

# The Majuro Sanitation Crisis and the Death of our Coral Reefs

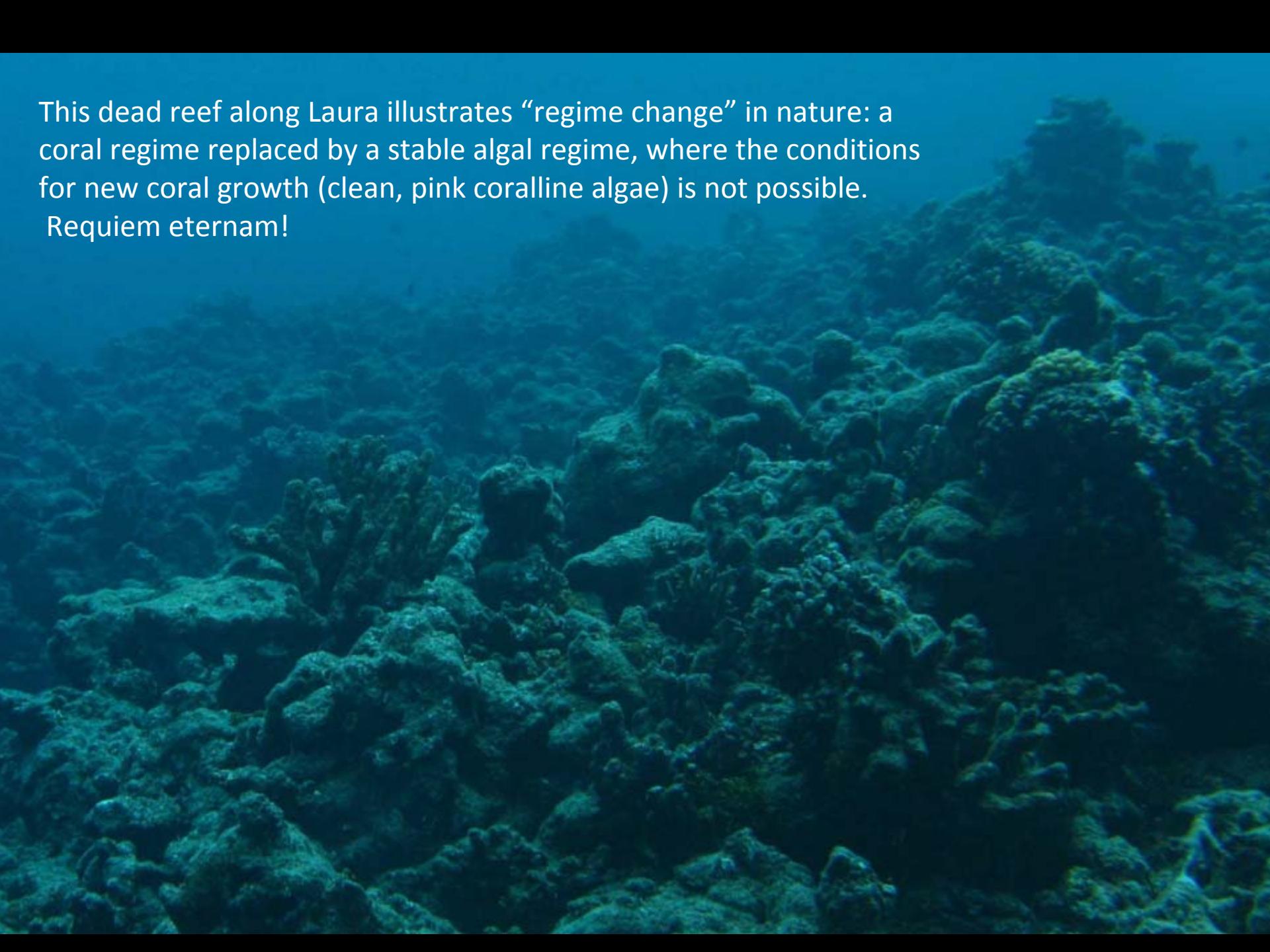
Dean M. Jacobson Ph.D.  
College of the Marshall Islands



I have set before you life and death, blessing and cursing, therefore choose life, that thou and thy seed may live.

Deuteronomy 30:19

This dead reef along Laura illustrates “regime change” in nature: a coral regime replaced by a stable algal regime, where the conditions for new coral growth (clean, pink coralline algae) is not possible.  
Requiem eternam!













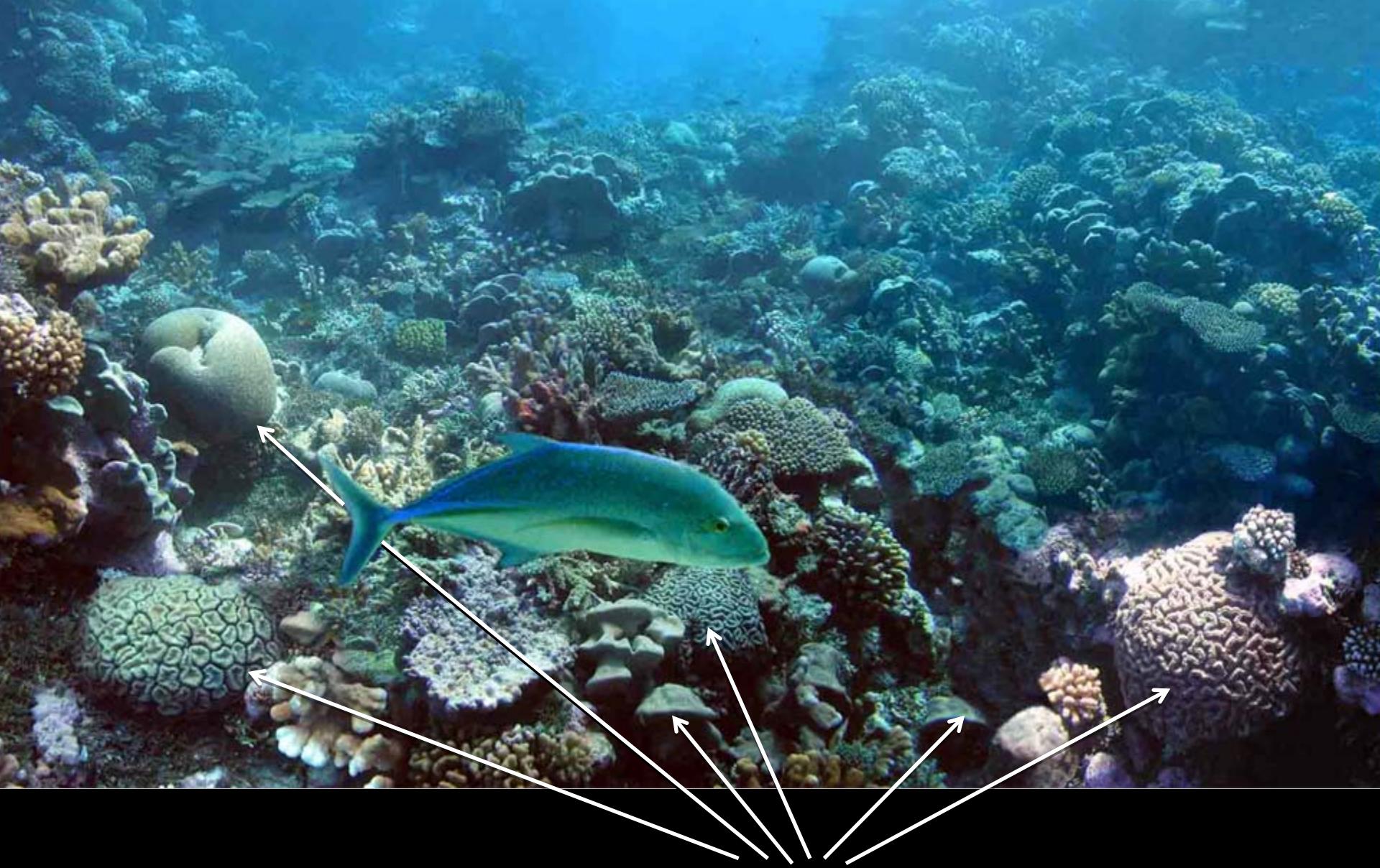






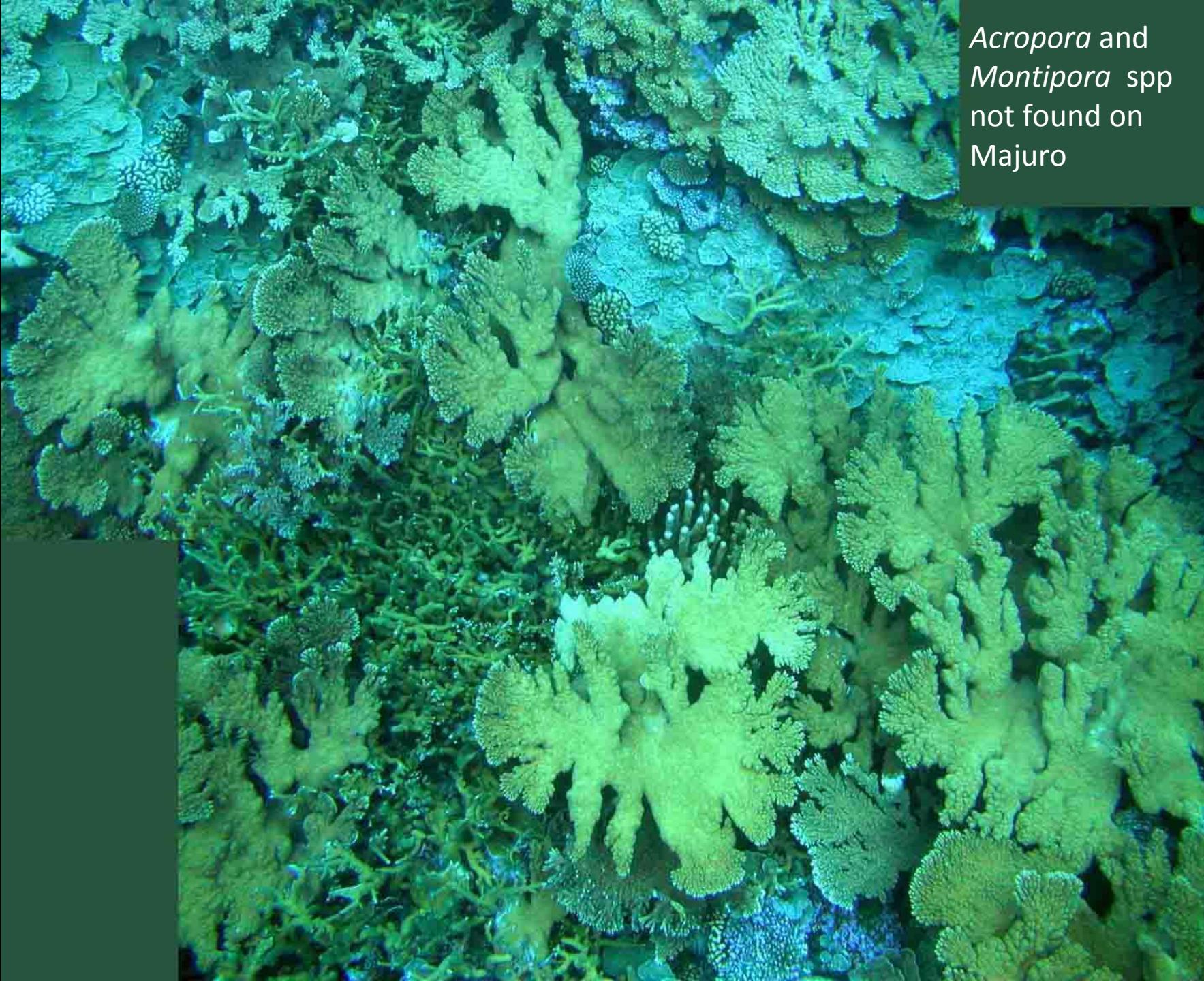






At intermediate depths, a high diversity of massive species grow, entirely healthy

*Acropora* and  
*Montipora* spp  
not found on  
Majuro





Healthy reefs are colorful... blue, yellow, red, especially pink!

A photograph of an underwater coral reef. The water is very clear, allowing for a deep blue color. In the center-left, a dark-colored fish, possibly a surgeonfish, is swimming near a large, flat, greenish-blue coral formation. The reef extends across the bottom and middle of the frame, with various types of coral and rock visible.

Outer island water is very clean!

A wide-angle underwater photograph of a tropical coral reef. The scene is filled with a variety of coral structures, from large, flat plate corals to more complex, branching and finger-like corals. Interspersed among the corals are patches of dense, bright green seagrass. The water is a clear, deep blue, and the overall lighting creates a vibrant, natural color palette.

Typical outer island reef...

*Isopora* is entirely absent in eastern Majuro, where a limited set of *Acropora* dominates



Note the low coral diversity

# *Isopora*: the dominant outer island coral

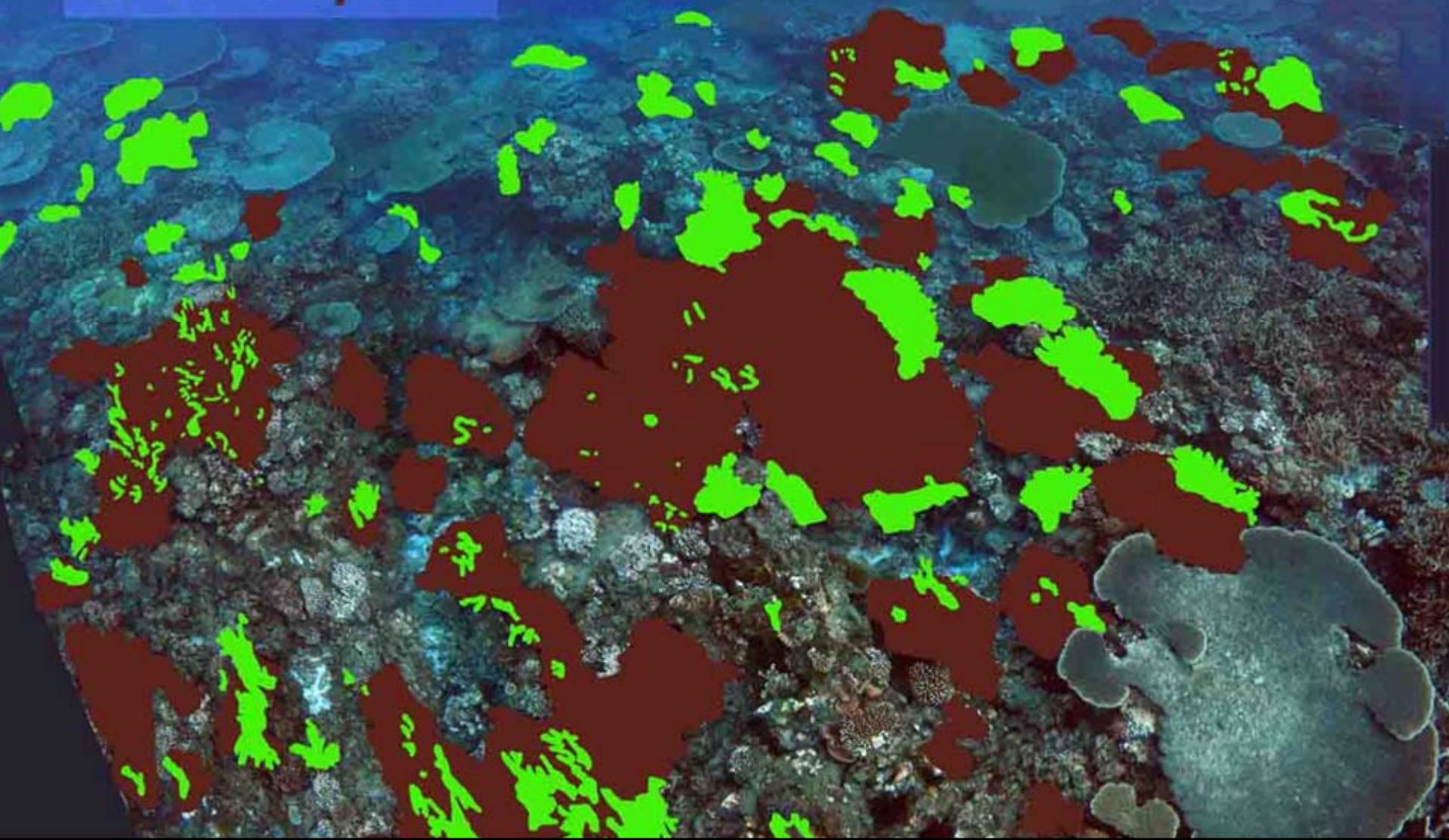


18 April 2010 eastern Ajeltake



*Live Isopora*

*Dead Isopora*





Majuro lacks the resources or the will to manage its solid waste problem: textiles and diapers litter the reef



This callous,  
thoughtless  
disregard for  
the plight  
of nature is  
summed up  
in a single  
word:

Autistic



The  
Lagoon  
and  
ocean  
have long  
been  
used as a  
dump and  
a sewer



The presence  
of diapers on  
coral  
correlates with  
coral disease

Yet, coral can appear resilient...



Uliga Dock 2008

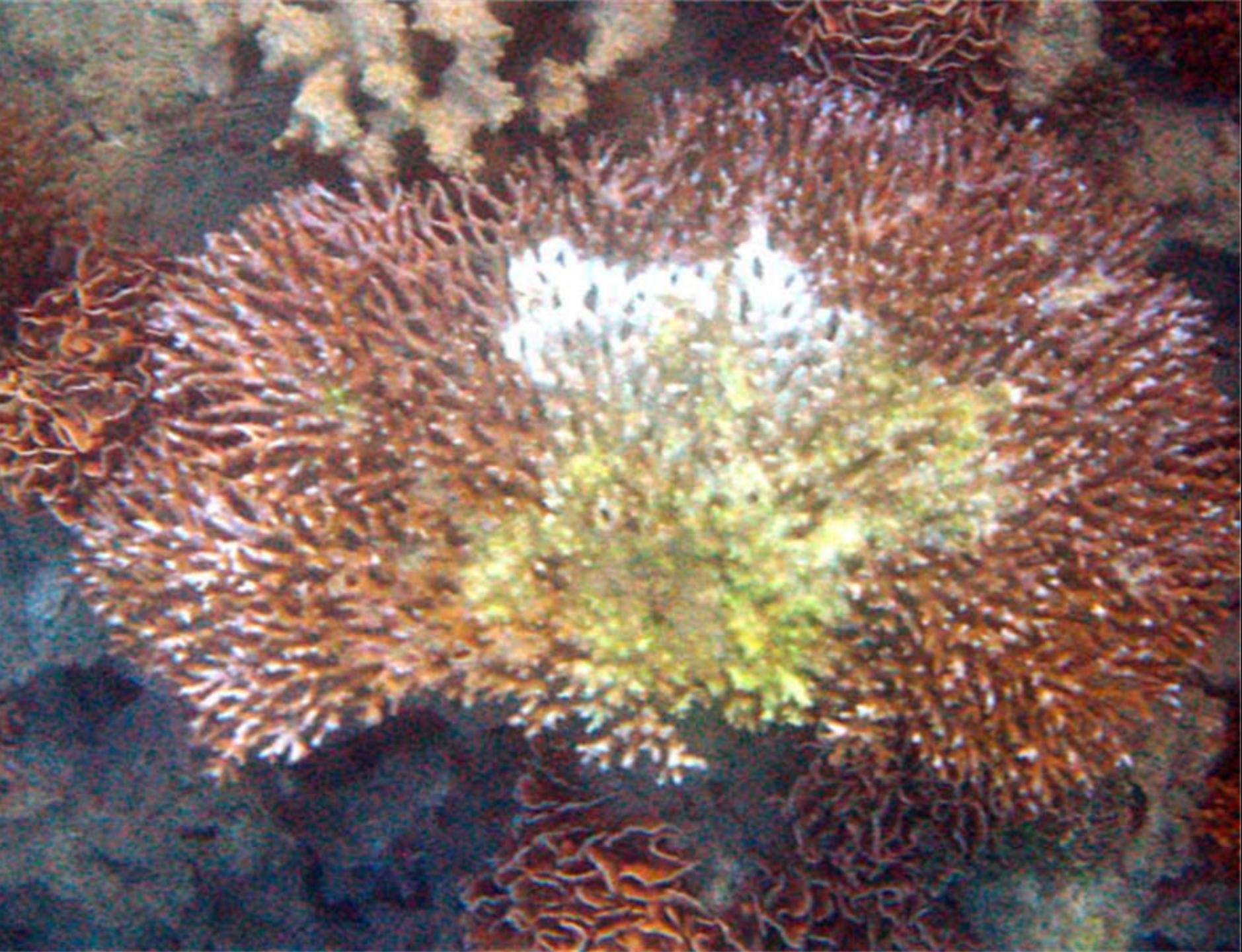
Though heavily polluted and trashed, Uliga Dock developed a small reef of thriving coral, and even attracted juvie Napoleon Wrasses!

