

Biology of Marine Life

Ninth Edition

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Chapter 9

Coral Reefs

Coral reefs are living structures that provide homes and attachment sites for countless marine organisms in shallow tropical oceans.

Coral Reefs – reefs made by corals (called hermatypic)!!! What a shocker!!!

- 🐟 Coral reefs are created by many species of colonial cnidarians.

What phylum?

What class?

- 🐟 These anemone-like polyps produce a CaCO_3 skeleton – connected by a cenosarc & sit in a corallite



© Photos.com

Fig. 9.1 Extended polyps of a coral colony. The numerous light-colored spots on the tentacles are batteries of cnidocytes.

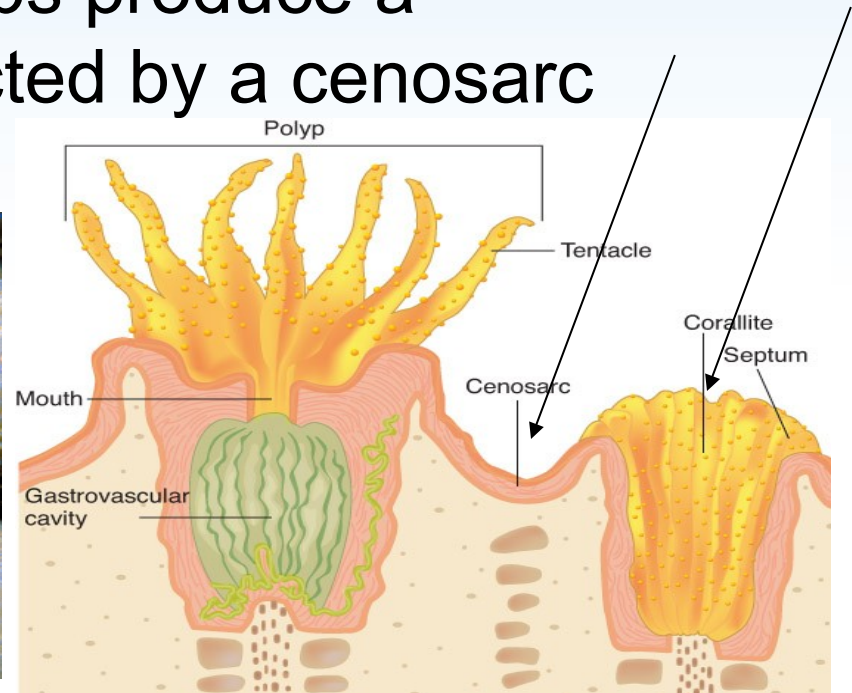


Fig. 9.2 Cross-section of a coral polyp and a calcareous corallite skeleton. The living coral tissue forms a thin interconnection, the cenosarc, over the surface of the reef.

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Coral Reefs – MANY different types of coral shapes and sizes!

I would know these by sight – there may be a picture on the next exam (hint, hint!!!)

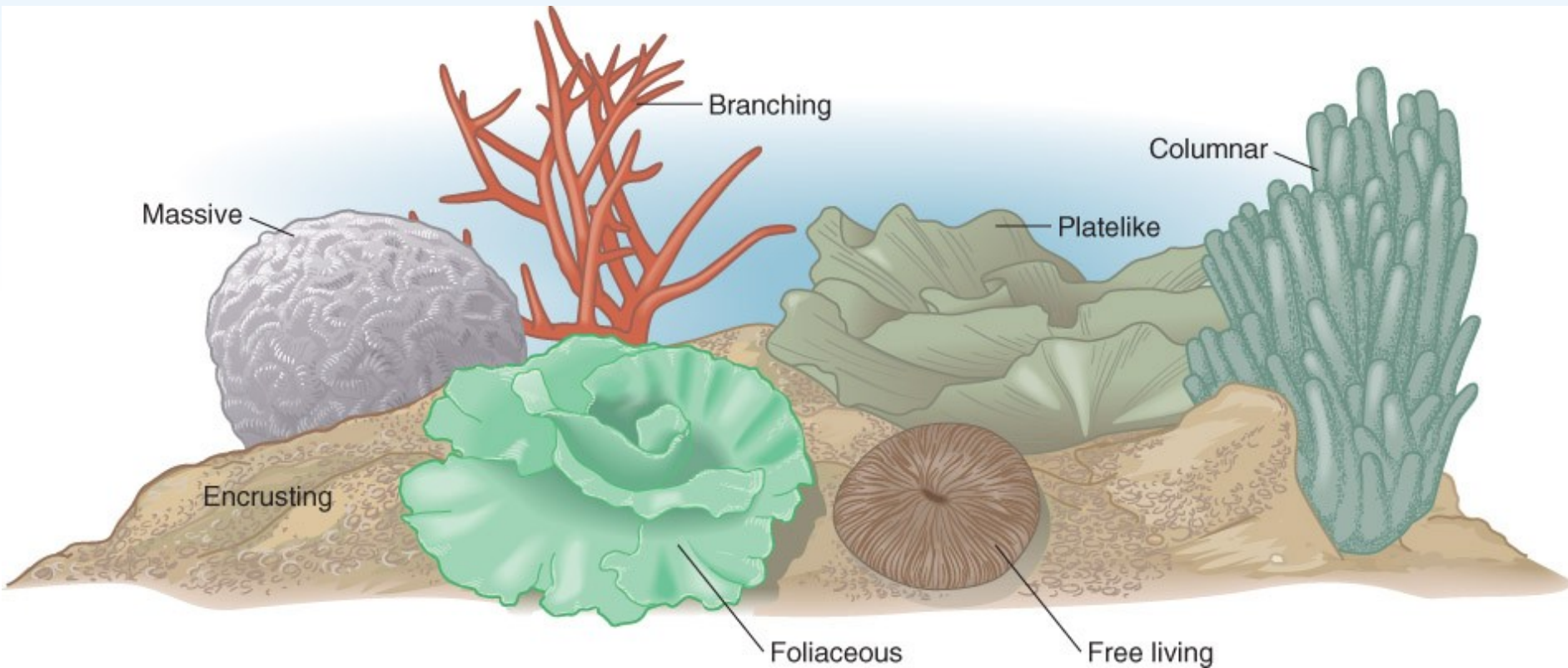


Fig. 9.3 Coral exhibit a large variety of growth forms.

Coral Reefs

Coral Distribution

- 🐟 Living coral reefs usually are located:
 - within 30° latitude of the equator
 - in water that averages at least 20°C (68°F)
 - **THEY LIKE WARM!**
 - on the eastern sides of most continents
 - within the photic zone at depths of 0-50 meters
 - **THEY LIKE LIGHT!**

