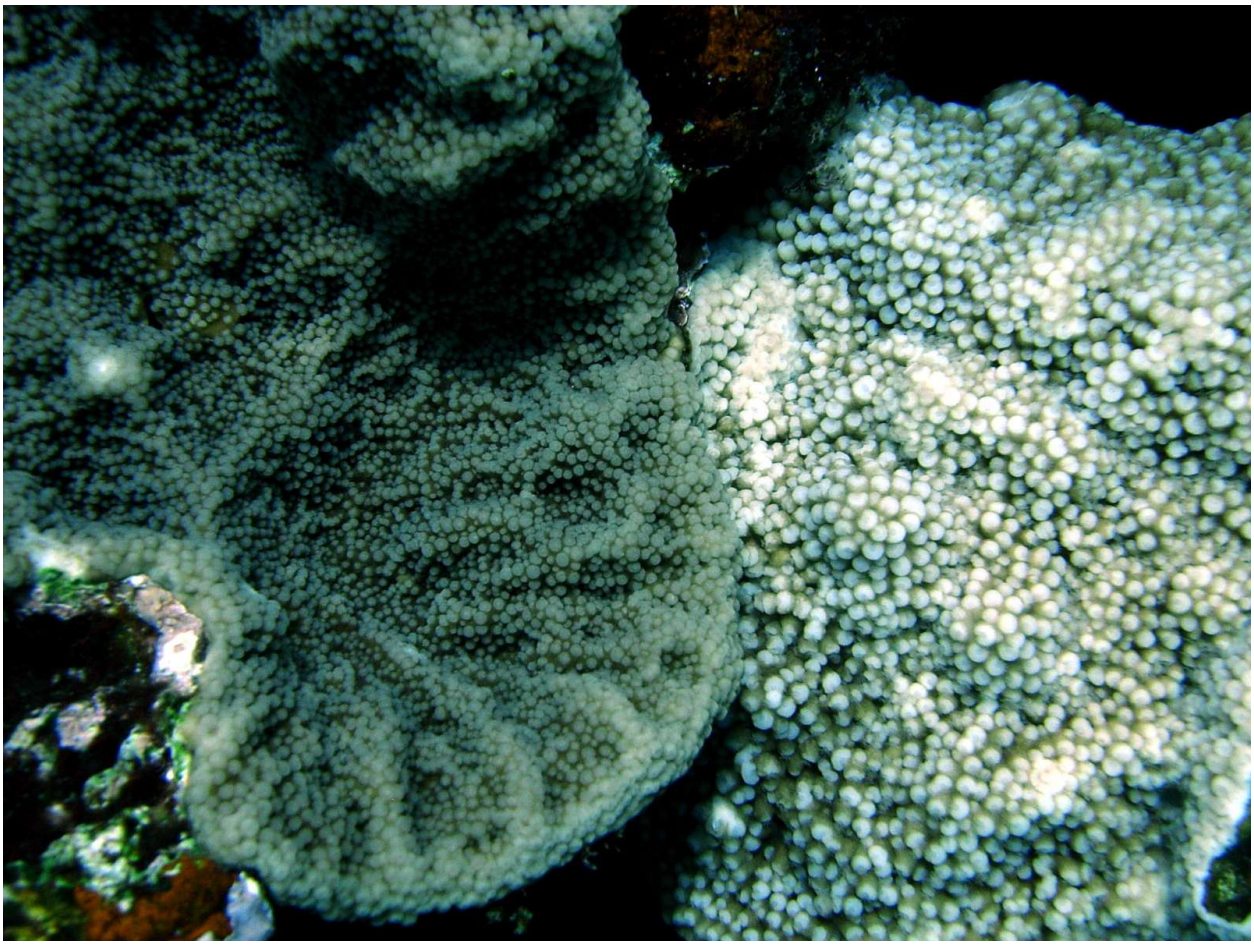


A closeup of a colony, showing the tubular corallites.

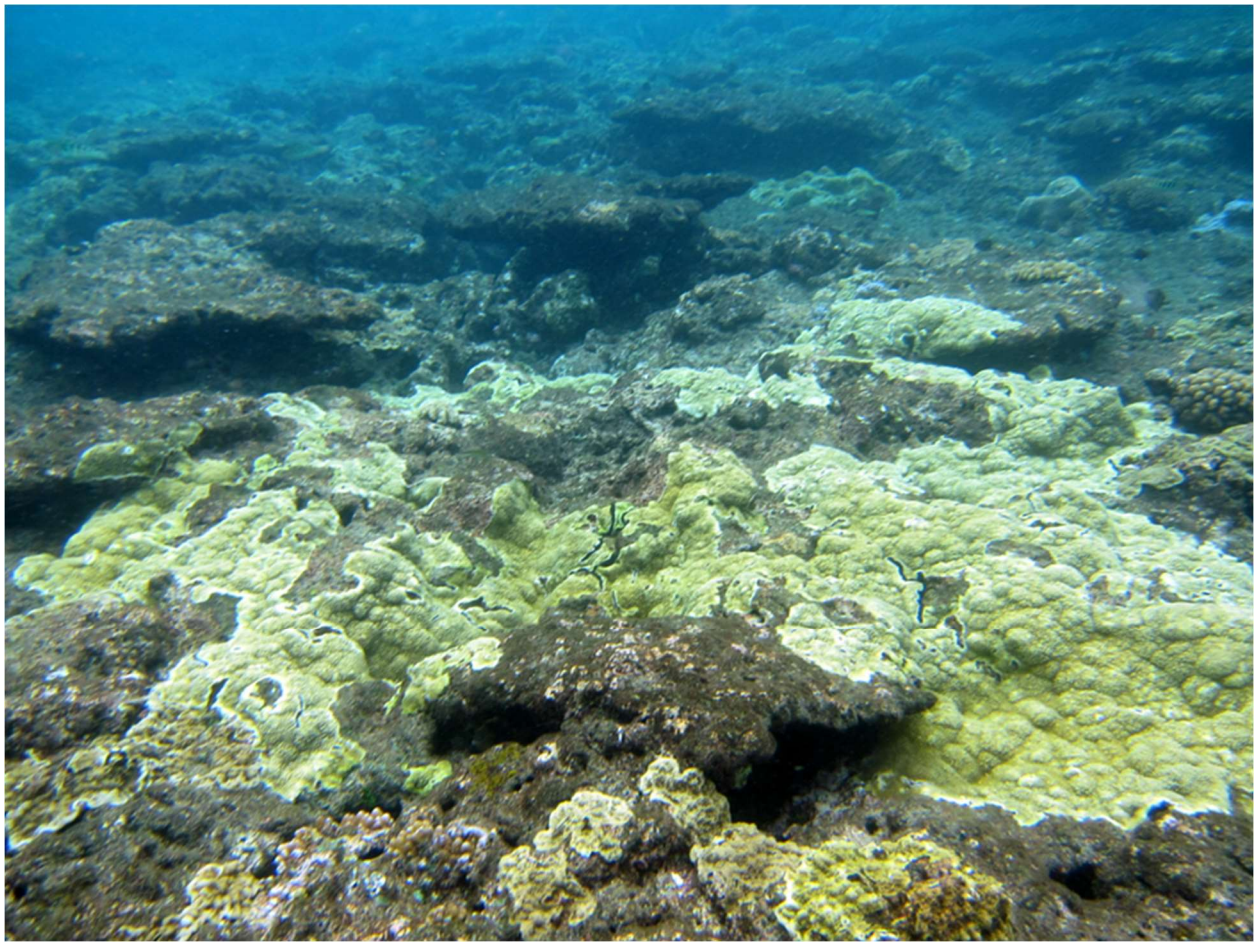


Isopora palifera, a different species within the same genus. *I. palifera* was not listed as threatened. *I. palifera* is common in a few places in American Samoa like Alofau outer reef flat and upper slope, but rare or absent elsewhere. In American Samoa it is always branching, with thick, short, rounded, oval branches about the size and shape of an arm and fist.

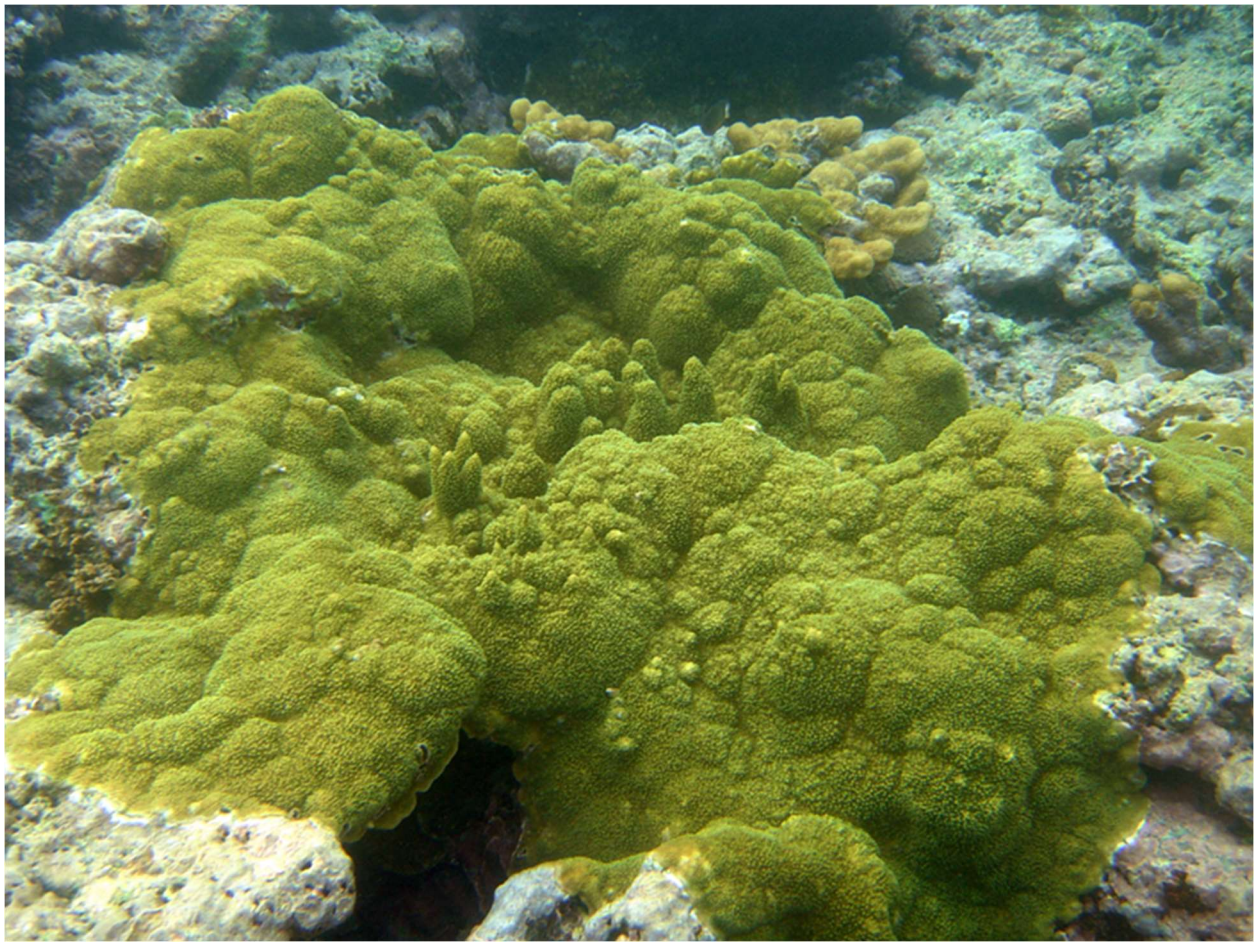
A closeup of an end of a branch of I. *palifera*. *I. palifera* has larger corallites than *I. crateriformis.* In American Samoa it is always completely branching, while *I. crateriformis* is always completely encrusting/plate. The difference in size of corallites is hard to tell unless colonies are side by side.



In some places, *I. palifera* can be encrusting. Here, I. *crateriformis* is on the left, with ridges and small corallites. On the right is *I. palifera* without ridges and with larger corallites. I. palifera also has larger corallites than *I. cuneata*, and branches tend to be rounder and smoother on *I. palifera*. In American Samoa, *I. palifera* makes colonies with branches no longer than one foot long, while in other places they can reach at least 3 feet long. In some places, *I. palifera* branches can be horizontal, but in American Samoa they are always vertical.

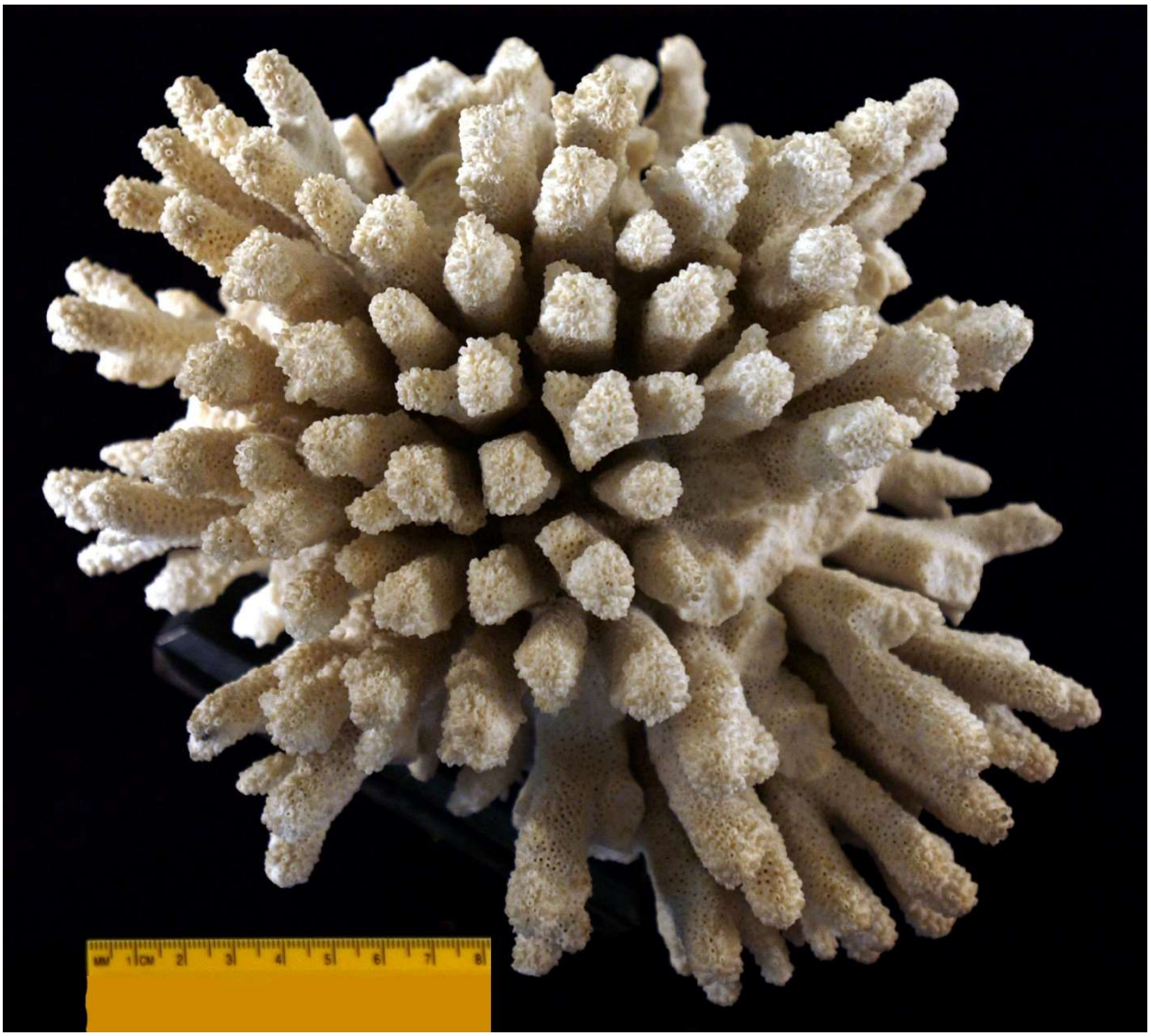


Acropora palmerae is another species which bears some resemblance to I*. crateriformis*. It was not listed as threatened. It always forms completely encrusting sheets, usually in shallow water. Colonies can be up to at least 3 m diameter, and can be green, yellow, purple, and possibly other colors. *Isopora crateriformis* is almost always well under 2 feet in diameter, and rusty brown or lighter tan, but rarely can be a light green with green polyps.



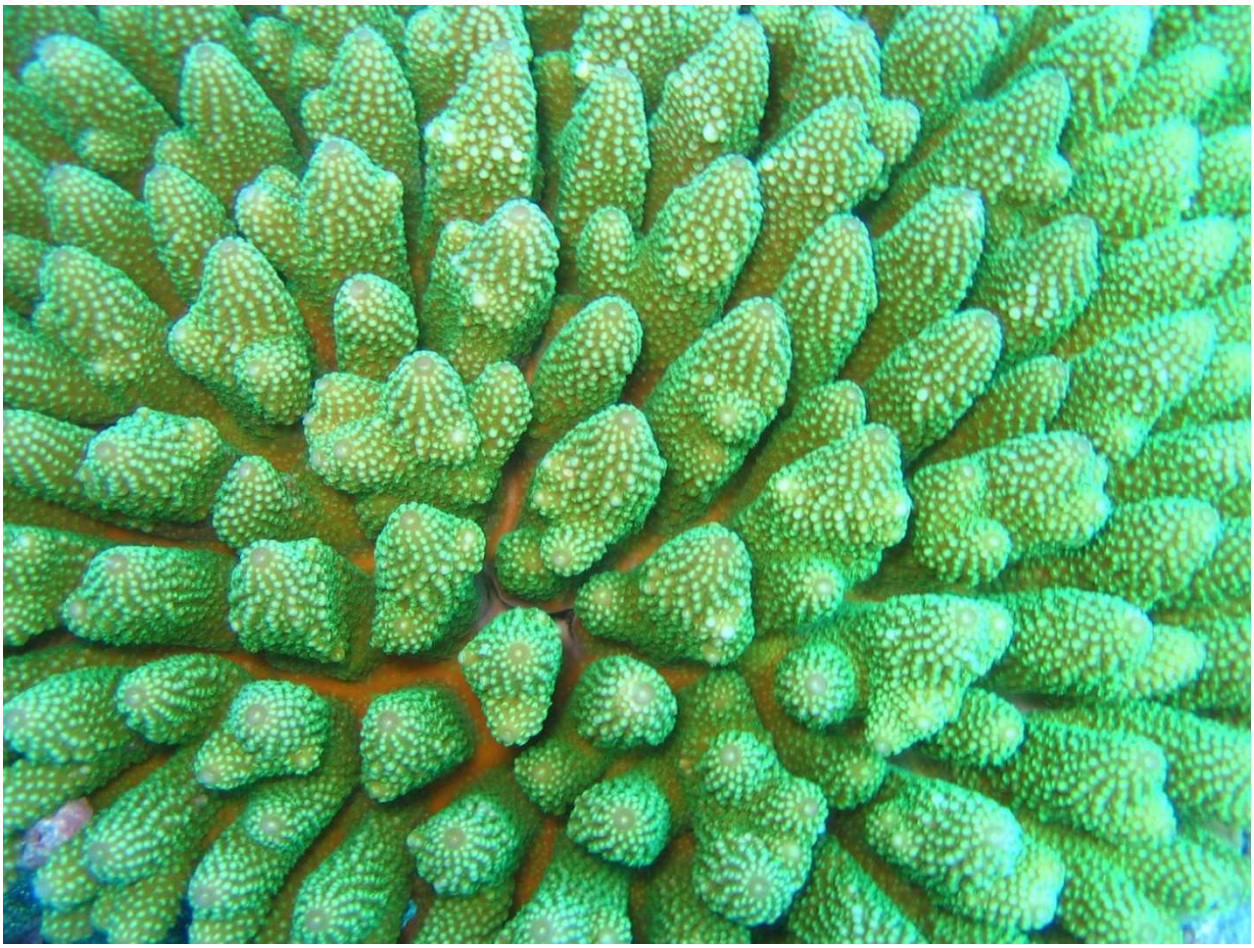
Slide 33: In this photo of *Acropora palmerae* from American Samoa the colony is green, encrusting, with small stubby branches in some parts of the colony. Colonies of this species can vary from completely encrusting to having a few relatively small branches, but always are mostly encrusting instead of mostly branching with a small encrusting base like *Acropora robusta*.

Slide 34: This is a closeup photo of *A. palmerae*. Here we see tubular, thin-walled corallites, some with tubular endings, some with oblique (sloping) openings, pointing in various directions. These are typical corallites of *Acropora*.



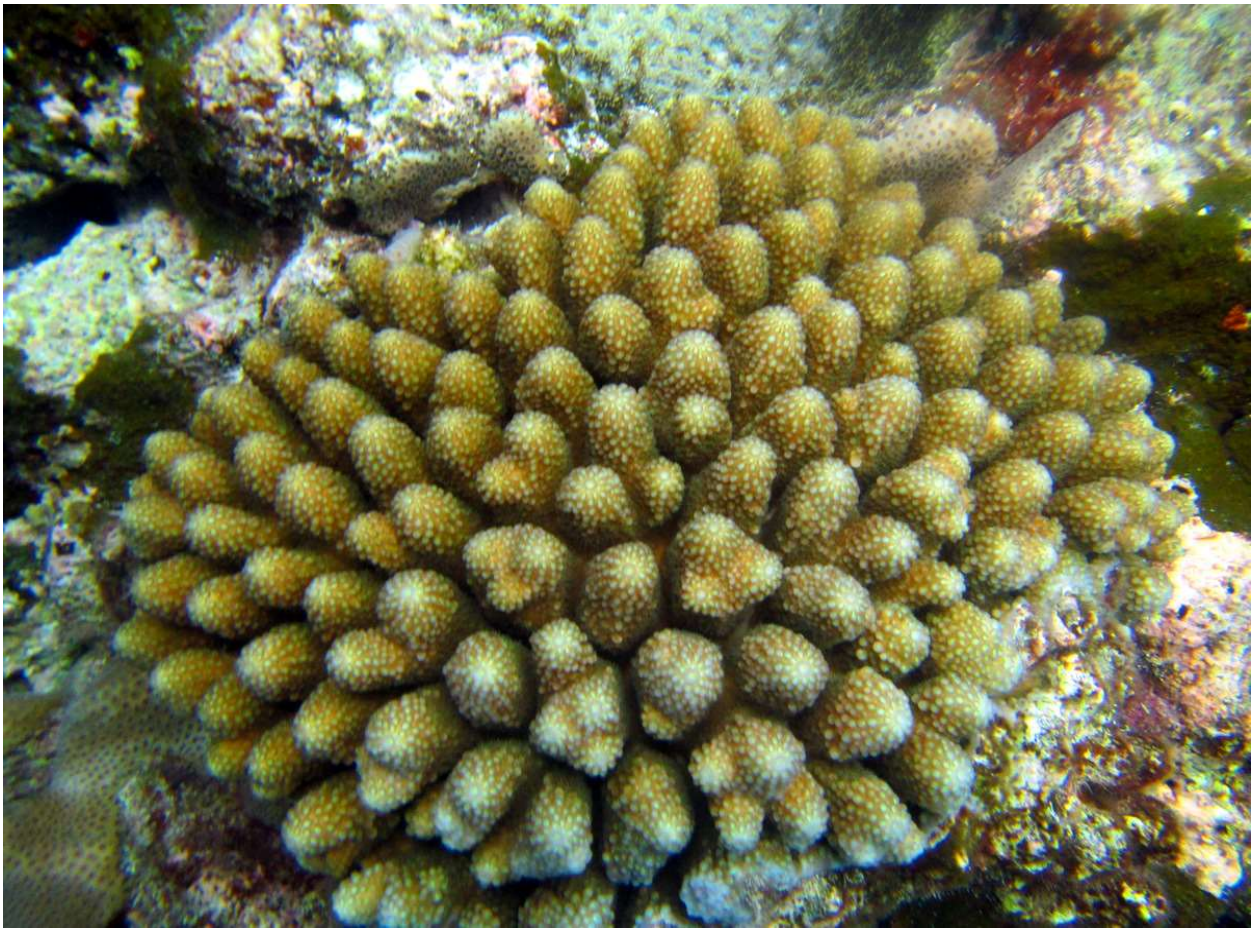
This is a photo of the type specimen of *Acropora globiceps*, our next species listed as threatened. The type specimen and original description define the species, so whatever this specimen is, is what *A. globiceps* is. This coral is in the Smithsonian Institution. Notice that the branches are like fingers, they have only a few, small side branches, and most have no side branches, and they are roughly finger sized and shape. We call this shape “digitate” for that reason. Notice that there is a uniform width, narrow crack between the branches, and the branches do not taper but have rounded ends. This is a species that was described in 1846 and then forgotten until 1999 and 2000 when Wallace and then Veron decided it was valid.

This is a closeup photo of the type specimen of *A. globiceps*. Here we see the uniform branches, their rounded tips, and the small, short, tubular corallites on the branches. In the genus *Acropora*, ALL species are branching, and in all species there is one corallite at the end of each branch, and many corallites on the sides of branches. The corallite at the end of the branch is called the "axial" corallite and those on the sides are called "radial" corallites. Often they are different from each other, but sometimes they are quite similar. Here they are similar and hard to tell apart in this picture. But note that the axial corallite is small like the radial corallites. The radial corallites are also close together.



This is a photo of a living colony of *Acropora globiceps* in American Samoa. Note that the branches have only a few small side branches, so this colony would be called “digitate.” Note that the branches are uniform in size and shape, and fairly close together like the type specimen we just saw. Note that branch ends are rounded, though they taper a bit before the tip. Note that there is a crack between branches that is fairly uniform in width. If you look at live colonies closely, you may see small black fish or sometimes tiny crabs, in the cracks. The fish are *Gobiosoma* sp. and may help keep the space uniform and open between branches by swimming through them, rubbing on tissues. This colony is a fluorescent green.

Here is a closer picture of another colony which is brown. Note the axial corallite is short and tubular, and a bit larger than the radial corallites, but not a lot. In some places on some branches, the radial corallites are in rows down the branches. The branches in this colony are a bit farther apart than on the previous colony. The type specimen defines the species, but it doesn't have to be typical, just within the range of variation of colonies in the species. When species are first named, the range of variation of the species is usually not known. We are just now learning more about the range of variation of this species.

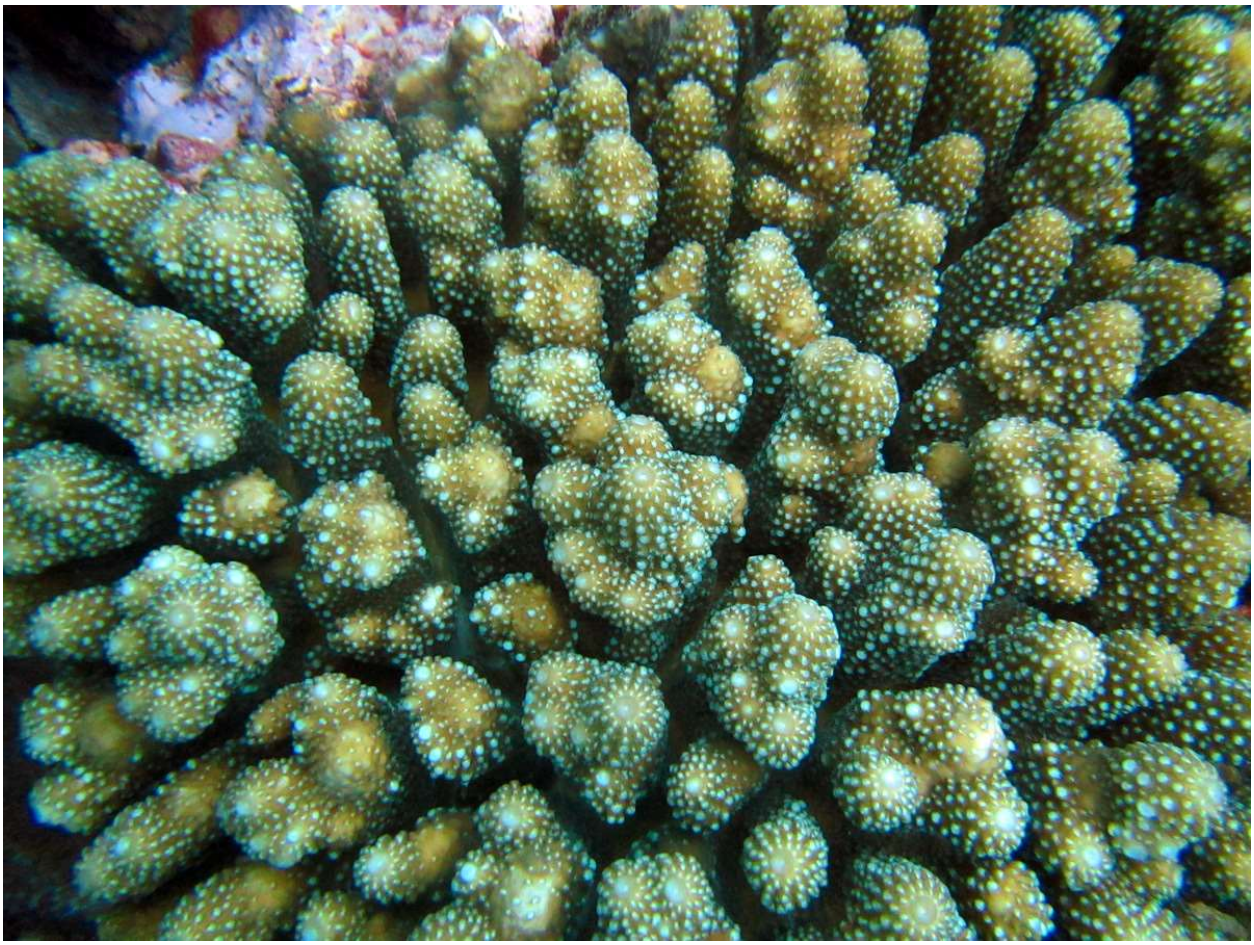


The two previous photos were from American Samoa, this photo is from Rota Island in the Marianas, where all the colonies near the harbor look like this. The branches are a bit shorter and closer together, and this is a typical color there. You can learn to identify this species easily, as shown by an experience at Rota. A diver on our surveys, Kevin Foster, pointed at one of these corals and I pointed thumbs up, you're right. Then he pointed at something else, and I pointed thumbs down. He then pointed at one after another correctly for the rest of the dive, didn't miss a one. It helps to have plenty of them to practice on. American Samoa has plenty at some dive sites at around 30 feet deep.