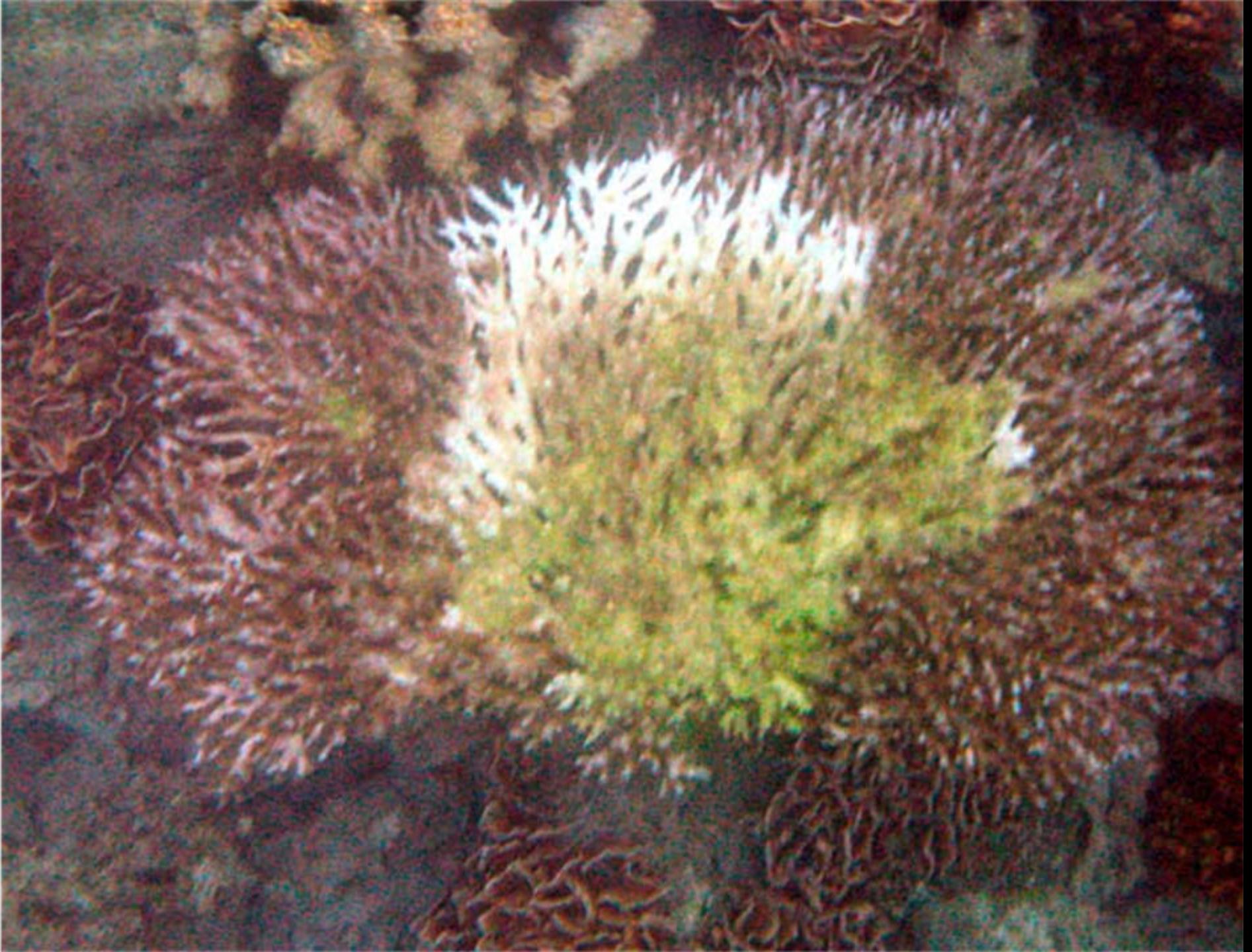


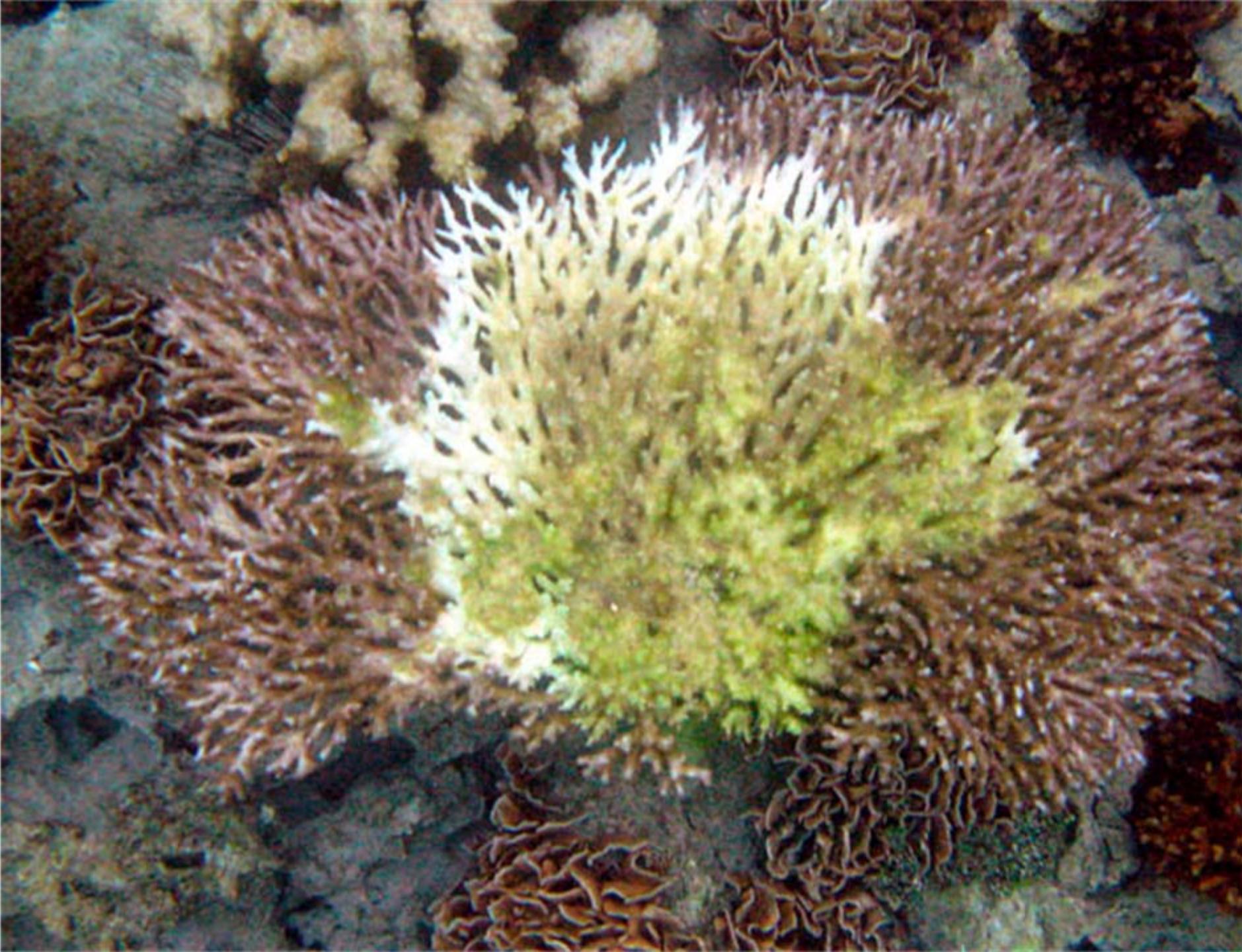


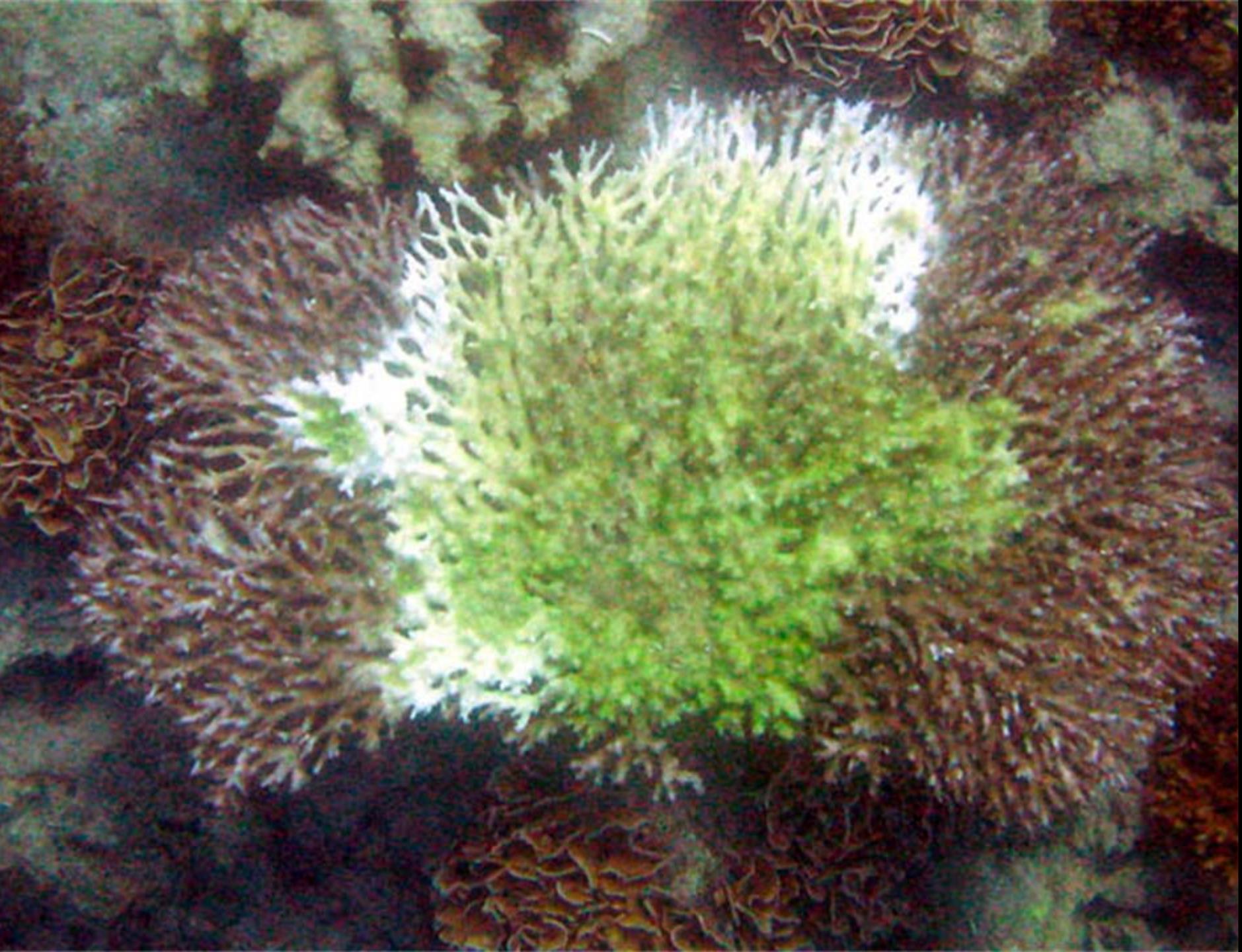
# Uluga Dock disease outbreak of August-Dec 2009





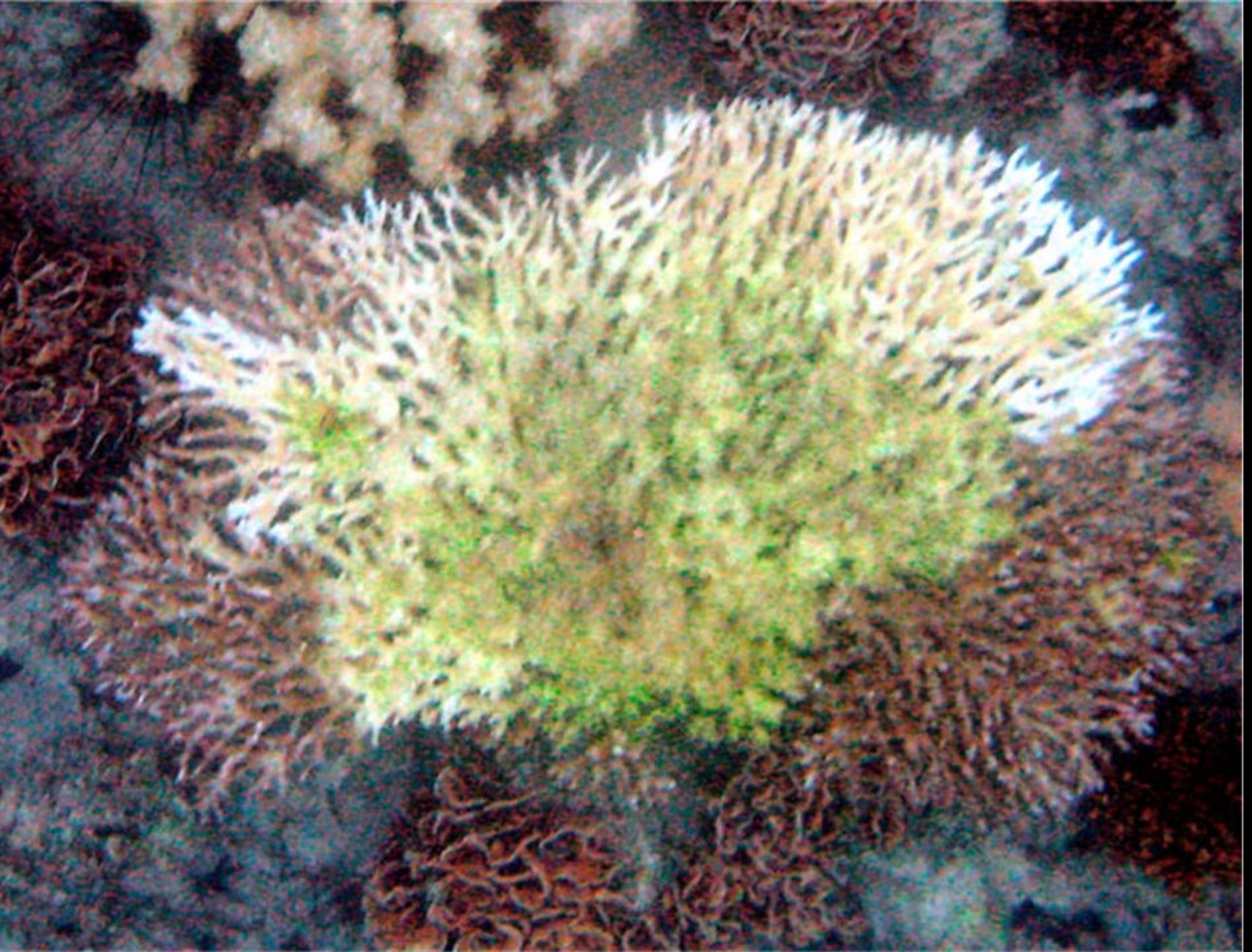


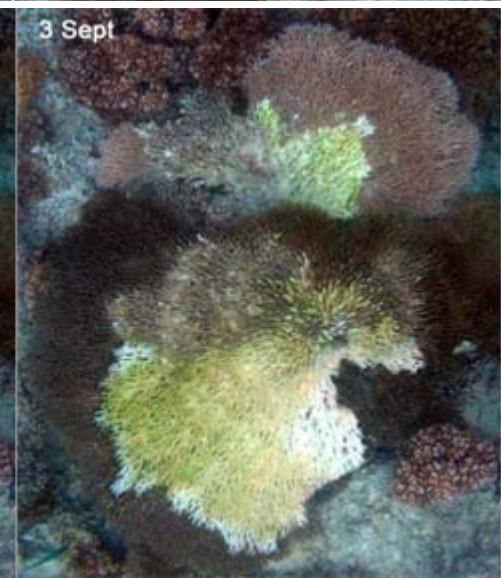
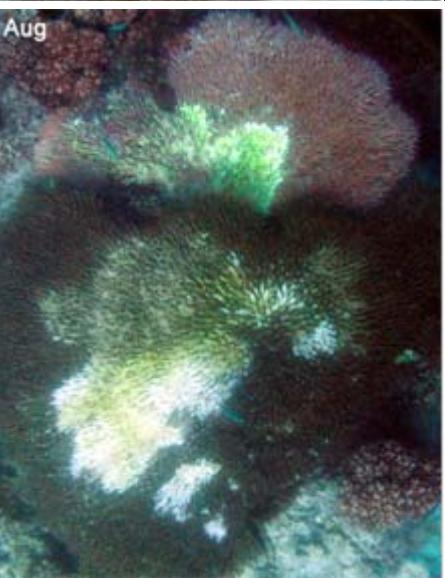
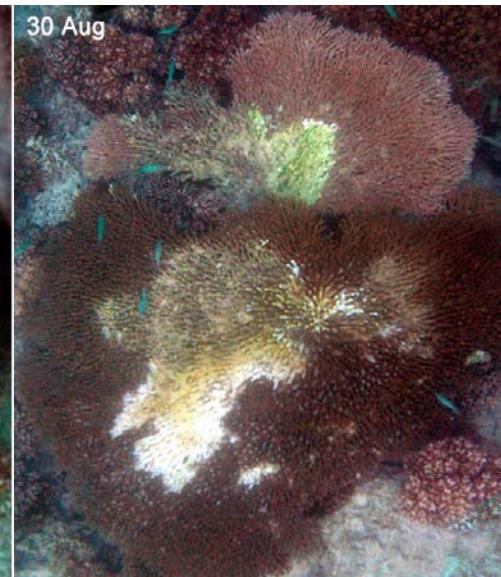
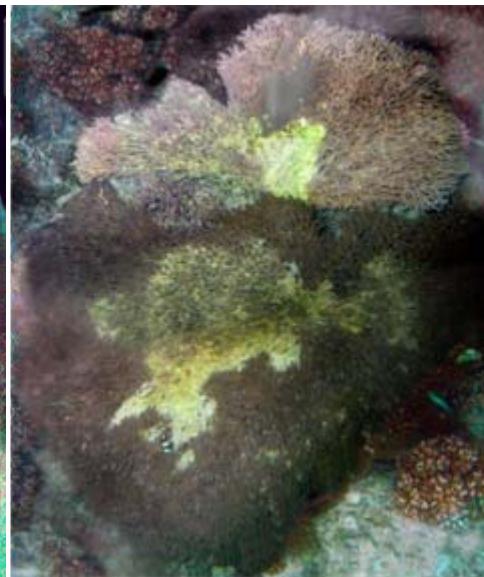
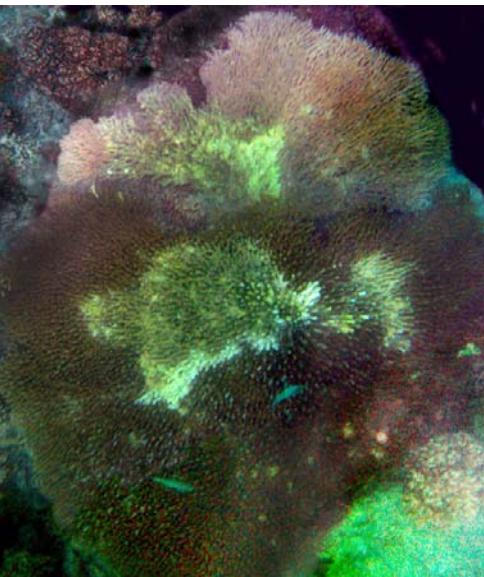
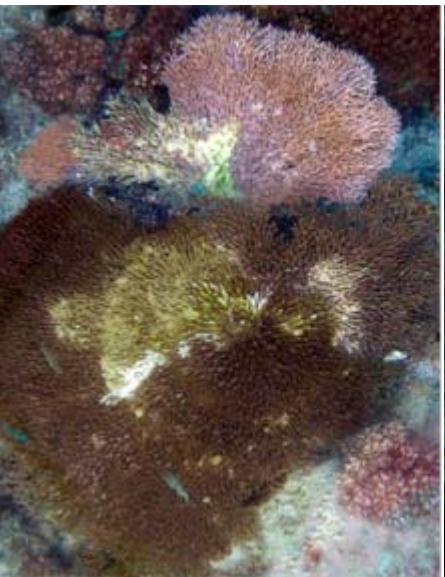