Coral Reefs

Coral Distribution

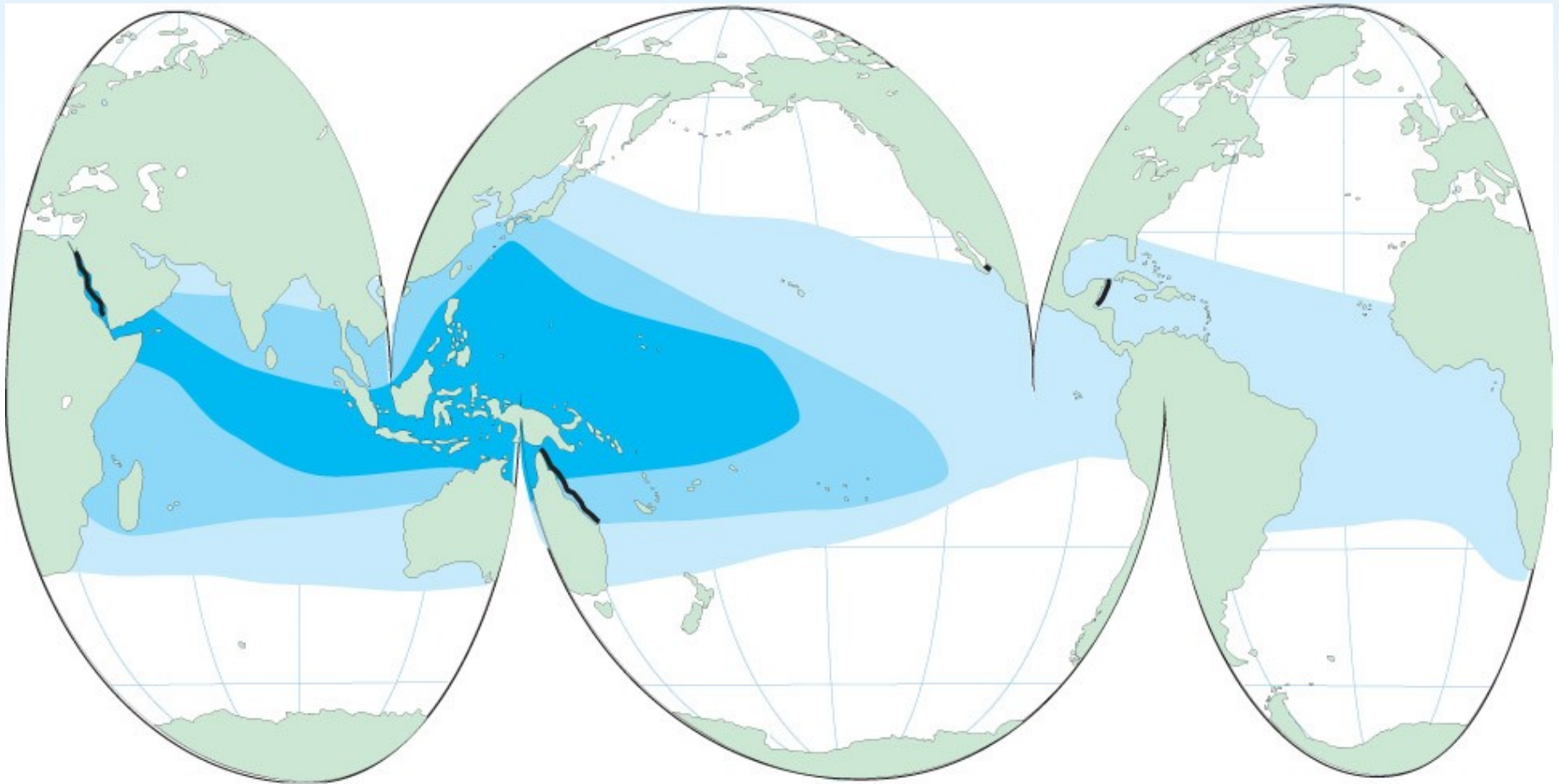
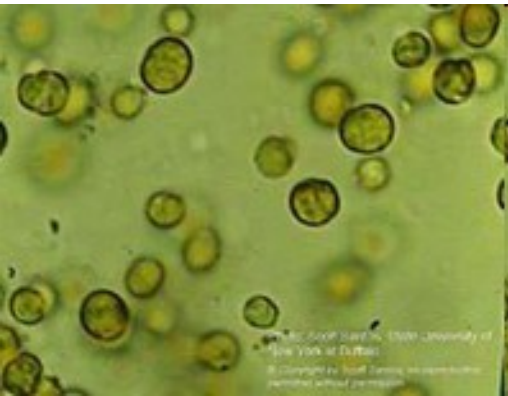


Fig. 9.5 Distribution of reef-forming corals, by number of genera. Heavy black lines indicate continental barrier reefs.

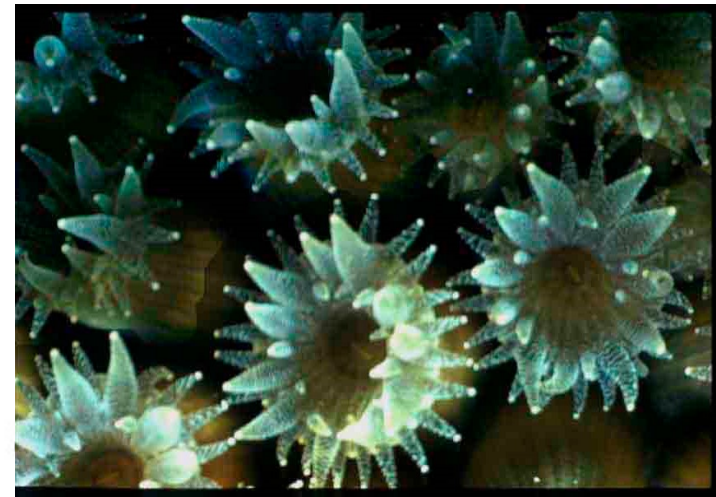
Light blue: <20 genera
Medium blue: 20-40 genera
Dark blue: > 40 genera

Coral Reefs – Coral Ecology

- Reef-building corals maintain a **mutualistic** relationship with zooxanthellae (a dinoflagellate)
- The alga provides photosynthetic products to the coral to aid in its survival and growth
- The alga receives unlimited carbon dioxide and nitrogenous wastes from the coral polyp in a competition-free setting



Some corals don't even need to eat!



Coral Reefs

Coral Ecology

The polyp also gains
by not having to
release as much
waste!!!

The zooxanthellae
uses it!!!