This photo of *A. globiceps* was taken at Palmyra Atoll, a very long ways from the Marianas, by the very same Kevin Foster that learned to ID them in the Marianas. Different color but nearly identical shape. Usually color is not very helpful in identifying Indo-Pacific corals, but sometimes it is.

Another light colored colony, this time in Wallis, of Wallis and Futuna, a French territory west of the Samoas. Note that the branches are tapering here, but otherwise seem very similar.

A closeup of a fluorescent green colony in Wallis. Some branches taper, others don't. You can see that short ring that is the axial corallite. That shape axial seems to be the same in all colonies of this species.



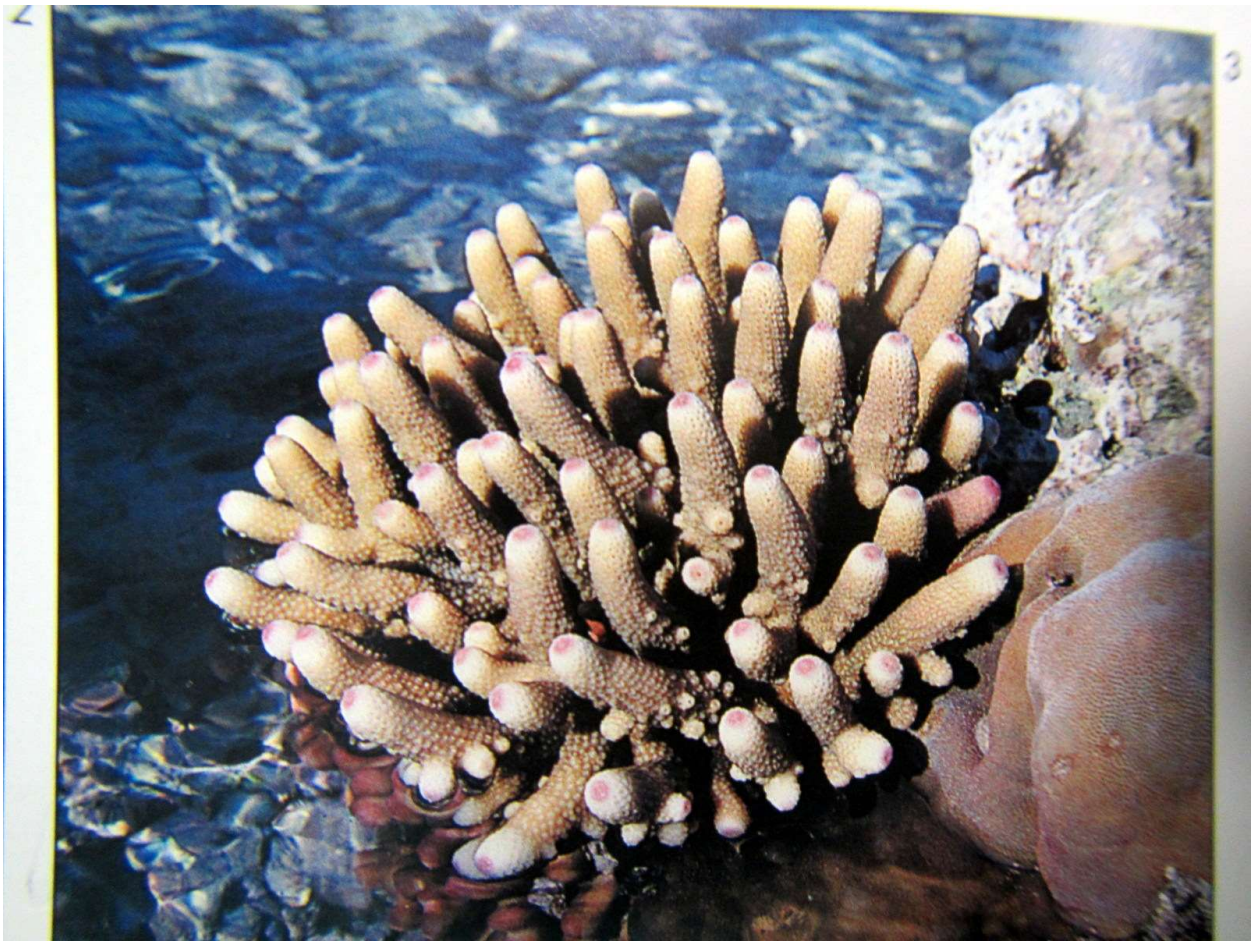
A colony that has much more side branching, but otherwise appears to be *A. globiceps*. This is one of only a couple colonies I have seen like this, this is quite rare.

A colony with very uniform branches that don’t taper and have rounded ends.

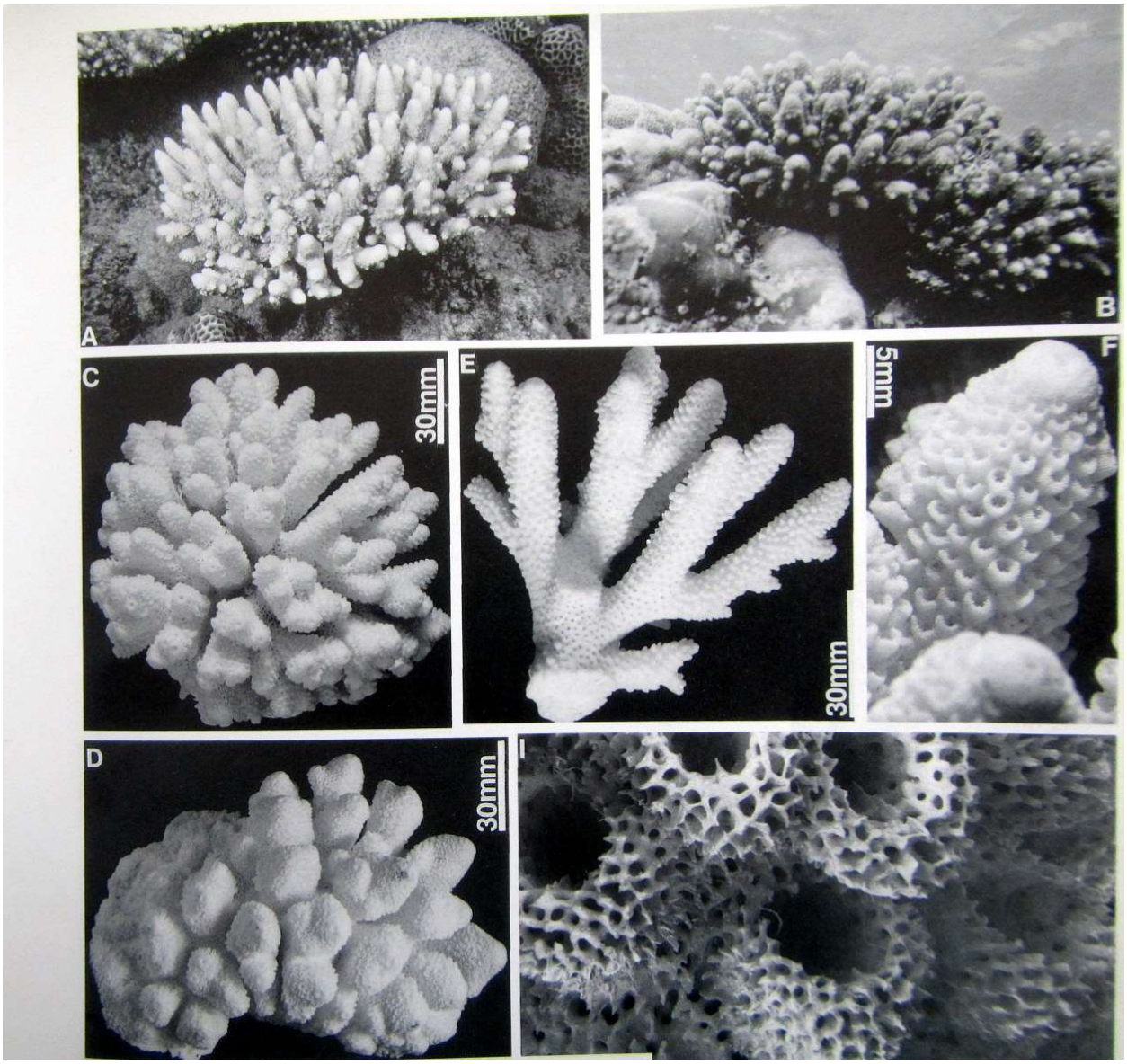
A colony that is somewhat similar to the last one, but with slightly more projecting radial corallites.

This is *Acropora humilis*, a species which is not listed but which has often been confused with *Acropora globiceps*. It was described at the same time as *A. globiceps*, in 1846, but unlike the latter it has been recognized by most everyone since then. This is a photo of a colony that comes from Veron's 2000 book. Notice the branches are very far apart and that the axial corallite is a huge dome at the end of the branch. The branches don't taper and the radial corallites are small like on *A. globiceps*.

Here is a closer Veron photo of *A. humilis*. Notice the branches are short and close together, don't taper, and have more side branches. The axial is again a large dome (the tiny white spot in the center is the polyp).



Another Veron photo, with long, widely spaced branches with few side branches. Looks like the axial corallite isn't a big dome.

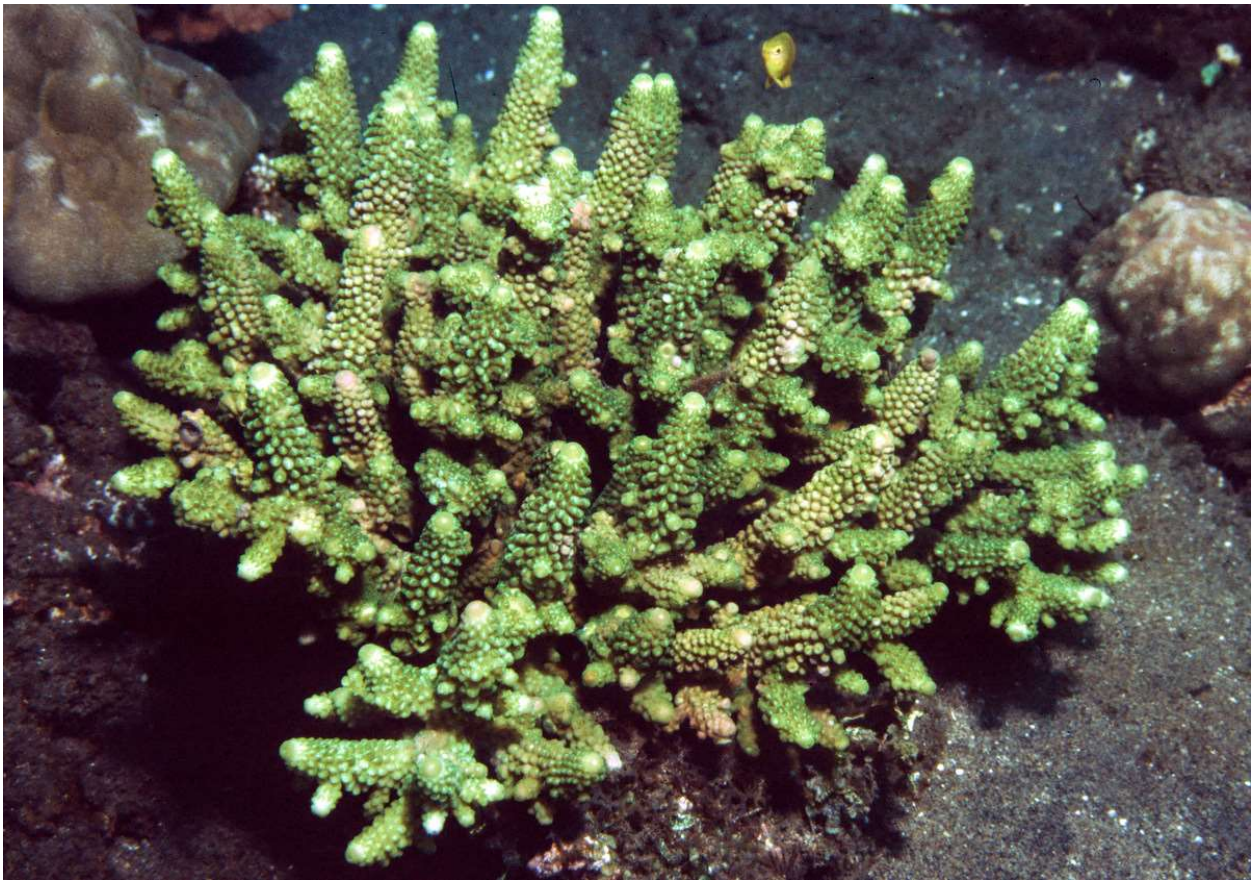


Slide 49: This is a photo of the page of photos of *A. humilis* from Wallace's 1999 book on *Acropora*. The top row has photos of living colonies, the other photos are of skeletons. Some have branches close together, others have them far apart. In the lower left they taper, in the middle row center they don't. In the middle row right it has big dome axial corallites. The photos and descriptions from books like Veron (2000) and Wallace (1999) present their concept of what the species are, picking photos and producing descriptions that fit with that concept, showing what they think are examples of the species with some of the species variation.

This colony from the Great Barrier Reef has large dome corallites. I used to think that was what was distinctive about *A. humilis*. But note it also has thick, tapering branches that are uniform in length and relatively sort, close together and not diverging much. But it has those huge dome corallites, which are very short. So what is it? Hybrid? Good question, we don't really know yet.

Closeup of the same colony. The axial corallite is a dome shape, with a very thick wall and a tiny polyp in the center.

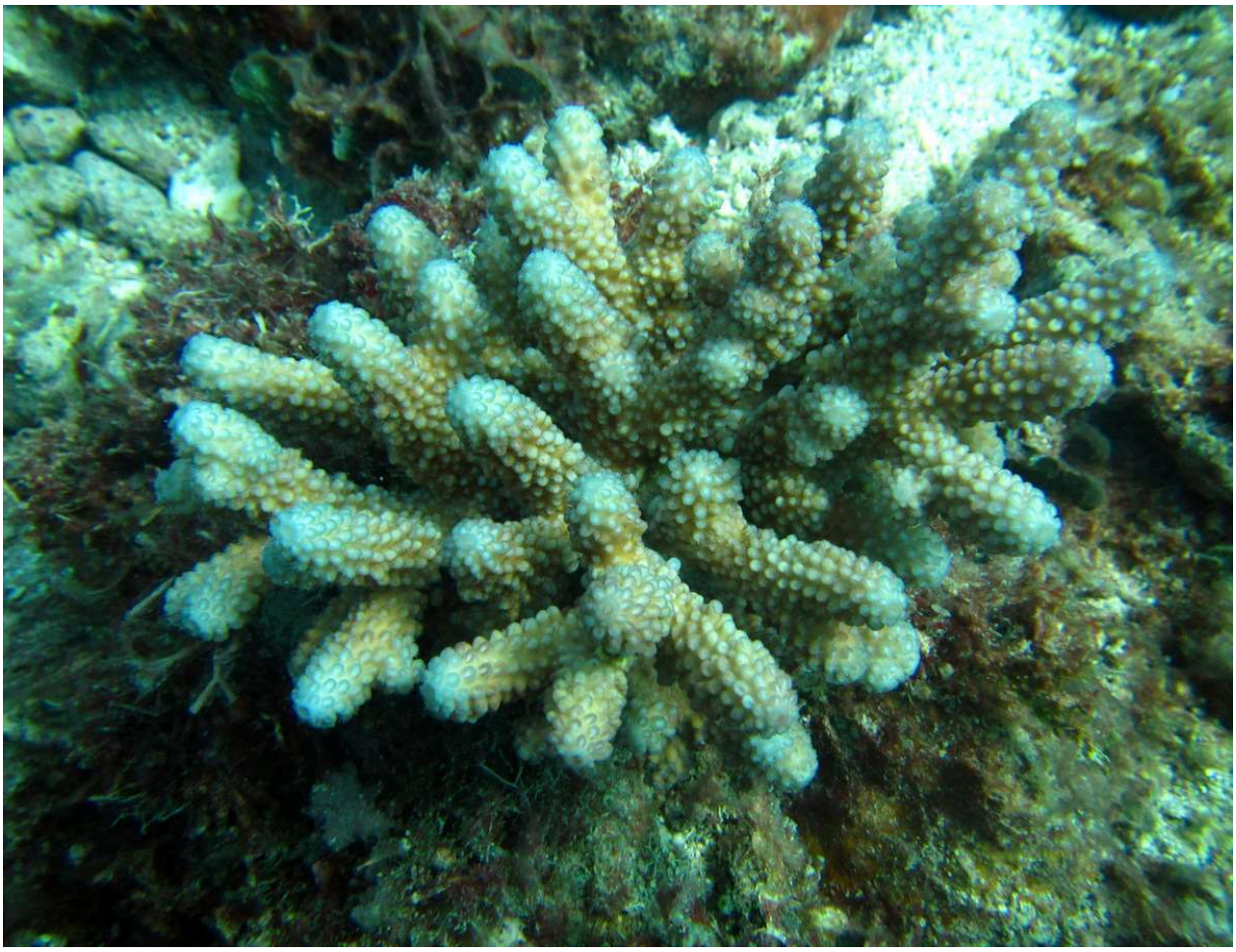
A photo from the Philippines of a colony with thick uniform branches close together that taper near the end and have lots of small side branches. It also has large dome axials, which project a long ways. The previous photo had very short dome axials.



A colony from the Philippines with widely diverging branches with lots of little side branches and it looks like large dome axials.

To try to solve these mysteries, we can look at the type specimen, again in the Smithsonian. This is the type specimen of *Acropora humilis* from the side. It has branches that are not very thick, diverging some, with many small side branches, and moderate size axials (which are hard to see).

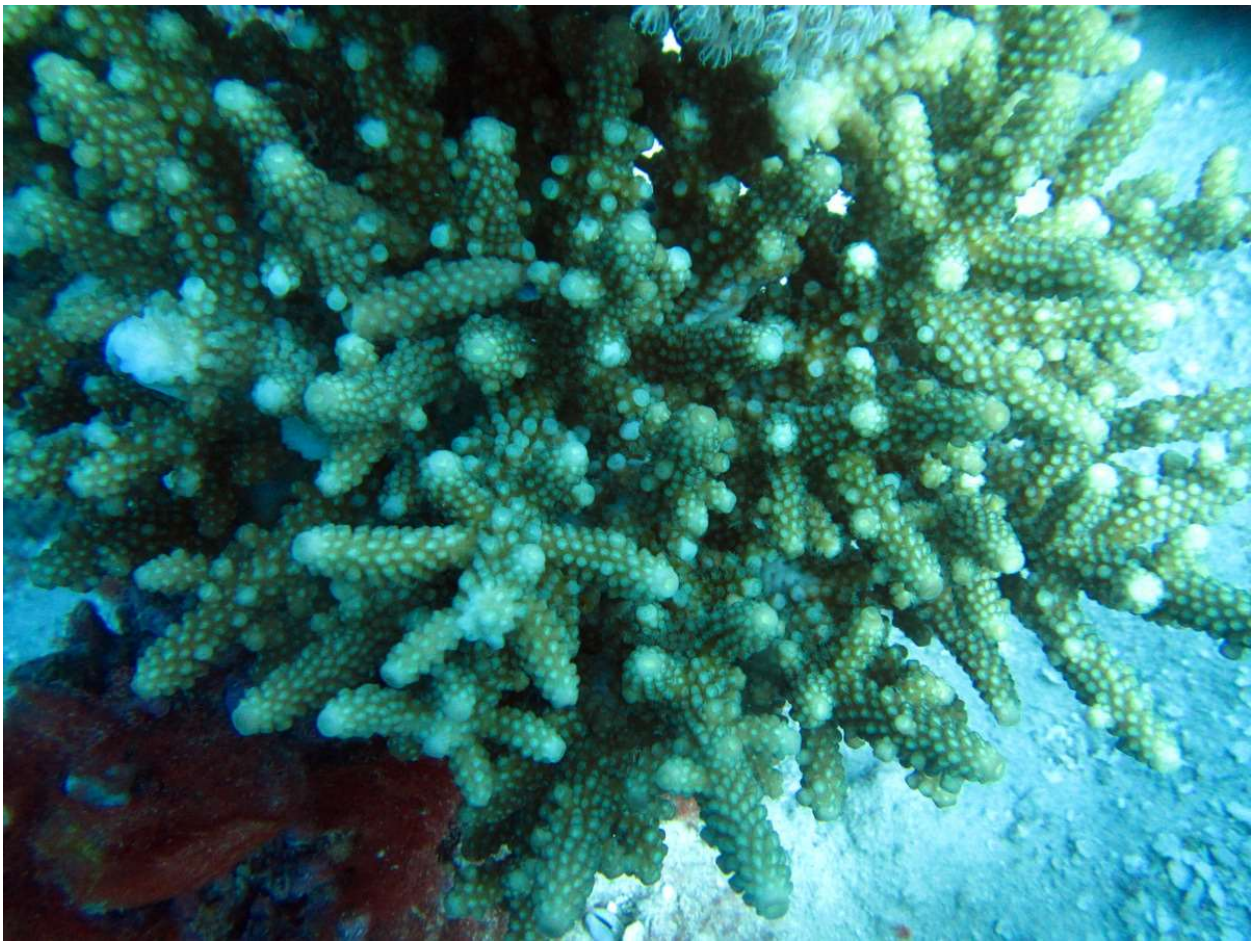
Slide 55: This is a top view of the same type specimen. The branches can be seen to diverge, there are fewer little side branches than in the side view, and the axials can be seen to be intermediate in size. This defines what *Acropora humilis* is, but only has to be one point in the variation within the species.



Here is a picture of a live colony in the Marianas that appears to me to be a good match for the type specimen of *Acropora humilis*. The branches diverge (even more than on the type), are relatively thin, don't taper, and the axials are moderate size, though it is hard to see that in this picture. There is some variation in branch length.

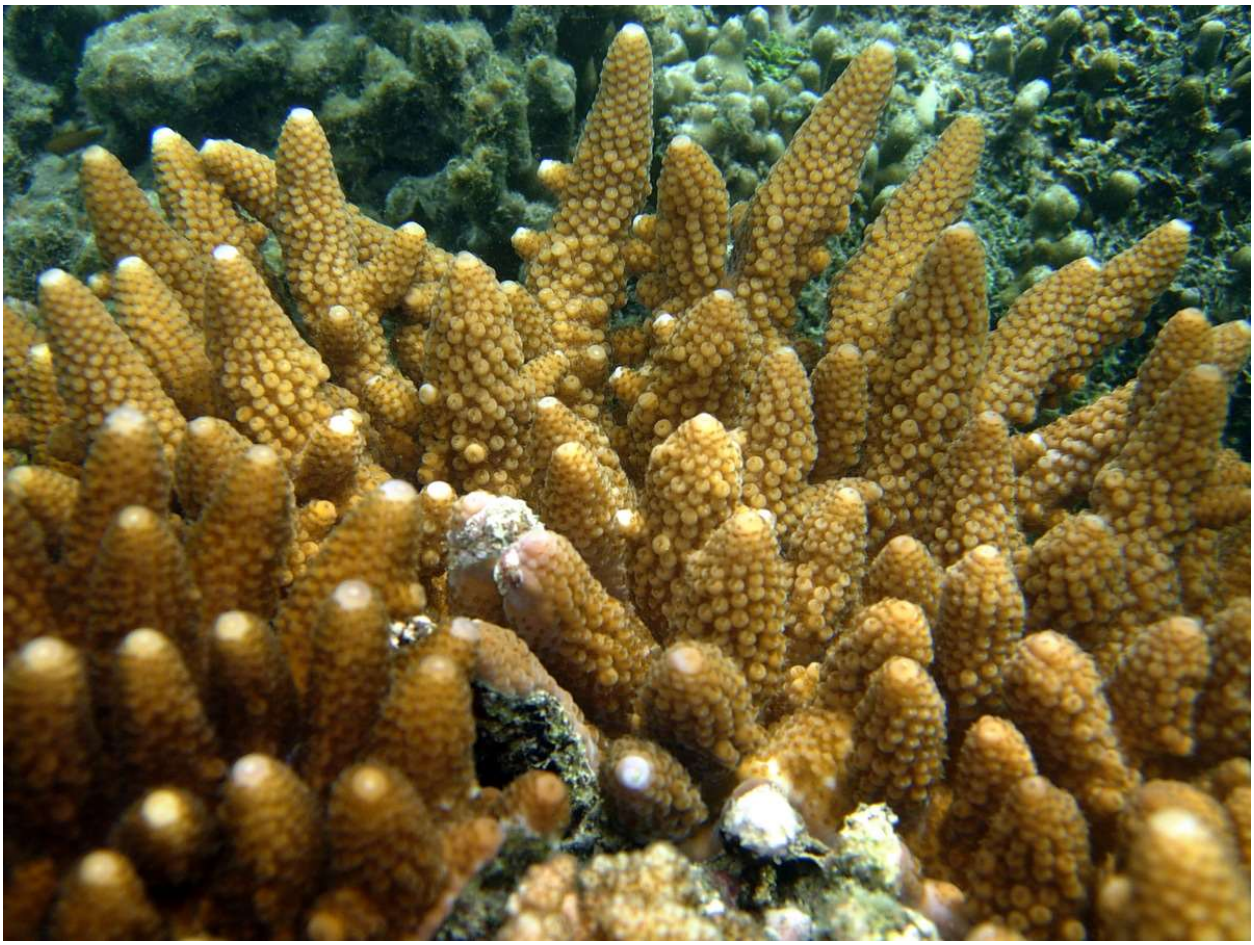
This seems to be *Acropora humilis* as well, but a younger colony. The branches diverge, they are variable lengths, they don't taper and are relatively thin. The axials are moderate in size, a bit larger than *A. globiceps*.

Here is a photo from Fiji taken by Victor Bonito, which appears to have *A. humilis* on the left and *A. globiceps* on the right. Branches on the left diverge widely and are longer than on the right, where they are closer together. The axials are very close to the same size and radials are very similar. It appears to me that there are several different characters which can appear in different combinations. A. *humilis* usually has longer, thinner branches which diverge more widely and may be different lengths. *A. globiceps* usuallhy has more uniform, shorter branches that don't diverge. *A. globiceps* almost always has small axials (I've just photographed one colony so far that has big dome axials), and *A. humilis* has axials that range from just slightly larger than *A. globiceps* has to very large domes that can be flat or project. By the way, I have only seen *A. globiceps* in American Samoa, never *A. humilis*. *A. humilis* have often been reported there, but I think all those reports are actually of *A. globiceps*. *A. globiceps* has not been distinguished until recently.



Acropora samoensis is named after Samoa but I have never seen it there. It is not listed. Recently I saw it for the first time, in Fiji. It appears to be near identical to *A. humilis*, except that the branches are smaller, it appears to be a miniature *A. humilis*.