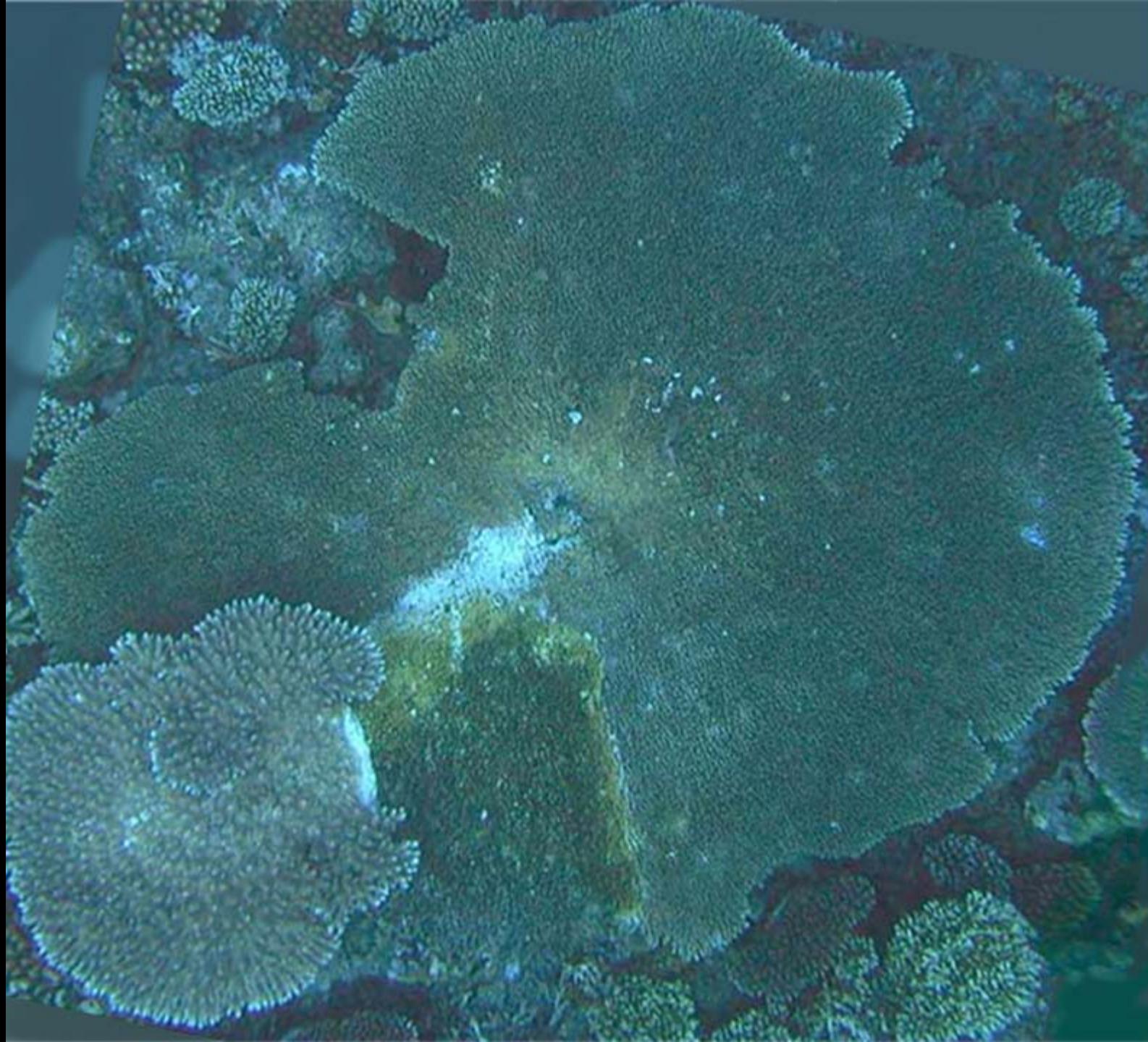


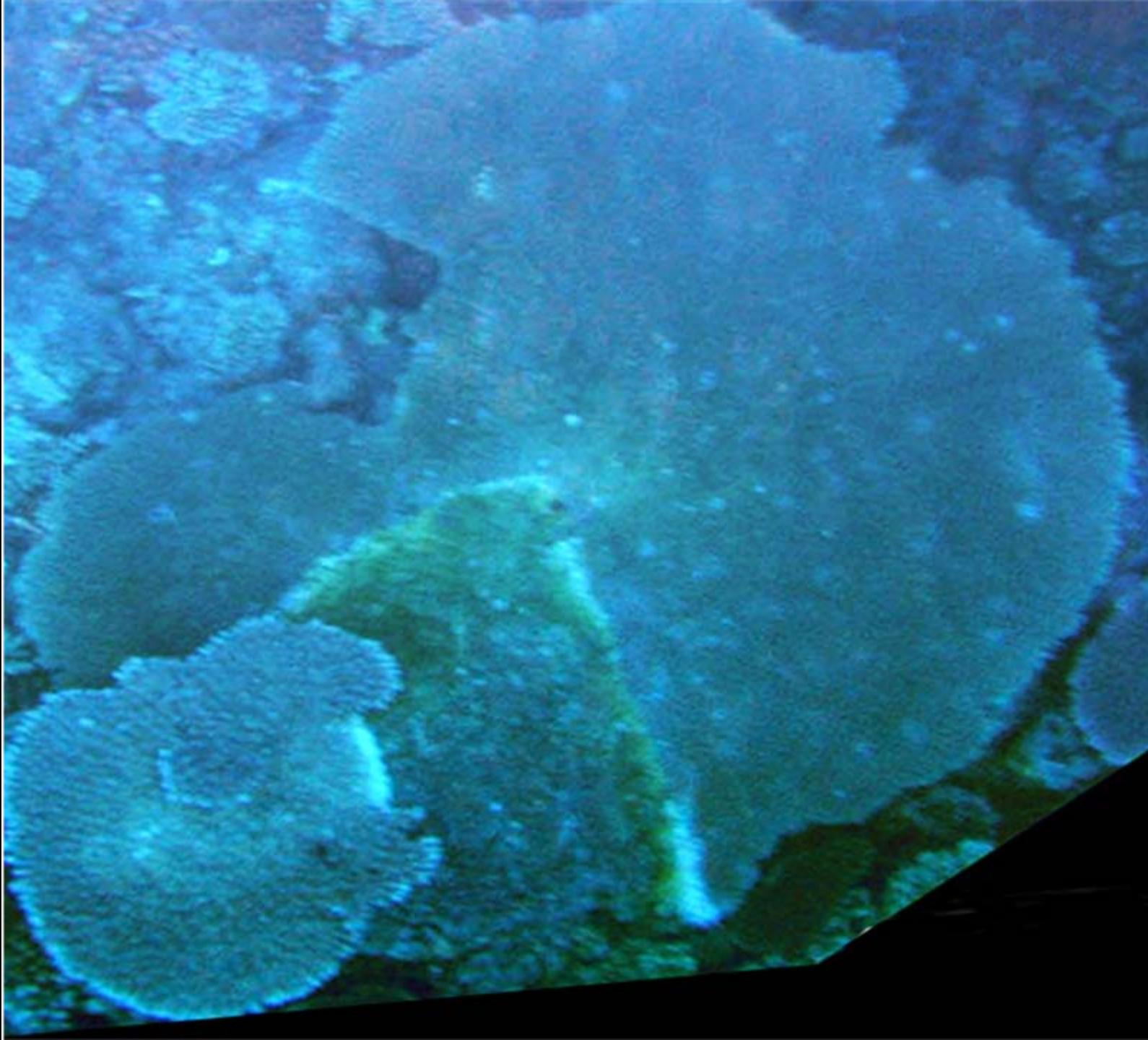


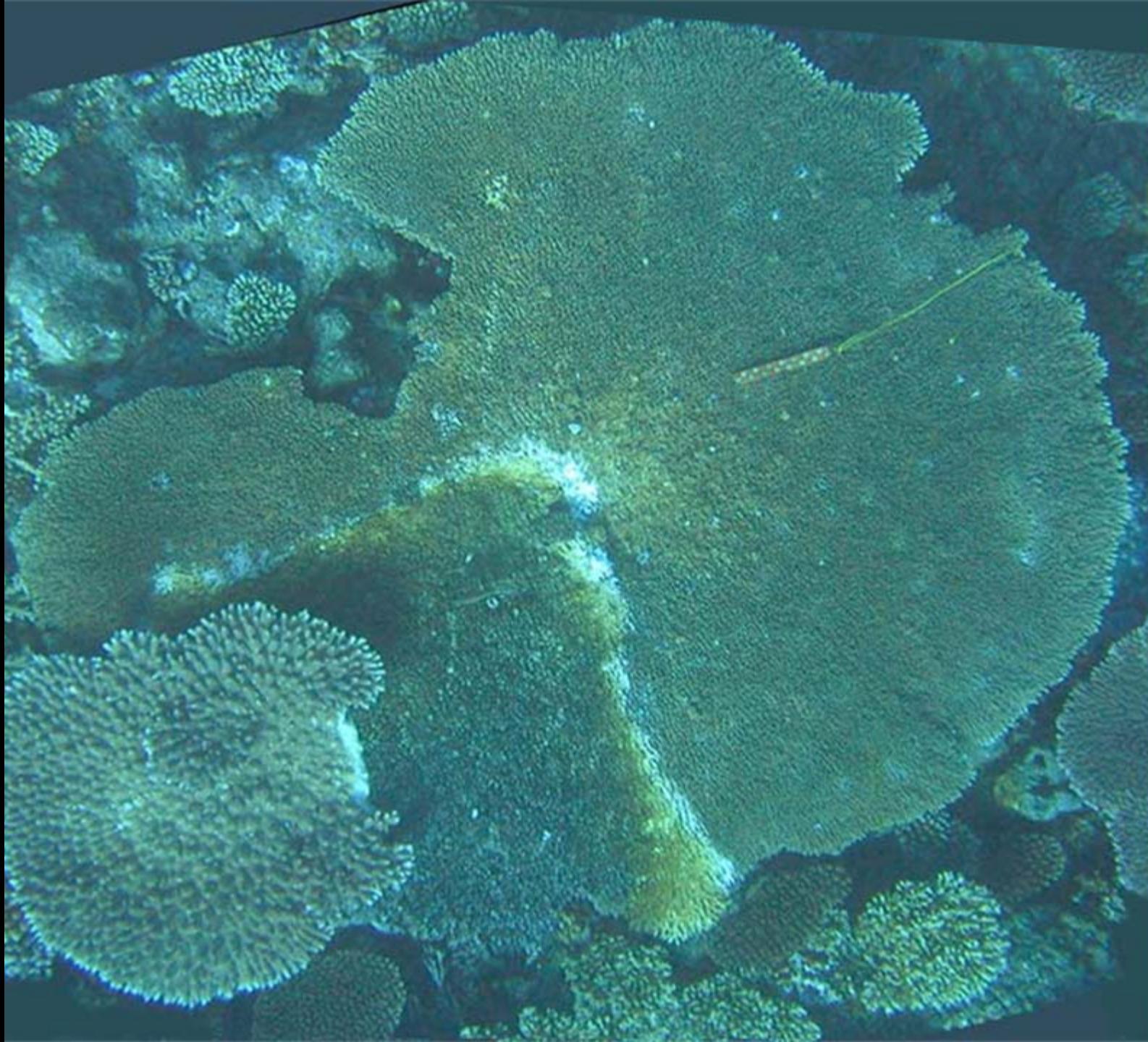




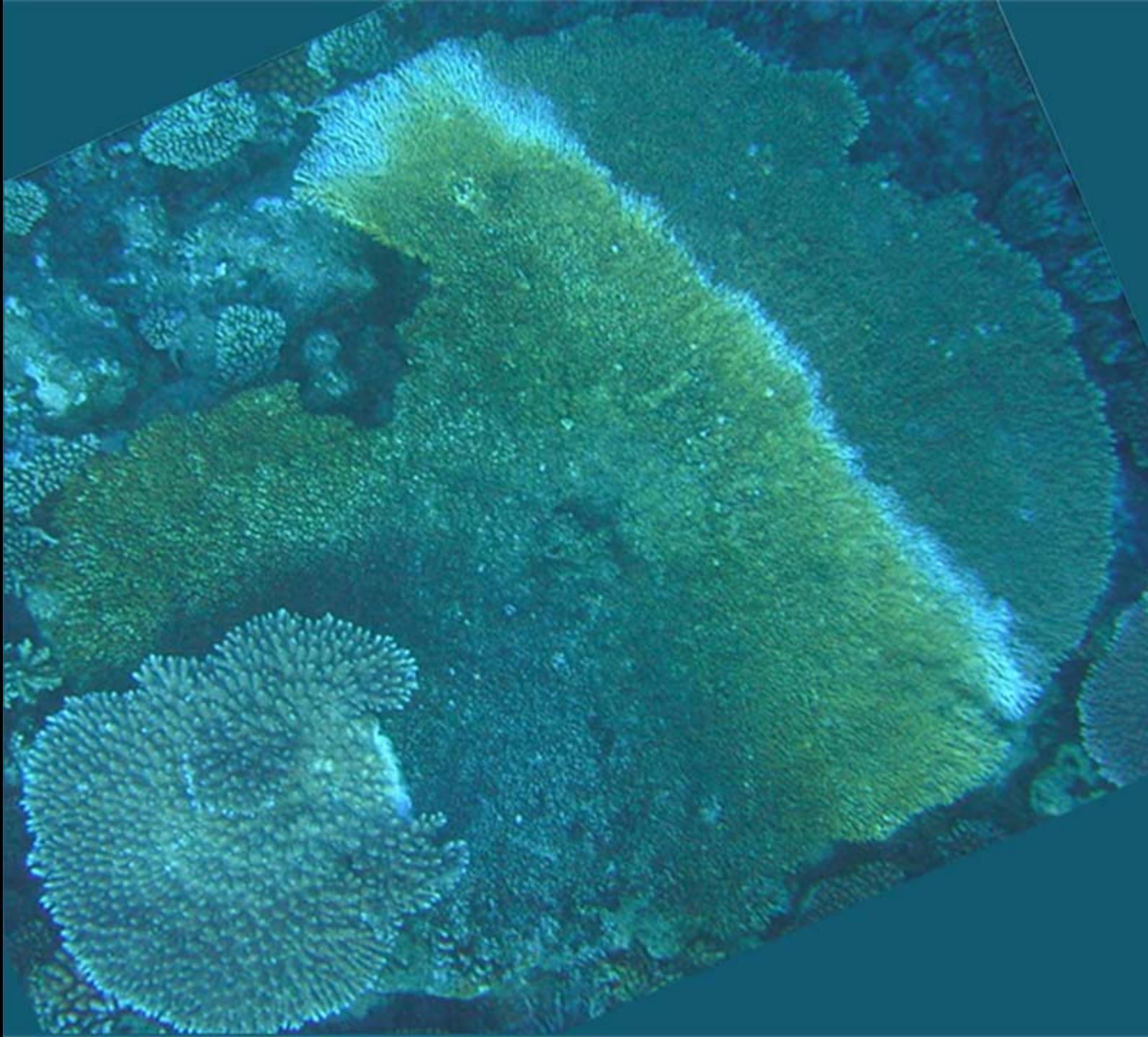


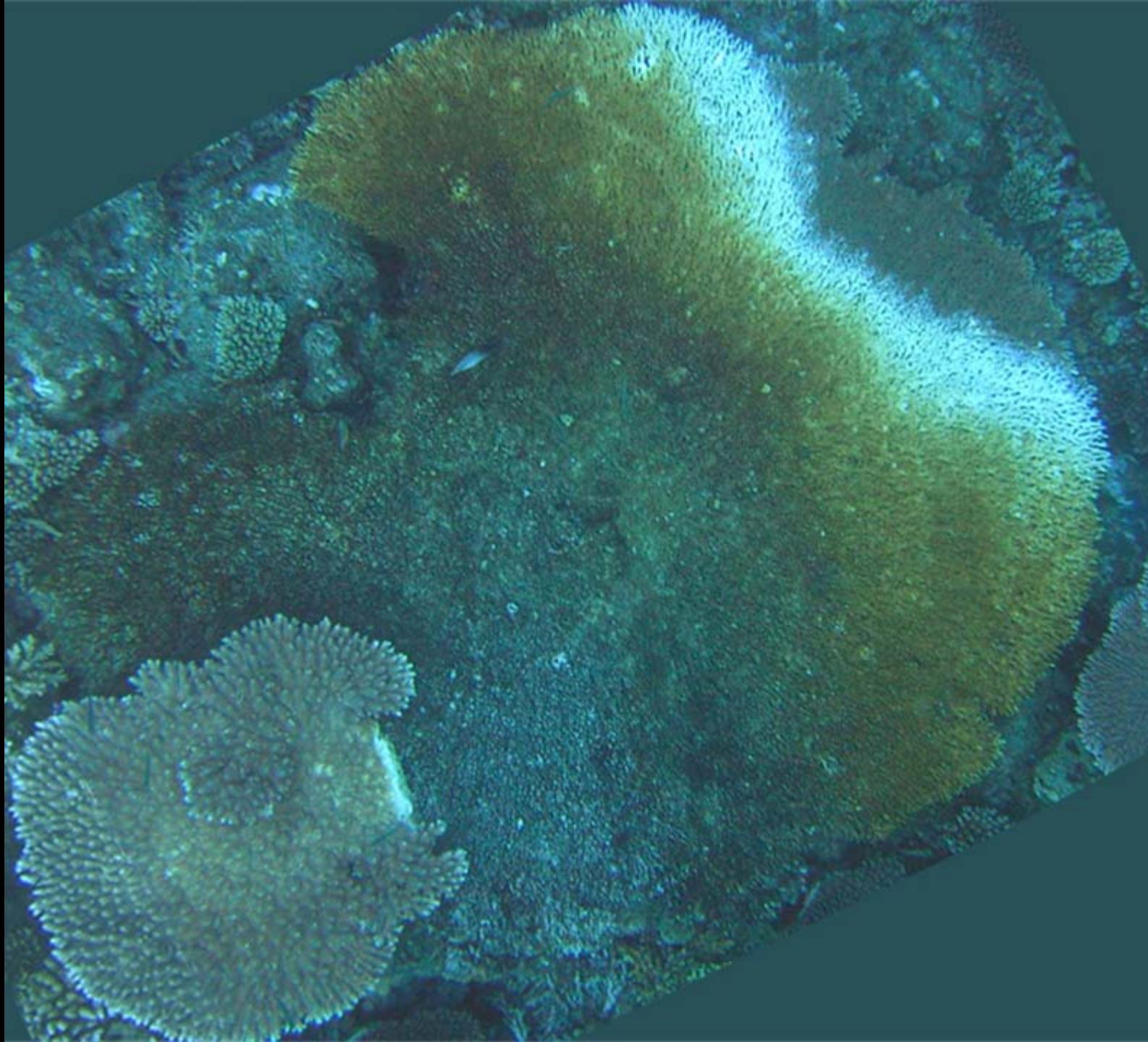




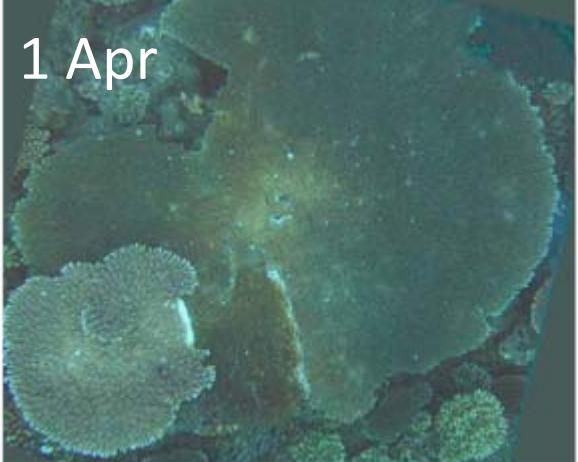








1 Apr



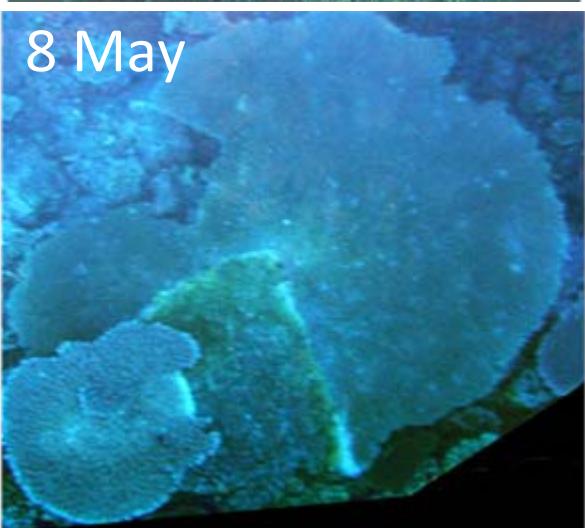
15 Apr



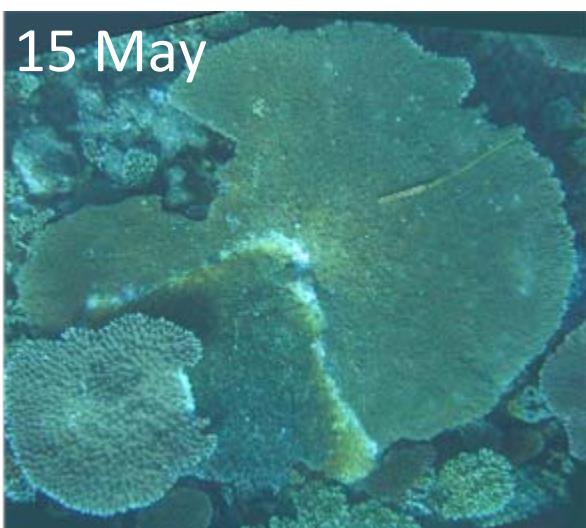
20 Apr



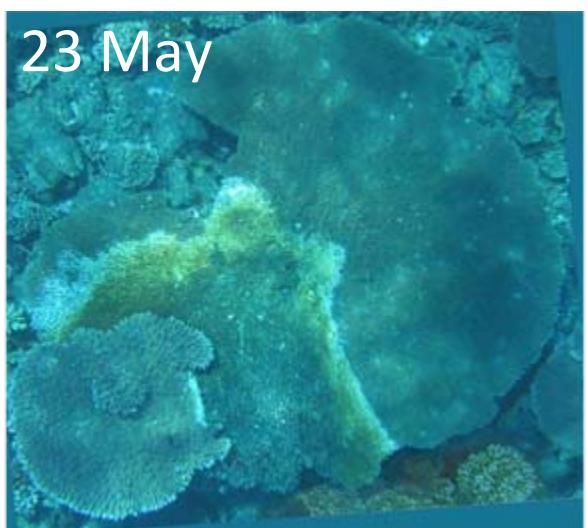
8 May



15 May



23 May



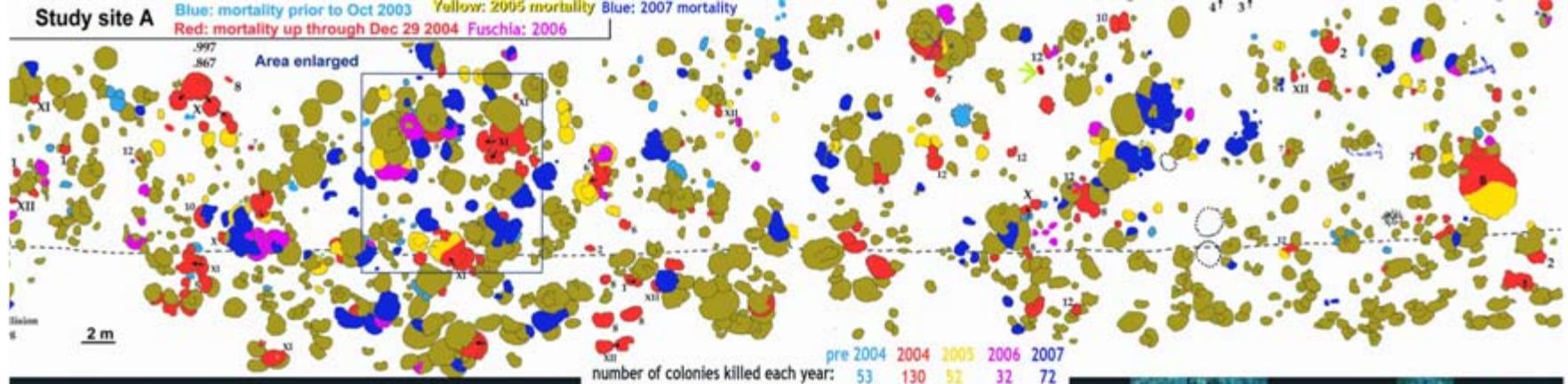
Spreading averages 2 cm/day,  
killing this 2 meter colony in  
less than four months

15 June

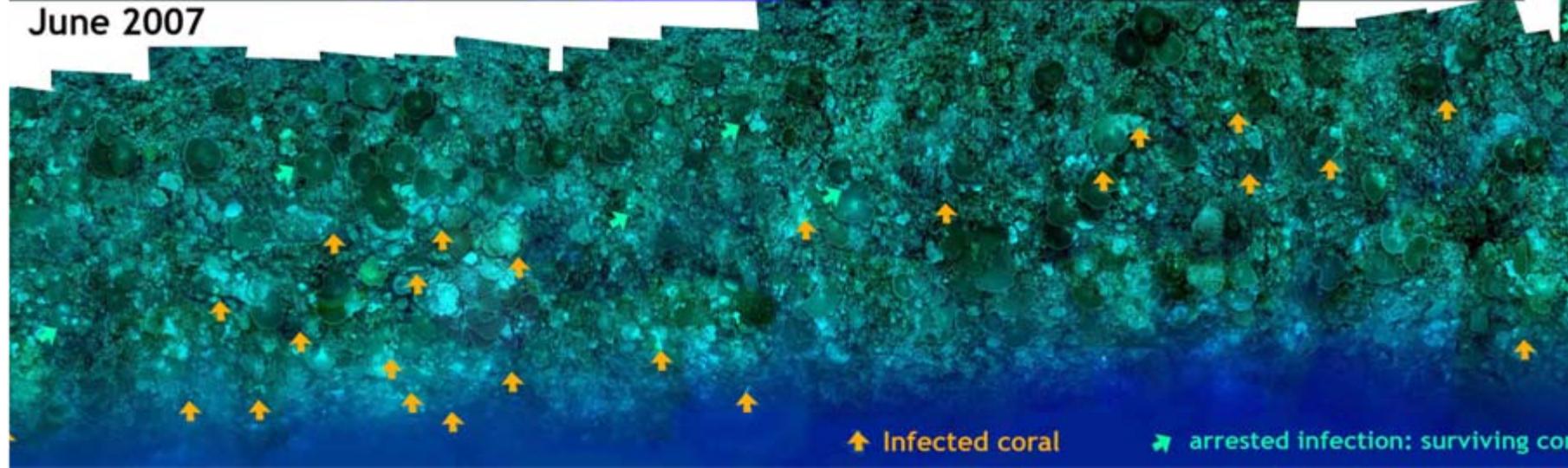


23 June



**Study site A**Blue: mortality prior to Oct 2003  
Yellow: 2005 mortality Blue: 2007 mortality  
Red: mortality up through Dec 29 2004 Fuschia: 2006**December 2004**

- 235 colonies infected by disease by the end of 2007
- Of these, all but 7 were completely killed