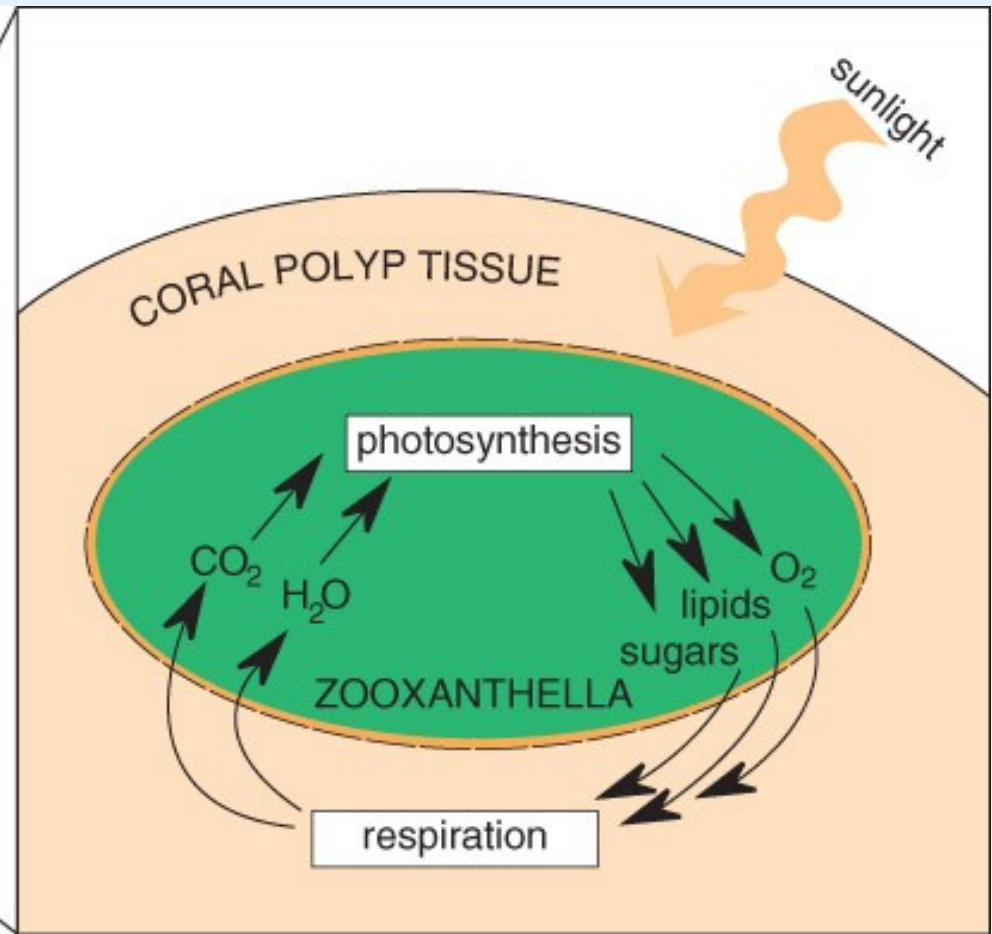
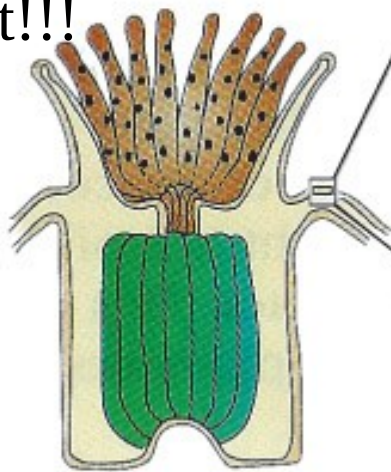
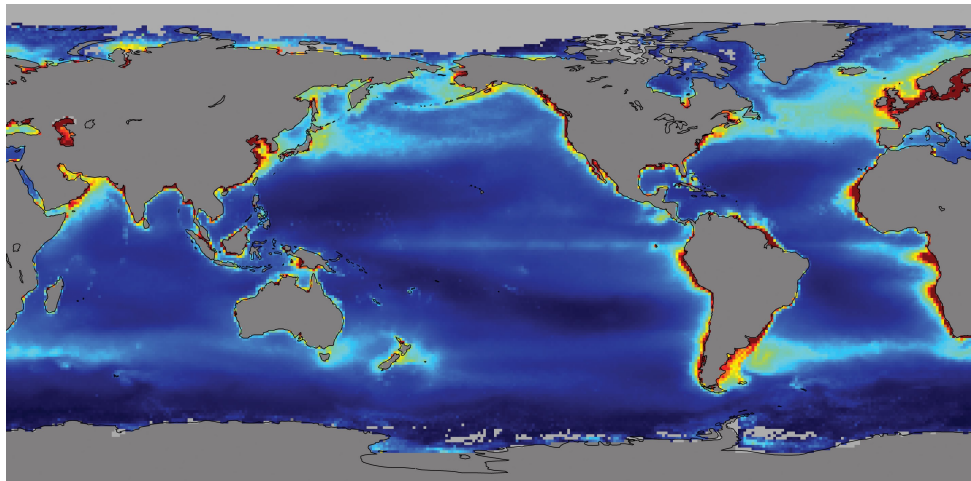


Fig. 9.6 Exchange of materials between zooxanthellae and their coral host.

Coral Reefs are very productive!



Tropical waters aren't!



Coral Reefs – how they form!

🐟 Charles Darwin was the first to suggest that coral reefs are sequential developmental stages in the life cycle of a single reef:

1. fringing reefs
2. barrier reefs
3. atolls

2 types of reefs:

Shelf reefs: by continents
(mainly fringing)