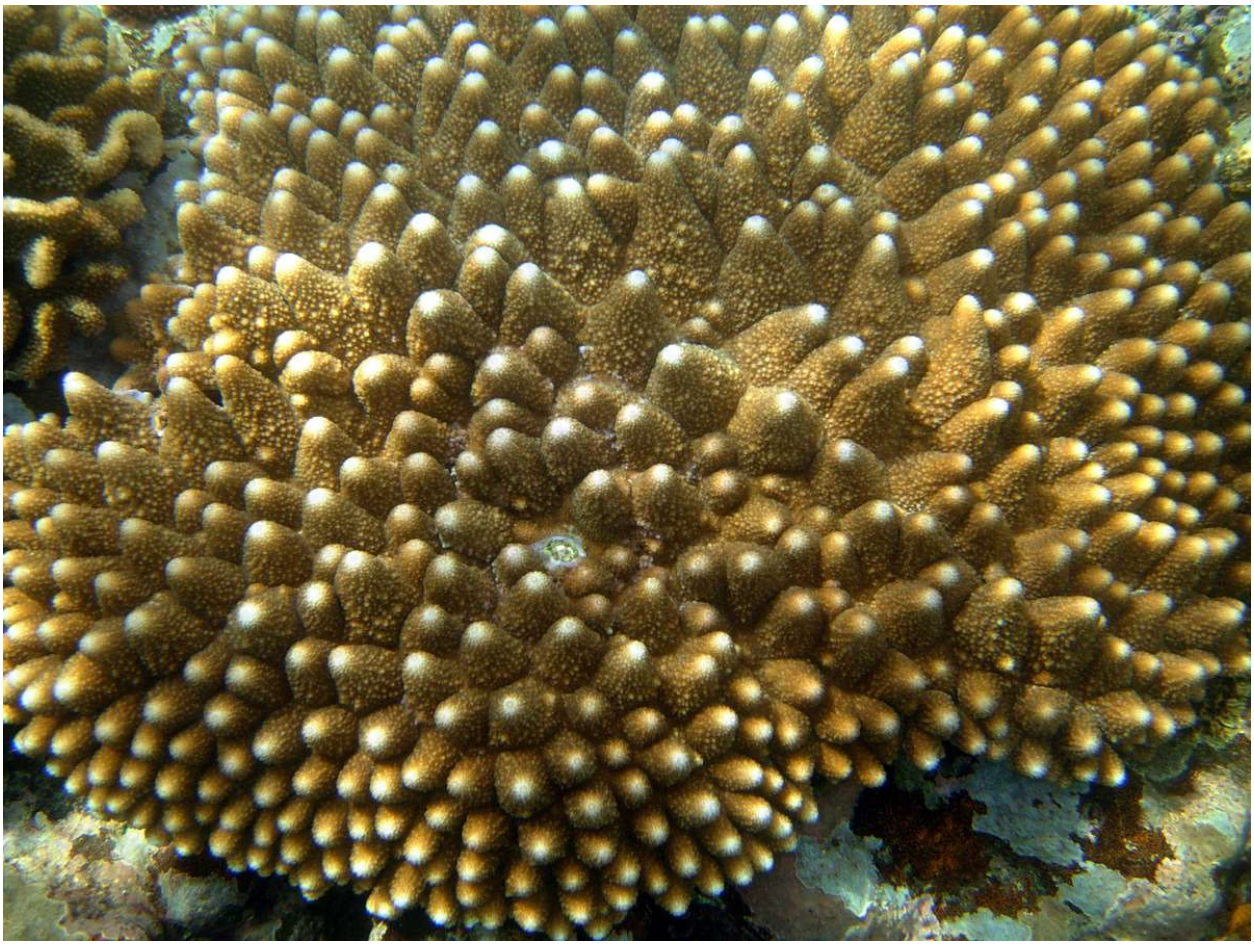
Acropora gemmifera is another species which is not listed but which is similar to *A. globiceps*. It is digitate, and sometimes the branches are uniform in size but other times they vary greatly within one colony. In this picture you can see that the branches taper to a point, are uniform in size, and close together. The axial is not large, in the lower part of the picture you may be able to see a little yellow ring in the white at the tip, the yellow ring is the wall of the axial corallite.



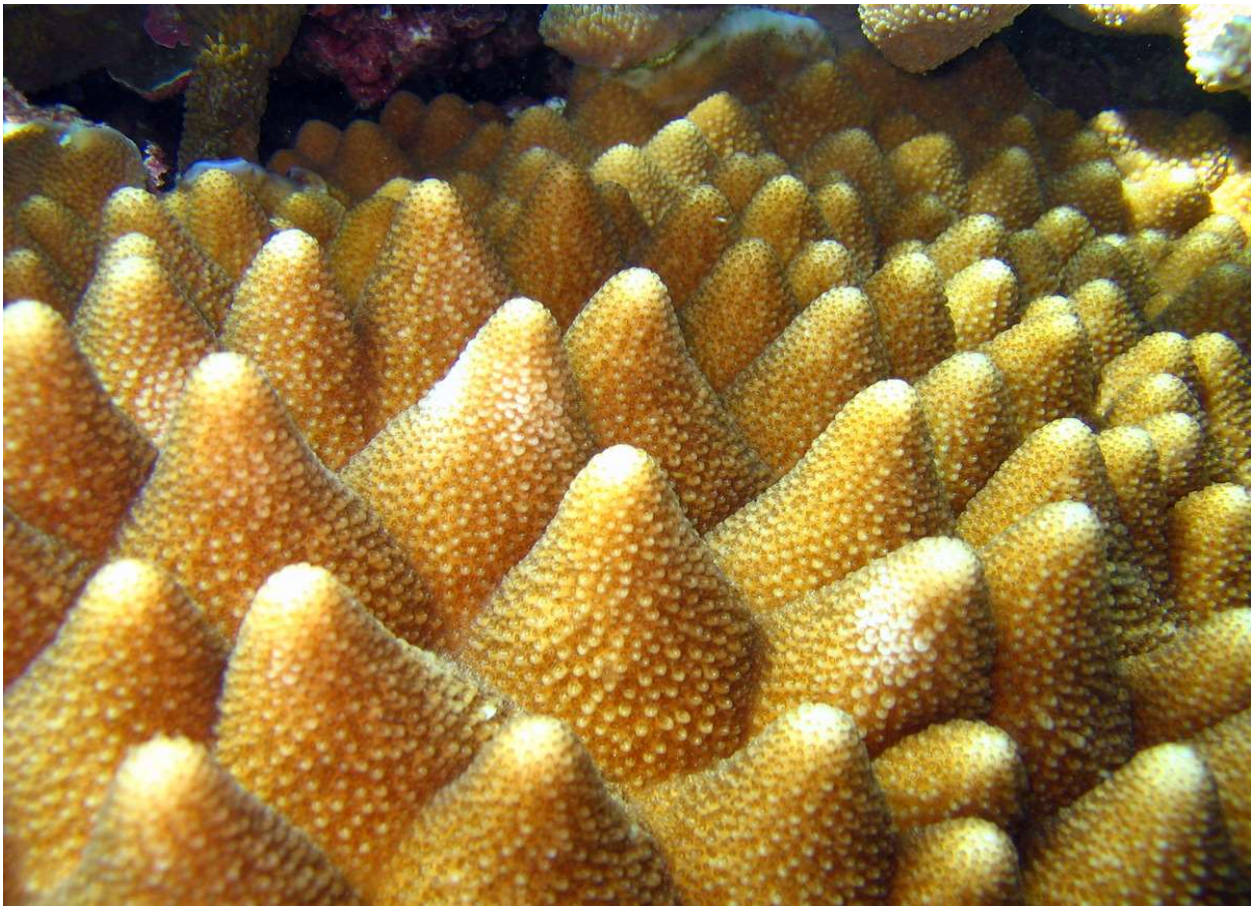
Here you can see a colony of *A. gemmifera* in which branches vary greatly in length, and some branches diverge widely.

This colony from Wallis has white corallites on a brown branch. The radial corallites increase in size down the branch. Also, they appear considerably larger than on *A. globiceps*.

Here is a closeup picture of *A. gemmifera*. The radial corallites are very large, short, fat with thick walls, quite different from those on *A. globiceps*. Also, it appears that the axials project and are larger than on *A. globiceps*.



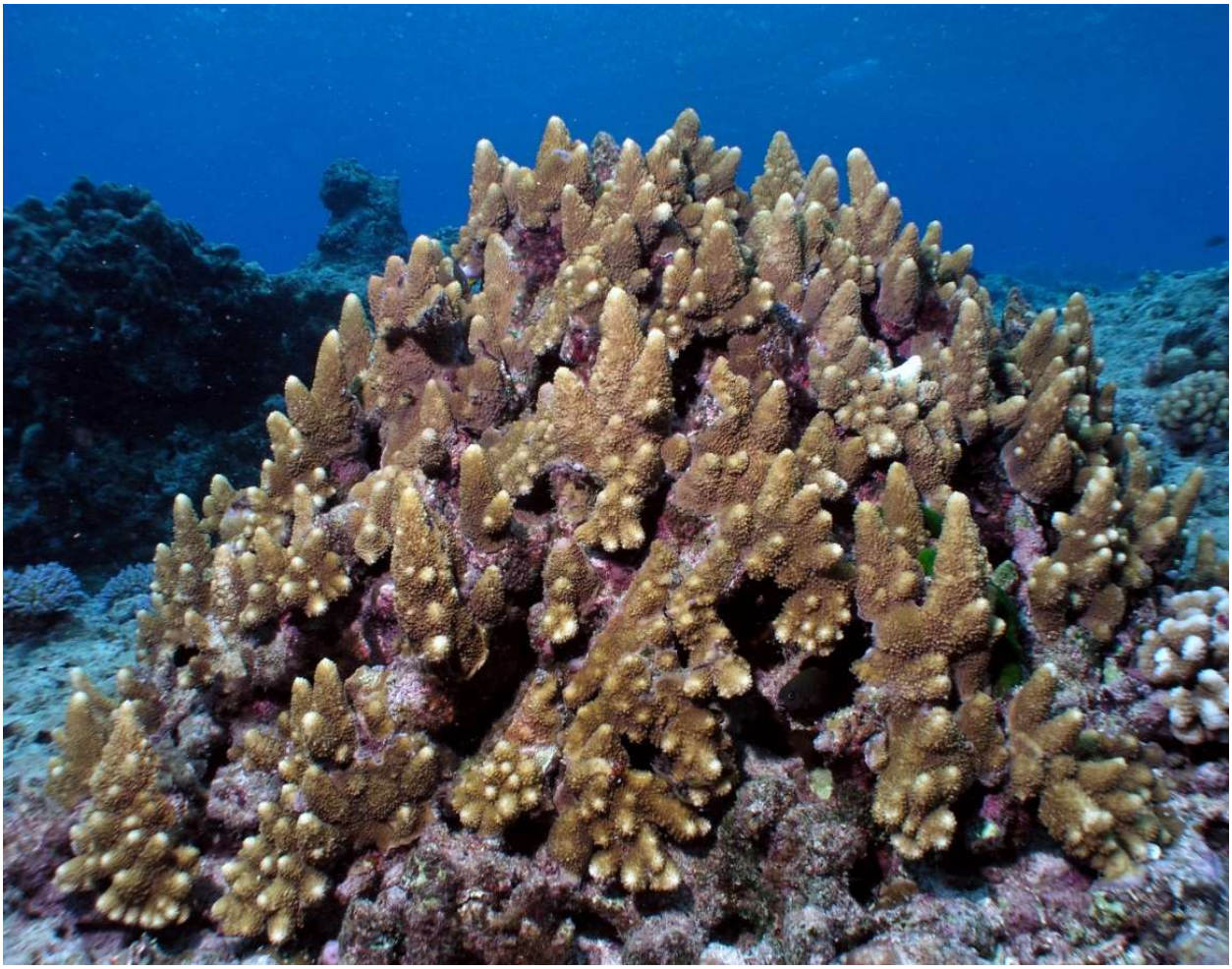
This is a photo of another species that was not listed but is similar to *A. globiceps*. This picture is of one of at least two morphs of *Acropora monticulosa*. This is the digitate morph, in which the branches are digitate and taper. Larger branches, often near the center of the colony, usually taper more than those near the edge, and they taper very strongly, much more strongly than on *A. globiceps* or any other species. They taper to a sharp point. The branches are all about the same length, though they differ in base diameter. Colonies are nearly flat. Note that there are virtually no side branches.



This is a closer photo, taken from the side, to illustrate the very strong tapering large branches of the digitate morph of *A. monticulosa*. Morphs are shapes. This digitate morph is much more common than the other morph in American Samoa, but I have only seen the other morph in the Marianas.

This is a photo of the other morph, called the branching morph, in the Marianas. Colonies have cylindrical branches that taper only a little and have rounded ends. The branches are variable in length and direction they point in. The corallites are small, like in the digitate morph. In the Marianas, branches often have blue tips.

Here is a photo that shows some of the variation in branch size, and also shows a branch that divides and branches in the lower left. The longest branches are also much longer than on the digitate morph.



Slide 68: A photo of a large colony of the branching morph of *A. monticulosa* in the Marianas. Large colonies like this are dome shaped instead of flat like the digitate morph. Also, they usually have dead areas covered with coralline algae between the live branching parts.

A photo of a branching morph colony in American Samoa. I have only seen two colonies here, both in shallow water in Fagatele Bay. I do not know if they survived the 2009 tsunami. Both colonies were green. They have long cyclindrical branches with rounded tips, and many side branches. I have seen similar colonies in sallow water in New Caledonia, but which were brownish red.

Another species that was not listed but is similar to *Acropora globiceps* is *Acropora digitifera*. There are at least two morphs of this species as well. This photo is of the tapering morph that is in American Samoa. These colonies are typical in shape but unusual to have their edges so far up above the substrate. *A. digitifera* has smaller branches than *A. globiceps*.

This is a closer photo of the tapering morph of *A. digitifera* in American Samoa. The branches can be seen to be quite short, close together, and separated by a crack. The sides of branches are rough with the lower lips of radial corallites.

Slide 72: In this photo of *A. digitifera* the branches are smaller than on *A. globiceps,* and in this colony aren't very close together and don't have the obvious crack between them. The branch sides may look a bit rougher too, as the corallites are cut at an angle, giving them a bit of projecting lower lip.

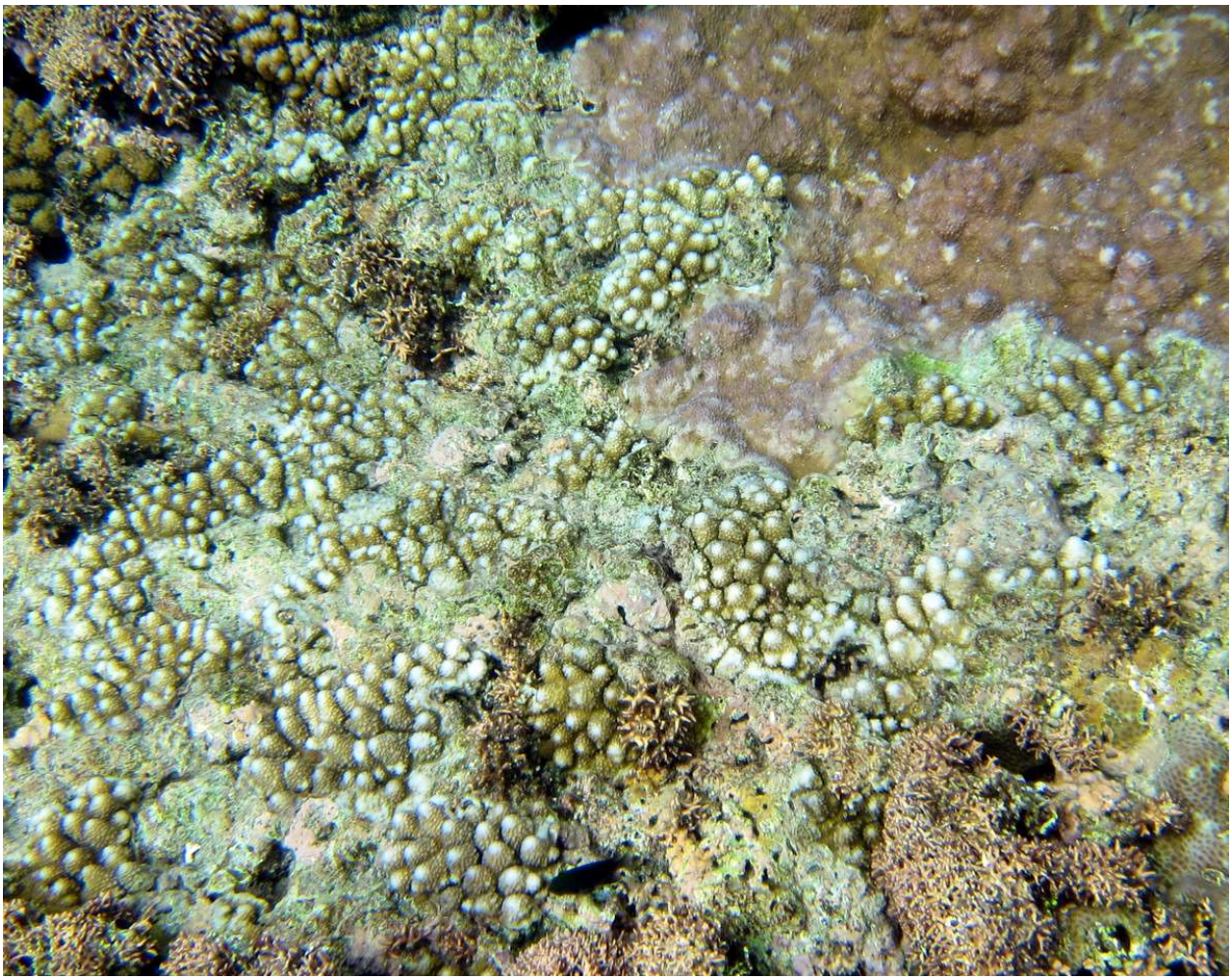
Slide 73: A close up photo of *A. digitifera* in American Samoa. The strong taper of the branches is obvious. Also, the lower lips of the radial corallites can easily be seen. This species really prefers shallow water near the reef crest, while *A. globiceps* is more common down the forereef slope.

This is a photo of the thin branch morph of *A. digitifera* in the Marianas. The branches are thinner than on the tapering morph, and don't taper. Usually the branch tips are blue, more blue than in this photo. This morph also likes shallow water like the crest or reef flat.

This is a closer photo of the thin branch morph. Although the branches are closer together, they don't have an obvious uniform crack between them.

This photo is of another digitate species that is somewhat similar to *Acropora globiceps* but has not been listed. We don't know for sure that this species has a name at present. It is somewhat similar to corals in the Marianas that Richard Randall has been calling *Acropora ocellata*. This species in American Samoa forms low rounded mounds up to around 3 feet diameter but often smaller. Usually there are dead areas between the live areas. There are small, digitate branches. This species seems to always be brown in American Samoa.

This is a closeup photo of the branches of this coral. The branches are smaller than on A. globiceps and don't have a crack between branches. Like *A. digitifera* it lives on reef crests or near them on reef flats.



This is a cluster of colonies in the Marianas that Randall has been calling *A. ocellata*. Like the American Samoa colonies it is typically a cluster of living colonies with dead areas between them. Unlike American Samoa colonies the cluster of colonies is flat not a dome, and the living parts are generally not brown. It does seem to like fairly shallow water. This may not be the same species as in American Samoa. Both in American Samoa and in the Marianas, it forms clusters of colonies with dead areas between the living parts, unlike *A. globiceps*, and the branches are smaller.

This is a photo from Randall and Myers 1983 book on Guam corals. Here, the branches have large dome axial corallites. This may be another, different species. Randall is working on finishing a series of books that will name many new species.

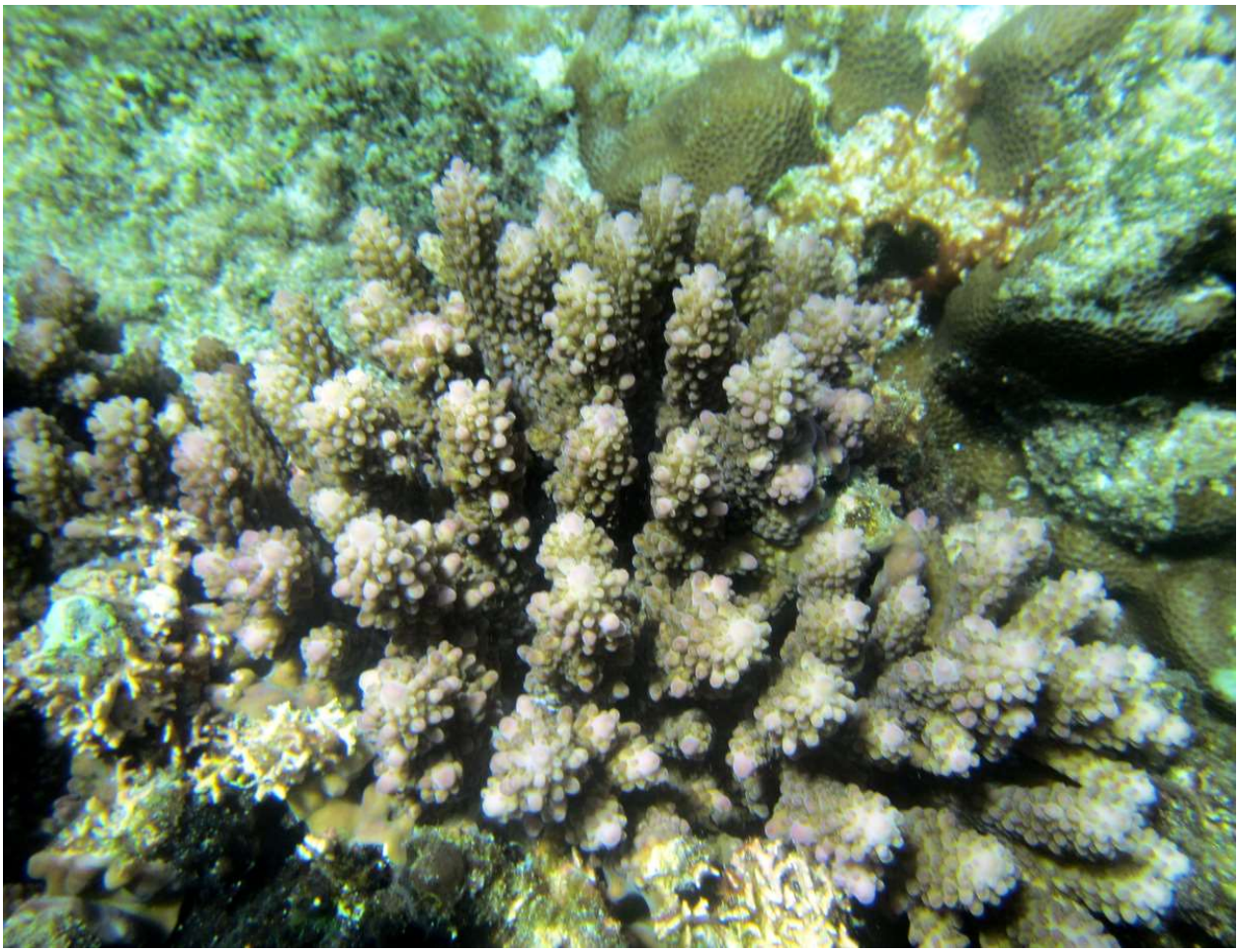
Slide 80: Here is another photo of a coral with small digitate branches in the Marianas. These corals are single colonies, not clusters of colonies. The identity of this coral is not known at this time.

Acropora retusa is another species that was listed as threatened under the Endangered Species Act. Like *Acropora globiceps*, it was named long ago but forgotten until 1999 and 2000. This species is also digitate, but the branches look rough due to large tubular radial corallites that extend variable distances from the branches, making the branches look rough or "prickly." So far it seems to be rare everywhere.

This is a closeup of *A. retusa* which shows the large radial corallites that extend variable distances from the branch. These radial corallites have relatively thick walls.

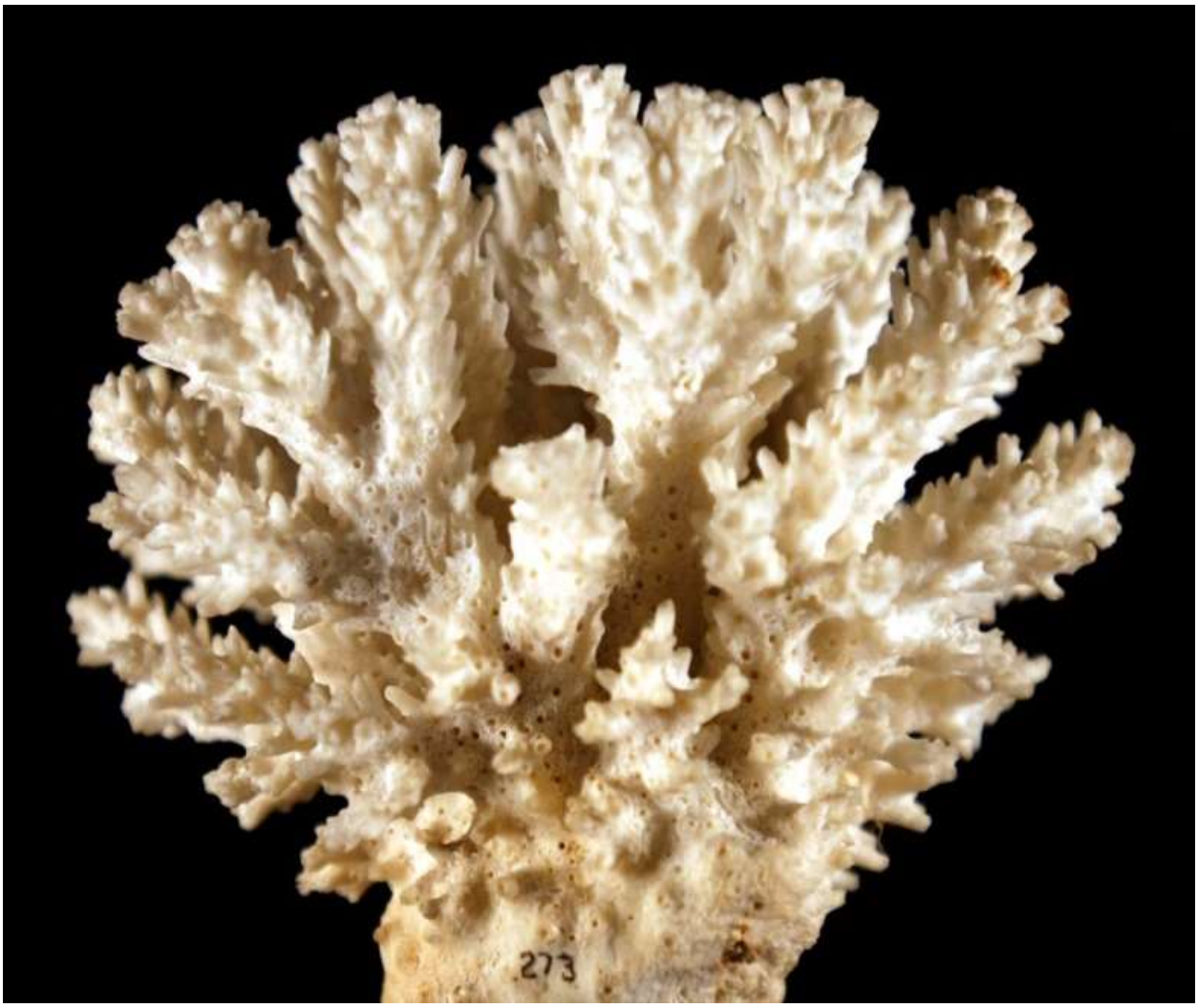
Slide 83: Another colony of *A. retusa*, with a different color and with the radial corallites not extending as far or being as irregular in length as in the previous photos.

A closeup photo of another colony of *A. retusa* with some but not a great deal, of irregularity in the length of the large tubular, radial corallites.



This colony in the Marianas may be *A. retusa*, or perhaps "*A. cophodactyla*." See photos below of "*A. cophodactyla*."

This photo is somewhat similar to *A. retusa* with the large radial corallites, but they are uniform. It is more similar to the Veron's photos of *A. ocellata*. Veron's concept has longer branches than Randall's, which radiate from the base more like the type, which has intermediate length branches (photos of the type on Veron's website). So this photo is probably not *A. retusa*.



This is the type specimen of *A. retusa* in the Smithsonian. Notice the digitate branches and relatively long radial corallites. You can see why interpreting type specimens can be difficult.