**June 2007**

Jan 2003

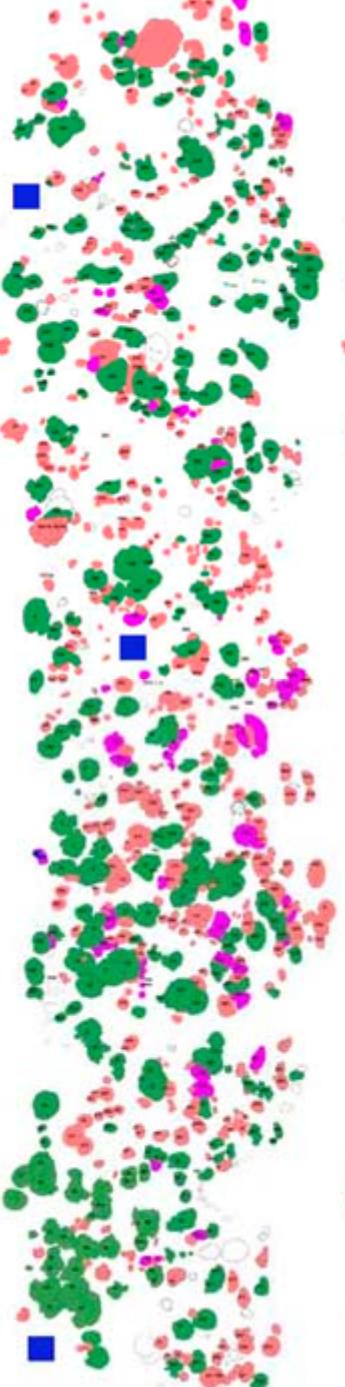
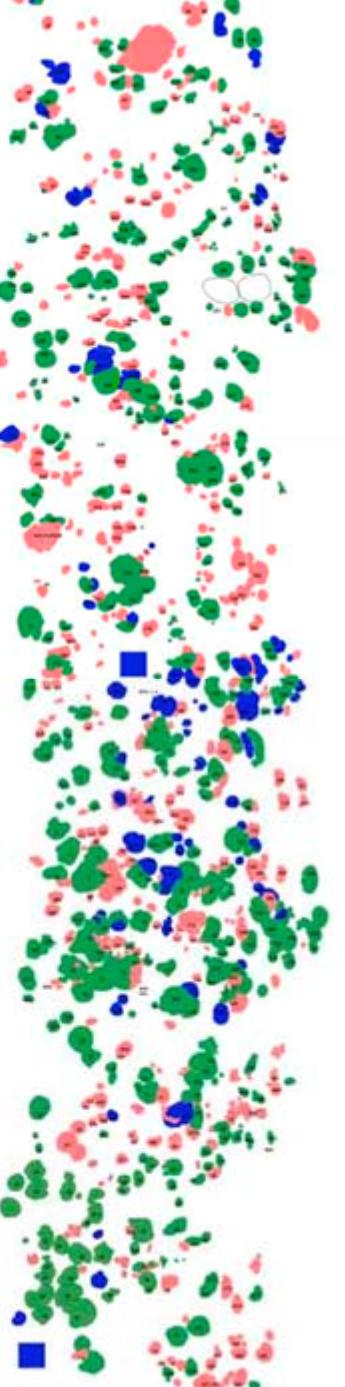
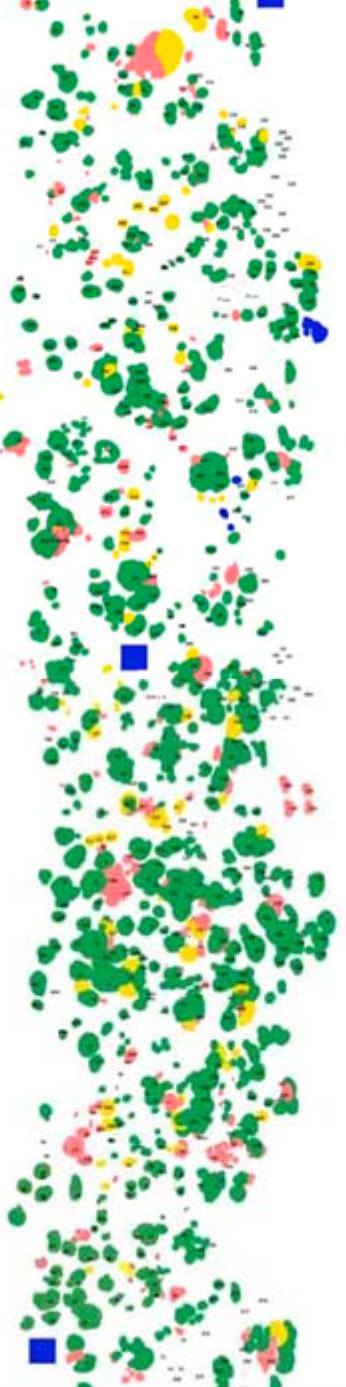
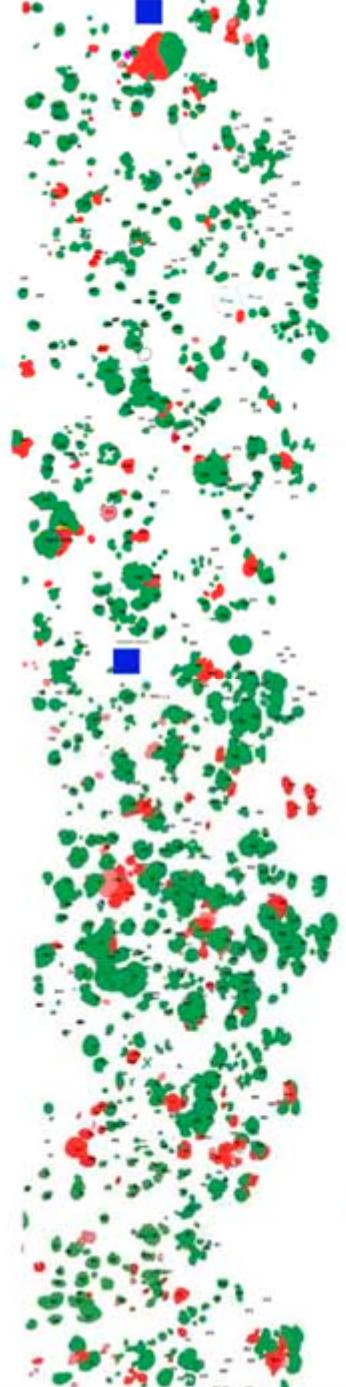
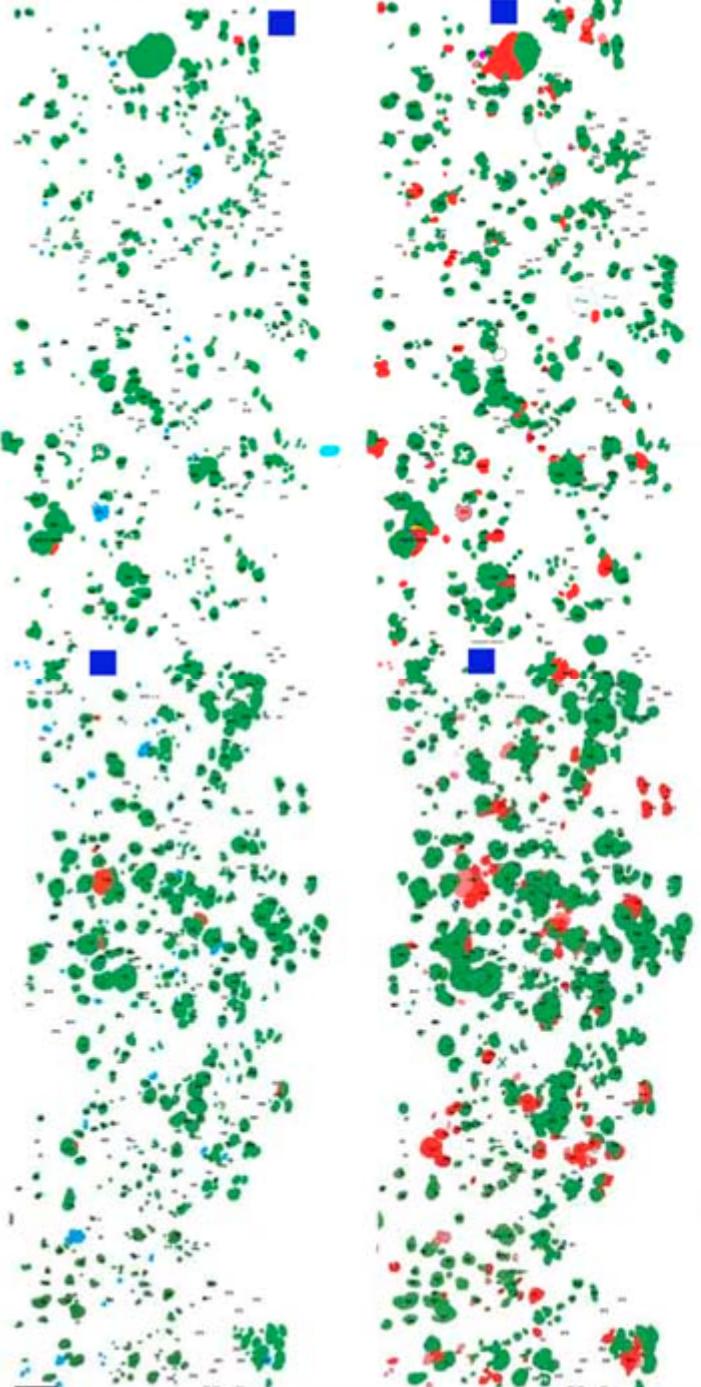
Jan 2004