Oceanic reefs: around
islands

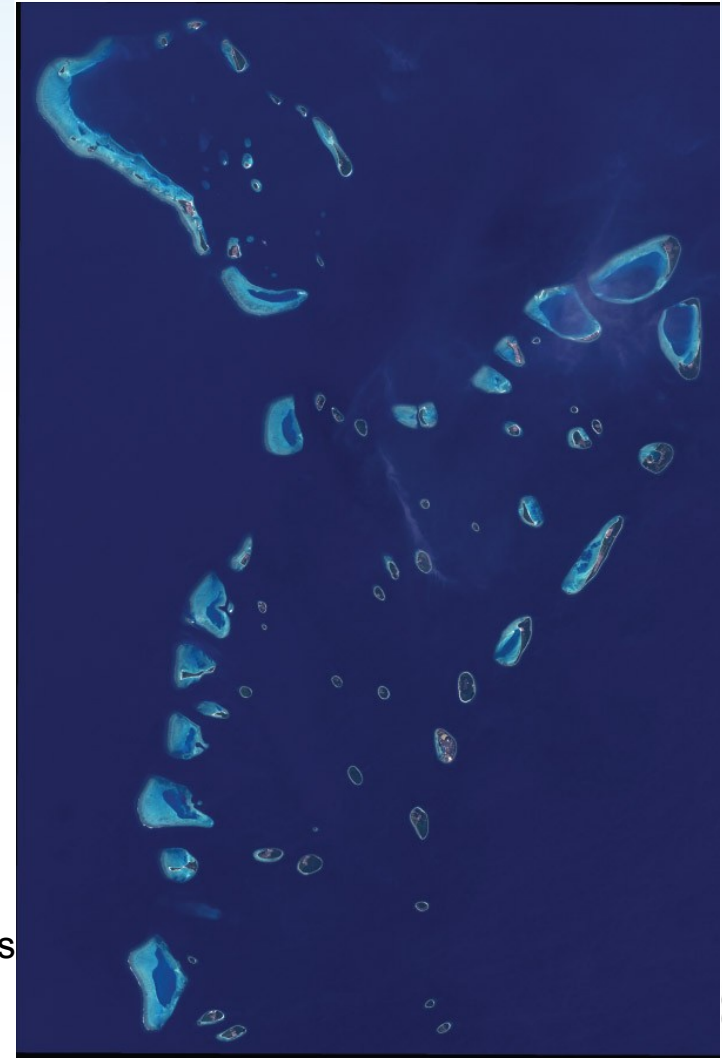
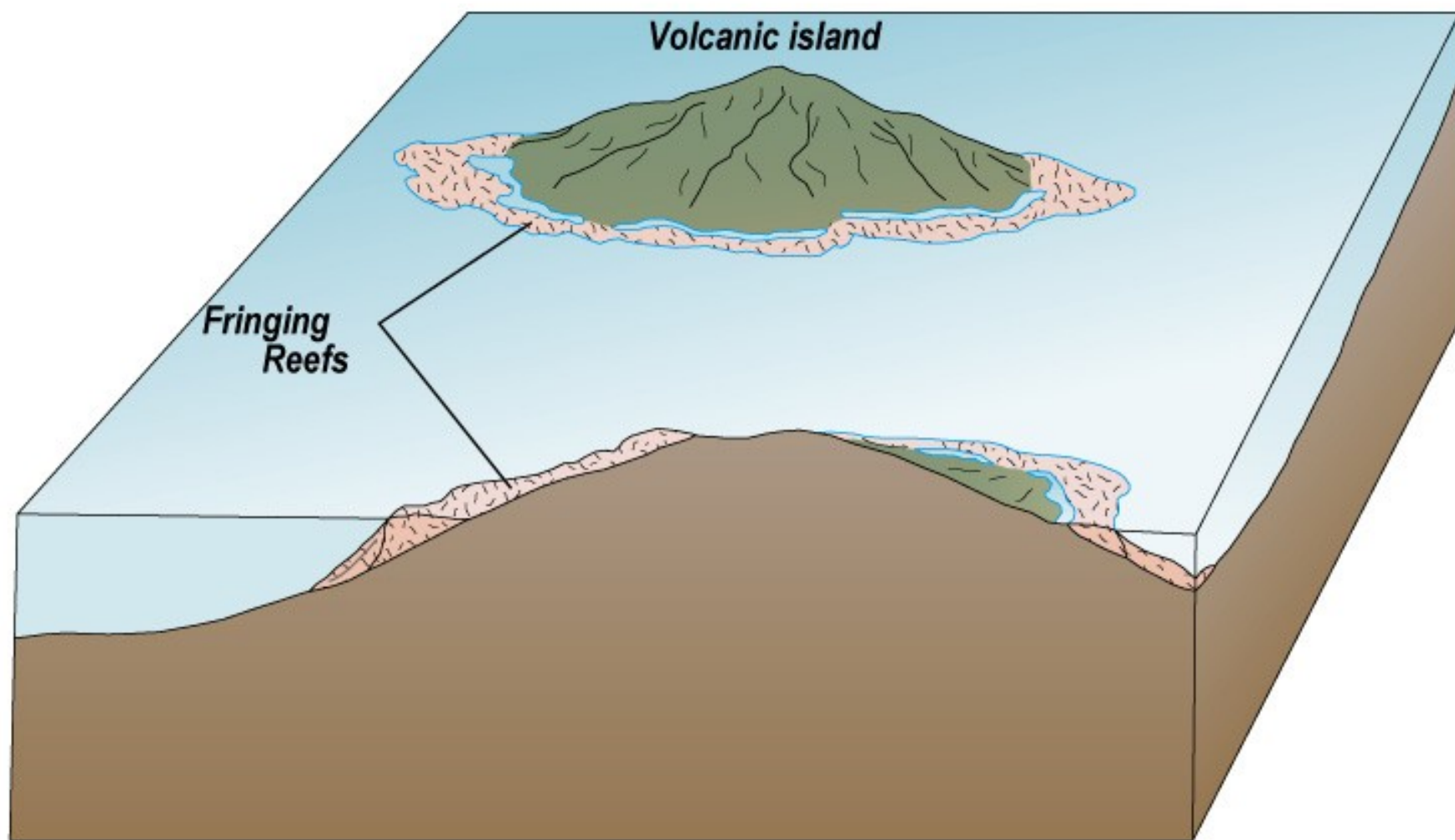
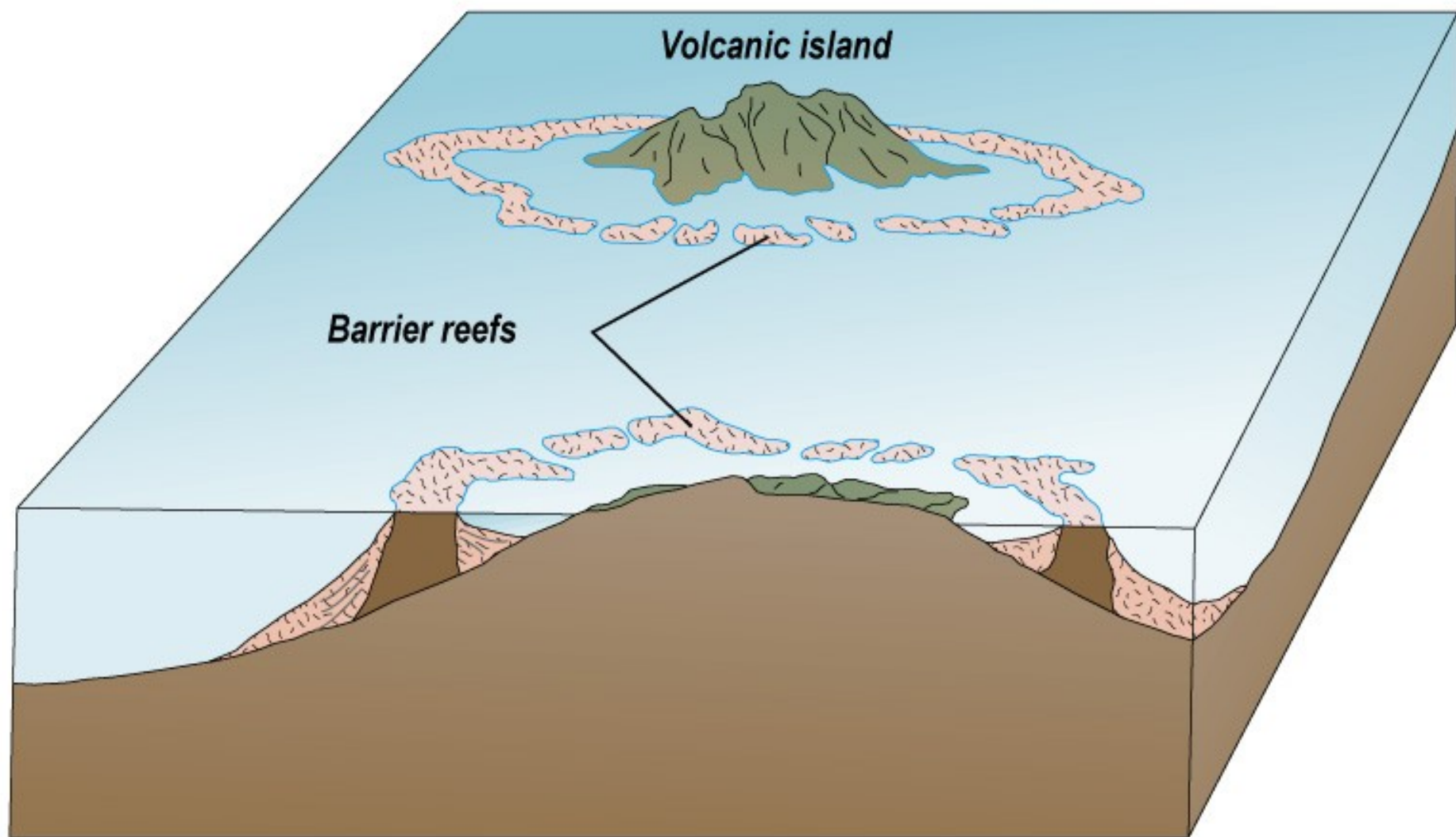


Fig. 9.7 A satellite view of a portion of the hundreds of atolls that make up the nation of Maldives.