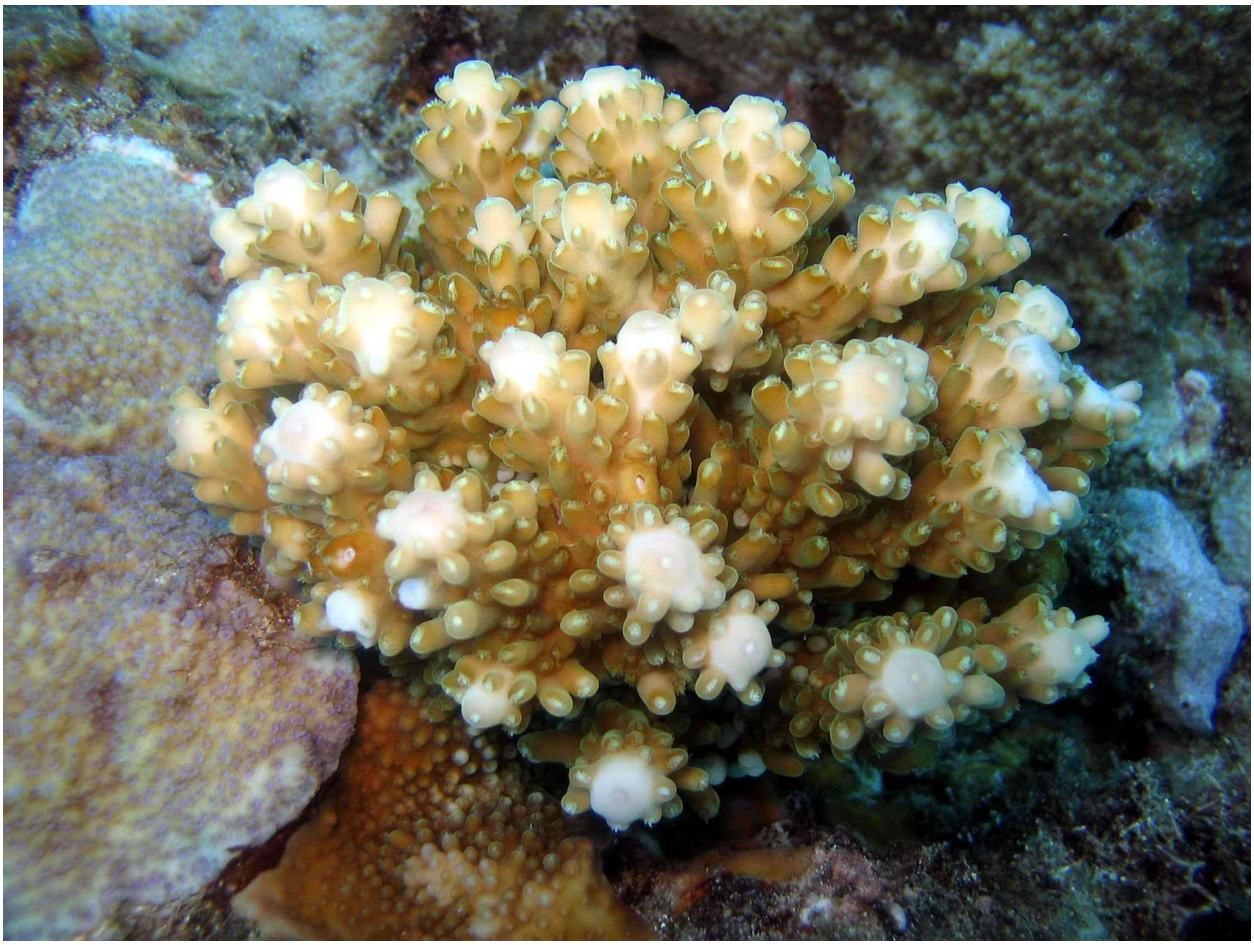
This is a picture of *A. globiceps* on the left and *A. retusa* on the right. These are easy to tell apart. Look how much smaller the radial corallites are on the left than on the right.

Slide 89: The difference is even more obvious in this closeup.

Slide 90: This is a photo of what may be "*Acropora cophodactyla*" in American Samoa, another species that was not listed. Veron indicates this species is digitate, has larger branches and a larger axial than similar species.

This photo from the Marianas appears to fit the concept of "*Acropora cophodactyla*" that Veron has. Note the large, tall, sometimes tapering axial corallite. The radial corallites are large and variable in length. Veron says that although he is using this name, he has checked the type and this coral does not match the type. So it is likely another species, but we don't know the name yet. The radial corallites in this colony are similar to that on *A. retusa* but the branches are longer and the axial projects upward farther. It is not clear whether this is part of the variation of *A. retusa* or this is a separate species. I need to see more *A. retusa* and this coral to try to work this out. This is a work in progress.

This may be *A. retusa*, but the radial corallites are not long and variable.



This young colony appears to be *A. retusa* with long and variable radial corallites, but it has huge axial corallites.

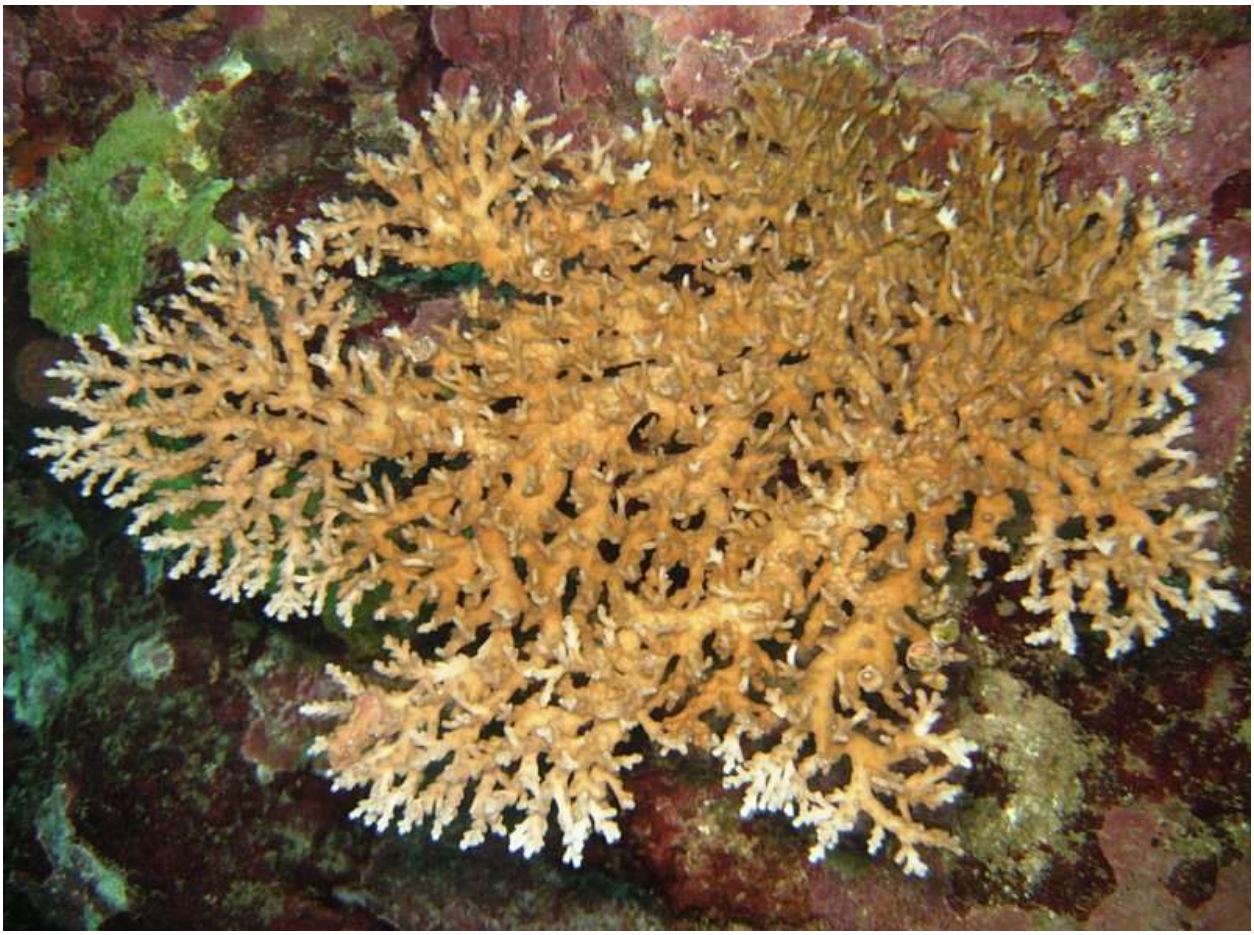
Slide 94: *Acropora lutkeni* is another unlisted species which can have some very large branches in a colony, with huge thick bases and a long branch. It typically has small branches starting to grow along the sides of the main branch near the base.

Slide 95: This coral appears to be *Acropora secale*, another species that was not listed. It has thinner branches and long irregular length radial corallites, but the radial corallites are thin.

Slide 96: A closeup picture of *Acropora secale*, with long thin, variable-length radial corallites.

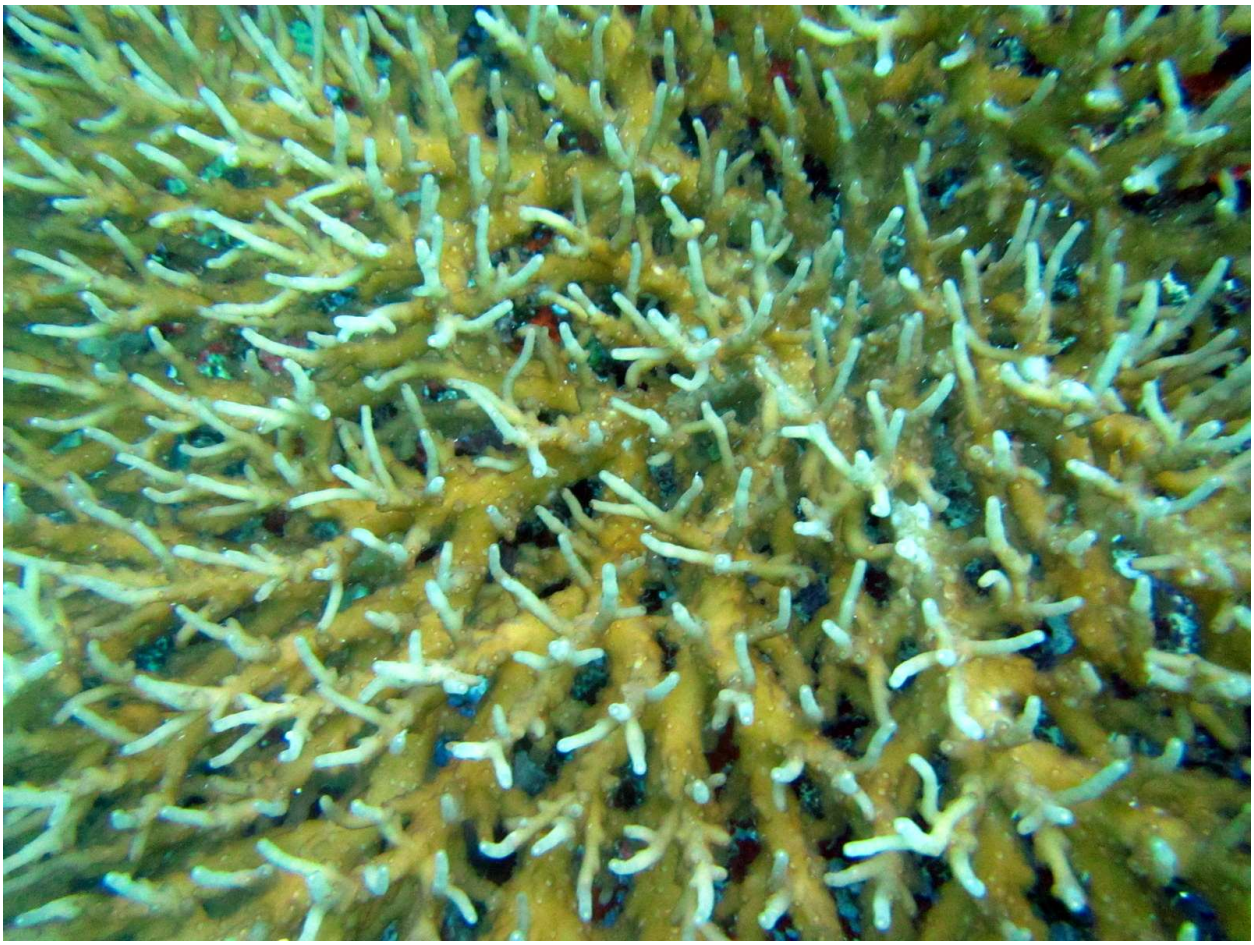
Slide 97: Another colony of *Acropora secale*.

Slide 98: Another colony of *Acropora secale*.

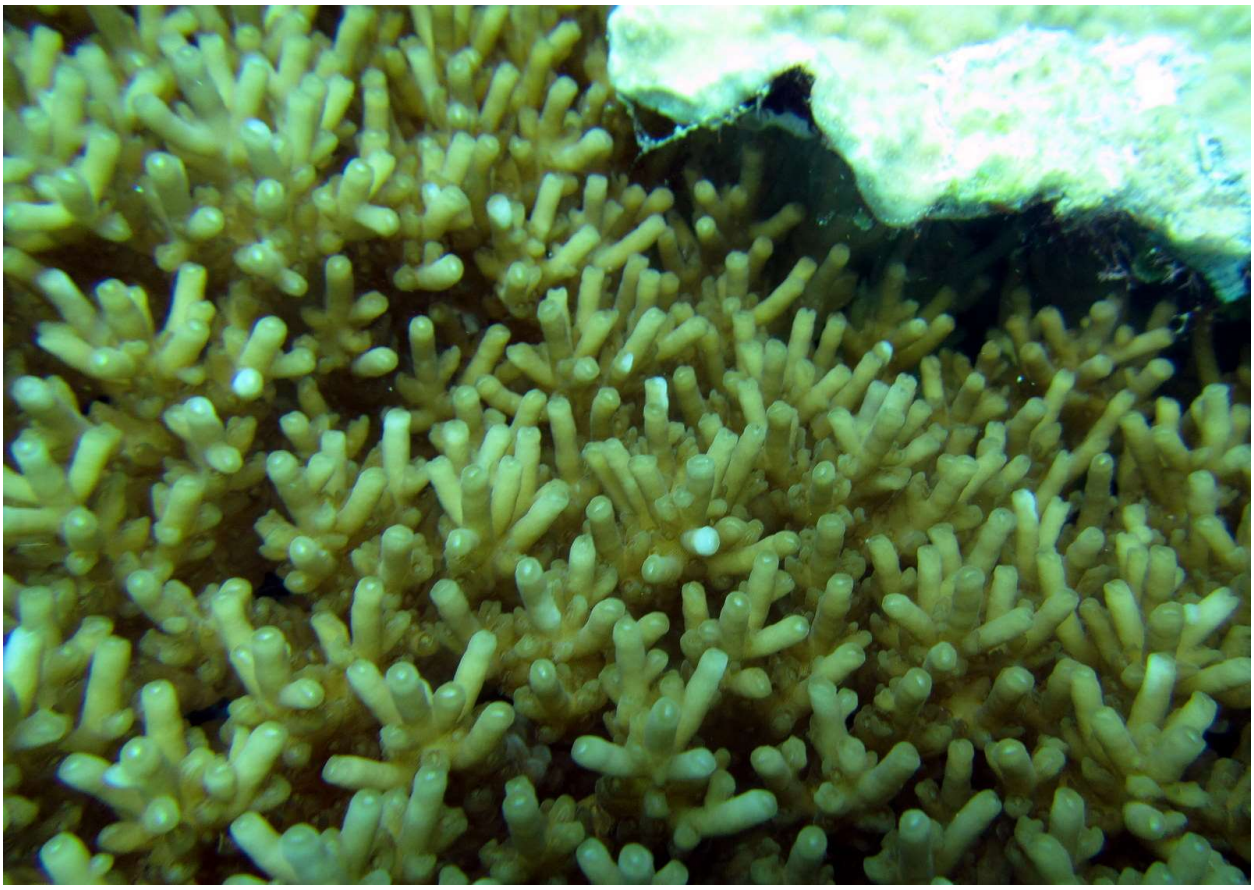


Slide 99: This photo is of *Acropora speciosa*, which was listed as threatened. Colonies are in deeper water on the slope, usually pretty rare, and form small flat plates that are usually attached on one side. Larger branches extend horizontally. Small long tubes which are the corallites grow upward from the horizontal branches. Generally they are not close together.

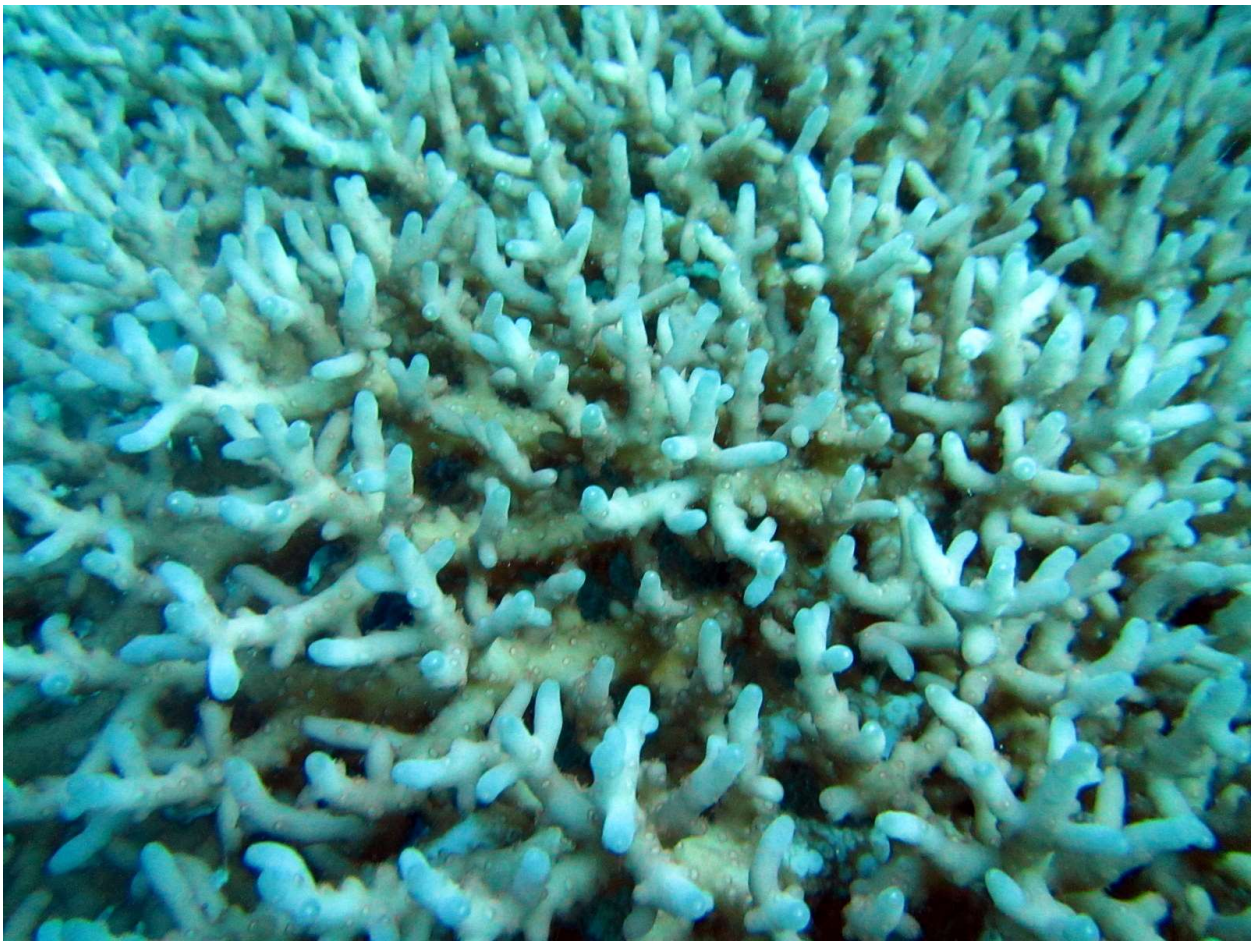
A closer photo of a colony. In this photo is hard to see the upward growing thin tubular corallites.



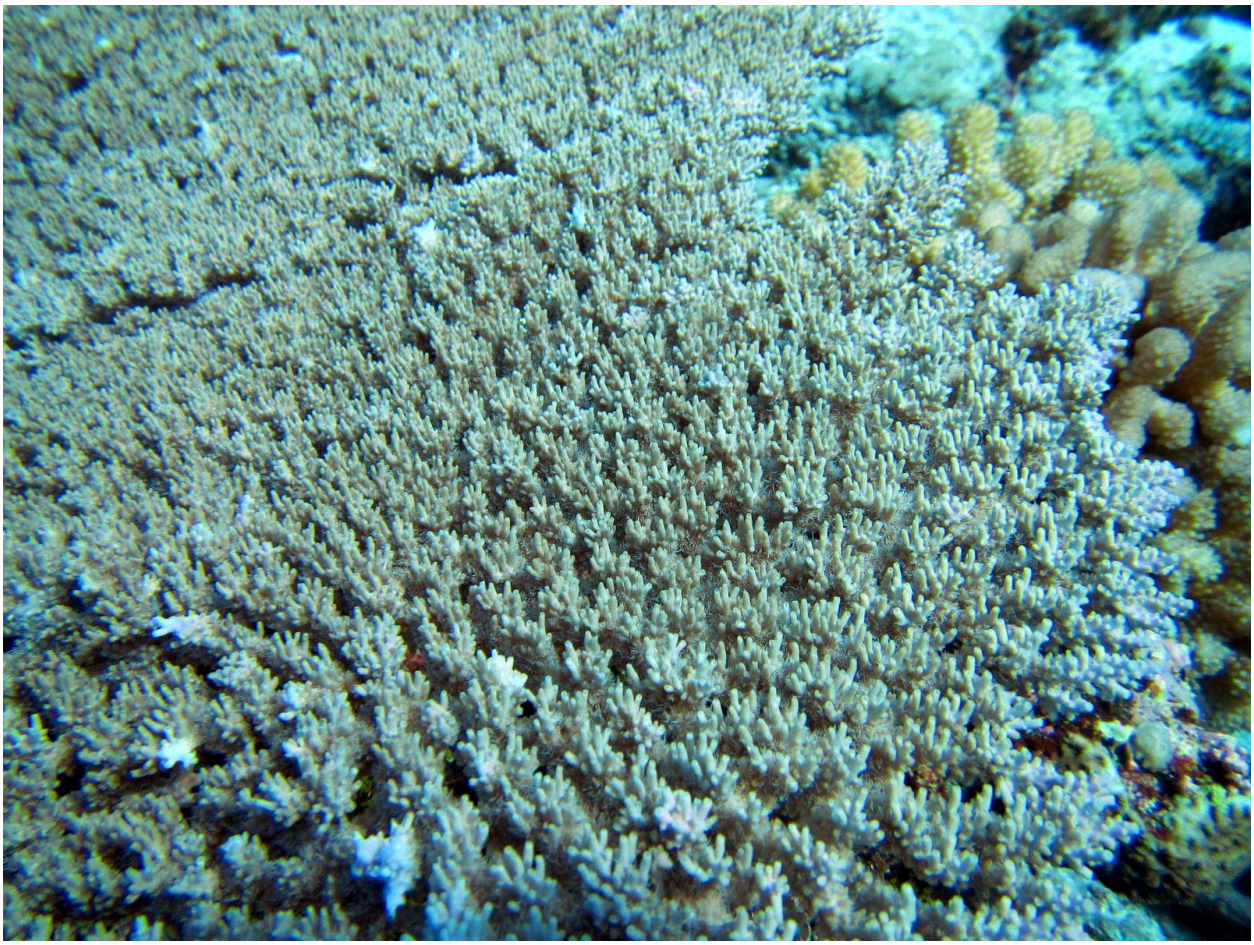
A closeup photo of *A. speciosa* in Wallis. Here the upward growing, widely spaced thin corallites can easily be seen.



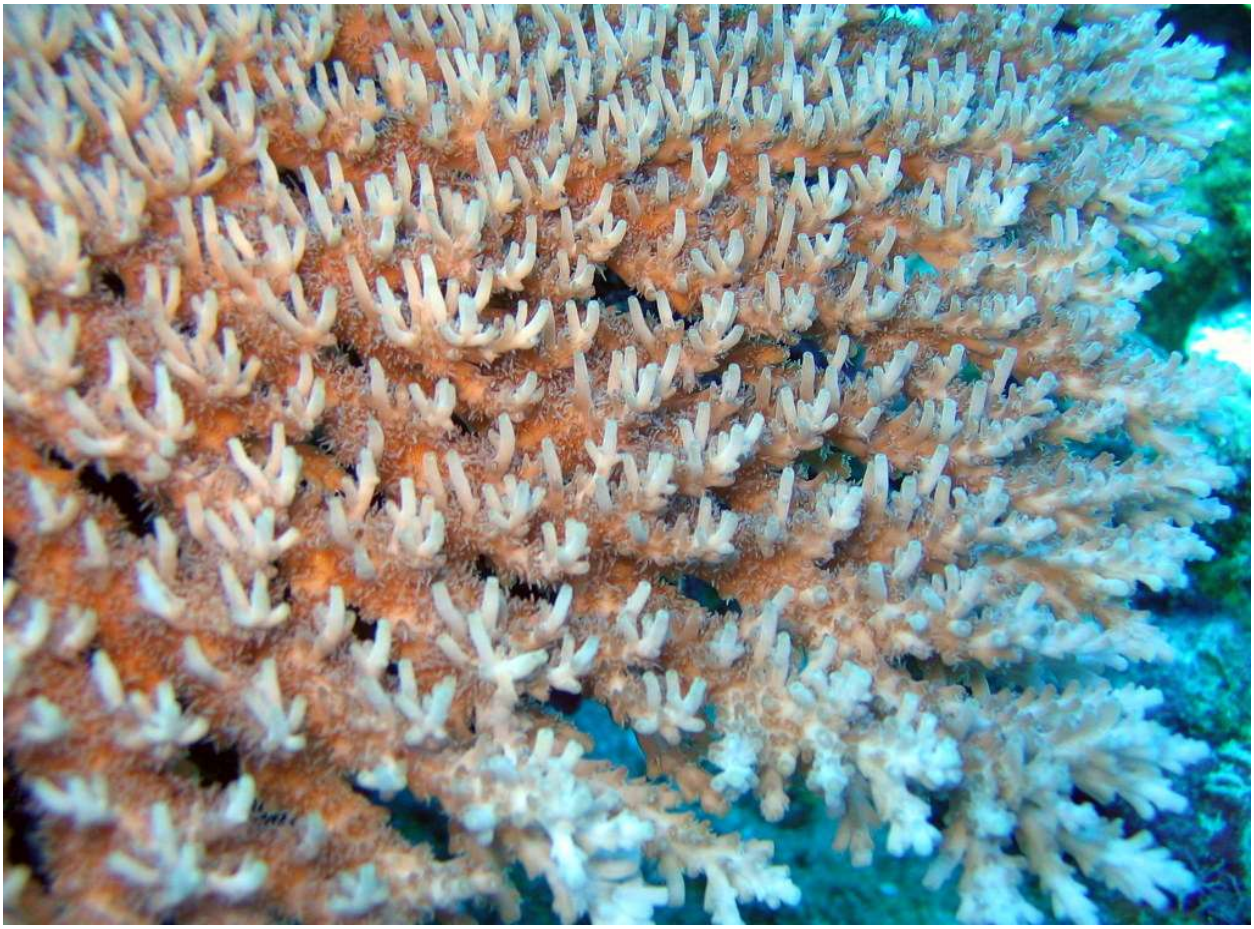
A photo of *Acropora granulosa*, a species that was not listed. This species is similar to *A. speciosa* except that the upward growing corallites are thicker than on *A. speciosa*. There is a range of corallite diameters in *A. granulosa*, and this is at the large end of that range. The corallites do not always grow upward in parallel and close together as on this colony.