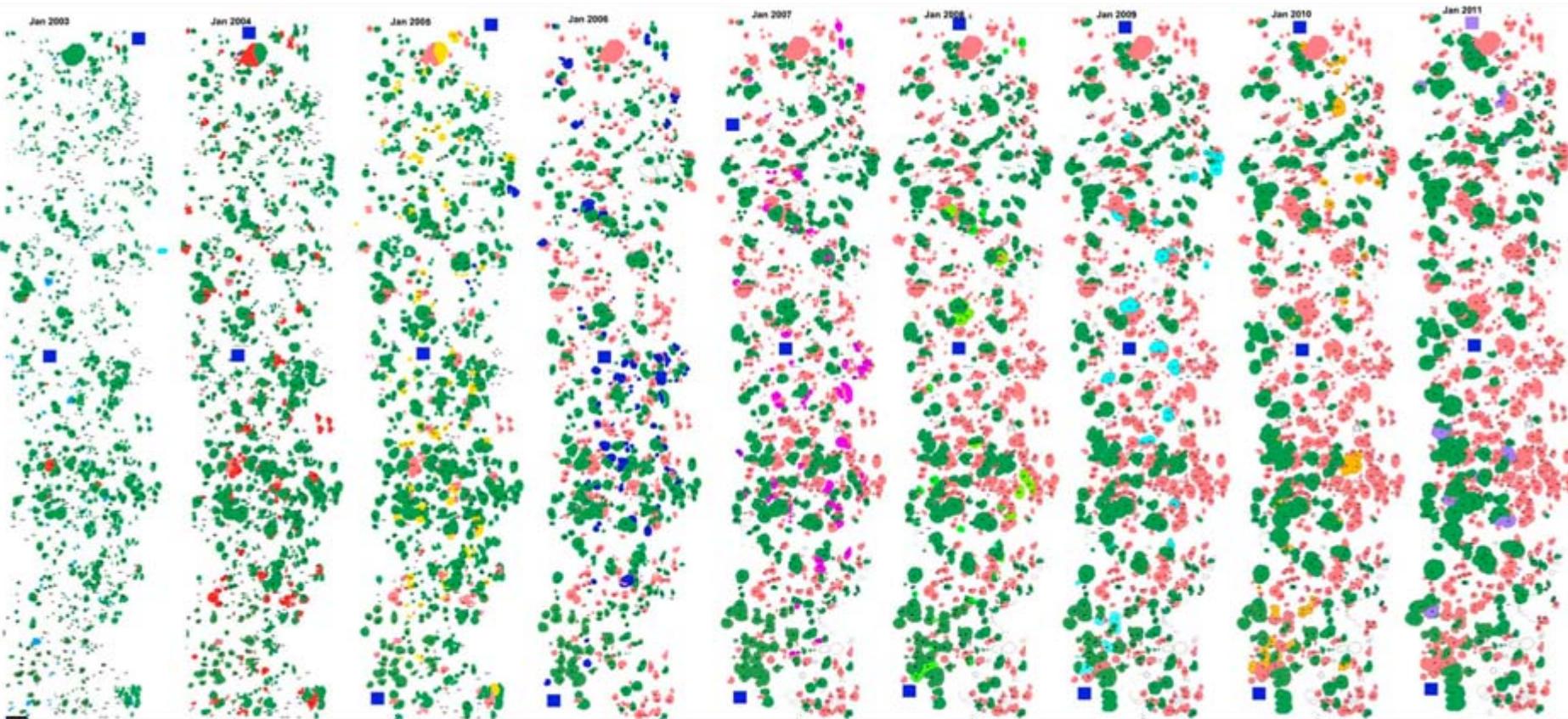
Jan 2005

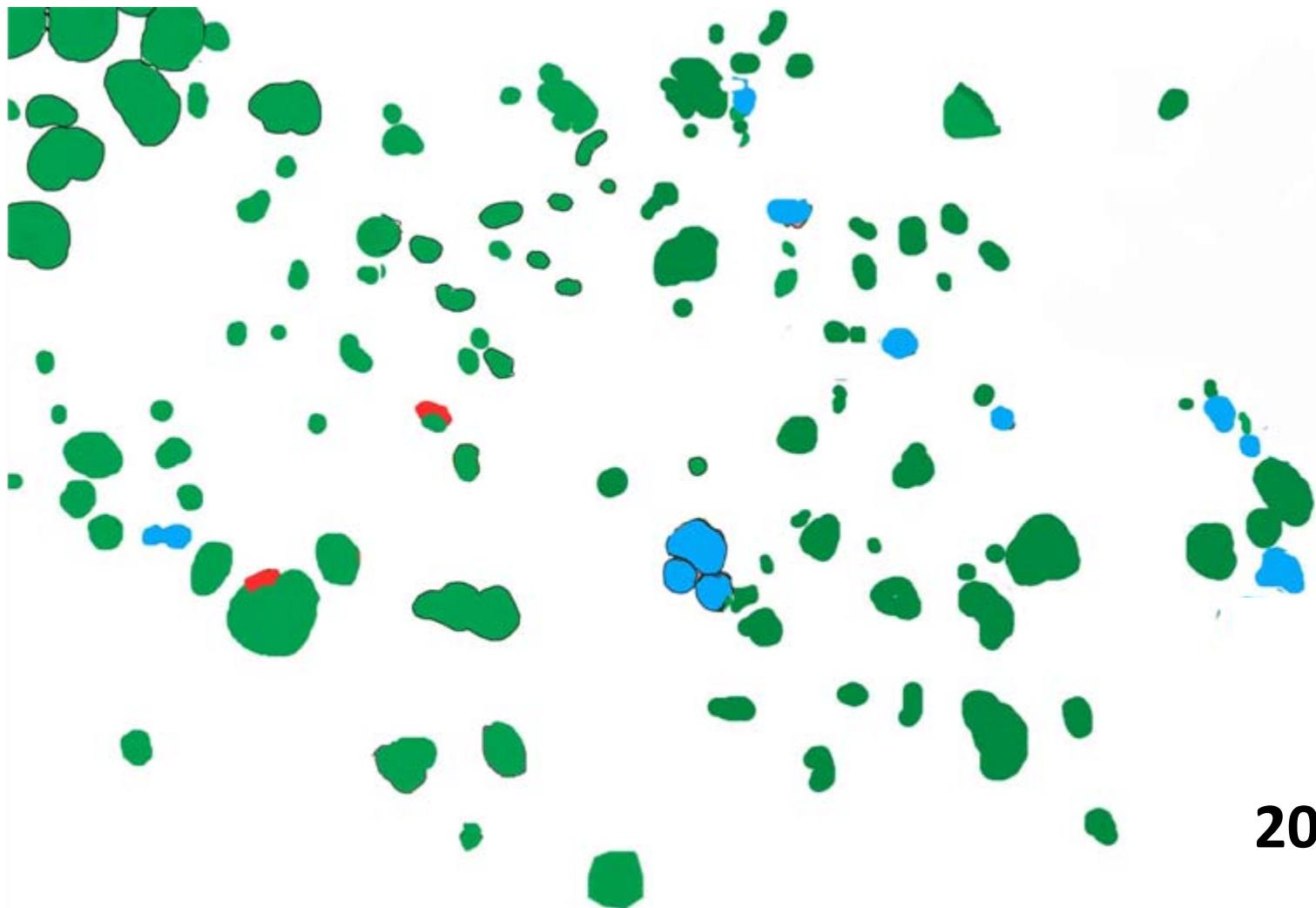
Jan 2006

Jan 2007

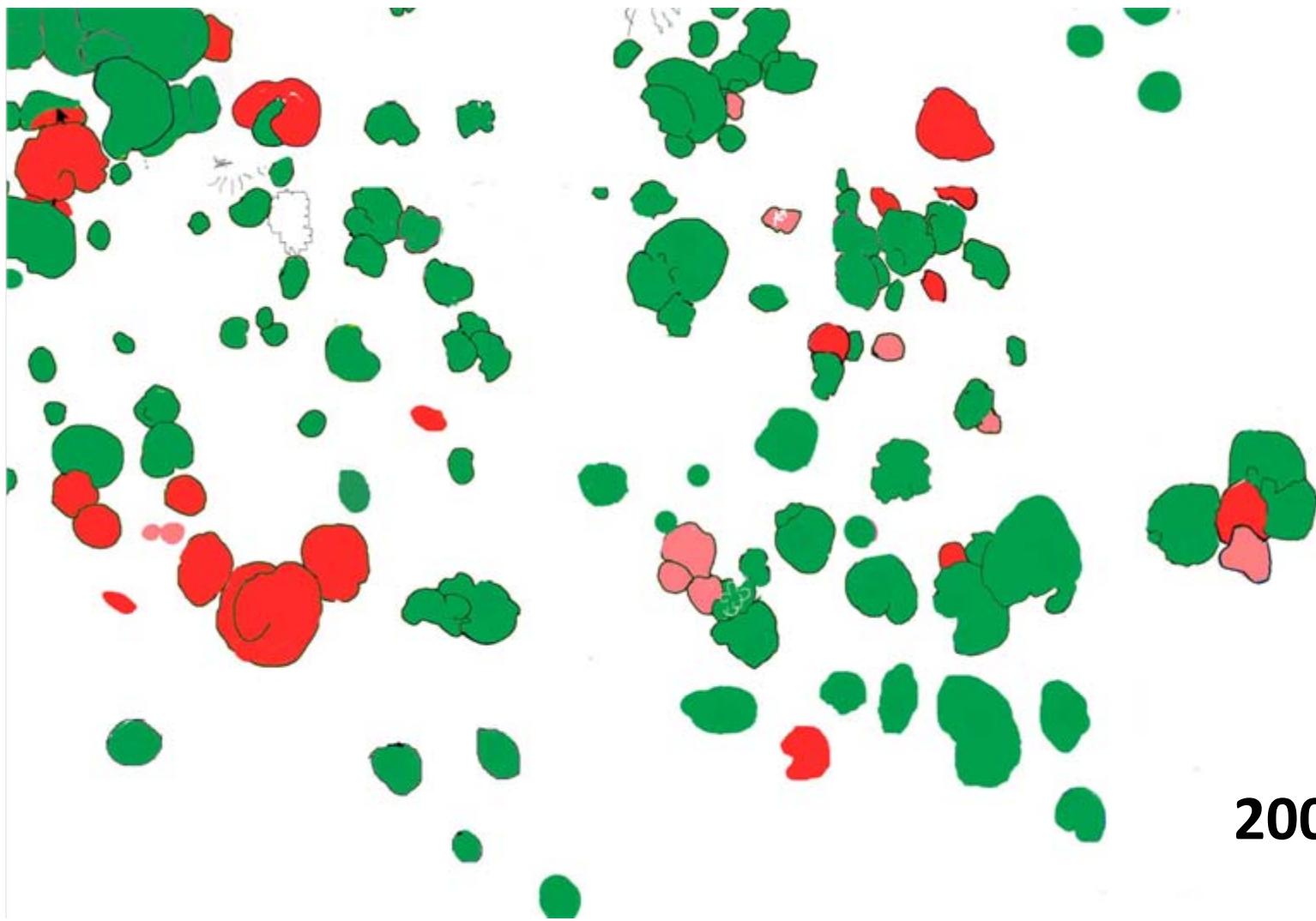
Ja







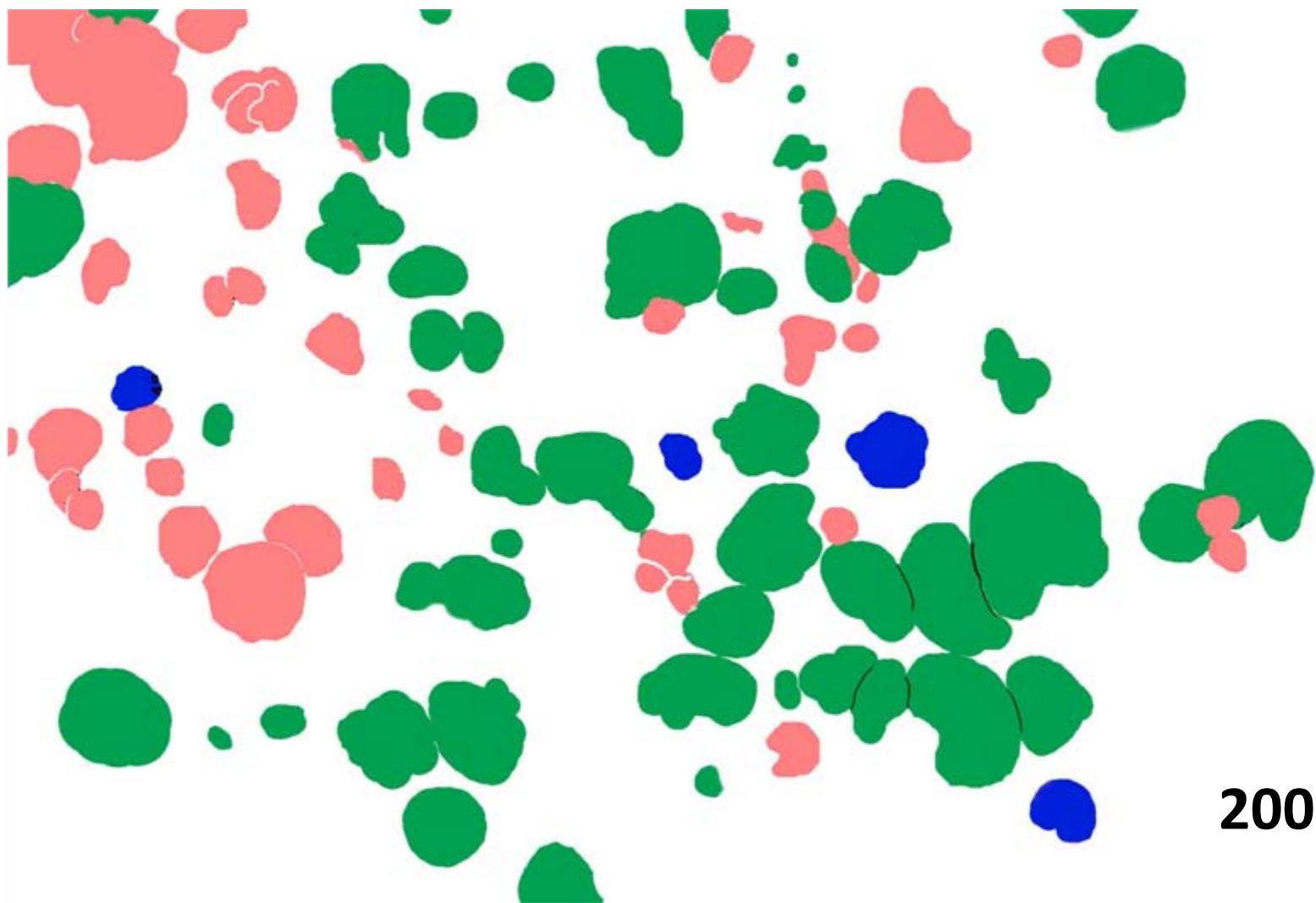
2003



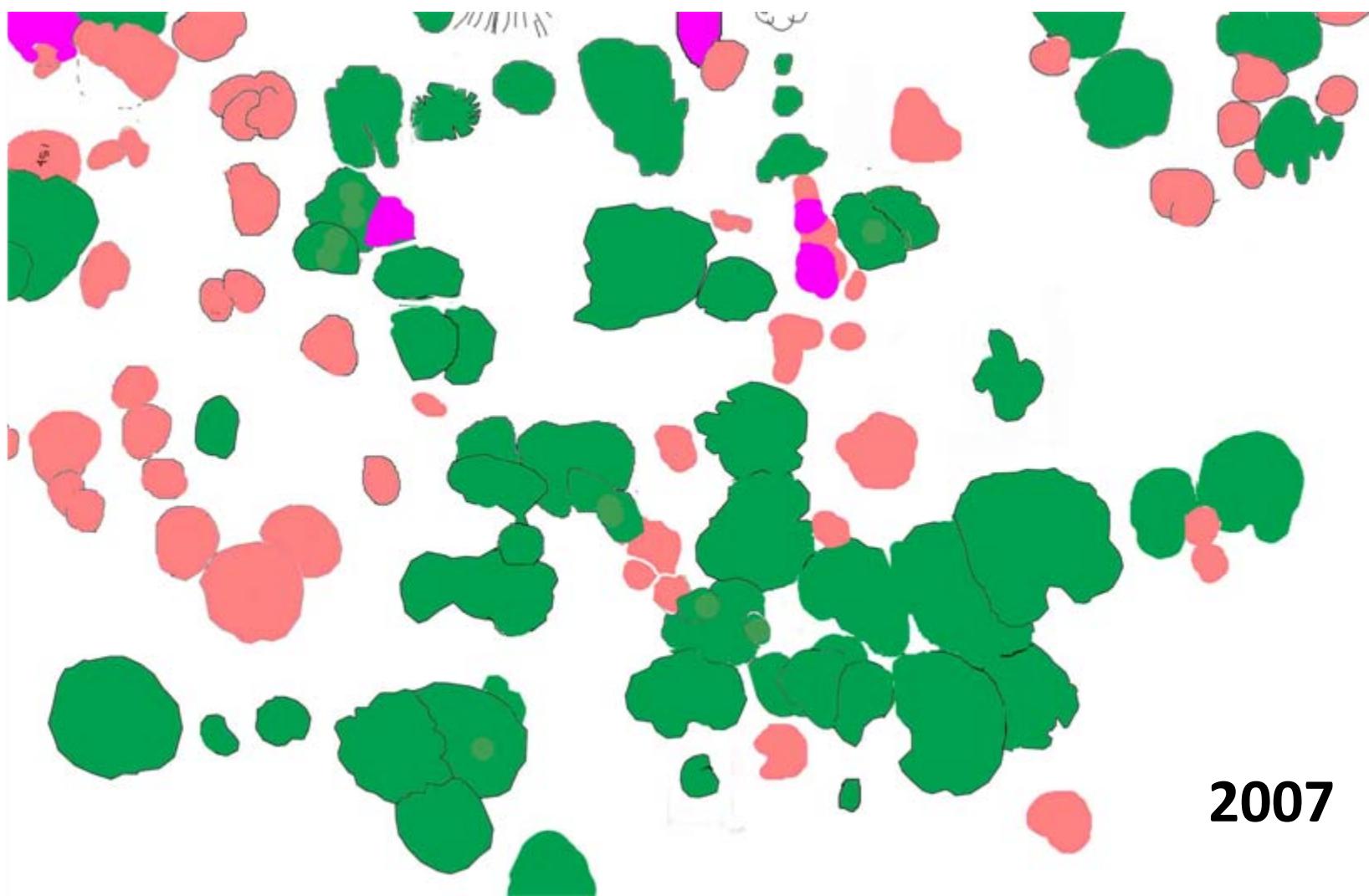
2004



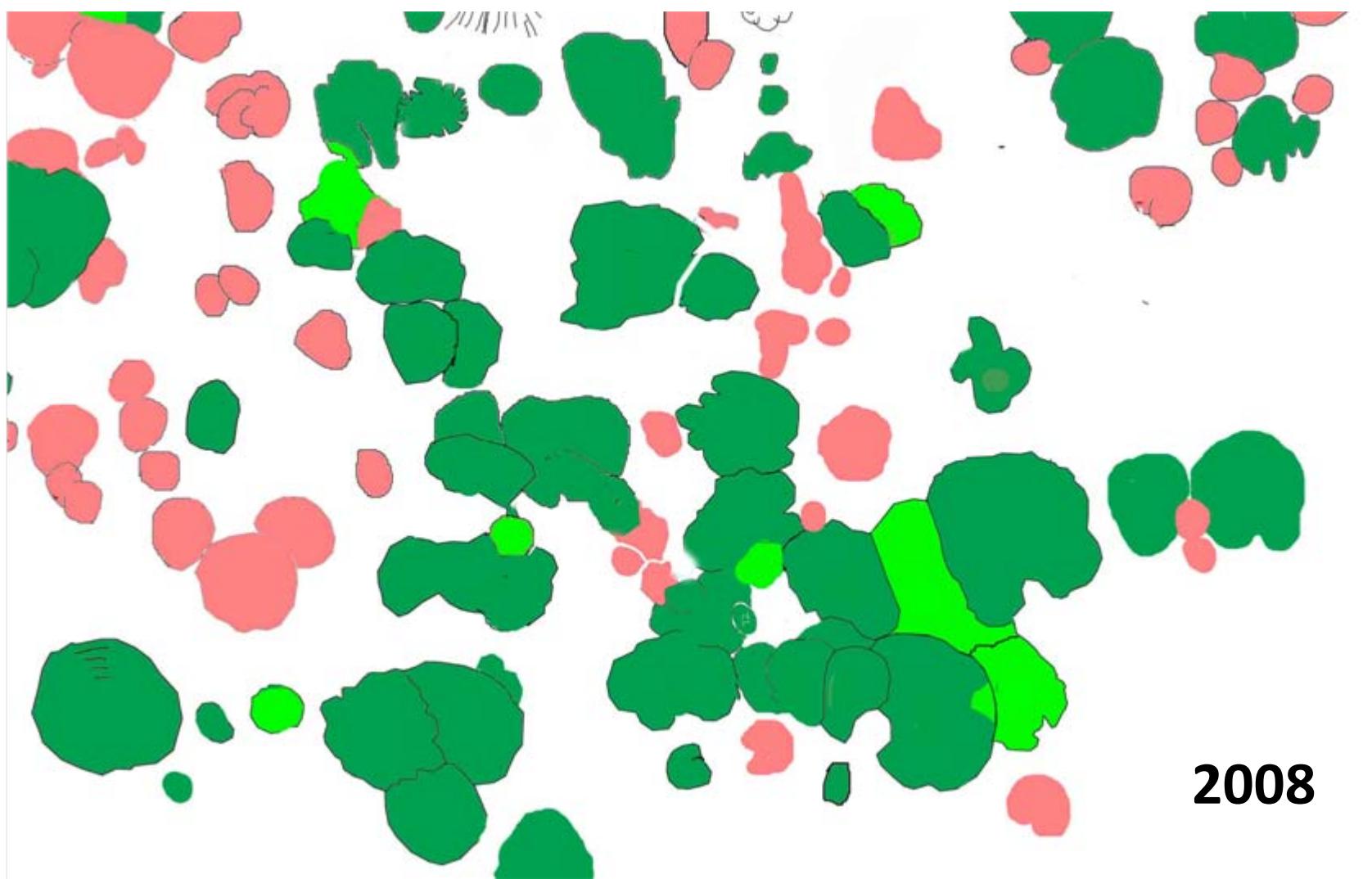
2005



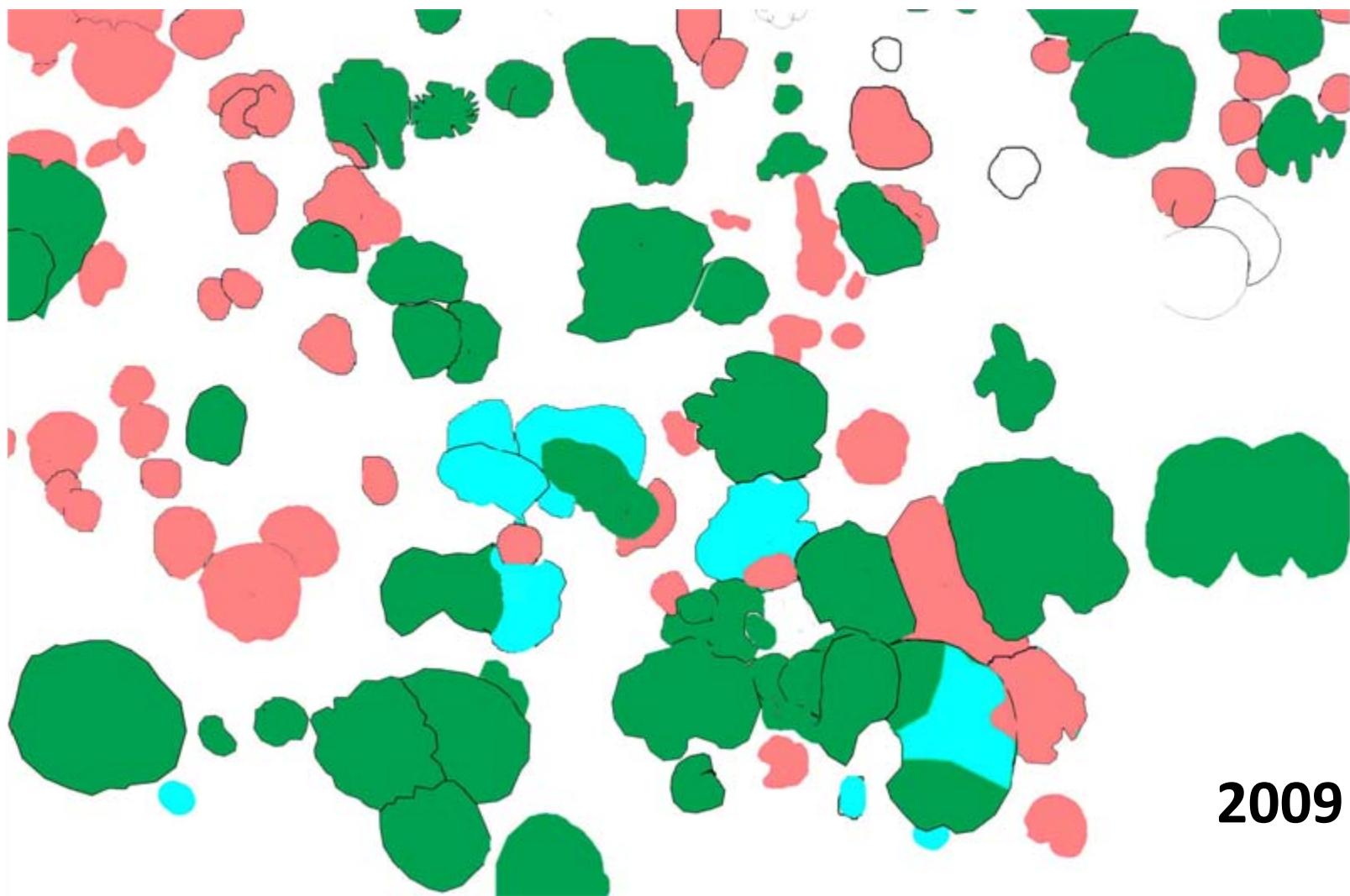
**2006**



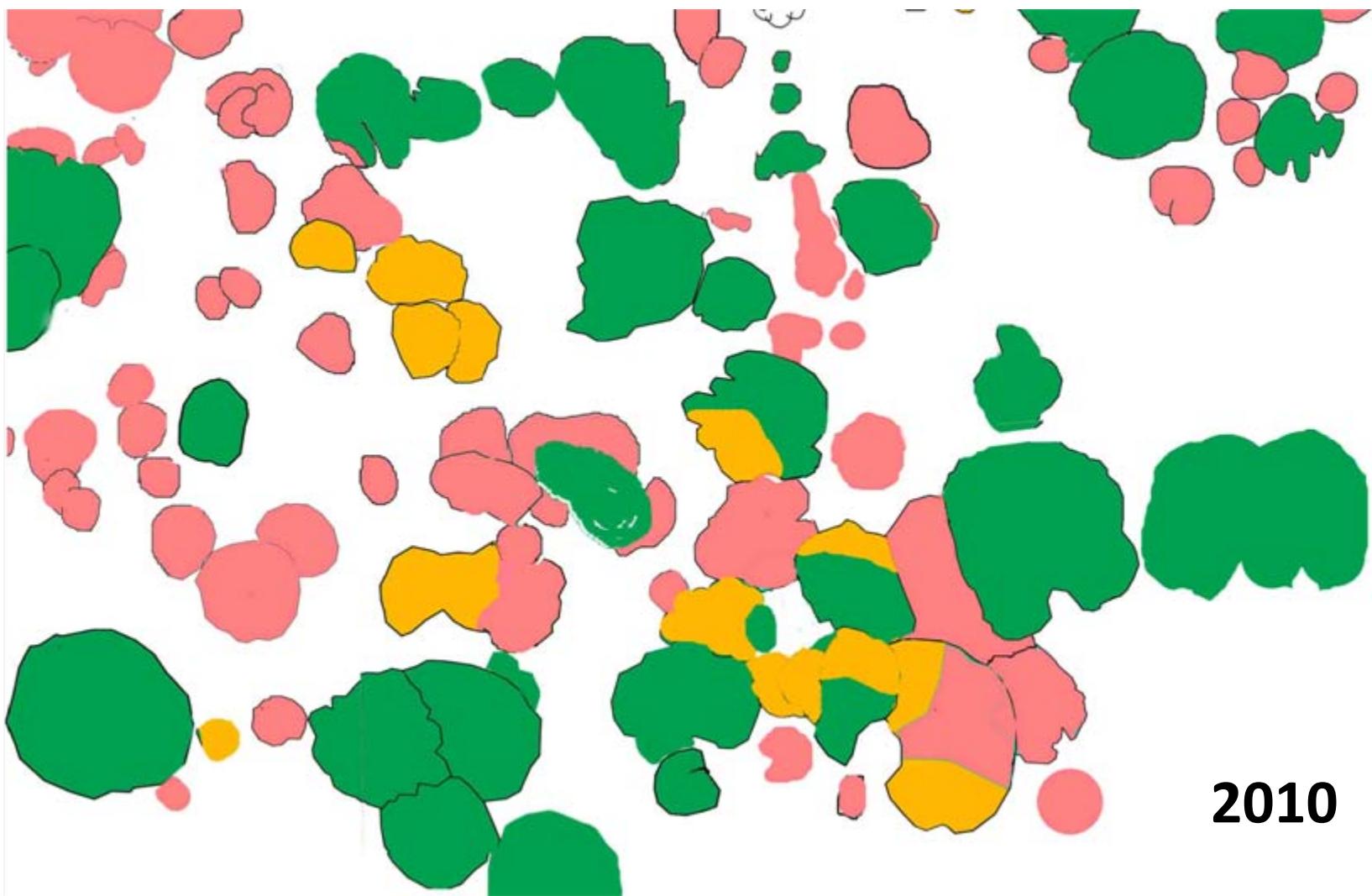
2007



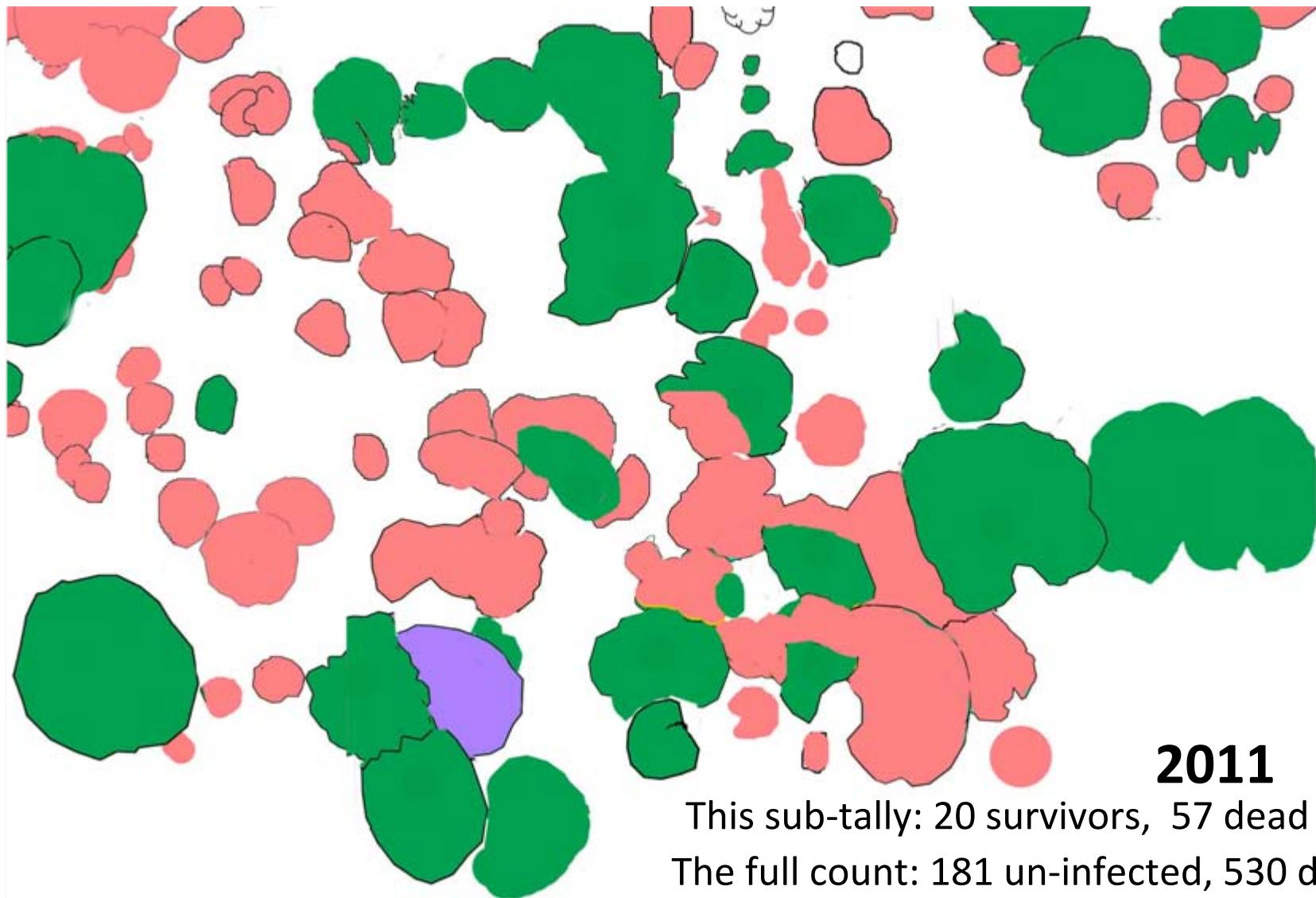
2008

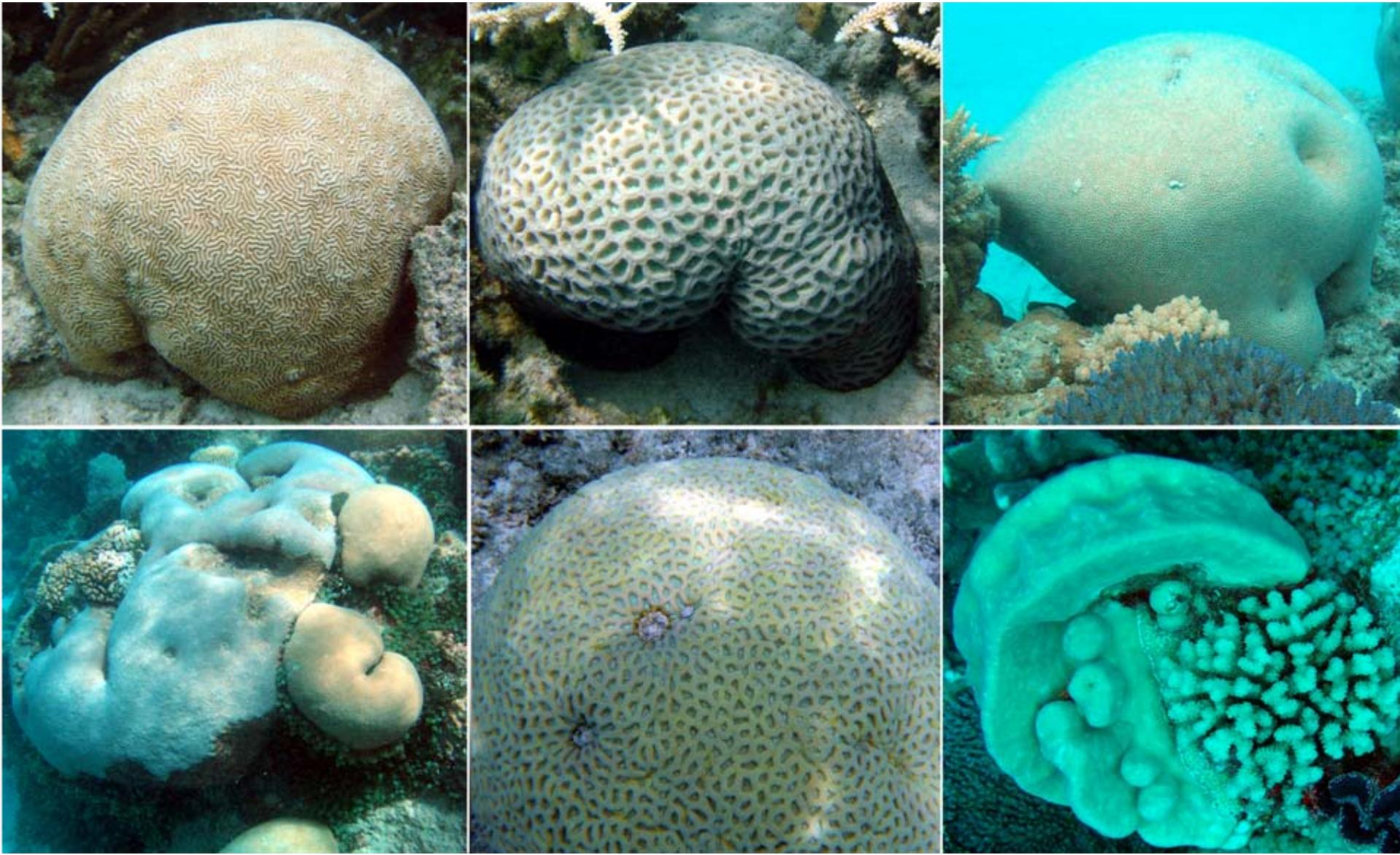


2009

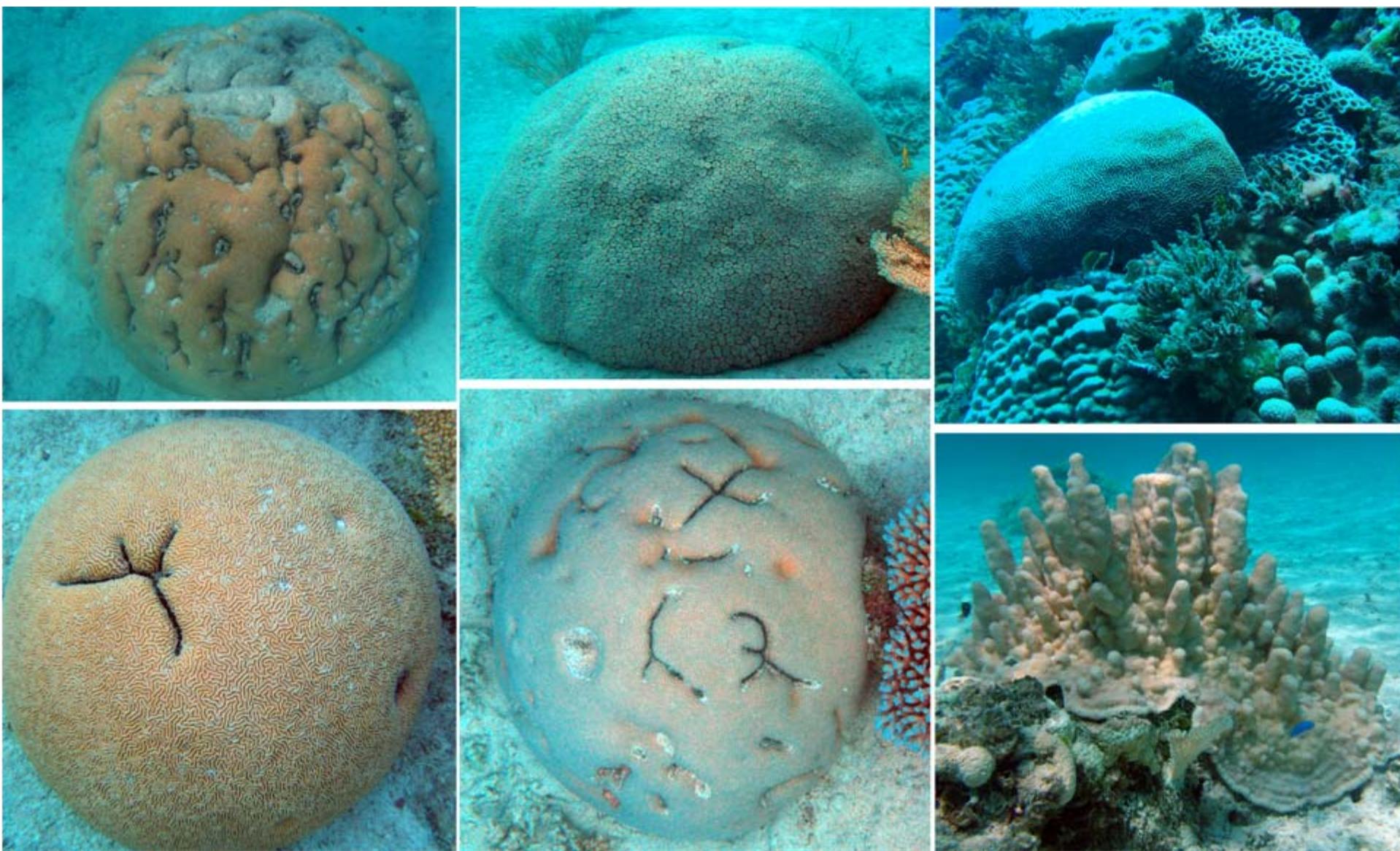


**2010**





On Rongelap atoll, these “brain” corals are healthy and unblemished



Some of these massive corals are quite large, and old (some have Alpheid shrimp burrows)



Northern Majuro, outside the pass, has healthy brain coral...