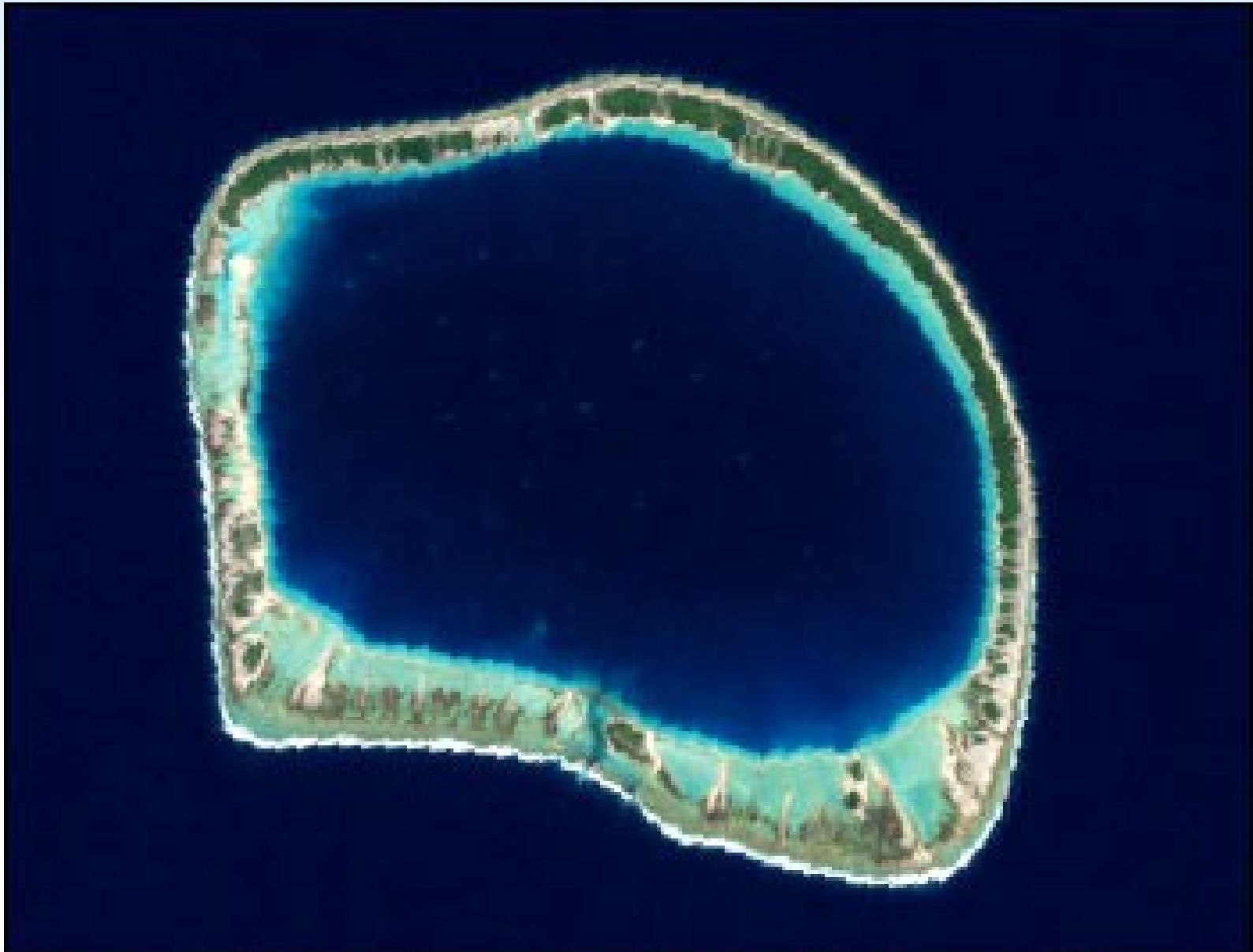


(a)



(b)

You atoll!



What happens if the reef doesn't grow fast enough???

Coral Reef Development

A guyot (a dead, sunken reef).

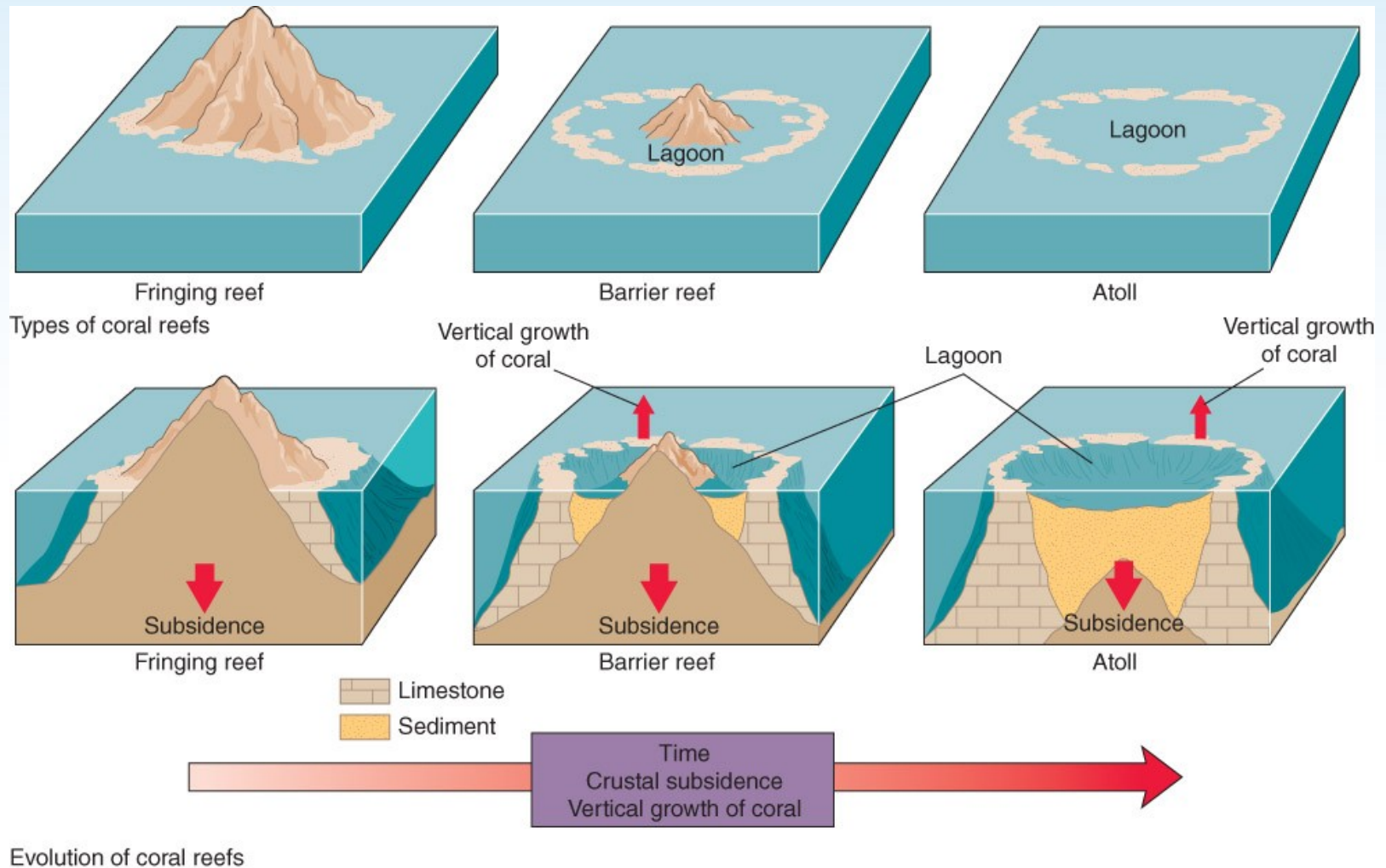


Fig. 9.8 The developmental sequence of coral reefs, from young fringing reefs (left), to barrier reefs (center), and finally to atolls (right).