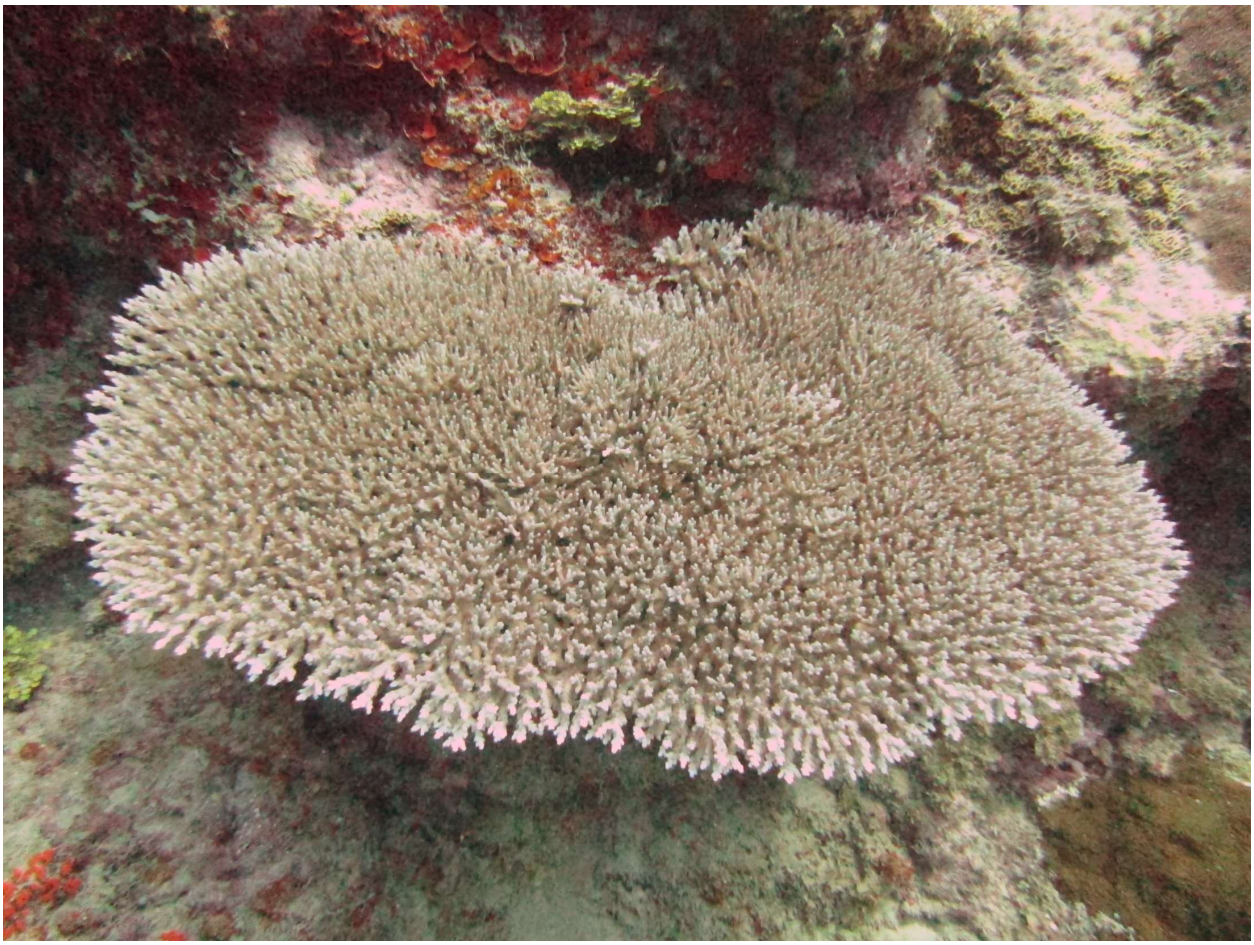
A photo of *Acropora granulosa* in Wallis. In this colony, the tubular corallites are thicker than on *A. speciosa*, but not as thick as in the previous slide.



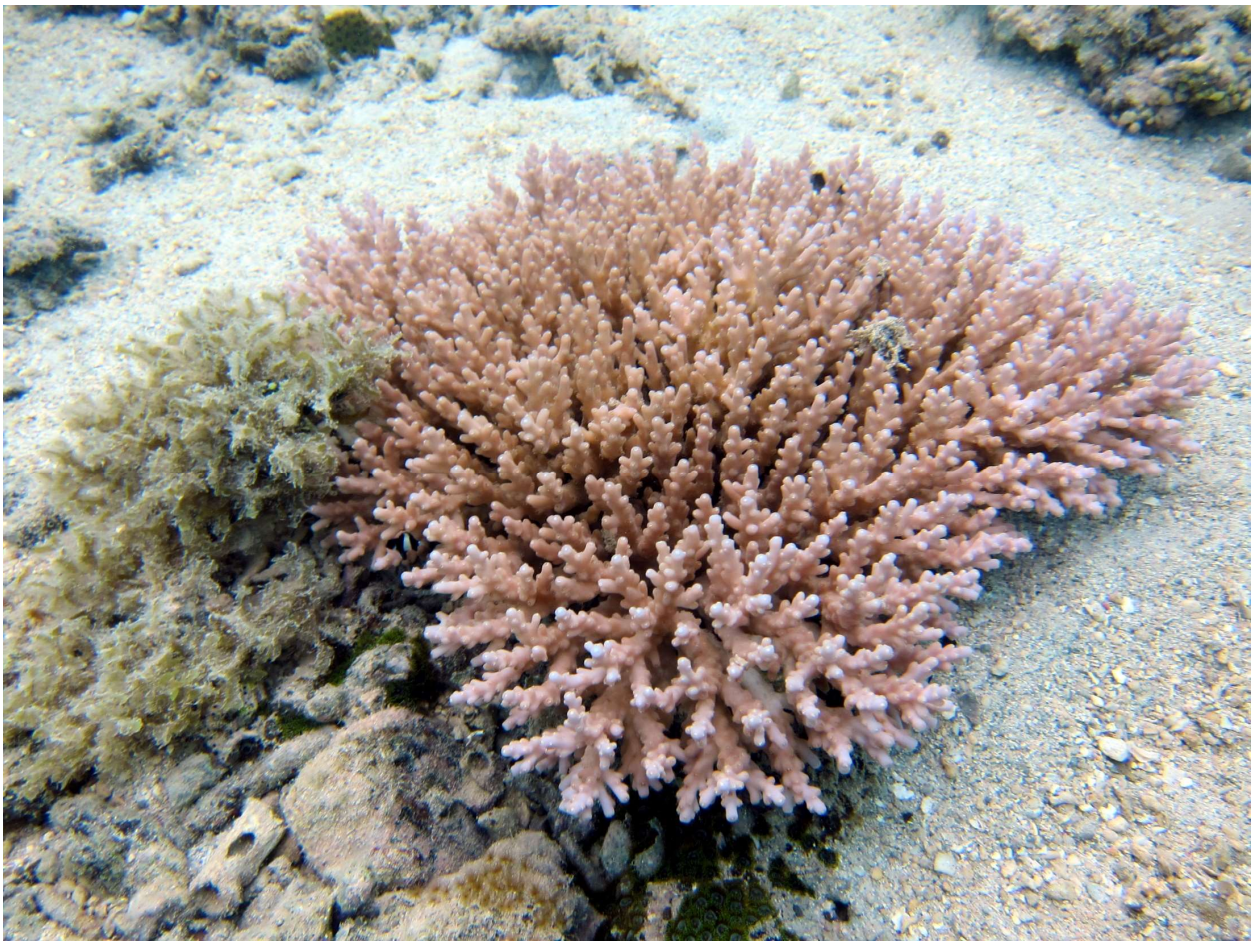
Another species that looks similar to *A. speciosa* but was not listed is *A. paniculata*. *A. paniculata* can make large flat tables, usually in fairly deep water. The upper surface of the plate has clusters of radiating, upward pointing tubular thin corallites. The colonies get much larger, are clearly tables, and the thin corallites are mostly in clusters radiating from a single spot.



A closer photo that shows the radiating corallites more clearly.

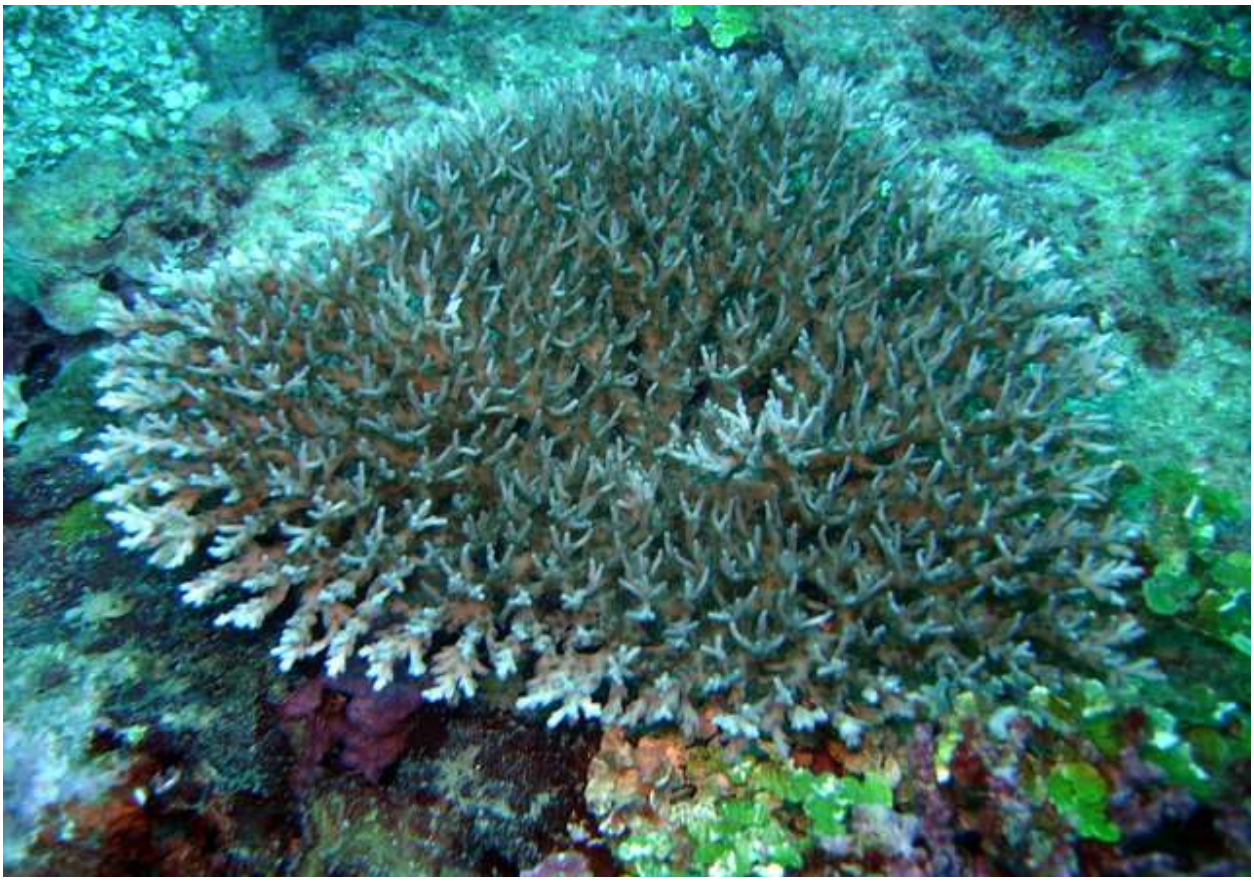


Another species that looks similar to A. species but was not listed is *Acropora aculeus*. *A. aculeu*s forms fairly small flat colonies that may be a bit thicker than *A. speciosa*. *A. aculeus* can be anywhere from shallow to deep.



A bit closer photo of a more cushion-like colony. The main difference with *A. speciosa* is that A. speciose has smooth tubular corallites growing upward, while *A. aculeus* has small radial corallites on the sides of the tubular corallites. The small radials may look a bit like ledges.

A closer photo showing the rougher sides of the tubular corallites or branchlets, made rough by small bumps that are radial corallites. *A. speciosa* has smooth tubular upward growing corallites.



This photo is of *Acropora jacquelineae*, which is a species that was listed as threatened, and also looks almost identical to *A. speciosa*. *A. jacquelineae* forms small flat brackets. The upper surface has thin upward growing tubular corallites. The size and appearance of the colonies and tubular corallites is almost identical to that of *A. speciosa*. One possible slight difference is that the tubular corallites of *A. jacquelineae* have thin walls, giving the end of the corallite a sharp, thin edged look. A. speciose has a bit thicker corallite walls, and may have a slightly more rounded look at the end of the corallites. The only sure way to tell these two apart is to look at the skeleton of the tubular corallites. In *A. speciosa* the corallites are covered with a fine, even, dense arrangement of tiny spines. In *A. jacquelineae* the corallites have thin tiny ridges running the length of the corallites, that may have tiny spines on their edges.

A closer look at *A. jacquelineae*. The diameter of the tubular corallites is essentially the same as *A. speciosa*. A sample of the skeleton of this colony confirms the identification. The sample was taken from the edge of the colony, where the tubular corallites have many radial corallites, unlike in the center of the colony. This can be seen in the photos of skeleton in Wallace (1999). The nearest this species was known from was the Coral Triangle, so it was a surprise in American Samoa.

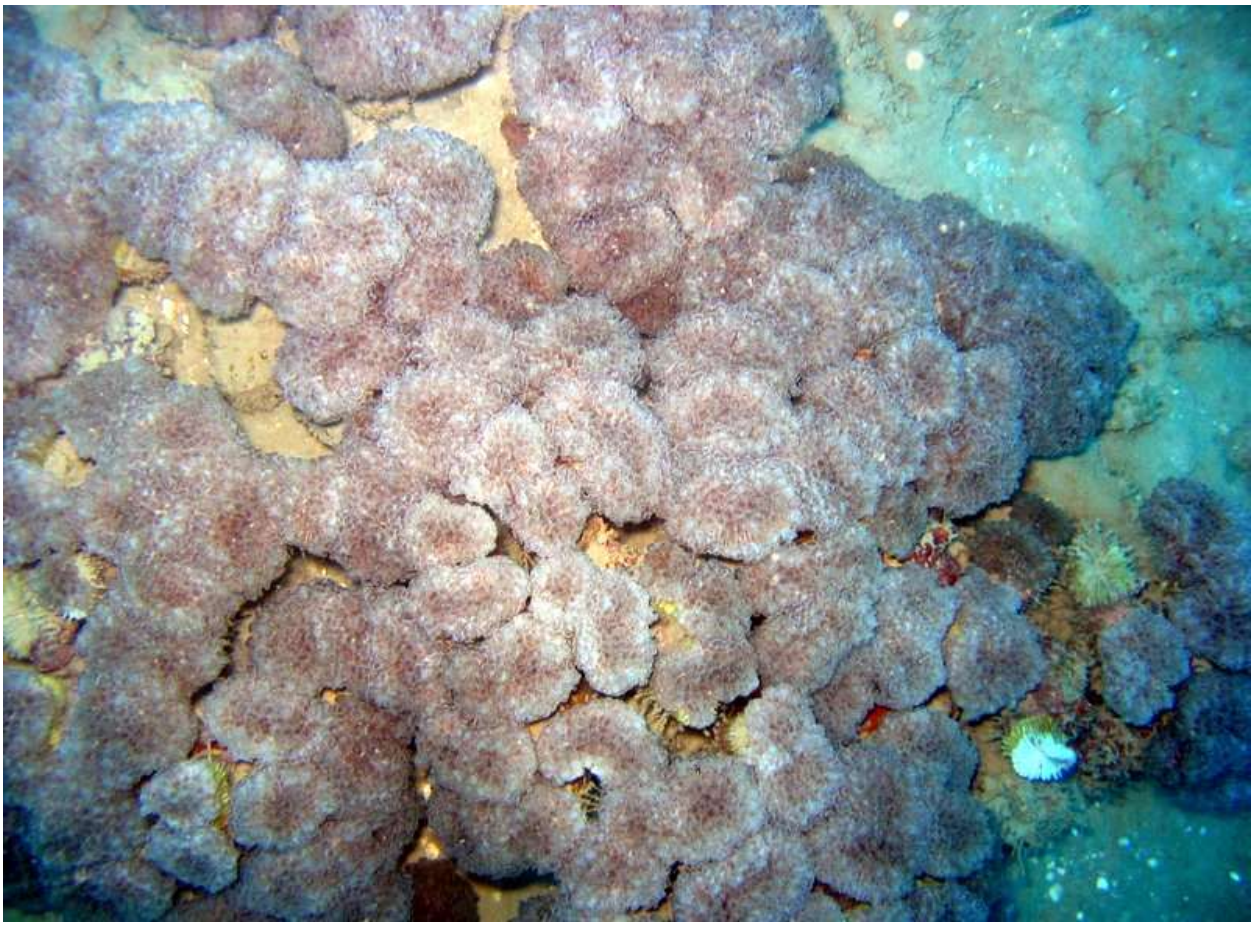
This is a photo of *Seriatopora aculeata*, which was listed as threatened. This genus forms branching colonies with branches about the diameter of a pencil or sometimes smaller. This species has very short branches which taper very quickly down to a sharp point. The corallites on the branch sides are tiny holes that usually can't be seen underwater. They are scattered on the branches and not raised. Other species in the genus have branches that are longer and/or more rounded branch tips and/or corallites that are in raised rows along the branches. This species is not known from American Samoa and known from the Marianas by only a very few photos. This photo is from Guam and is by David Burdick. It is not as rare elsewhere.

Slide 112: Another photo of *S. aculeate*, also by David Burdick.

Slide 113: A photo of *Seriatopora stellata*, which was not listed. This species has much longer branches, and corallites are in rows along the sides of branches and are raised. The raised rows can often be seen. The branches may taper gradually to a point as in this photo, or quickly to a point. Photo by David Burdick.

Slide 114: A photo of *S. stellata*, showing corallites in raised rows, and long branches that taper quickly to a point. This species is usually uncommon or rare.

Seriatopora hystrix, a species that was not listed. This species is usually the most common species of *Seriatopora*. It has long branches that gradually taper to points, and the corallites are not in rows or raised and usually can't be seen.

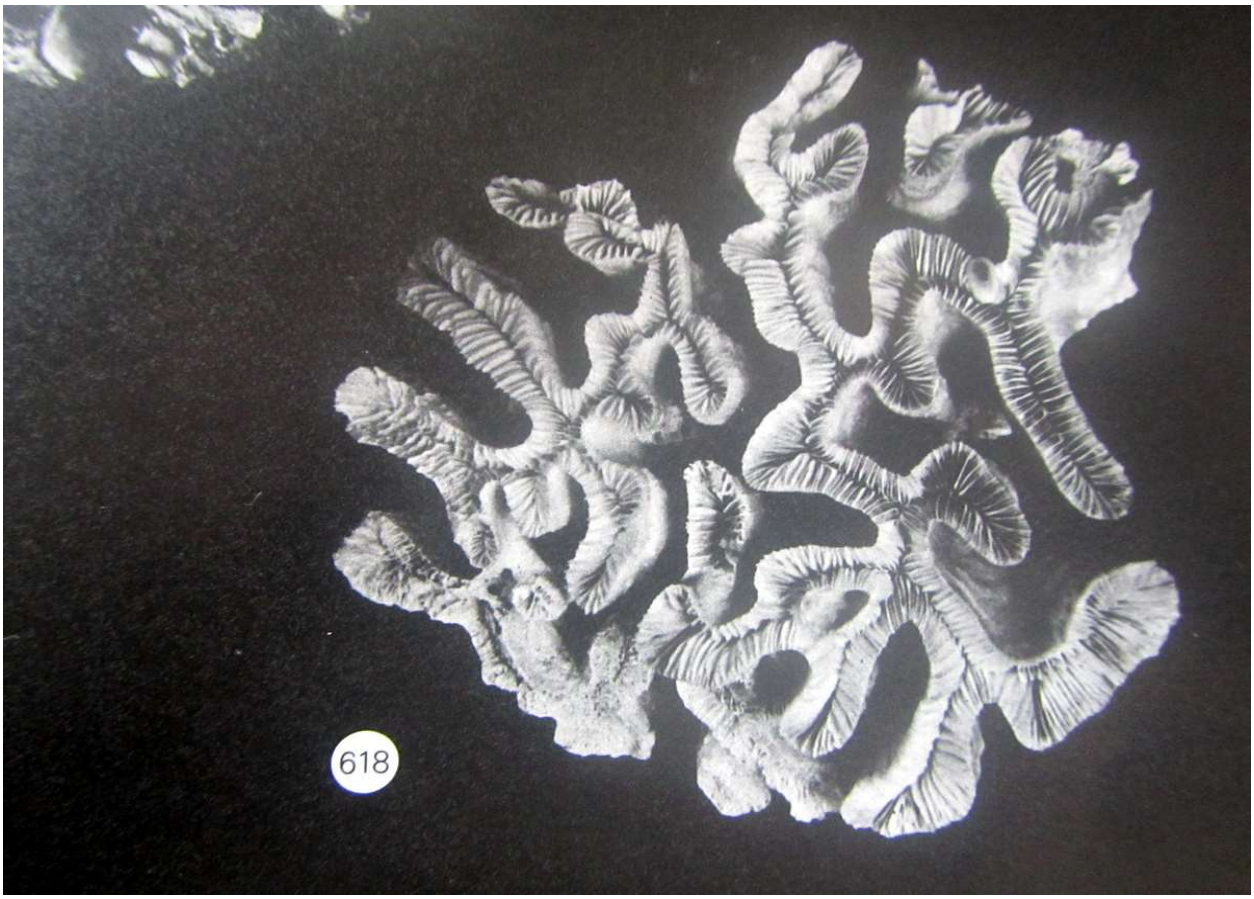


Slide 116: *Euphyllia paradivisa* was listed as threatened and is in a genus that is very different from anything we have looked at so far. It forms branching colonies with branches around 1 inch or 3 cm diameter. The living polyps are only at the ends of branches. If the polyps are close together it can look like the colony is solid (massive) but it is not, it is always branching. Note in this picture that the brown polyps form ovals and not meandering ridges. Also, the ovals in some places are separate with dead material in between.

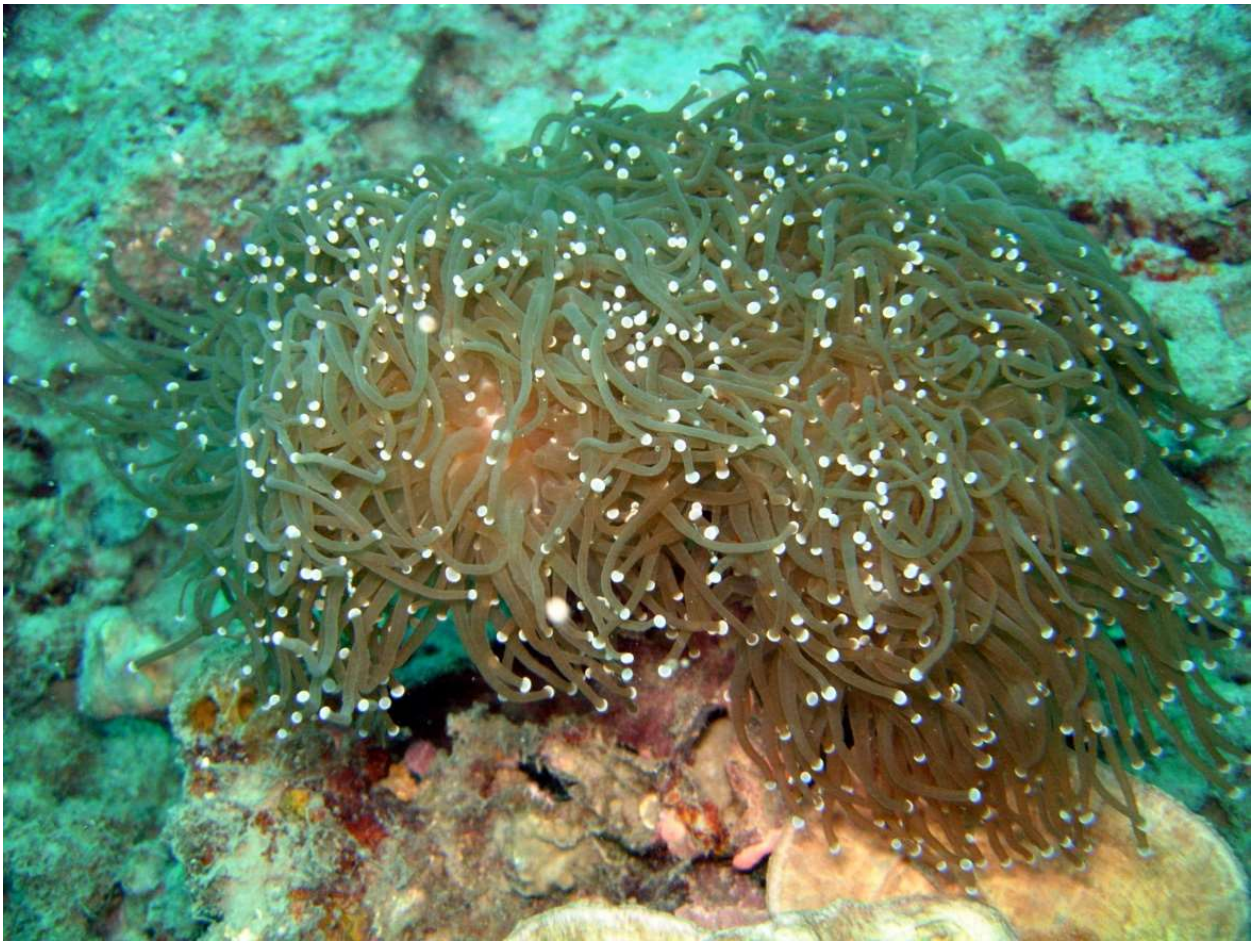
Slide 117: This closeup photo of *E. paradivisa* shows the large oval polyps as in the previous picture. Each oval is one polyp. It is the same colony. The ovals show that the colony is branching and not flabello-meandroid like another species in the genus. Also, close inspection of the tentacles will reveal that there are large circles that are the ends of the main tentacles, and small circles that are the tips of small side branches on the larger tentacles. The tentacles are retracted, making the branching tentacles harder to see. The combination of branching skeleton and branching tentacles is unique to *E. paradivisa*.

This photo shows *E. paradivisa* with the tentacles inflated. Here it is much easier to see the branching pattern of the tentacles. Other photos clearly show the branching skeleton. The nearest this species was known from was the Coral Triangle, but the evidence is such that it is a strong identification. The author has photographed a pink colony with retracted tentacles in Fiji as well. This and A. jacquelineae illustrate that you can't completely eliminate the possibility of any species from the Indo-Pacific anywhere from the Red Sea to Panama, being in any one location, though for some it is unlikely.

A photo of *Euphyllia divisa*, which was not listed as threatened. This species also has dividing tentacles, but the skeleton is a meandering thick wall instead of branches. The skeleton can't be seen in this photo, but a finger in among the tentacles can feel whether there are branches or continuous wall.



A photo of the skeleton of *E. divisa*, showing the continuous, meandering wall that the polyps and tentacles grow on top of.



A photo of *Euphyllia glabrescens* in American Samoa. This species has not been listed. This species is branching and has essentially identical skeleton to *E. paradivisa*, but the tentacles do not branch. The tentacles on this colony are completely extended.

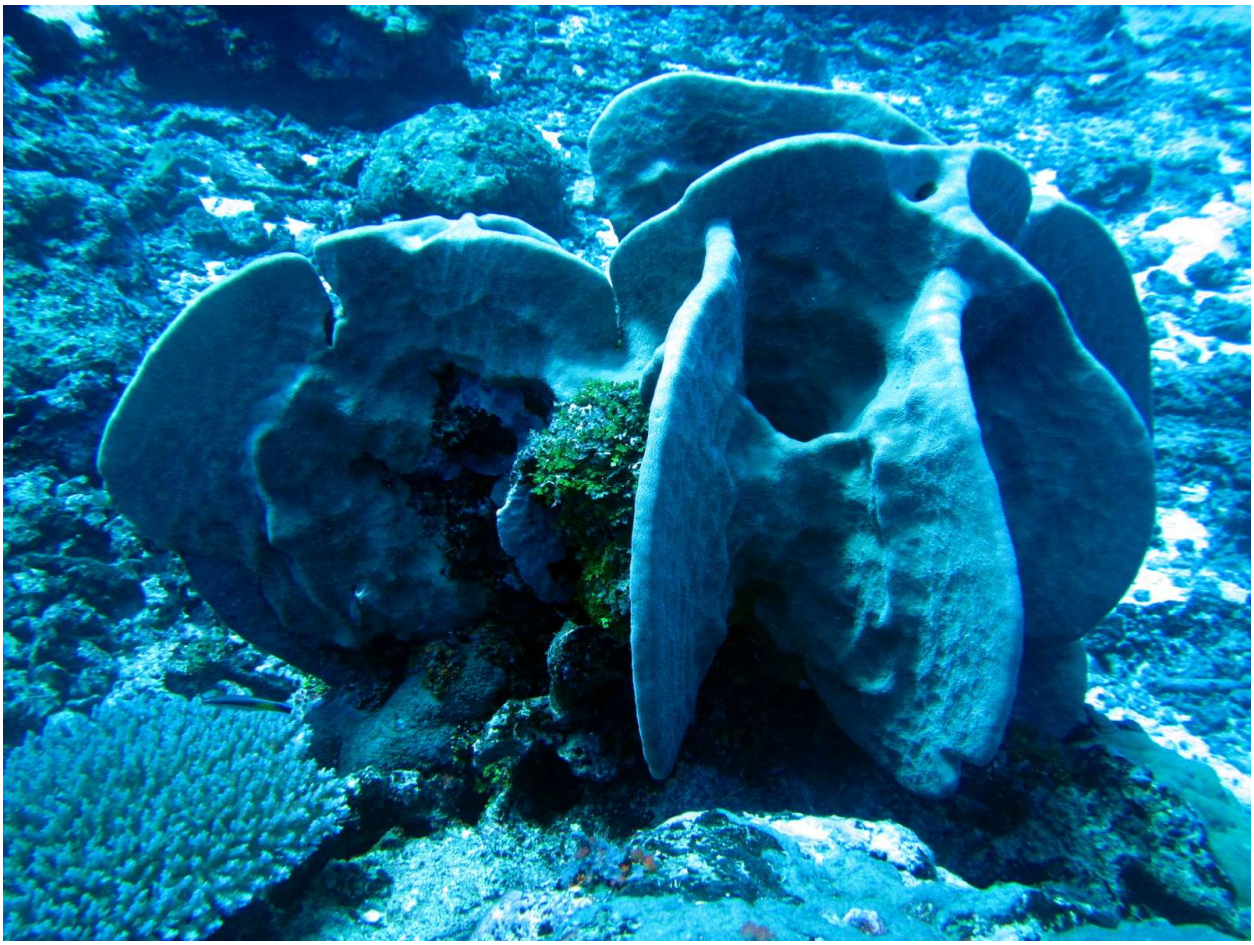
A photo of *Euphyllia glabrescens* with tentacles partly contracted.