Very large, healthy *Platygyra* and *Hydnophora* are found outside the north shore





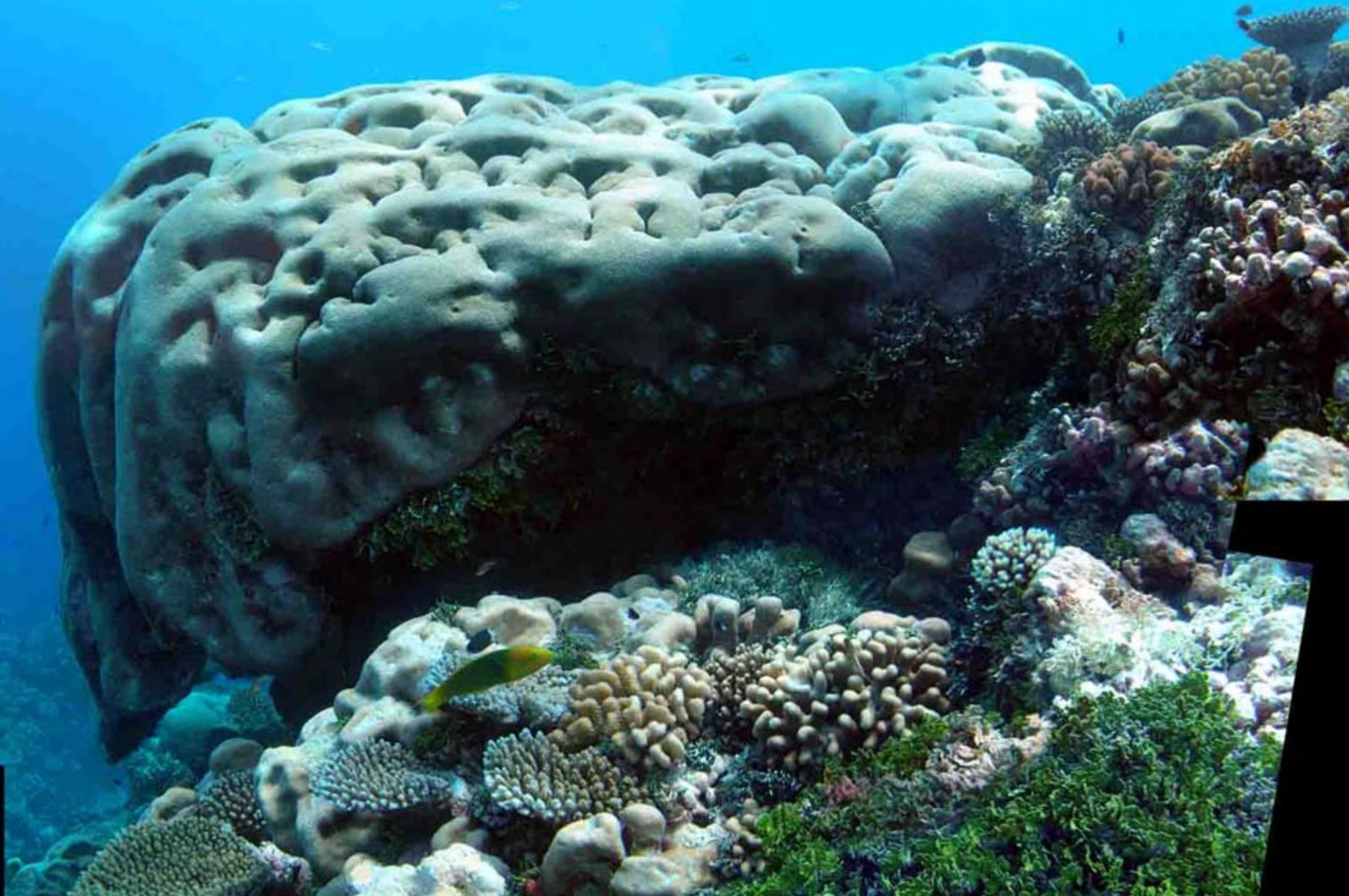


Note how this giant *Isopora* towers over “normal” massive colonies



This enormous, ancient *Leptoria* colony (a very uncommon species, with only 2 colonies on Majuro) is found on Arno... it is a testament to prolonged healthy conditions, and it has a twin nearby!

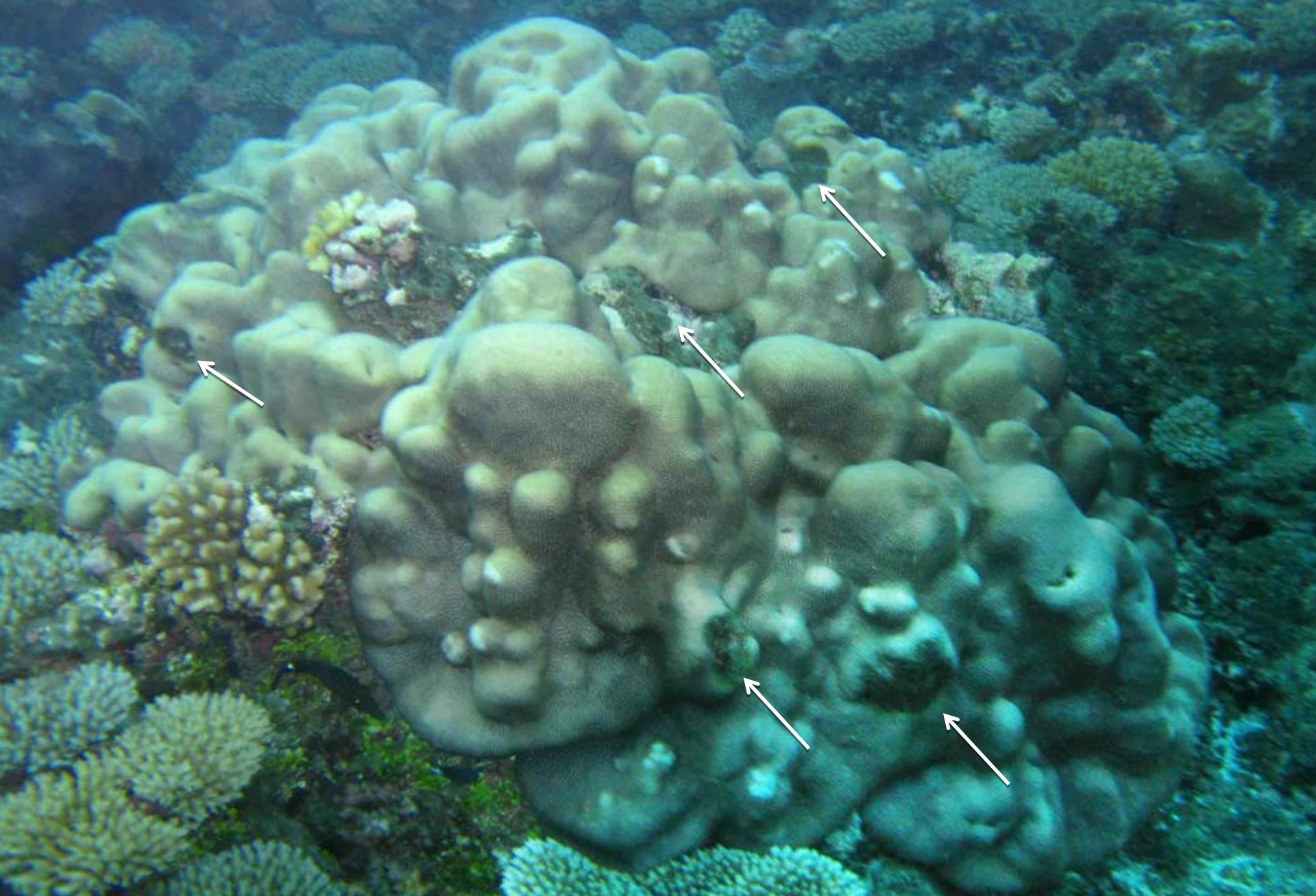






Sadly, one of the two Majuro colonies has multiple, expanding infections





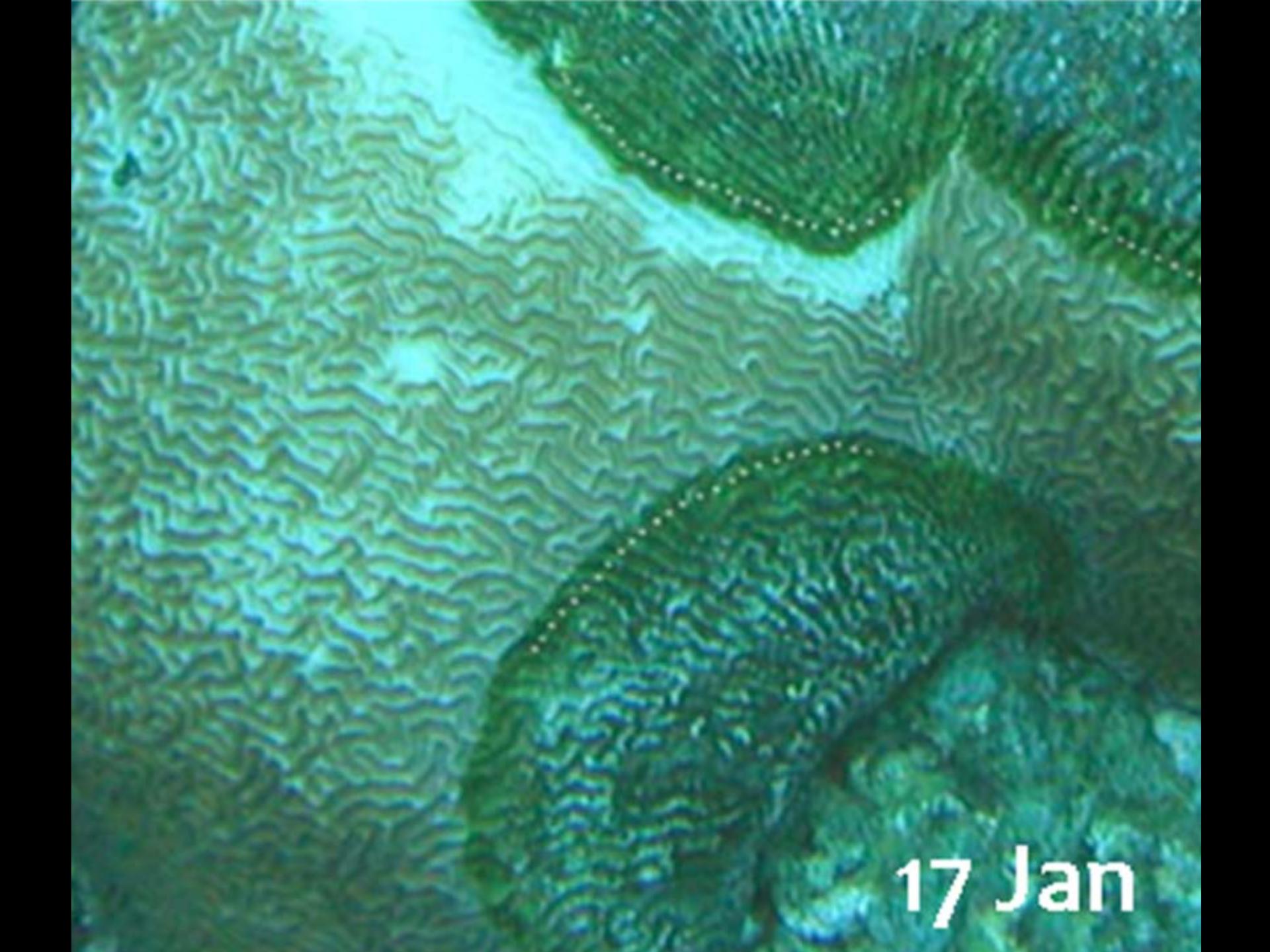






Back on Majuro...



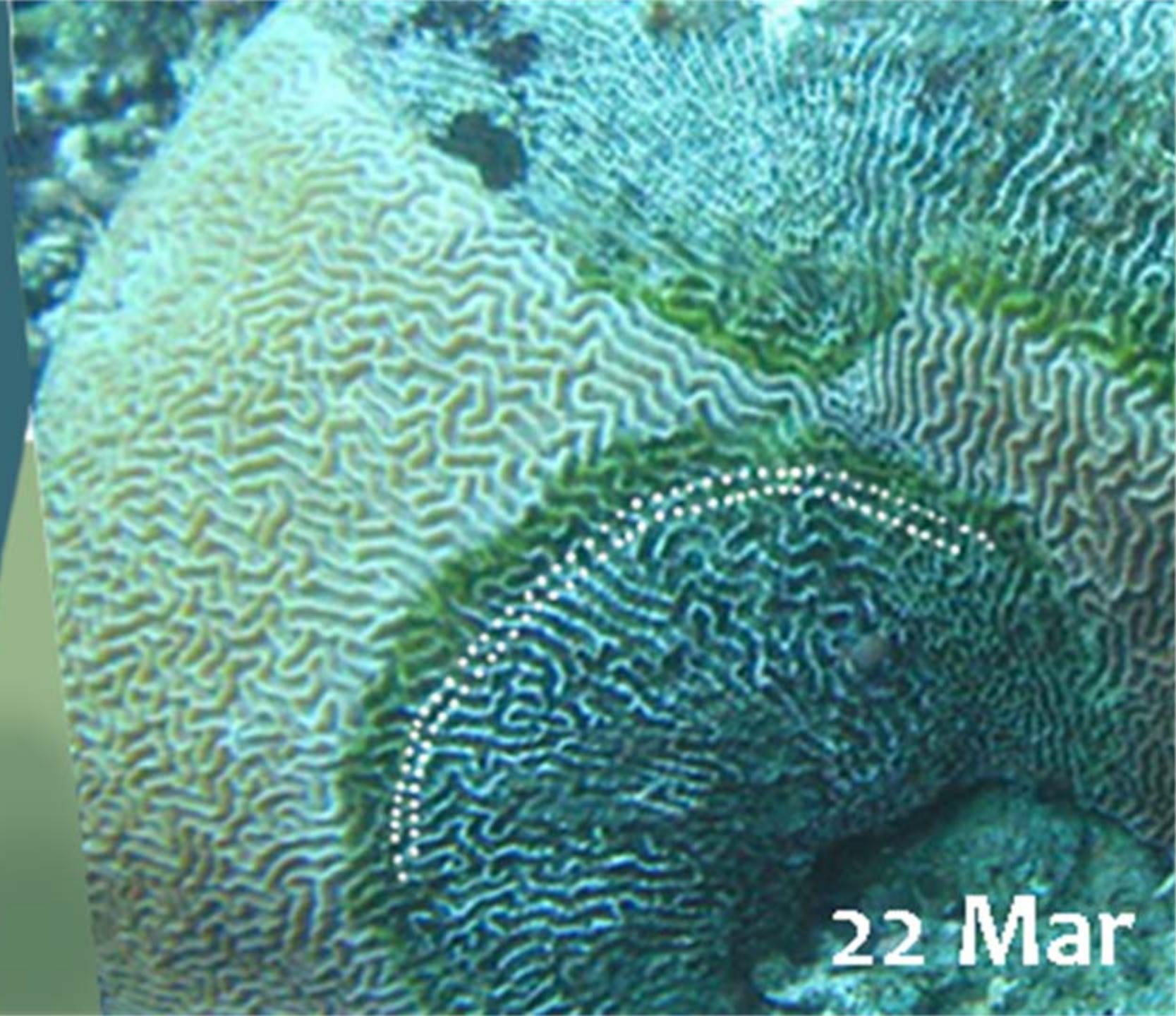
A high-magnification microscopic image showing a tissue structure with a distinct wavy, undulating pattern. The color palette is dominated by various shades of green, from bright cyan to dark forest green. Scattered throughout the field are numerous small, white, circular or oval structures, which appear to be nuclei or specific cellular components. The overall texture is somewhat organic and rhythmic.