Coral

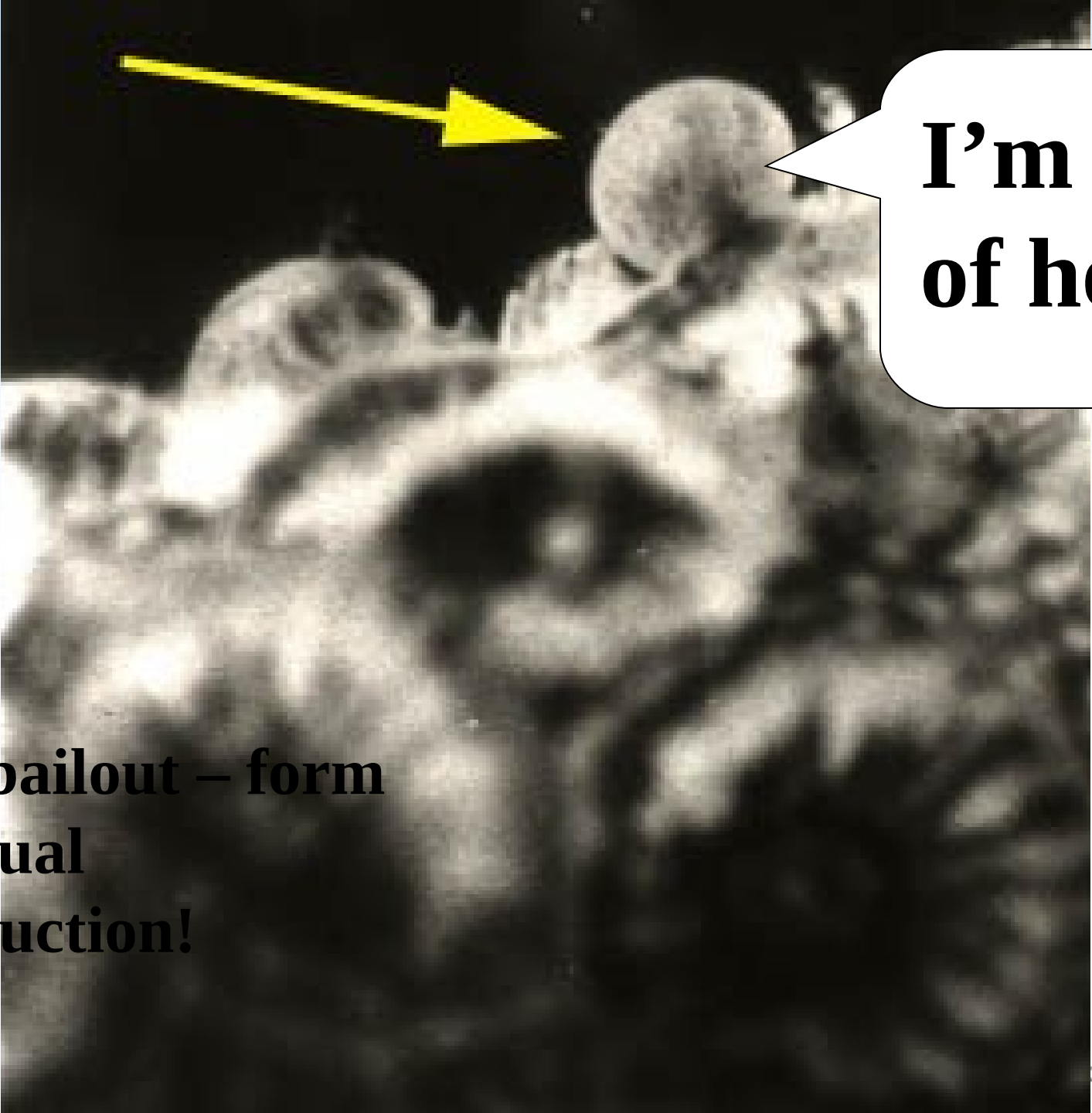


Corals
asexual



Most se
spawn



A black and white microscopic image showing a cluster of cells. A yellow arrow points from the top left towards a single, rounded cell at the top of the cluster. A speech bubble originates from this cell, containing the text "I'm out of here!". The rest of the image shows a dense, textured mass of cells.

**I'm out
of here!**

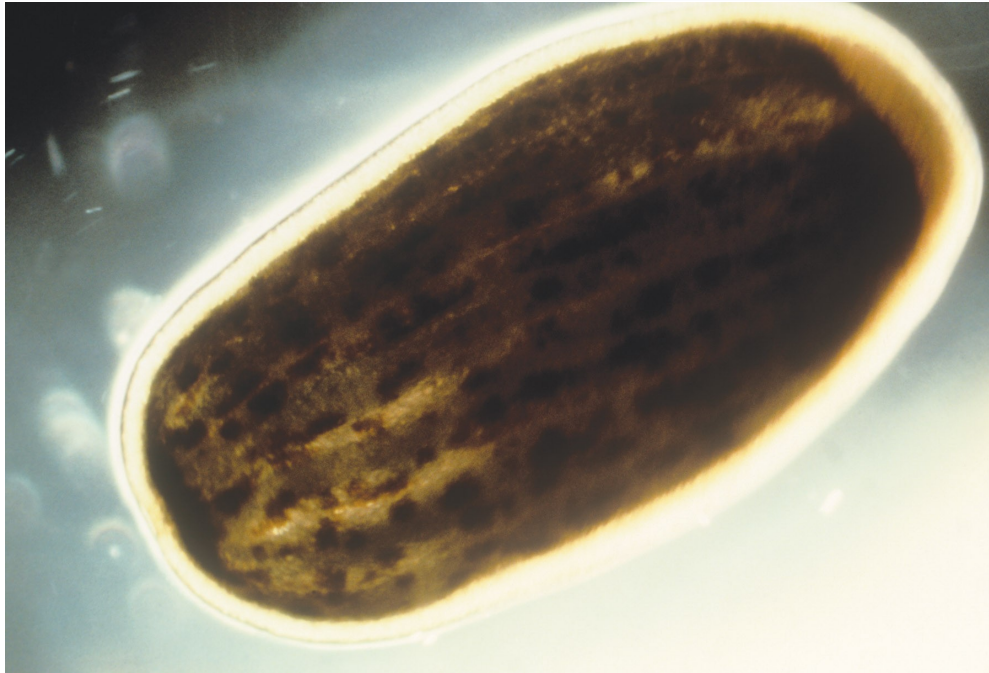
**Polyp bailout – form
of asexual
reproduction!**