A photo of a broken branch from a *E. glabrescens* colony, shown from the side, showing the branches dividing.

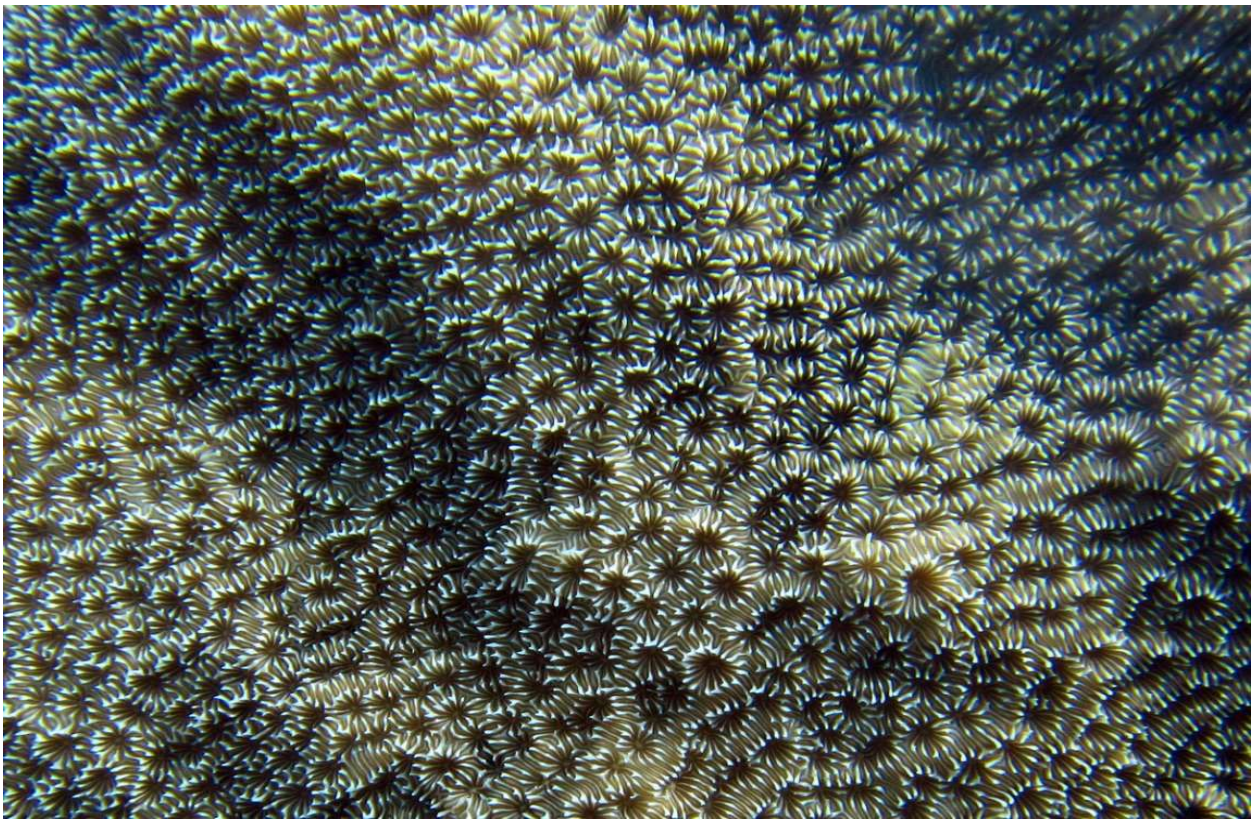
This photo is of *Pavona diffluens* in the Red Sea by Veron. This species was listed as threatened. Pavona species have fairly small corallites on branching or plate colonies. The septa (walls) inside the corallites extend up over the corallite wall and connect to those in the nearby corallites. In this photo the hole is the center of the corallite where the polyp is retracted, and the tiny septa can be seen connecting between adjacent corallites.

Slide 125: Another photo of *P. diffluens* from Veron. Colonies can be various lump shapes. The hole in the middle of each corallite is larger than in other species of *Pavona*, and the corallites are larger than in some Pavona. In addition, some *Pavona* have different, distinctive, colony shapes.

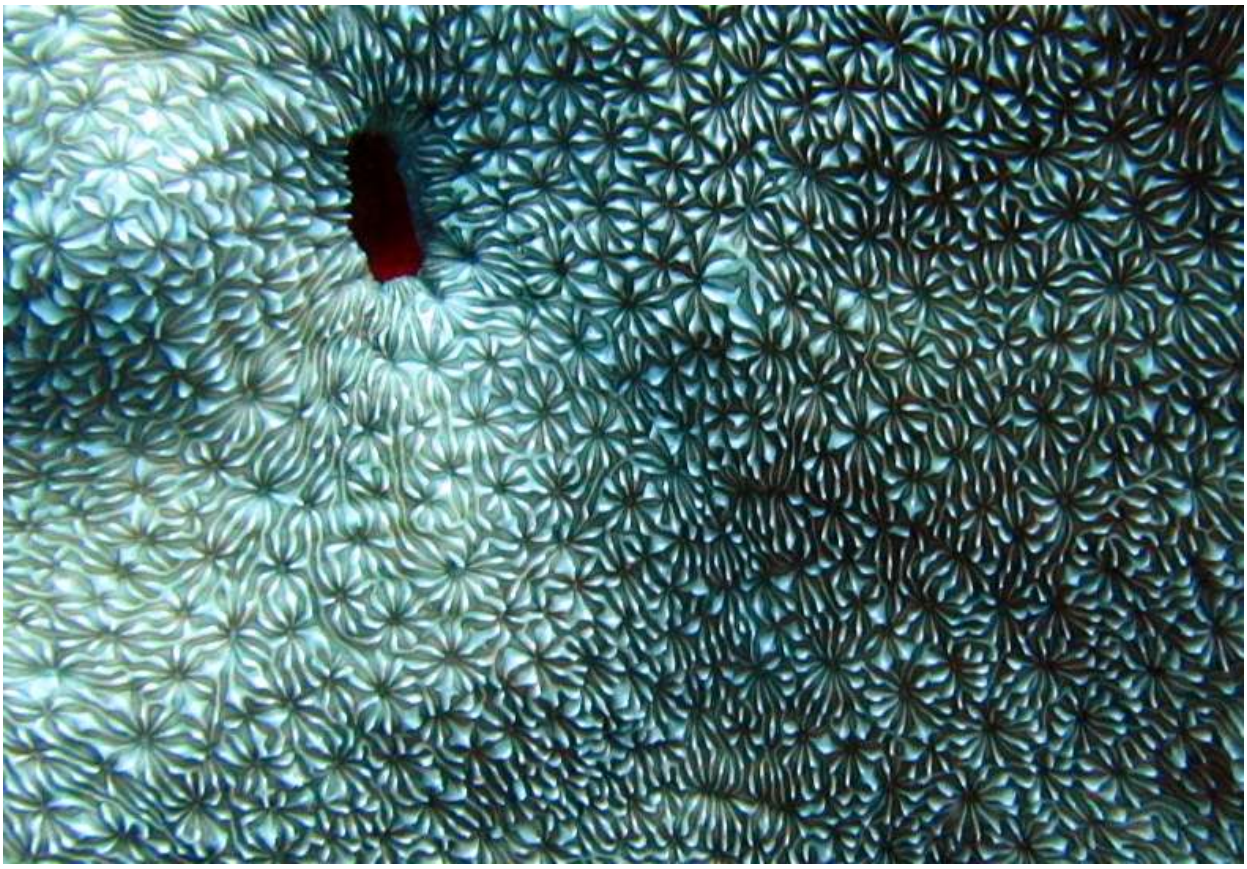
Slide 126: A colony in American Samoa. Randall found colonies in Guam, the Marianas, and American Samoa which he came to realize were very similar to *P. diffluens* in the Red Sea. The Red Sea is the type locality (where the species of that name was originally described from), but Veron contends that it is not known outside the Red Sea and colonies in the Marianas and American Samoa are a similar but distinct, unnamed species with different size corallites. Looking at the photos of skeleton in Veron and in Sheppard and Sheppard (1991), Corals of Arabia, the corallites in American Samoa appear to be of a similar size to that in the Red Sea, but this needs to be investigated more closely, preferably putting skeletons side by side. Colonies in the Marianas can have a shape like *Pavona duerdeni*, with vertical walls that can be at least 40 cm across and about 2 cm thick.



A colony from the Marianas. This colony shape is similar to *Pavona duerdeni*.



A closeup of a colony in the Marianas.



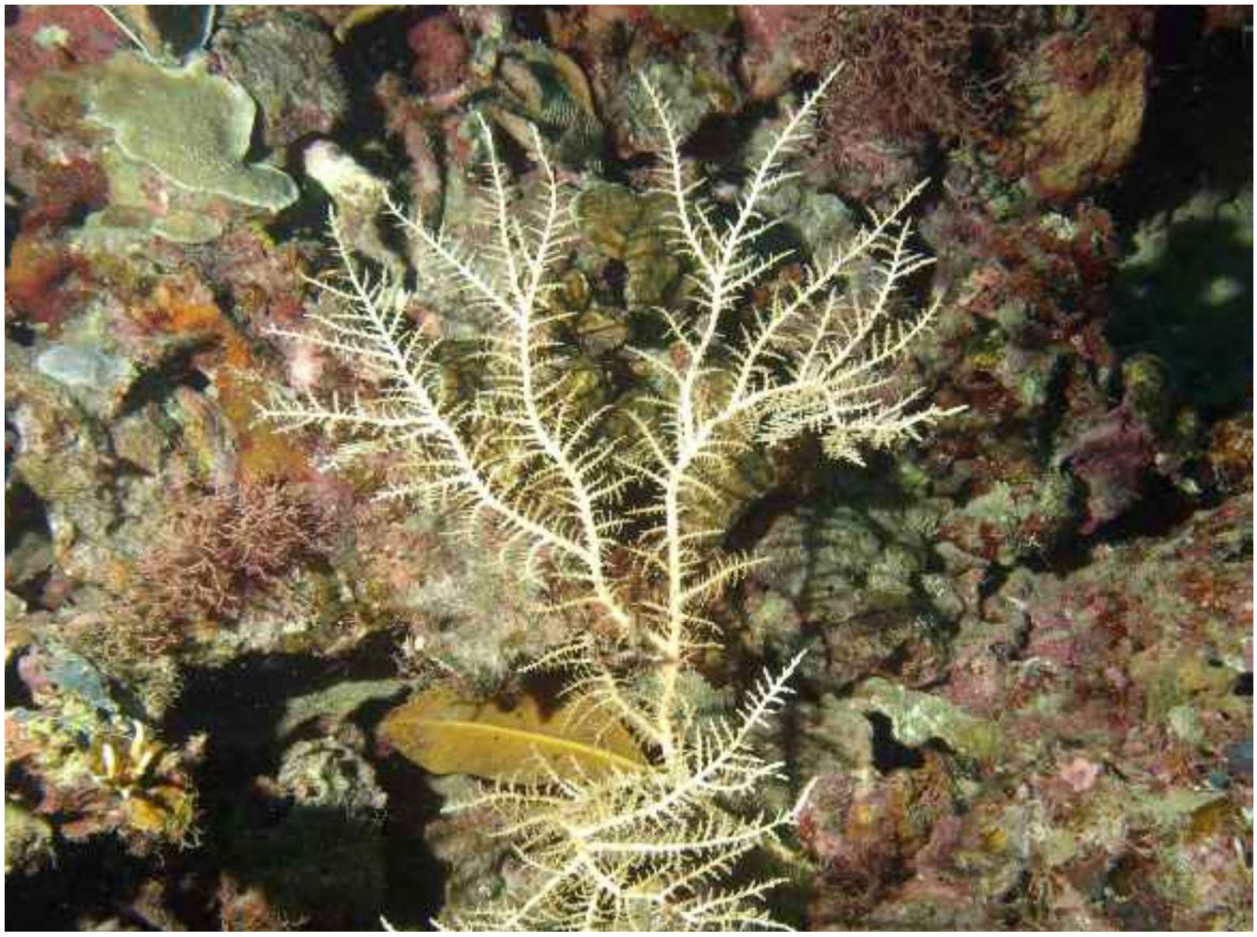
A closeup of a colony in Tonga.

Pavona bipartita has not been listed. It forms lumpy colonies with corallites smaller and harder to see with smaller pits in the center than *P. diffluens*.

Pavona maldivensis has also not been listed. It forms branching colonies with corallites that are circular and raised, and smaller than on colonies that look like *P. diffluens*.

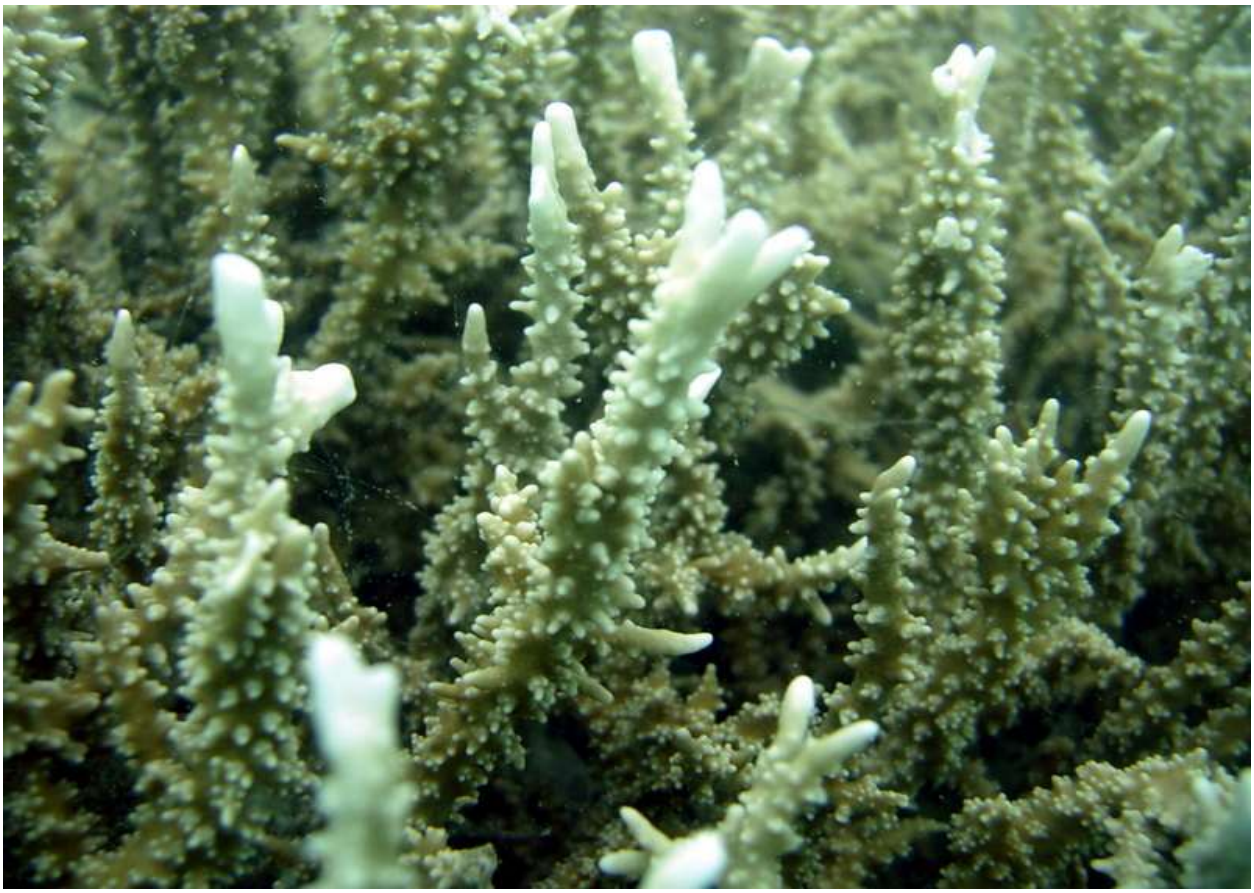
Pavona explanulata has not been listed. It forms plate colonies with corallites that have shallower centers than *P. diffluens*.

Pavona gigantea has not been listed. It forms massive colonies with lumps of various sizes and shapes. The tentacles are almost always extended, particularly on the top, making them look very different from *Pavona diffluens*.



Acropora tenella was listed as threatened and is shown in this photo. It is not yet been found in the U.S. Pacific, but has been reported from the Marshall Islands among other places. It is quite different from most other *Acropor*a, with a lacy pattern of tiny branches. It is found only in deeper waters. Photo by Paul Muir.

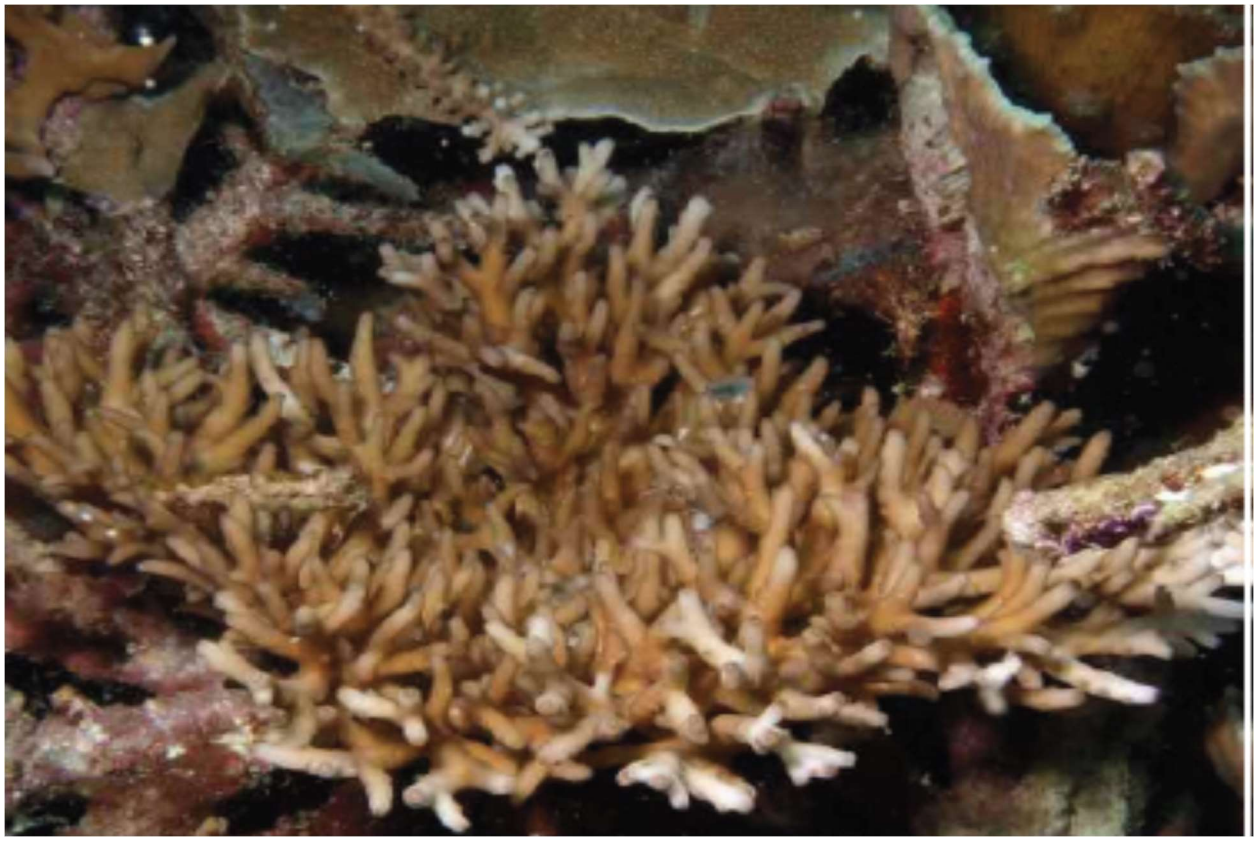
A closeup photo of *Acropora tenella*. The Veron et al website (www.coralsoftheworld) shows colonies with branches much closer together, which may be the same species as in this photo. Photo by Paul Muir.



Slide 134: *Anacropora spinosa* was listed as threatened and is shown in this photo. It is not yet been found in the U.S. Pacific. These photos are from New Caledonia. *Anacropora* is like a branching *Montipora* with thinner branches and no plate base, and often with small spines under each corallite. There are several species. *A. spinosa* has more spines and they are larger than other species.

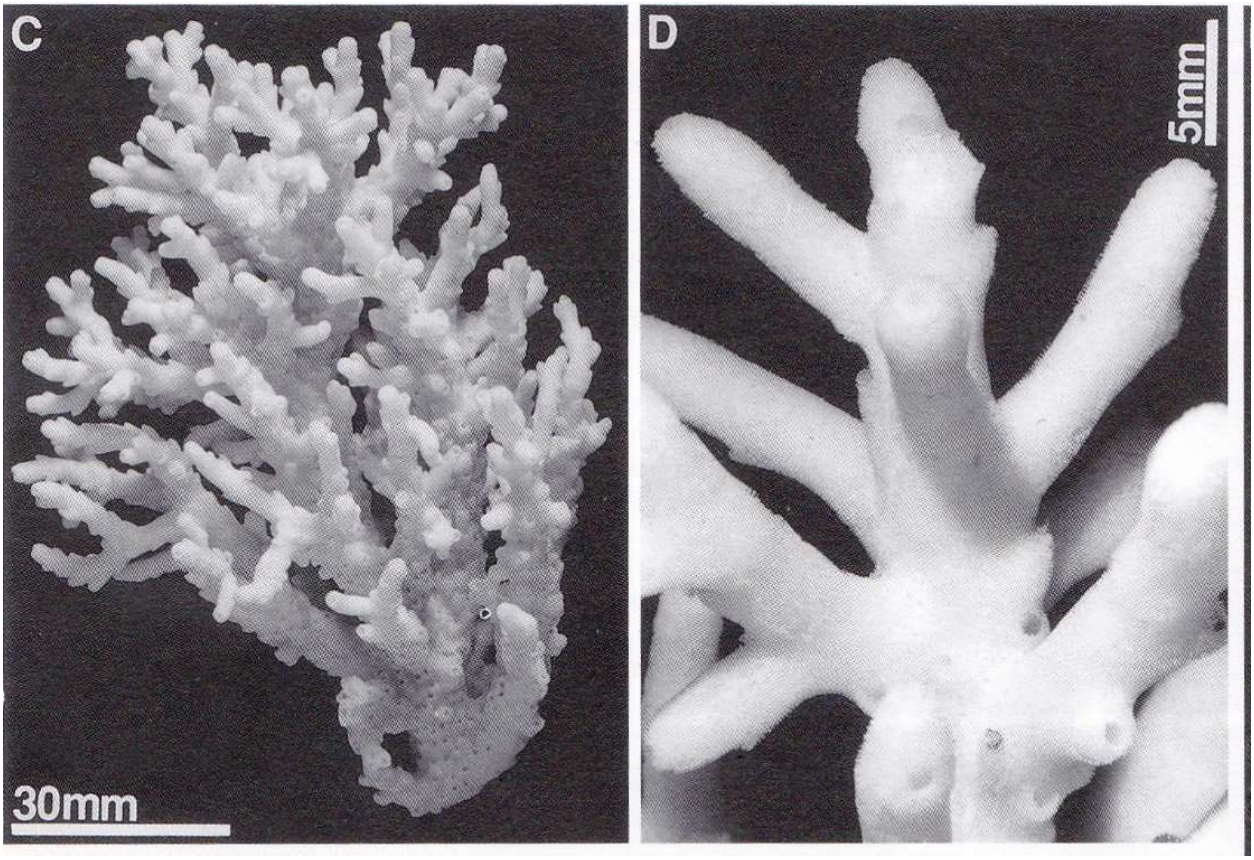
Another photo of *A. spinosa* showing the many large spines. These branches are only about 3 mm diameter, and so are fairly easily broken. *Anacropora* is often found in thickets with many branches, probably because the branches are delicate and easily broken and start new colonies.

Anacropora puertogalerae which was not listed, is of similar size and shape but has many fewer spines which are thinner and usually are like pegs that don't taper.



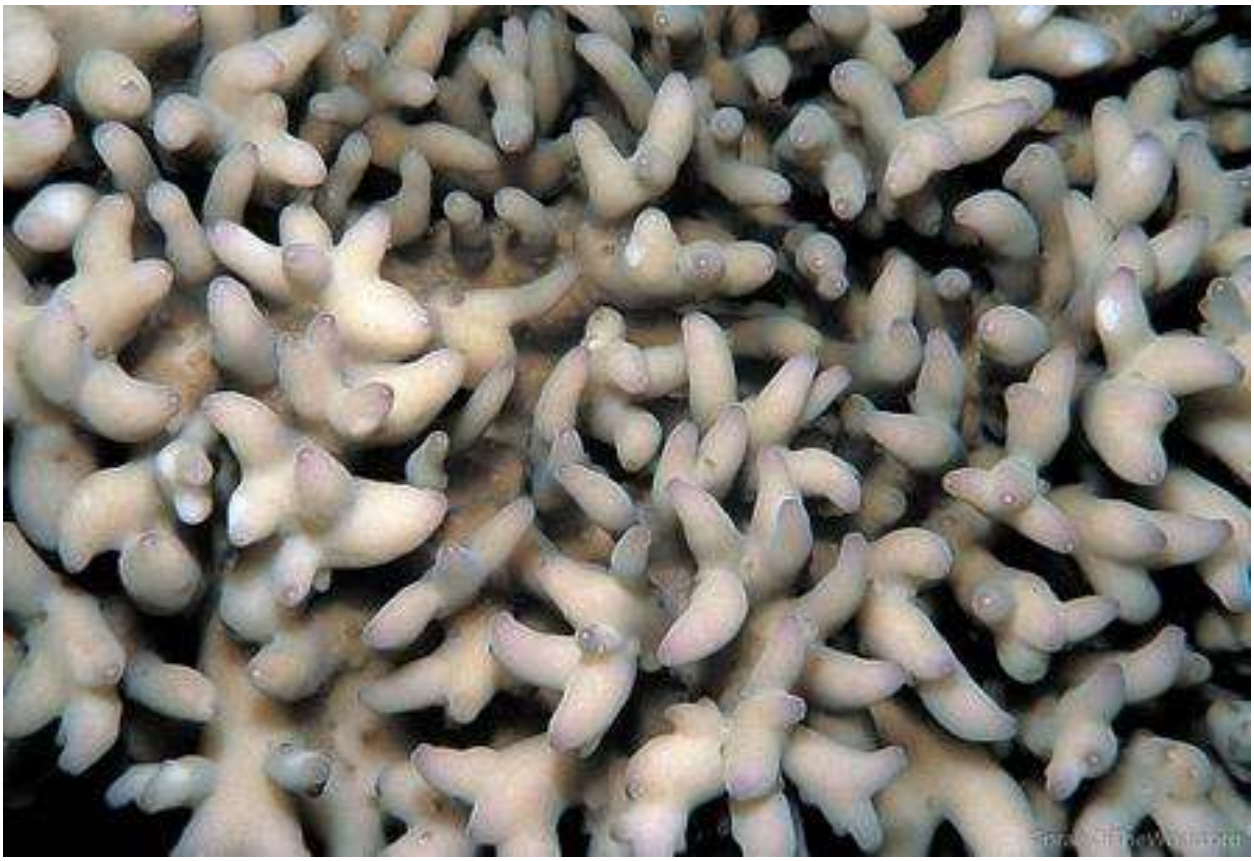
Acropora lokani was listed as threatened, but has not been found in the U.S. Pacific. Colonies are very similar to *A. granulosa* with smooth tubular corallites that grow upward which are similar in diameter to those on *A. granulosa*. However, the corallites divide in a dichotomous fashion (with 2 equal branches).