17 Jan

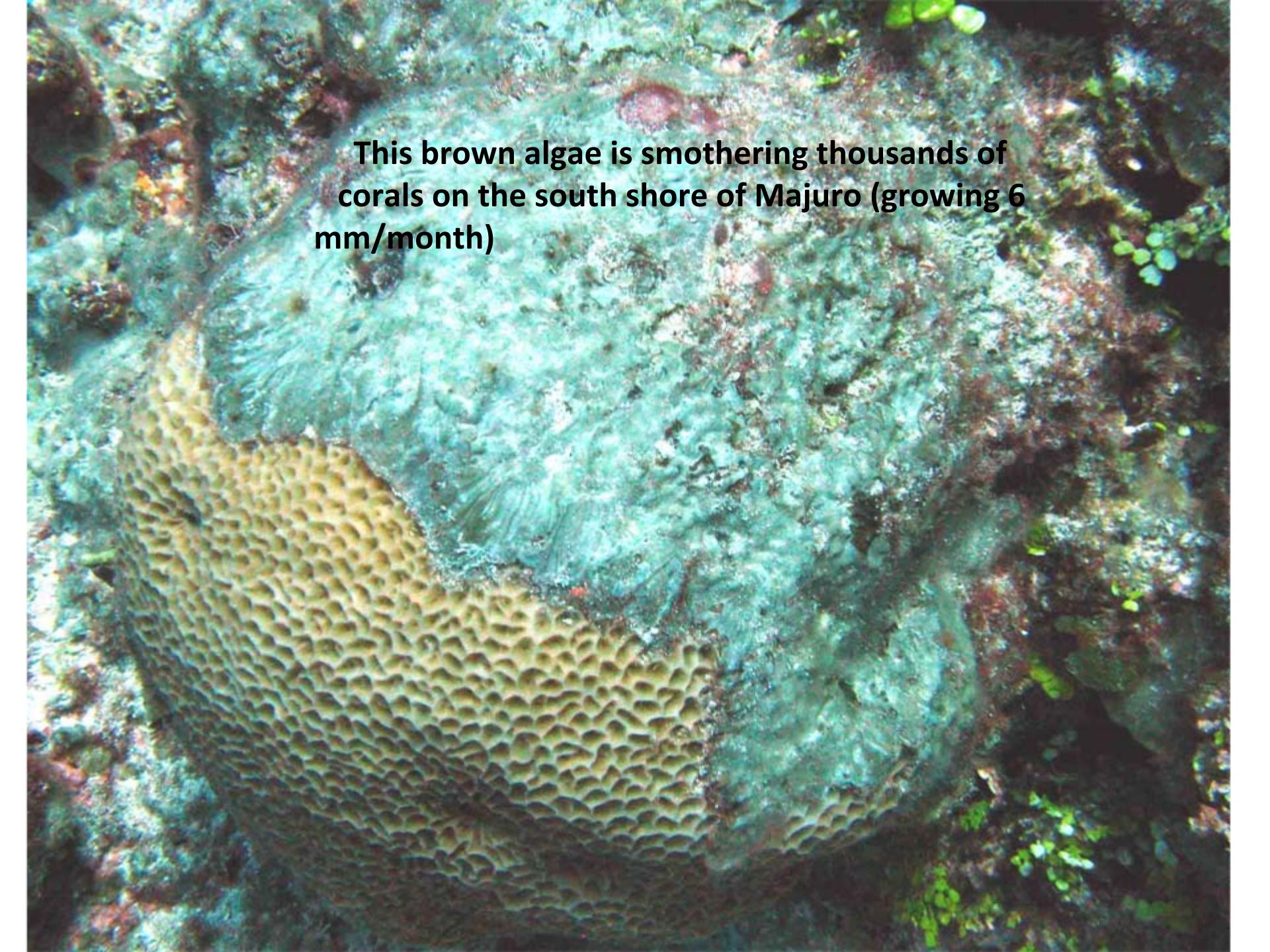


— 30  
— 13  
DAY

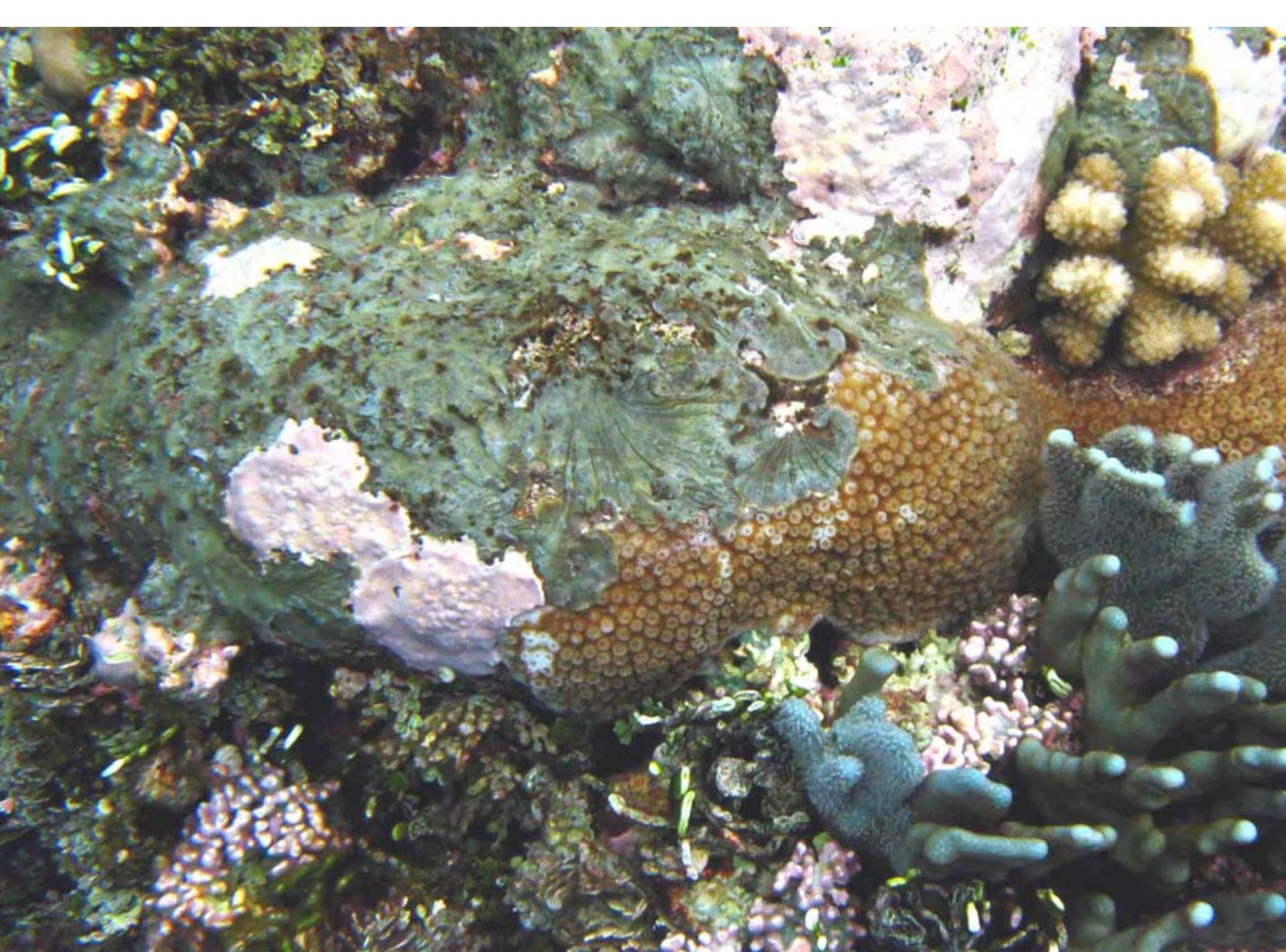
4 Feb



22 Mar

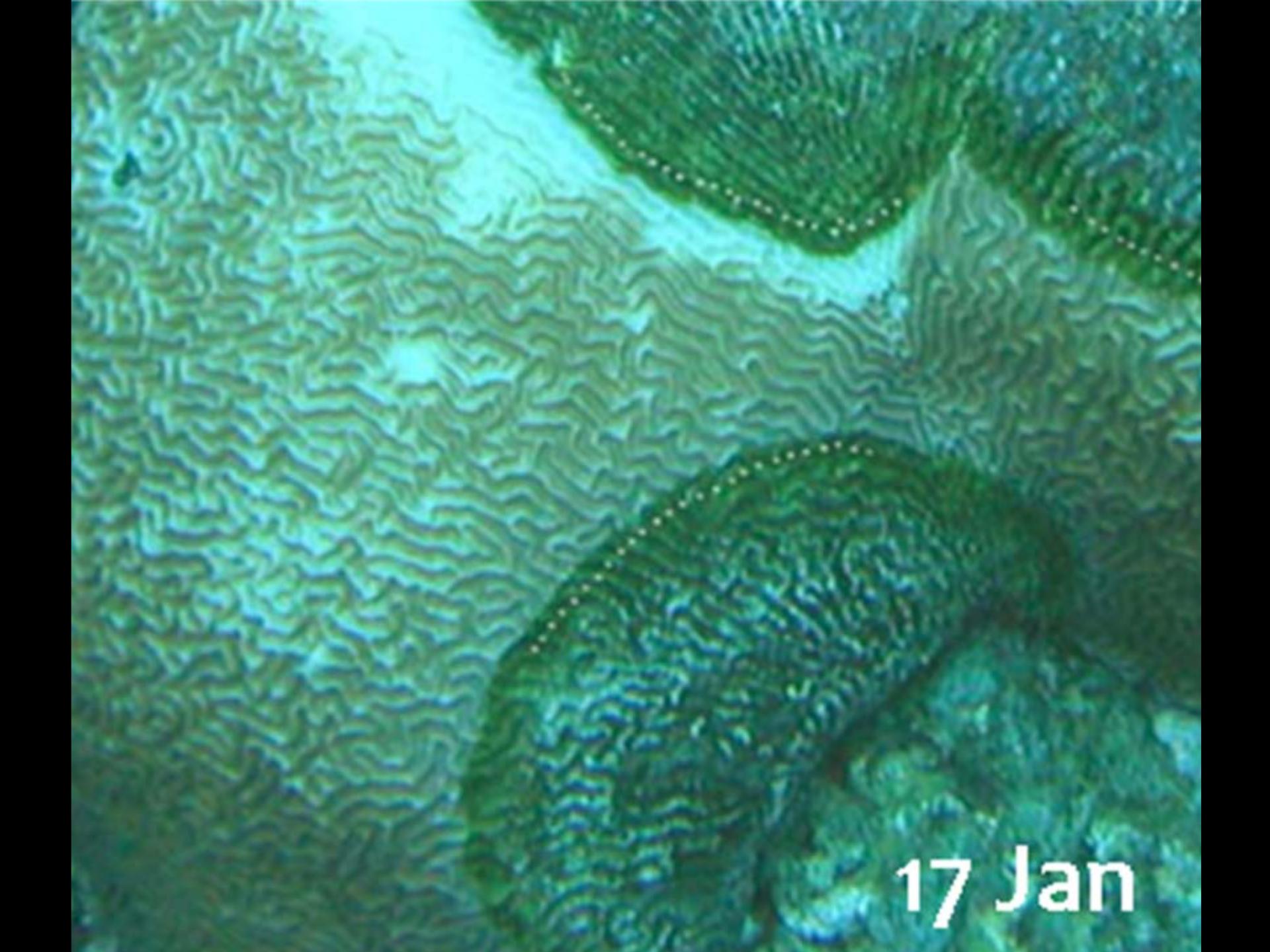
A close-up photograph of a coral reef. In the foreground, a large, healthy-looking coral with a distinct yellowish-green, honeycomb-like texture is visible. Behind it, a massive area of the reef is covered in a thick, dark brown, fuzzy substance, which is identified as smothering brown algae. The algae has completely overtaken many of the coral colonies, particularly in the upper right and center areas of the frame.

**This brown algae is smothering thousands of corals on the south shore of Majuro (growing 6 mm/month)**

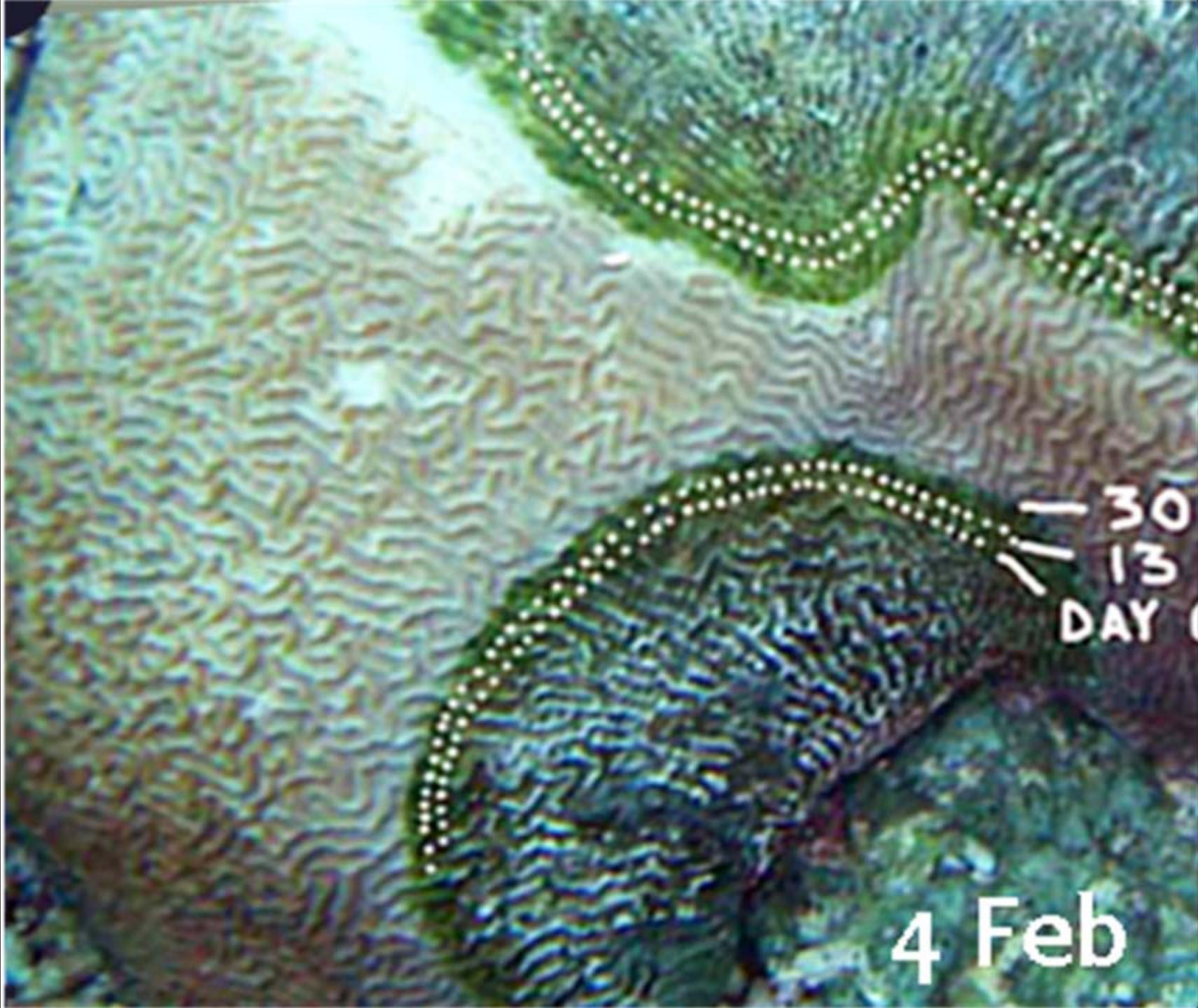


Back on Majuro...

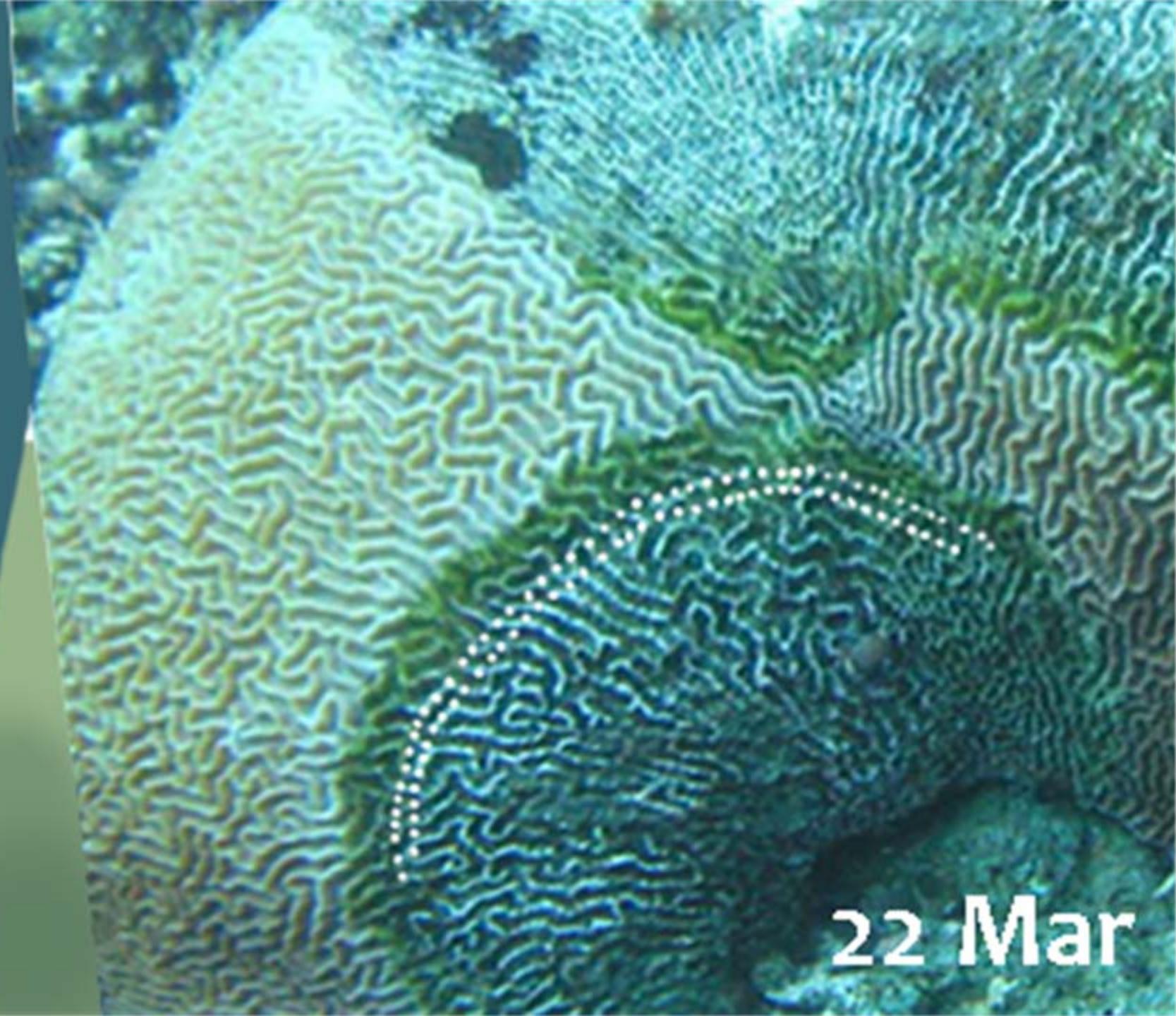


A high-magnification microscopic image showing a tissue structure with a distinct wavy, undulating pattern. The color palette is dominated by various shades of green and blue, with some darker, more granular areas. Small, bright white dots are scattered across the surface, particularly concentrated along the wavy lines and in certain clusters.

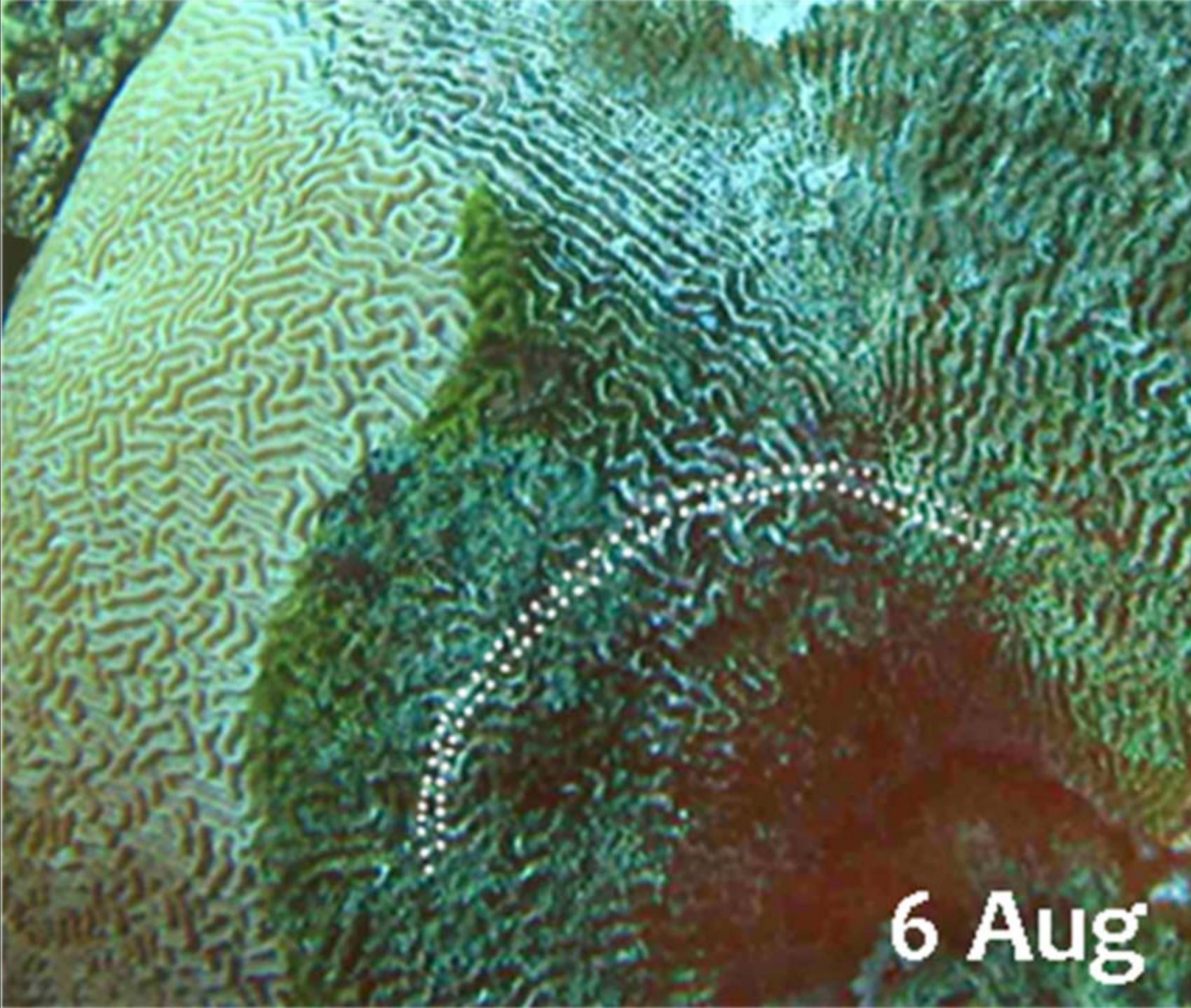
17 Jan



4 Feb



22 Mar



6 Aug

Mar 2007



In Ajeltake, where massive corals (especially *Hydnophora* and *Platygyra*) are still common, disease was uncommon before 2006...

I documented this colony  
In 2007 not knowing it  
was infected, but routine  
follow-up monitoring  
revealed a disturbing  
truth:

A slow disease syndrome  
is now killing most of  
these brain corals

12 Jan 2008



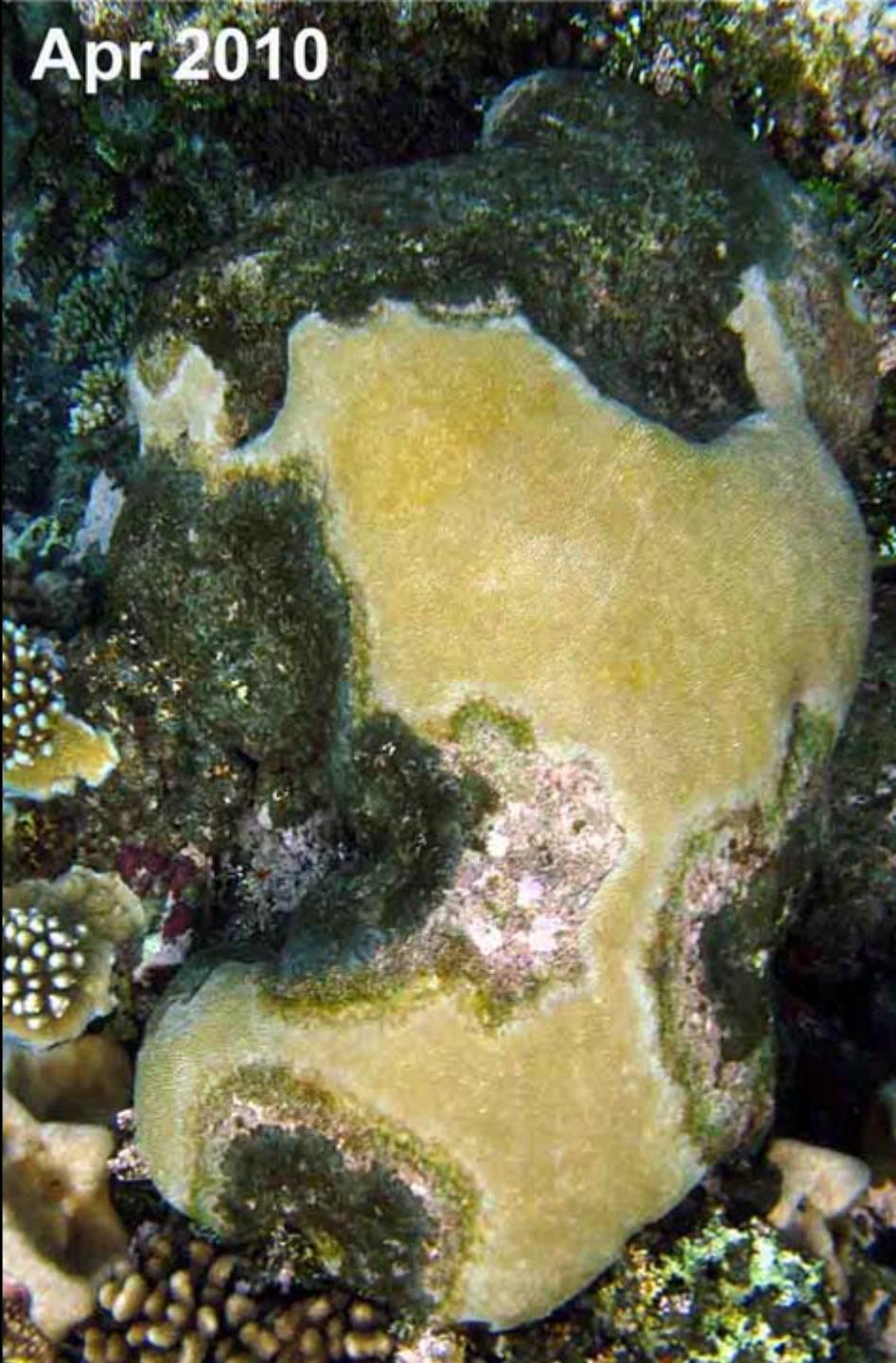
**Nov 2009**



**Mar 2010**



Apr 2010



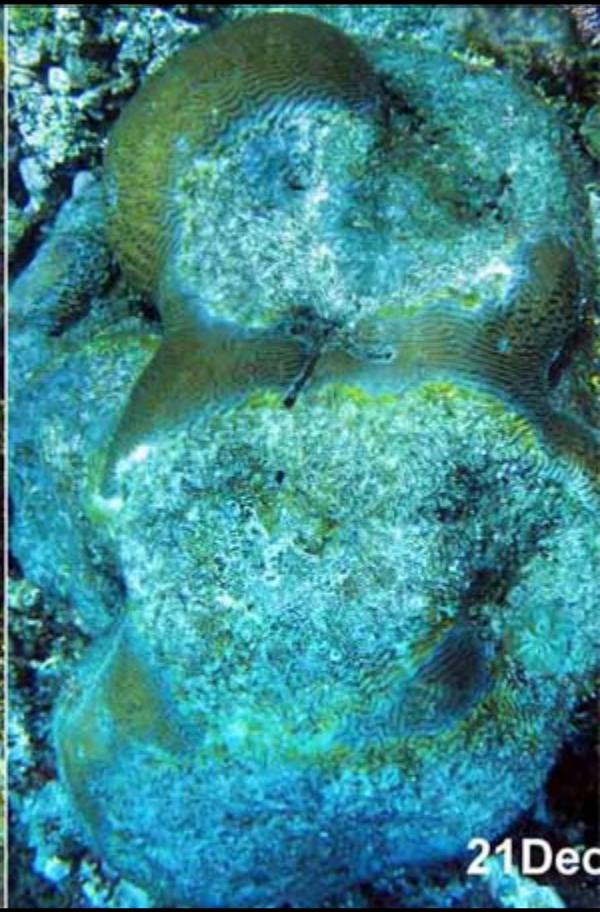
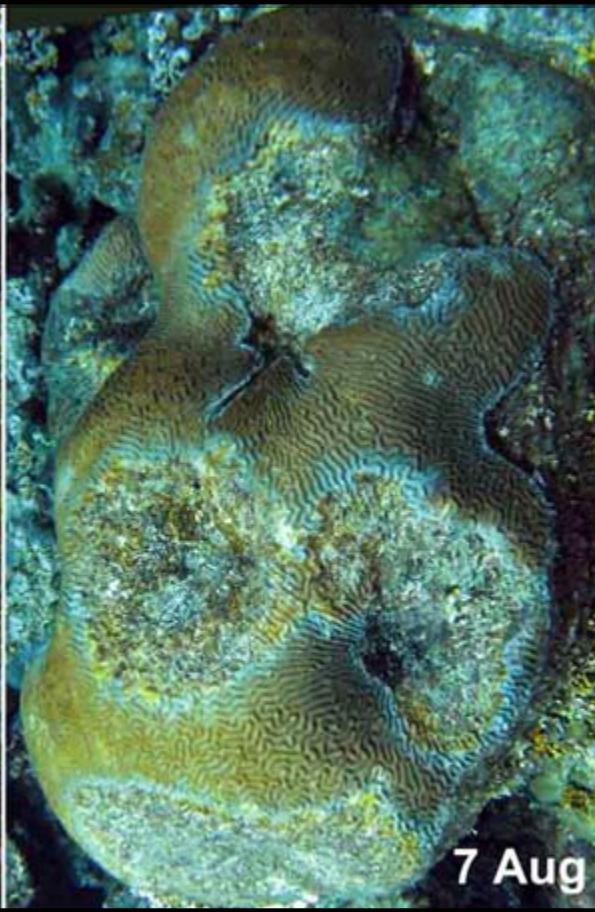
Dec 2010



I soon realized that thousands of brain corals were suffering a wave of disastrous destruction, making the “white band” table coral disease look like a picnic!