Coral Reefs

Most corals are spawners

<http://www.youtube.com/watch?v=pnDJvhgPn8o>

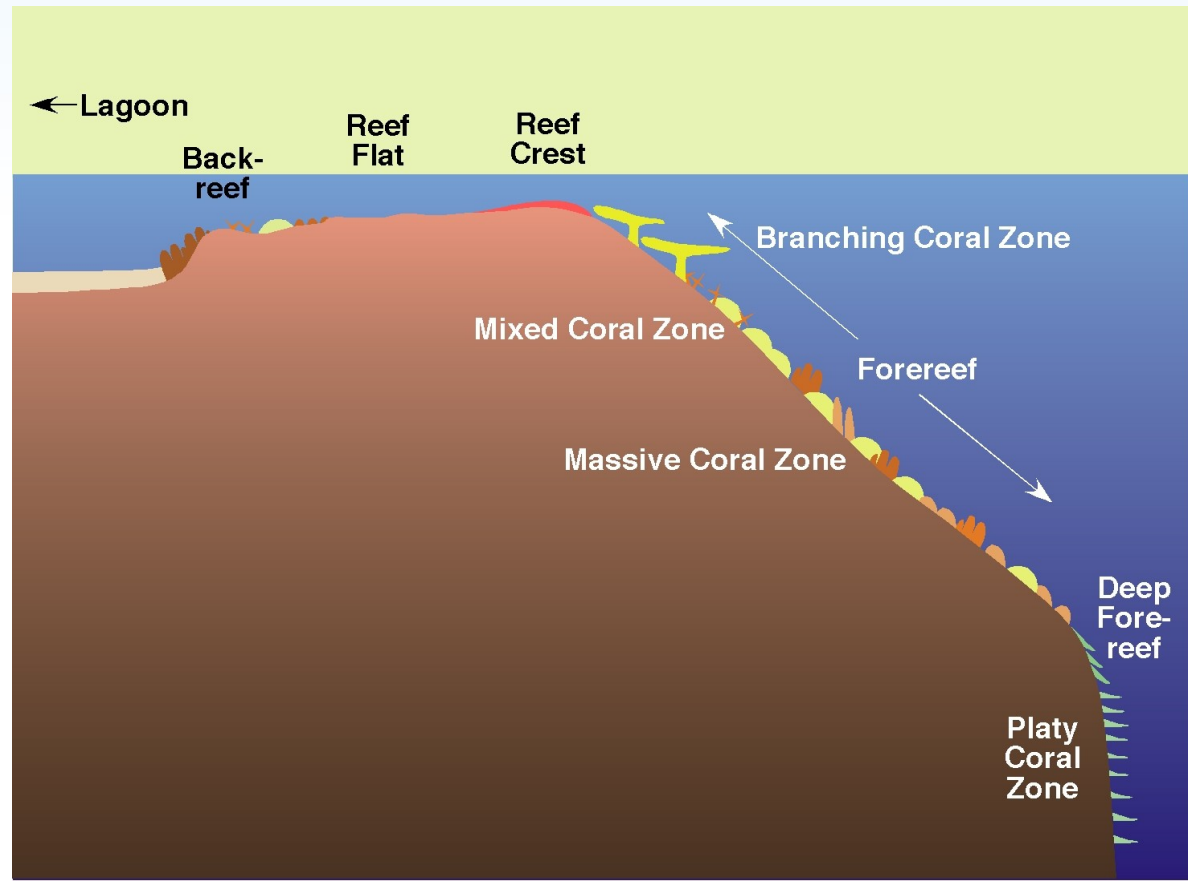
Planula larva



Coral Reefs – Zonation on Coral Reefs

➤ Wave force, water depth, temperature, salinity, and a host of biological factors vary greatly across a reef

- results in horizontal and vertical zonation of species



Coral Reefs



Fig. 9.13
Echinometra, a
common tropical
sea urchin.

Coral Reefs

Fig. 9.14 A giant clam, *Tridacna*, amid mixed corals. Note the blue mantle tissue that is brightly colored due to the presence of innumerable mutualistic zooxanthellae.



© Andy Lim/Shutterstock, Inc.

Coral Reefs

Fig. 9.15 Variations in coral growth forms: (a) table coral, *Acropora*; (b) brain coral, *Diploria*; and (c) staghorn coral, *Acropora*.



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C

Zonation on Coral Reefs

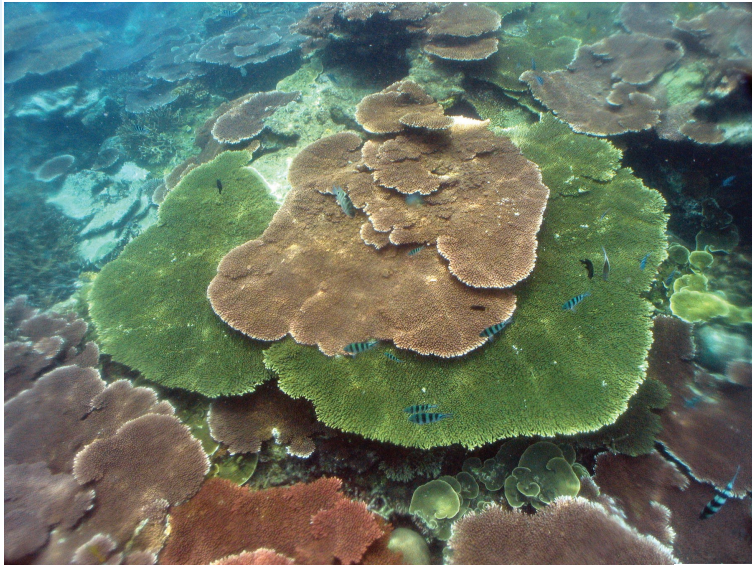


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b

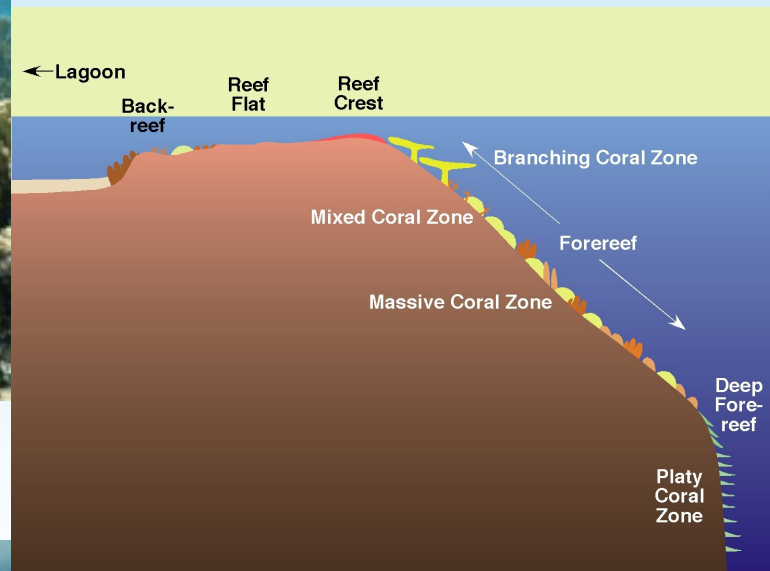
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a



Millepora (Fire Coral) Encrusting Shallow reef crest

Photo by D. Hubbard (St. Croix)



Coralline Algae (Algal Ridge) Encrusting Shallow reef crest (high energy)

Photo by D. Hubbard (Tikehau)



Acropora palmata Branching Shallow forereef

Photo by D. Hubbard (Buck Island)



***Acropora
cervicornis***
Branching
Mixed Zone
(mid forereef or
backreef)



photo by Rich Aronson from Belize

***Montastrea
annularis***
Forereef
(D=30-60 ft)

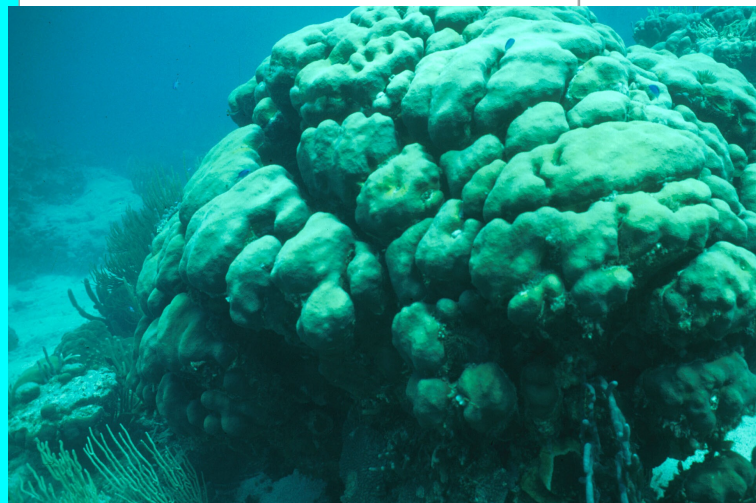
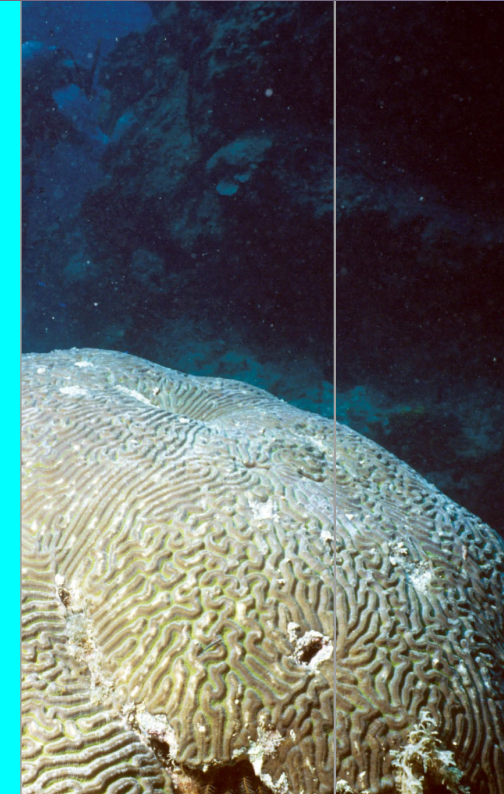
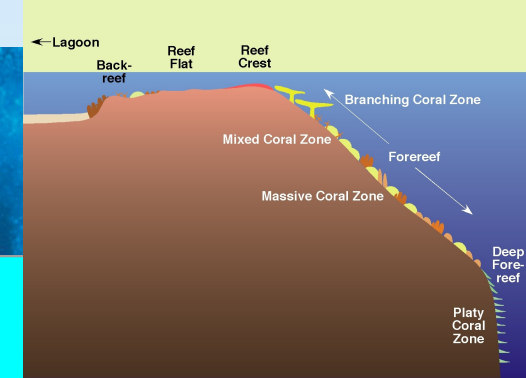