A closeup photo of *Acropora lokani*.

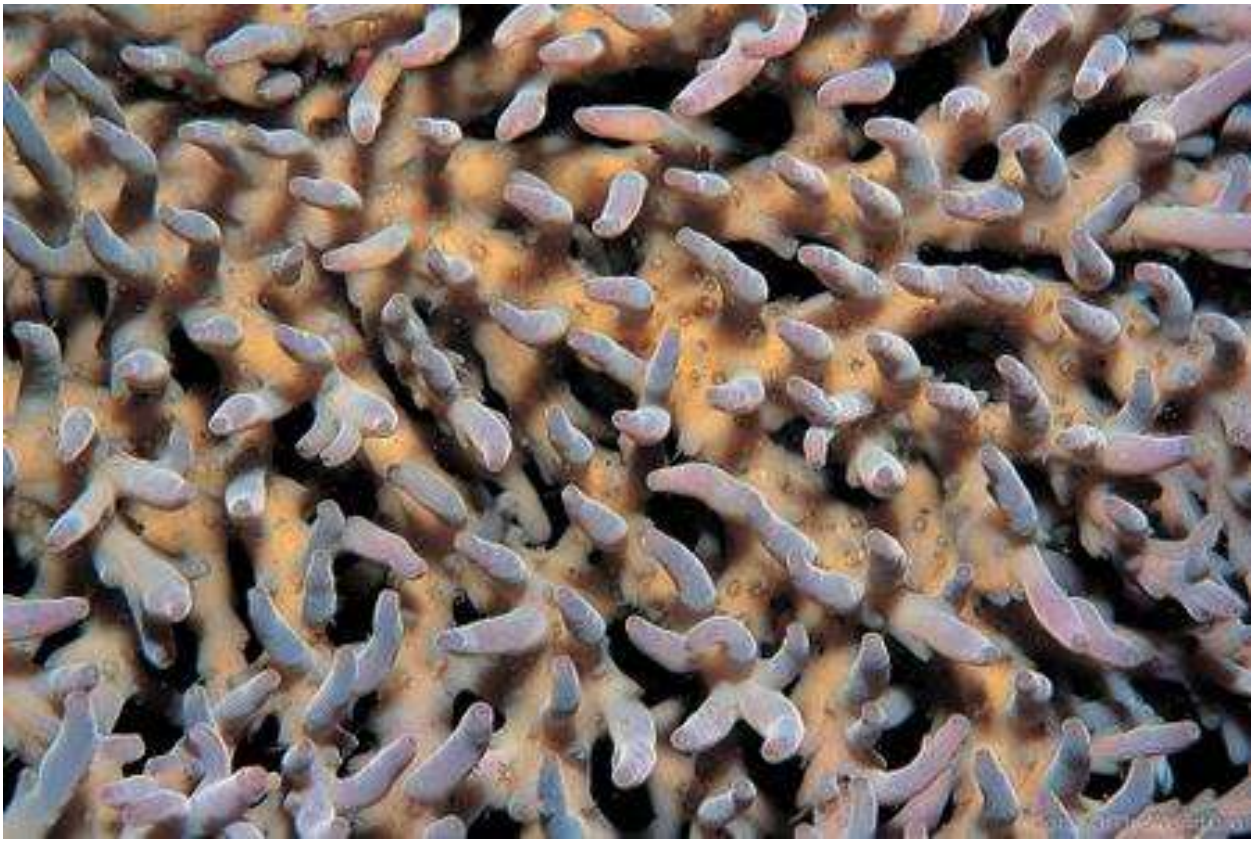


Pictures of *A. lokani* skeletons from Wallace (1999). She named the species, so she knows best what it is.

This is a photo of *Acropora carolineana*, a species not listed. This is a photo from Veron. The main difference with *Acropora lokani* and *A. granulosa* is that the long tubular corallites taper.



Another photo of *A. carolineana*, which shows tapering corallites. The amount of taper varies somewhat, obvious on some corallites, not so obvious on others. This is another Veron photo. So these photos are showing what Veron's concept of the species is. His descriptions also point to the tapering corallites.



Another photo of Veron's which he provides for *A. carolineana*. The corallites taper much less in this colony, not very obvious.

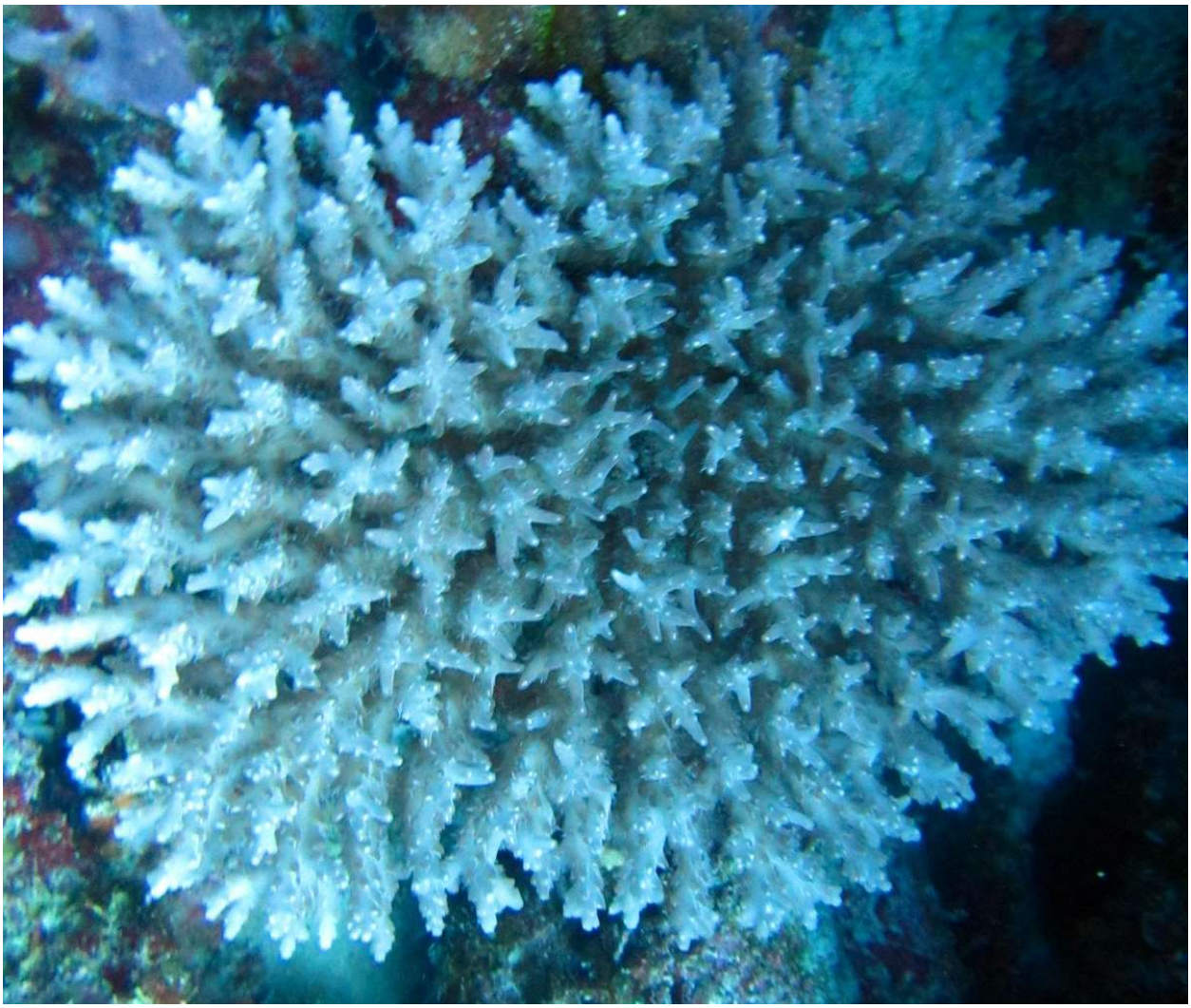
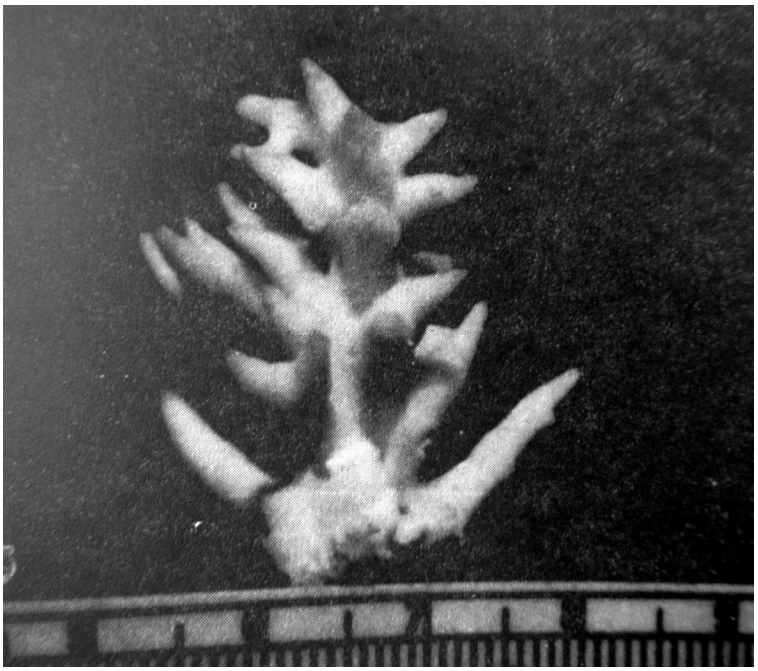
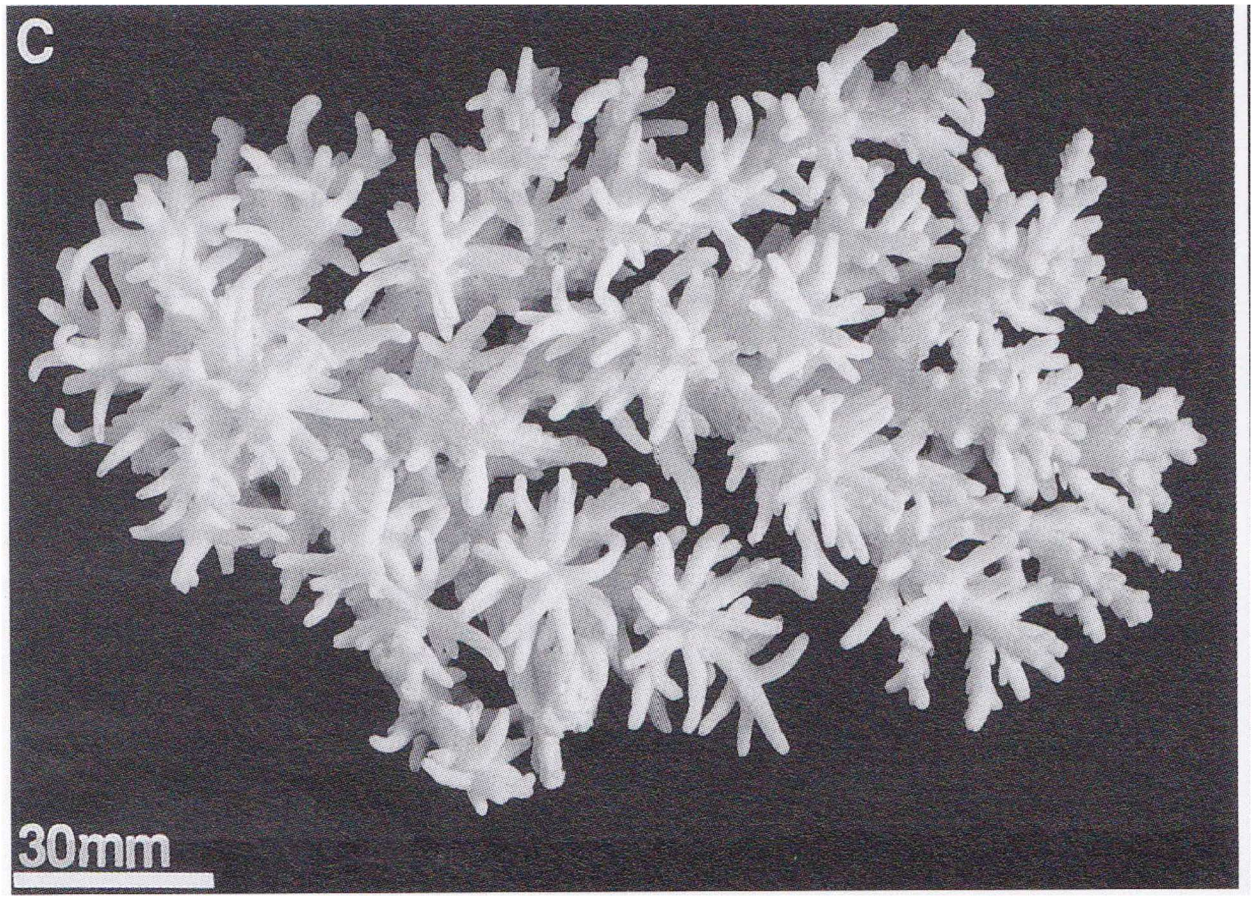


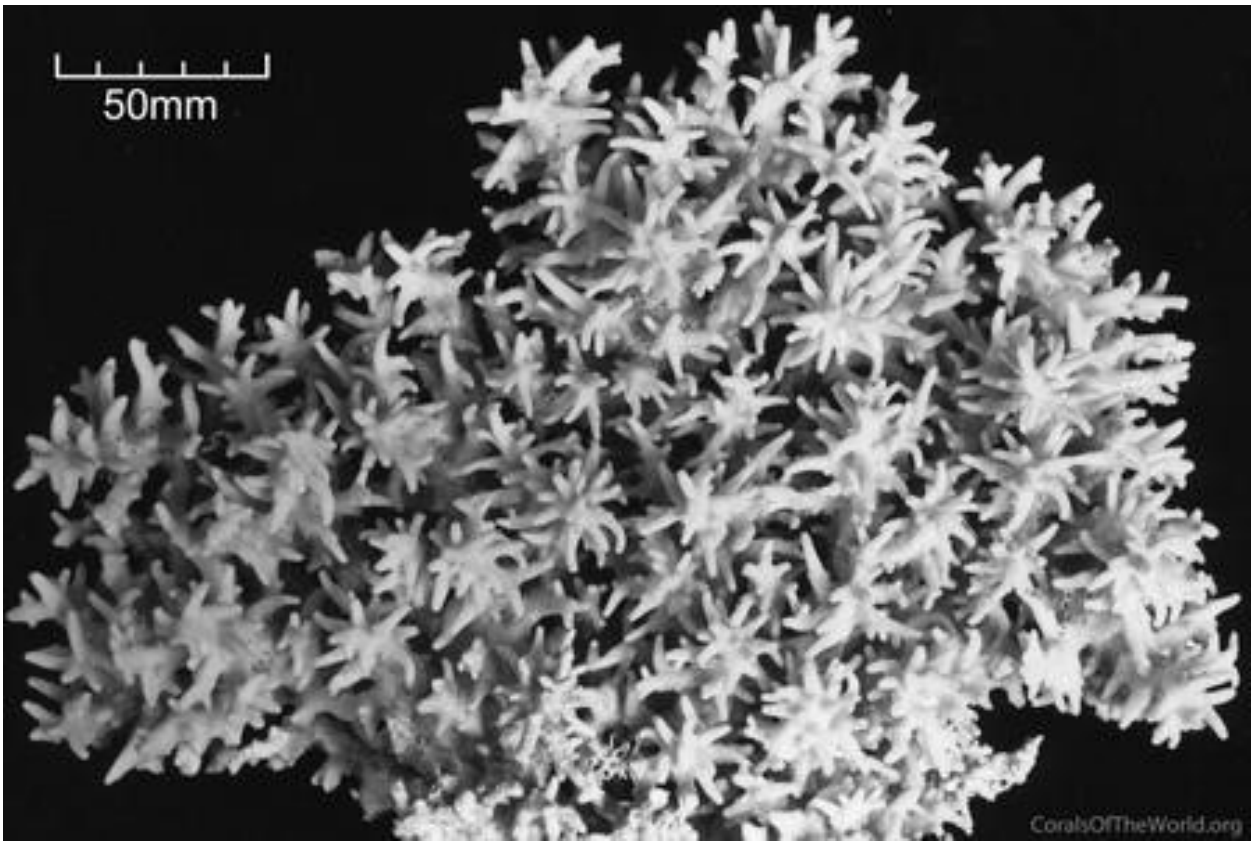
Photo I took of a colony in Fiji that has tapering corallites.



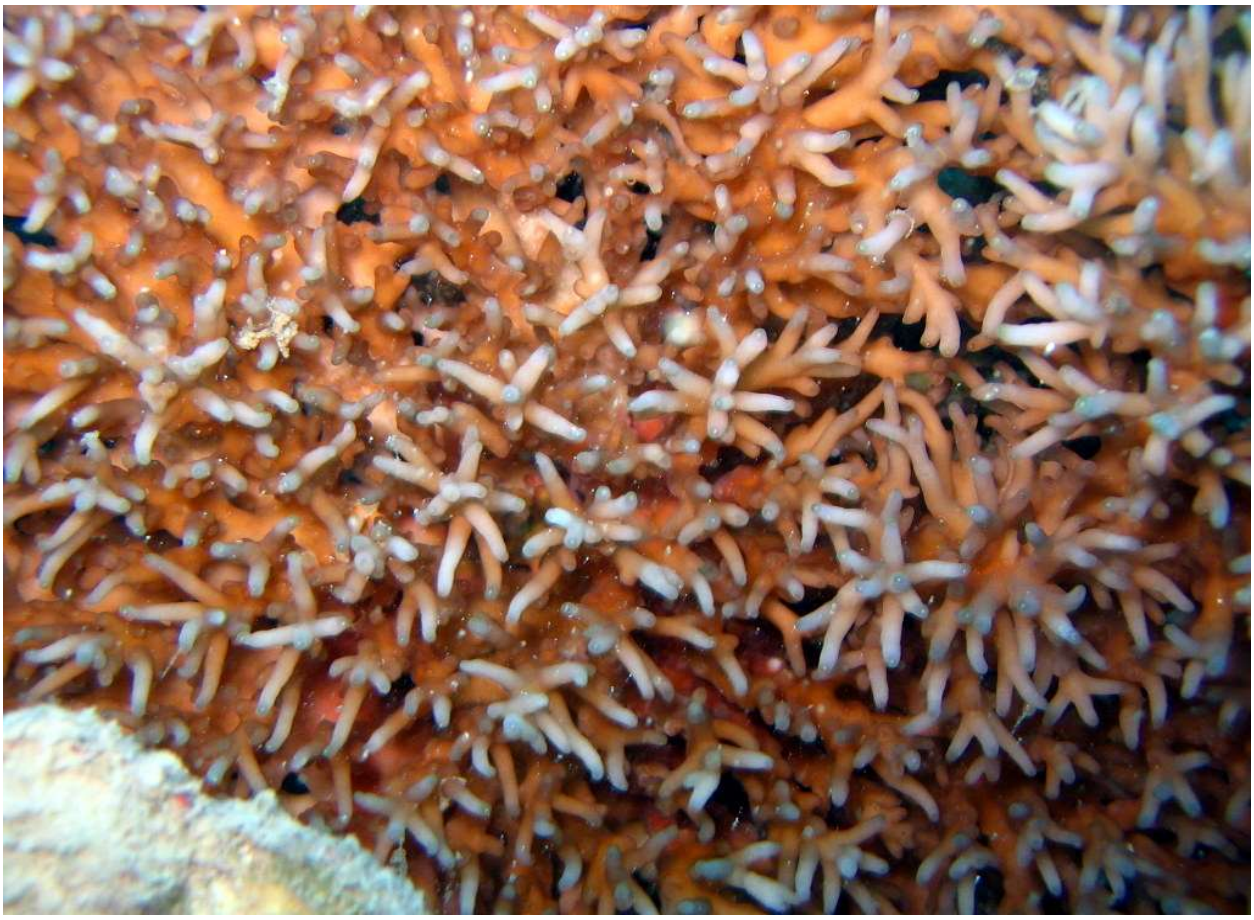
Slide 144. A photo of *A. carolineana* from a book by Nemenzo. Nemenzo described the species, and this may be a picture of the type. It clearly shows the tapering corallites. He says that 'corallites have very inflated bases so they look like elongated cones." This is surely not a whole colony, it appears to be a single branch. He says that colonies are side attached corymbose and spread horizontally. That's the same as *A. lokani* and *A. granulosa*. Notice that in the photo the branch has lots of corallites extending out all directions.



A photo of an *A. carolineana* skeleton from Wallace (1999), showing her concept for this species. Do the corallites taper? Maybe some do a little, but not much.



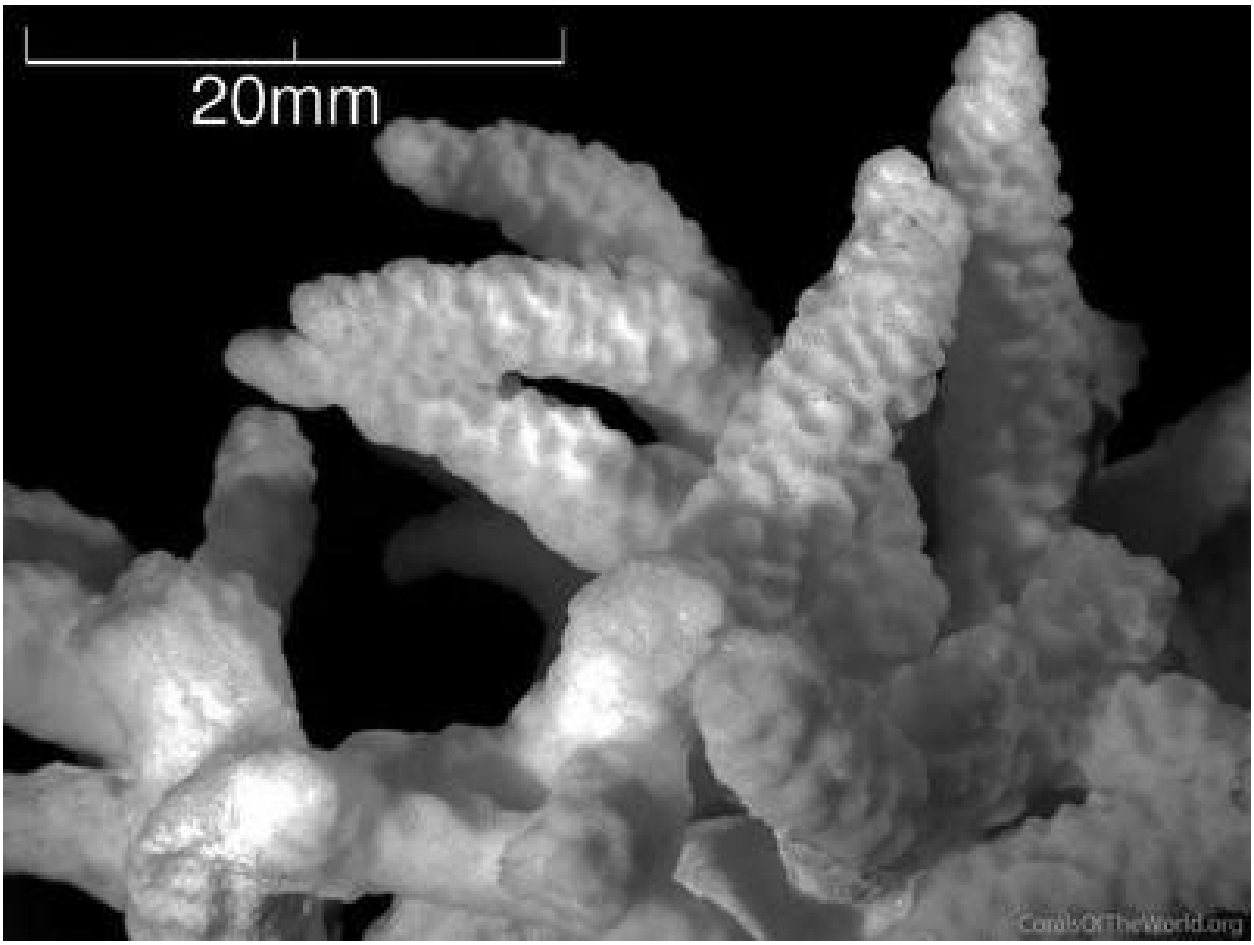
This is a photo of one of the skeletons shown by Veron. Notice the Christmas tree like radiating corallites. The corallites taper a little. So it may be that *A. carolineana* can have tapering corallites and/or Christmas tree formations. But all of Veron's photos of live corals show tapering corallites and no Christmas tree formations. Plot thickens.



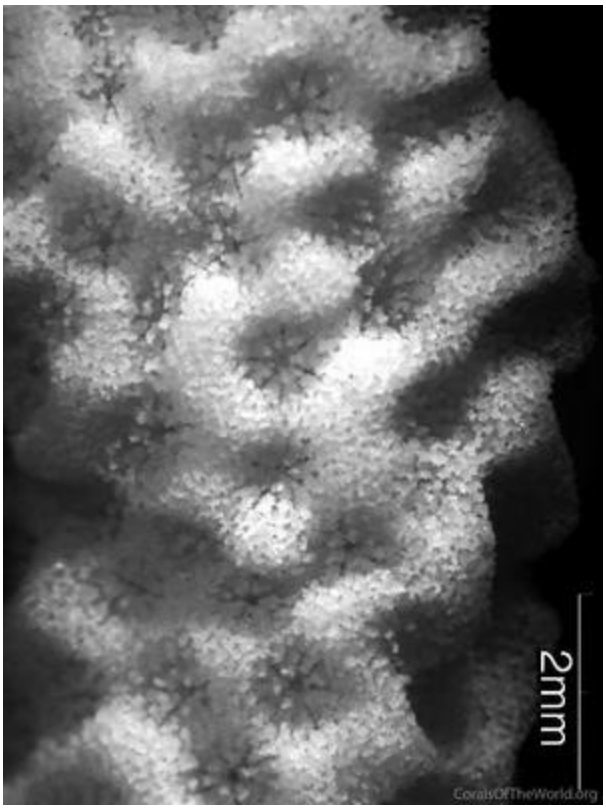
This is a photo of *Acropora carolineana* from American Samao like the concept of Wallace, 1999. Colonies are similar to *A. granulosa* and *A. lokani*, however some of the branches have radiating long tubular radial corallites which make them look like Christmas trees. Corallites do not taper in this photo. But notice in Nemenzo's photo that the corallites go out from the branch in all directions; if we looked at it from the top it would have the Christmas tree shape. SO, it appears that there are colonies with tapering corallites but no Christmas tree formations, colonies with Christmas tree formations but no tapering corallites, and colonies with the formations and tapering corallites (which is probably what the type is). It appears these may be two independent characters, and further the degree of taper varies between colonies in a more or less continuous fashion. All this raises the question of whether *A. carolineana* is a distinct, valid species. We need photos of many more colonies.

Porites napopora was listed as threatened, but has not been found in U.S. Pacific waters. *Porites* species have tiny corallites about 1 mm diameter. There are at least 65 species in the genus currently recognized. This species forms colonies with thin near-horizontal plates and curving branches. In these photos, the corallites are indented between thin ridges that project above the corallites. In at least some colonies, the polyps in the center are a different color than the rest of the colony.