After all, the brain corals are not growing back!

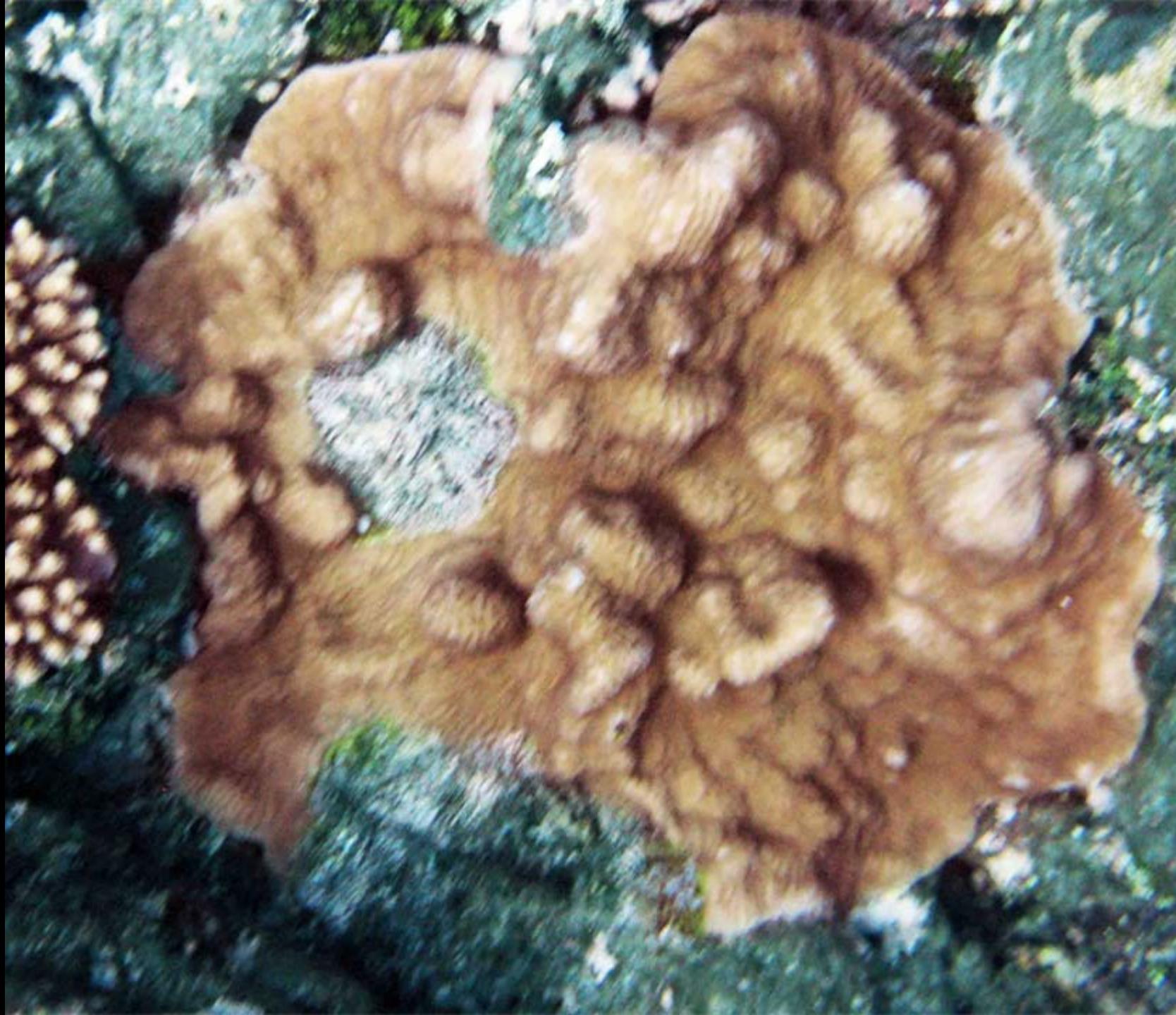














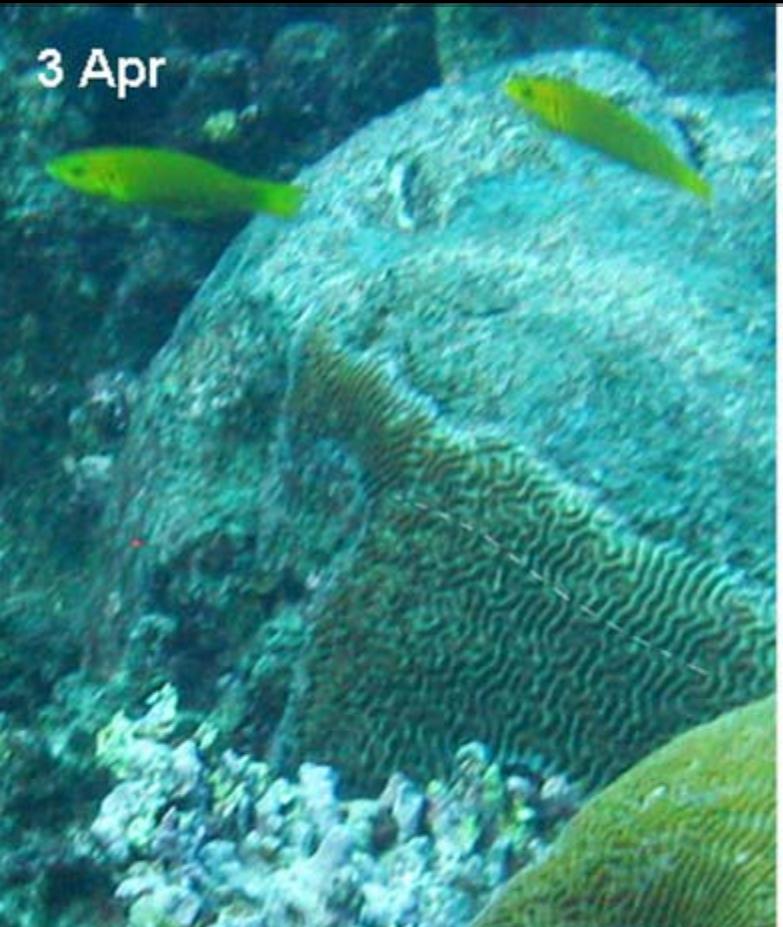


3 Apr

*Platygyra*



29 Jan





*Sympillia* (left) and *Favia* spp in Ajeltake





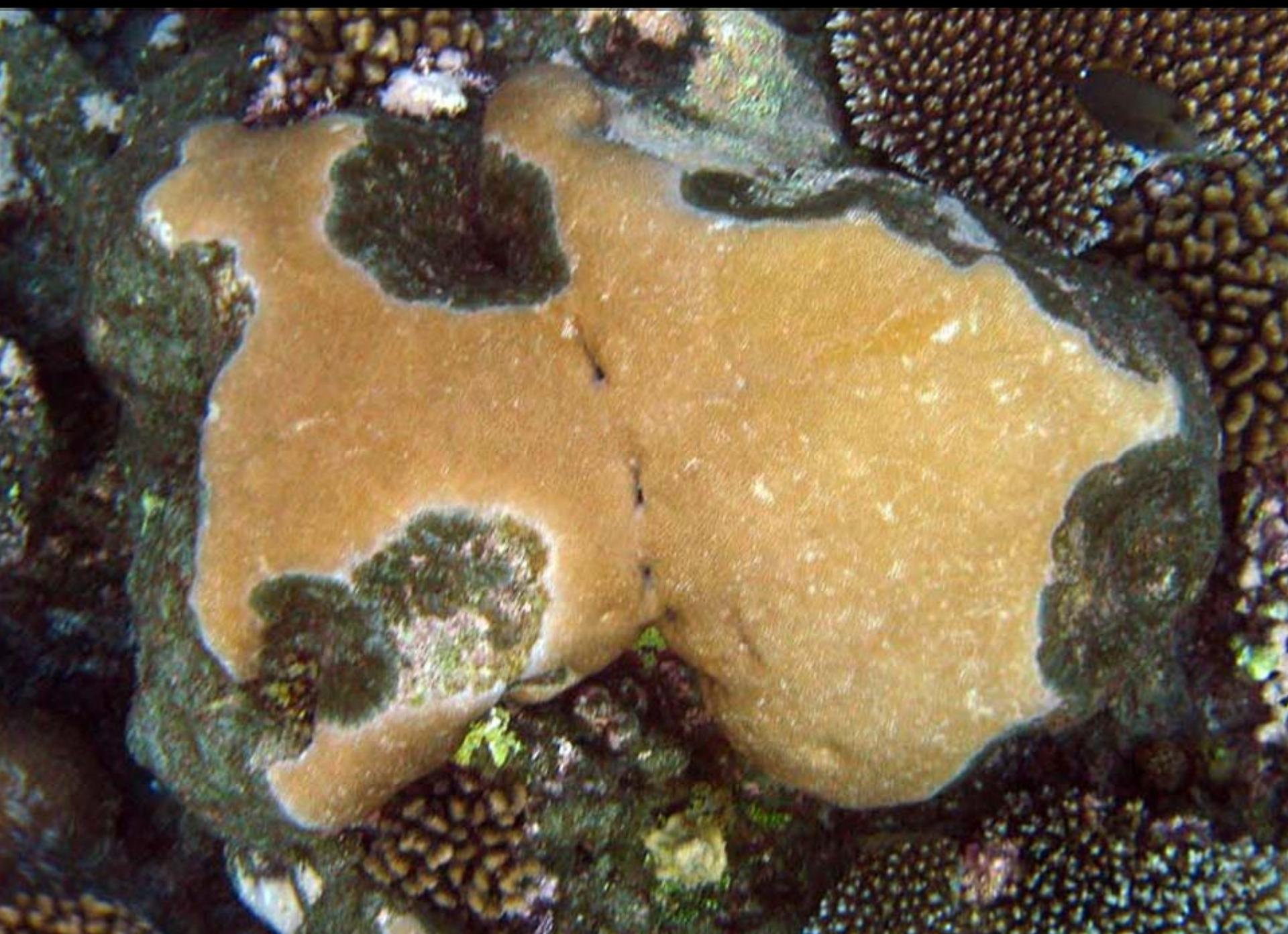
3 Apr



7 Aug













*Pavona duerdeni*



3 Apr



29 Jan



3 Apr



3 Apr



3 Apr



7 Aug



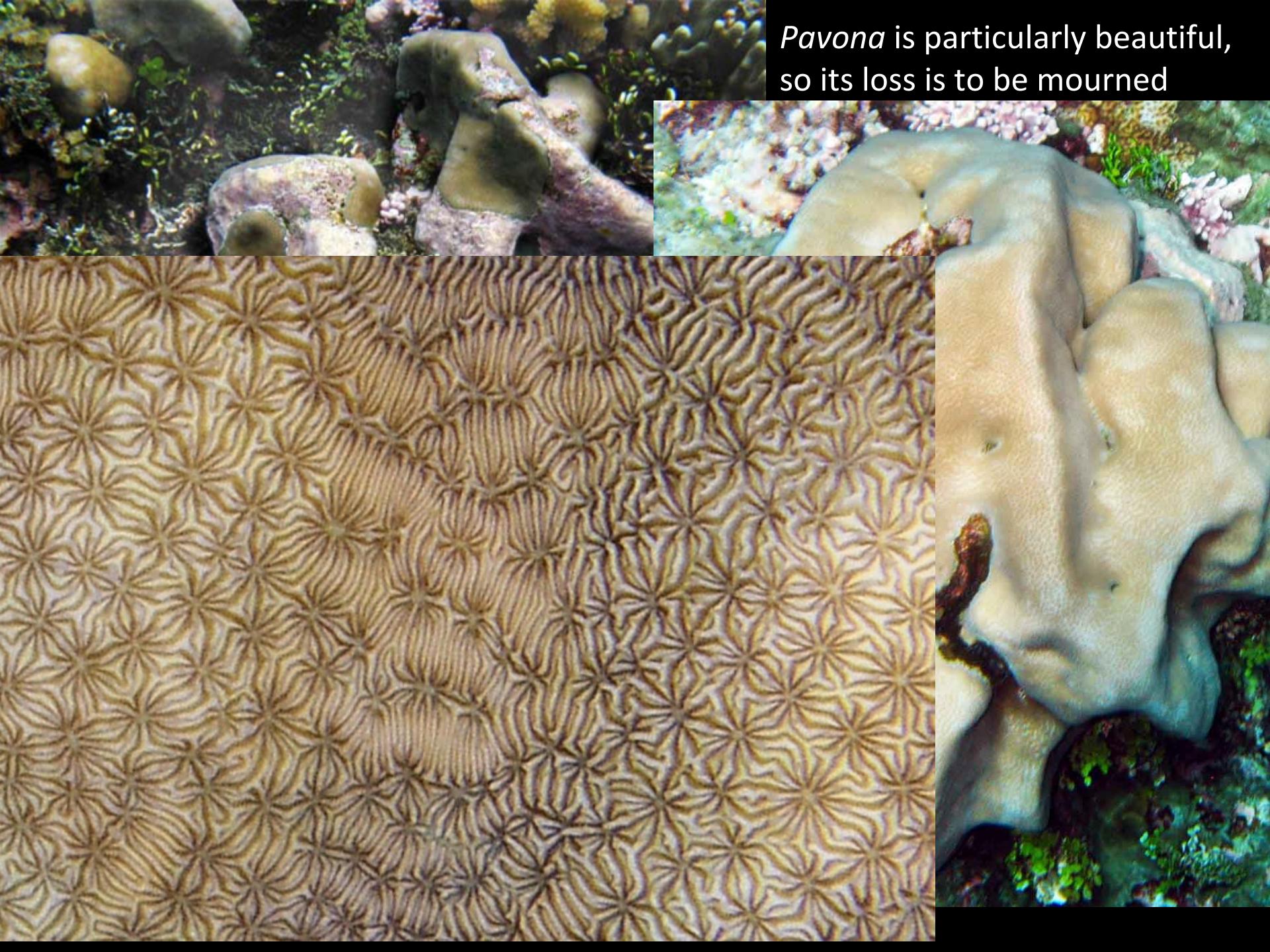
29 Jan



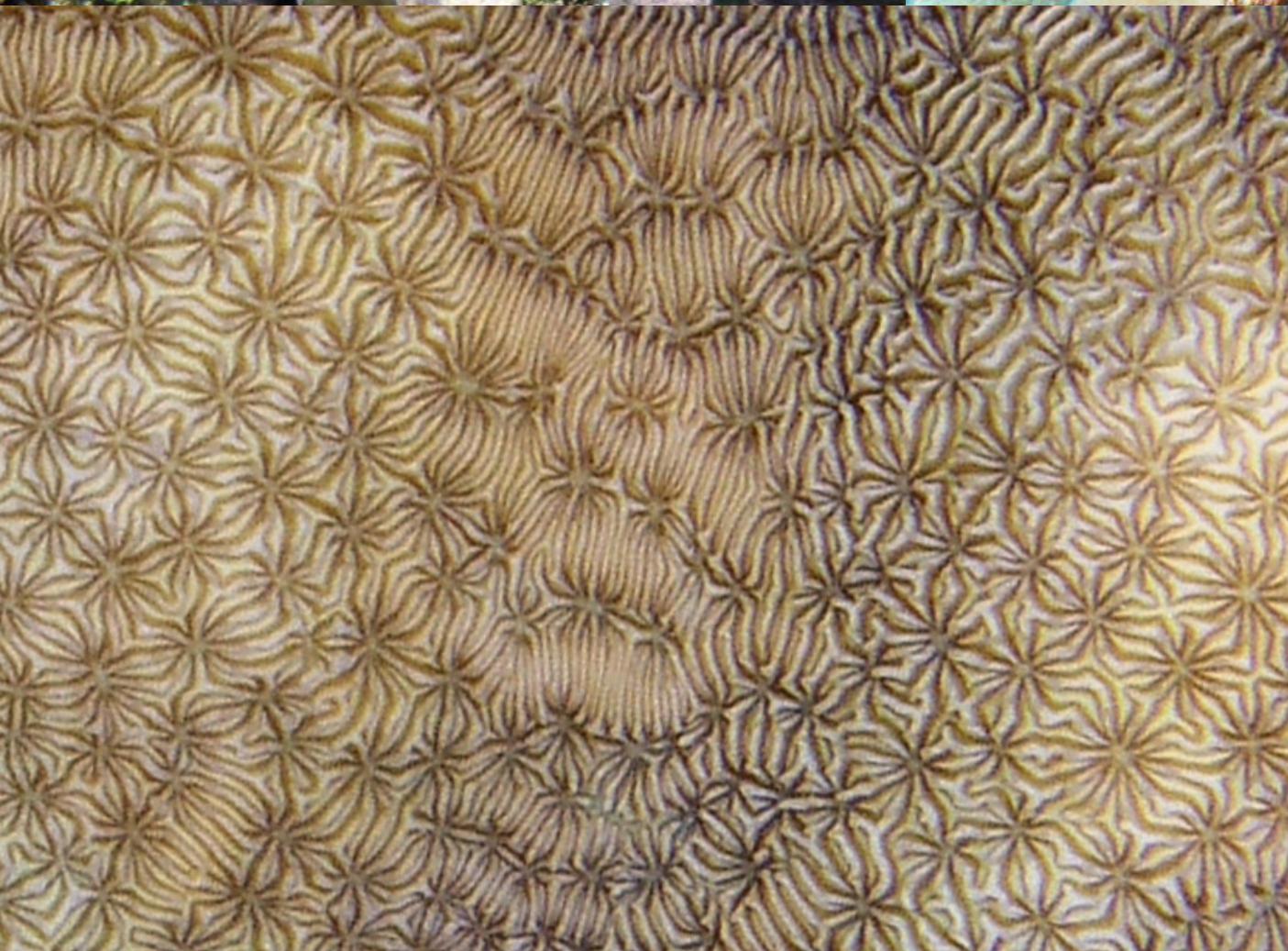
7 Aug



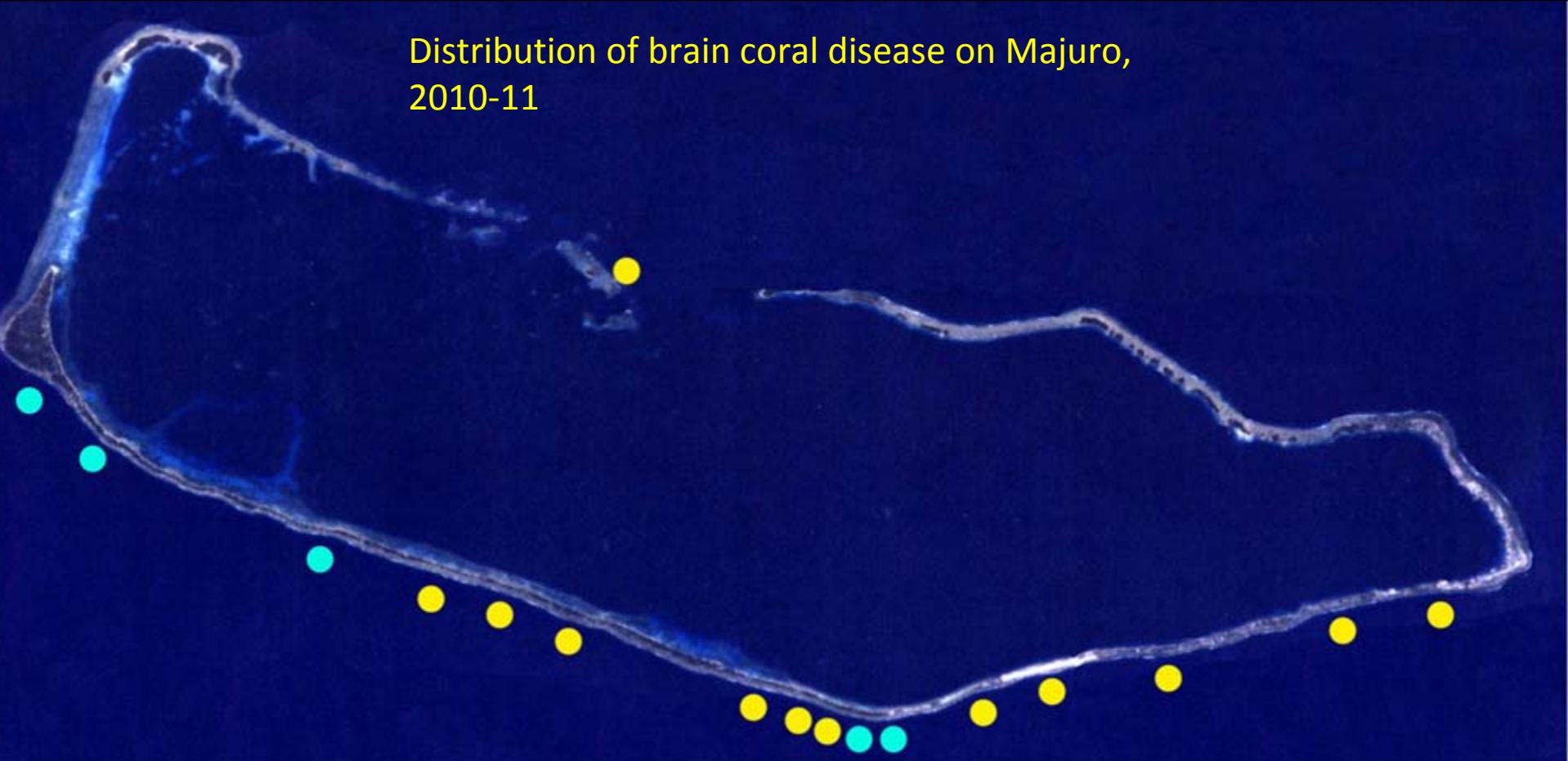
29 Jan



*Pavona* is particularly beautiful,  
so its loss is to be mourned



Distribution of brain coral disease on Majuro,  
2010-11







The presence  
of diapers on  
coral  
correlates with  
coral disease

## Outer Islands:

Healthy,  
unblemished coral

Pink substrate

High coral diversity

Lack of “black  
slime” or other  
smothering algae

Rarity of COTS

Dominance of  
*Isopora, Astreopora,*  
*Pavona, Montipora* etc.

Coral, algal disease  
rare



## Majuro south shore:

Diseased, pock-marked  
coral

Grey substrate,  
lots of “whisker”  
algae

Low coral diversity

Black slime and smothering  
algae common & increasing

Catastrophic COTS plague

Near complete loss of  
*Isopora, Astreopora,*  
with most *Pavona*  
diseased or overgrown  
with algae

High incidence of coral and  
coralline algal disease, high  
mortality especially among  
young coral recruits

Eventual ecosystem  
collapse



Without coral, there is a near absence of fish,  
and the shore is less-protected from wave  
damage... and a loss of wonder, of beauty