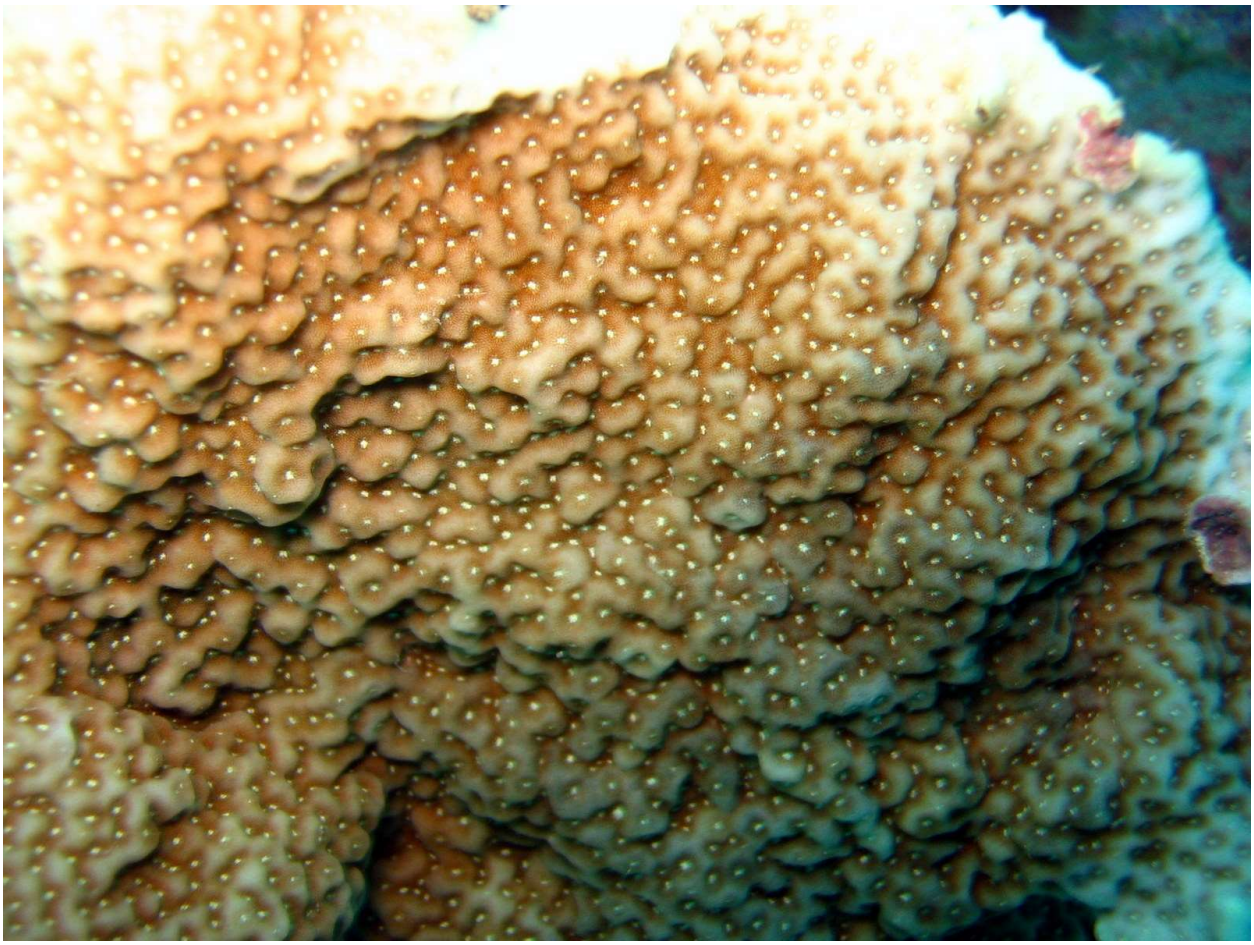
A closer photo of *Porites napopora*. These photos come from Veron.



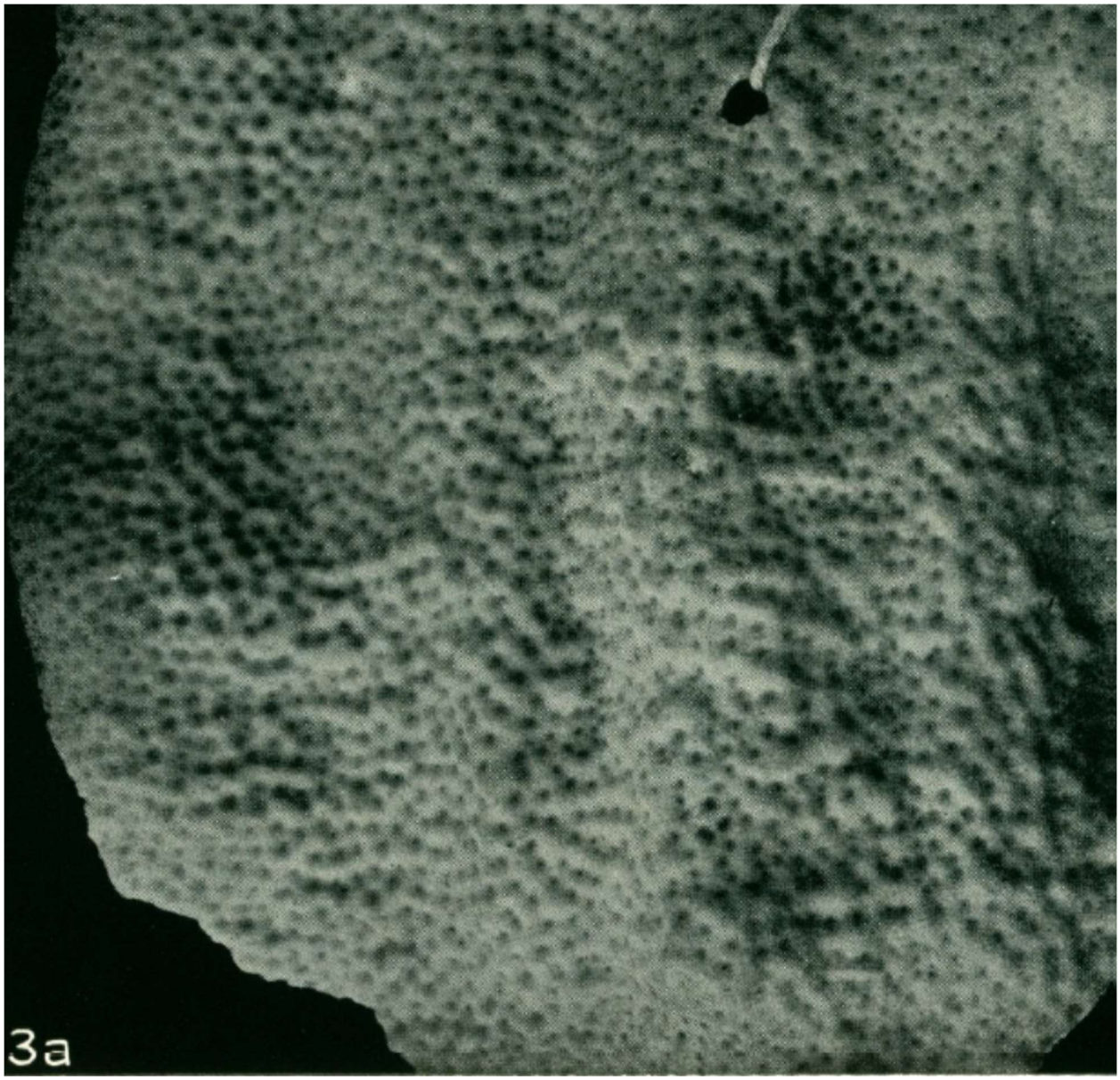
Slide 150. A photo of the type specimen of *P. napopora* from Veron. Notice that the ridges between the corallites are not thin and sharp, they are variable thickness but often thick and rounded.



Slide 151. A closeup of the type of *P. napopora*, showing the ridges between the corallites.



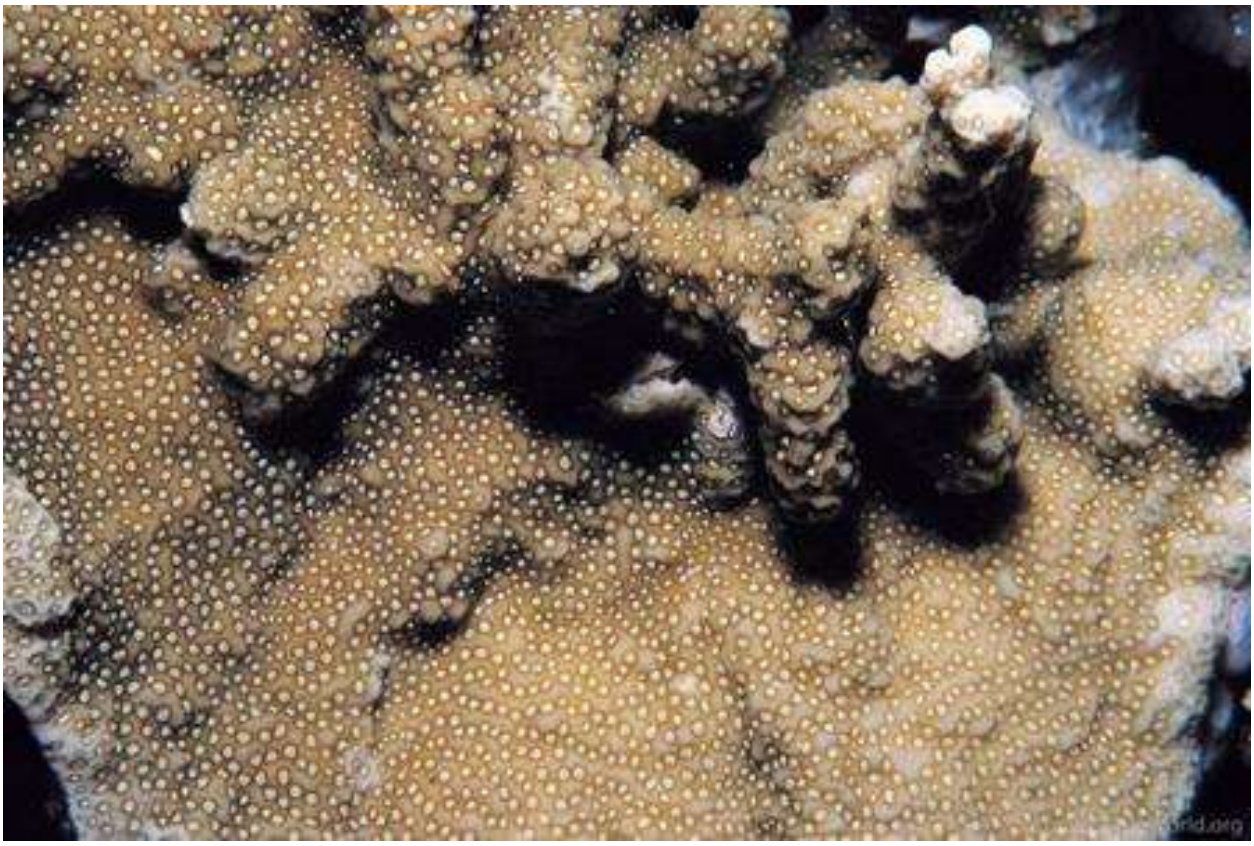
Slide 152: *Porites horizontallata* was not listed. It was named from American Samoa which is its type location. In American Samoa it forms thin plates only, but in other places such as the Coral Triangle and the Marianas corals that have been identified as *P. horizontallata* can also from branches. All colonies in American Samoa are gray. Corallites are recessed, but the ridges between corallites are large, rounded, and smooth instead of being sharp like on Veron's pictures of living *Porites napopora*. This can be seen in this closeup photo. However, the ridges are more similar to the type specimen of *P. napopora*. There are details of the corallites that differ between these two species, but you can't see them under water.



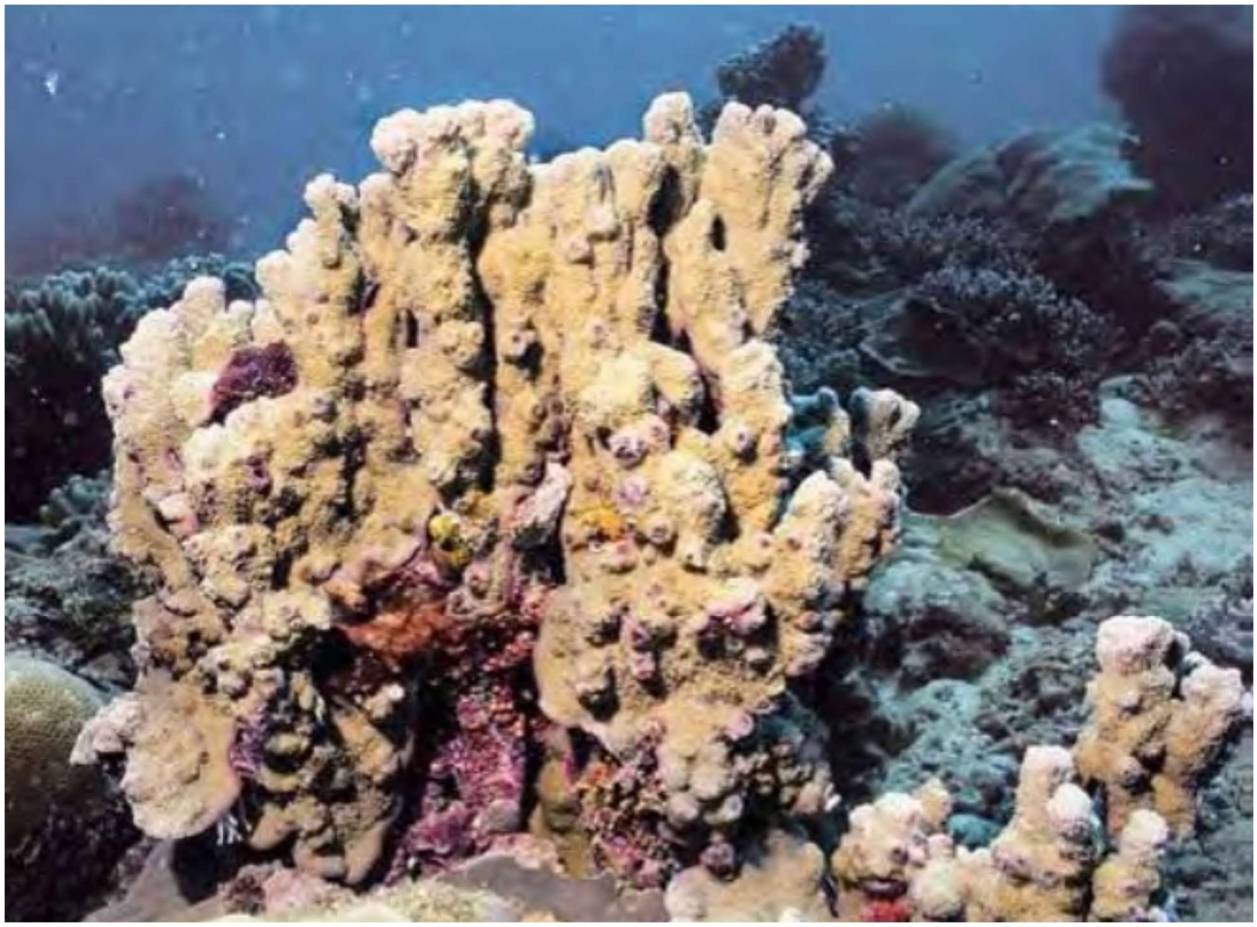
Slide 153: This is a picture of the type specimen of *Porites horizontallata*, from American Samoa, which I copied from the original description from American Samoa (Hoffmeister, 1925). You can see that the ridges between corallites are rounded, not sharp or thin.

Slide 154: A Veron photo that he says is *Porites horizontallata*. Note that the ridges between the corallites are thinner and sharper than in my photo and the type. All of my photos in American Samoa show thick rounded ridges or knobs between corallites. So in some of my American Samoa photos the ridges are continuous or nearly so, but in others they are divided up into many rounded bumps. American Samoa is the type location for this species, so this species is here and my photos correspond well with the type. However, this photo differs and maybe even looks a bit more like Veron's photos of live colonies he called *Porites napopora*.

Slide 155: A Veron photo he says is *P. horizontallata*, showing branches. He does say that *P. horizontallata* is a species complex.

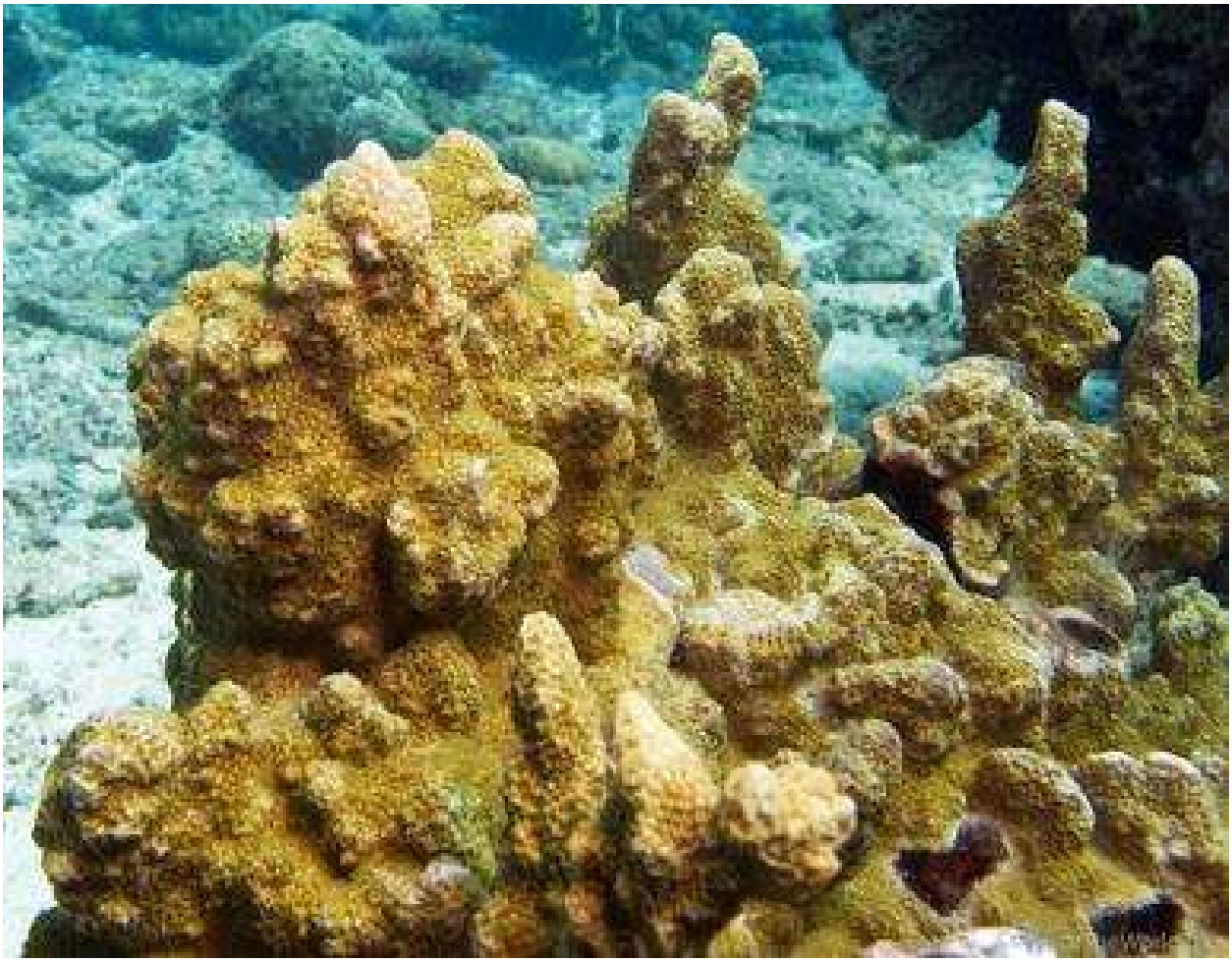


Slide 156: Another photo Veron says is *P. horizontallata*. Note ridges are thicker where present, but there is little if any ridge development on the plate. The boundaries between species in this species complex have not been worked out yet.



Slide 157: *Montipora australiensis* was listed as threatened. It is not known from U.S. waters. This species forms plates with irregular upward growing columns. This is a rare species, very rarely reported. The columns can be thicker than most other *Montipora*.

Slide 158: this colony in a photo from Veron looks similar to *M. turtlensis*, but would need microscopic examination of skeleton to confirm.



Similar to the previous slide.

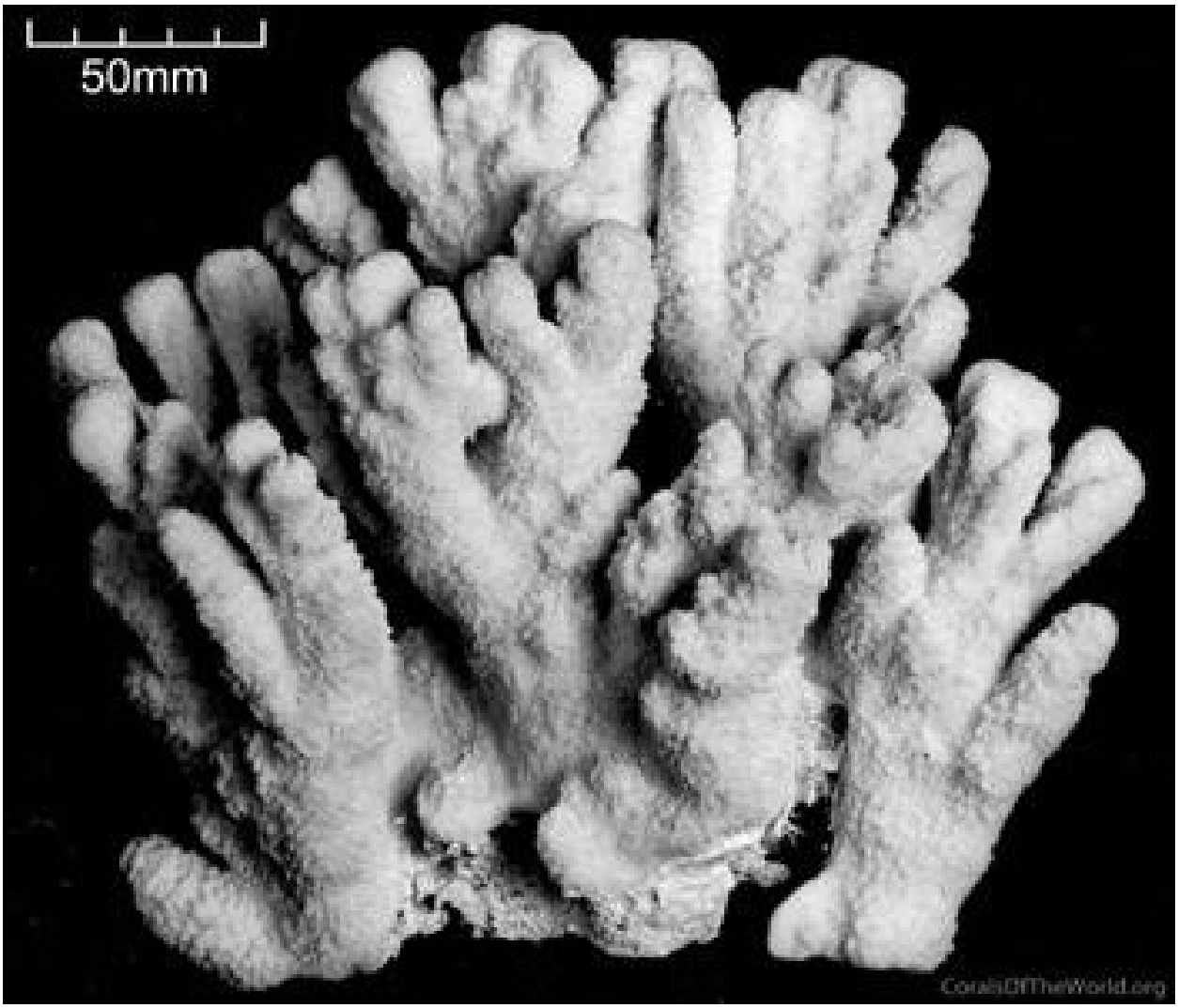


Photo of skeleton of *M. australiensis* from Veron

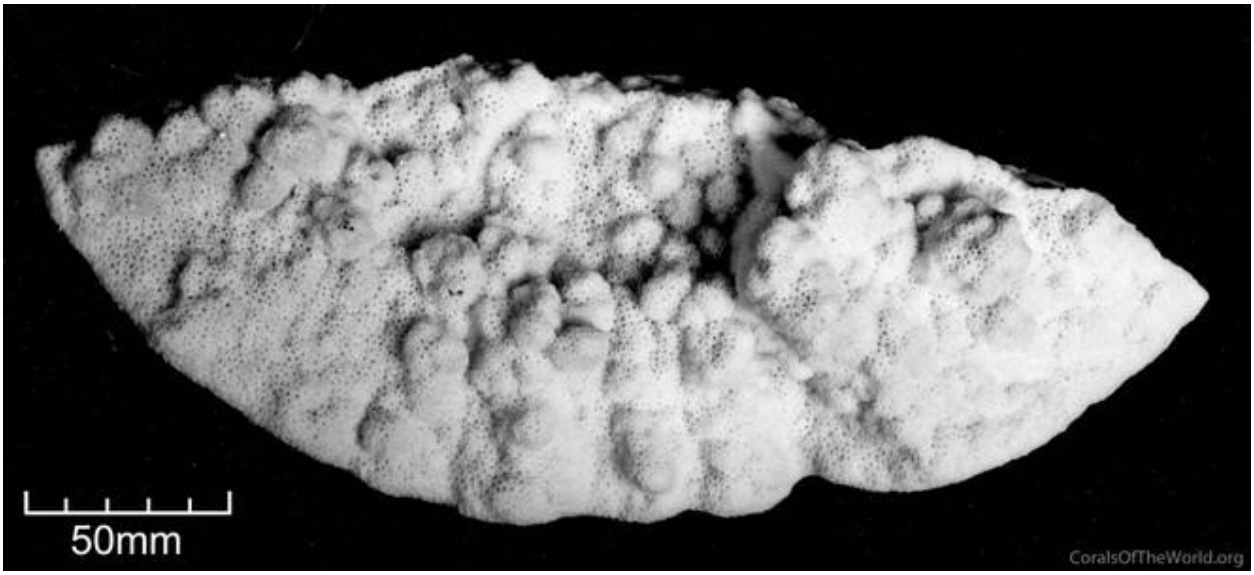


Photo of a base plate from Veron.

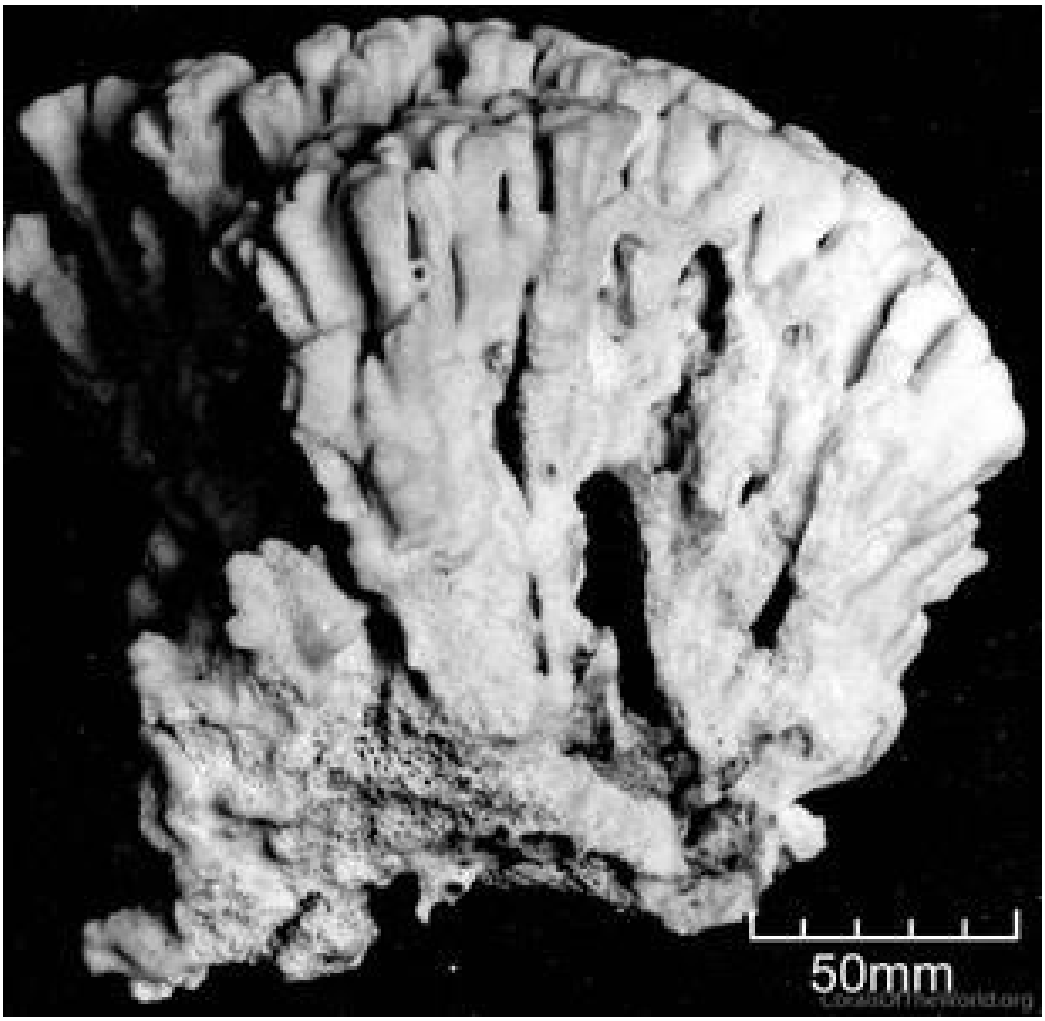


Photo of another specimen from Veron.