Photo by D. Hubbard (Buck Island)

***Diploria
sp***
Massive
Massive
/Mixed
Zone
(30-60
ft)

Photo by D. Hubbard (USVI)



Porites porites
Massive/Finger
Coral
Mixed/Massive
Coral Zone
(forereef or
backreef)

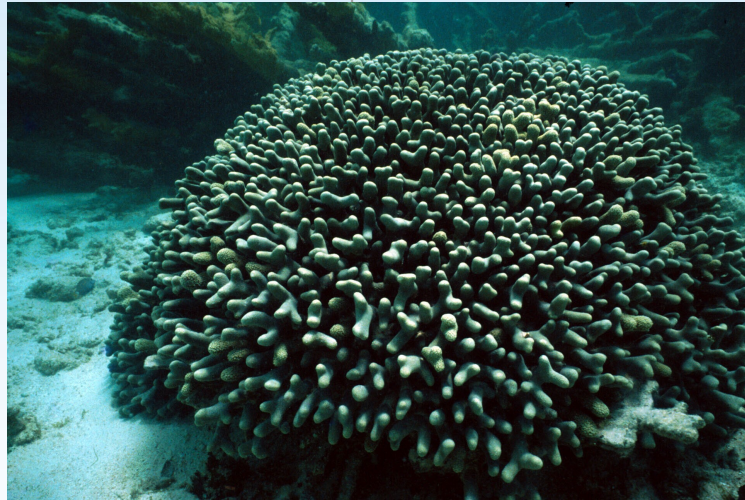


Photo by D. Hubbard (St. Croix)

***Agaricia* sp.**
Platy Coral
Deep forereef

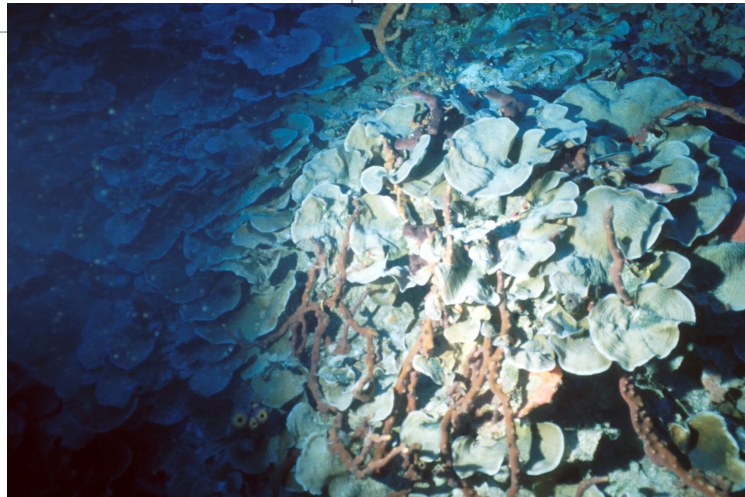
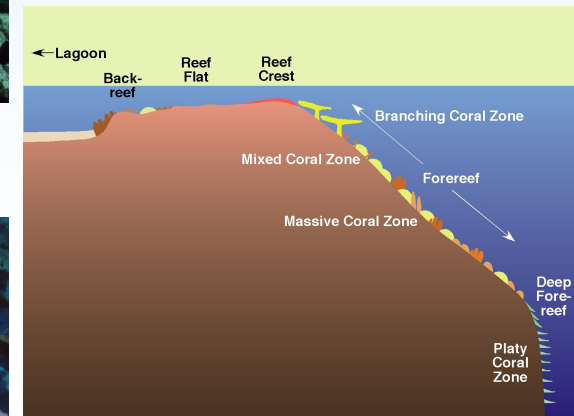


Photo by D. Hubbard (Cane Bay)

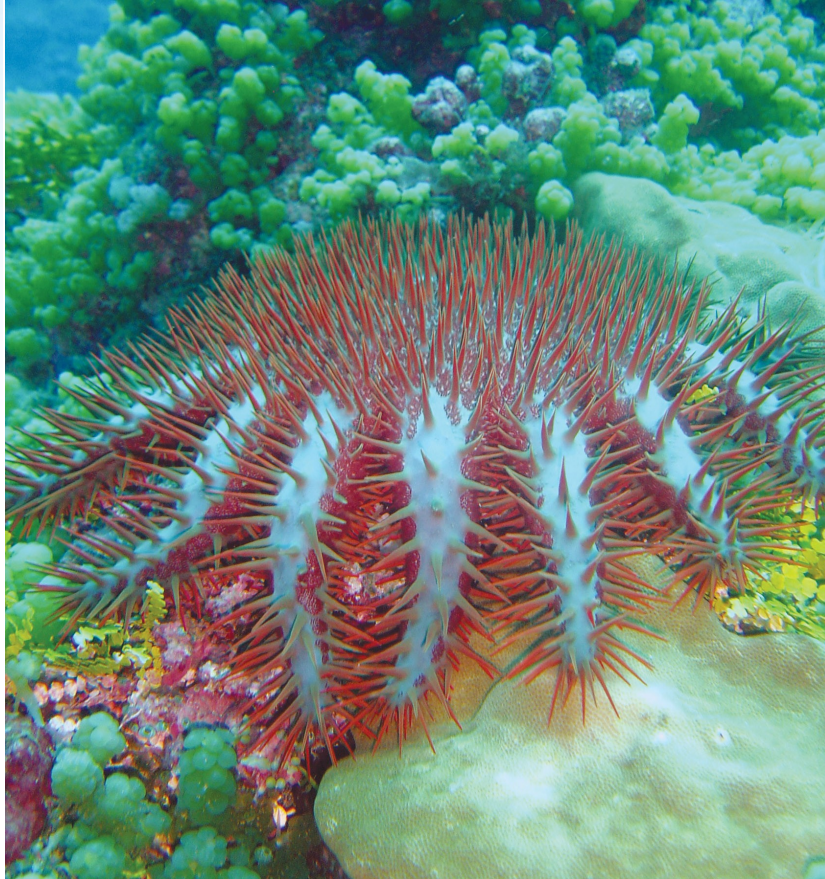


Coral Reefs

Coral Diversity and Catastrophic Mortality

- Reefs worldwide are threatened by human activities, succumbing to:
 - pollution
 - destructive fishing practices
 - bleaching
 - a host of diseases

Coral Reefs



a

Courtesy of David Burdick/NOAA



b

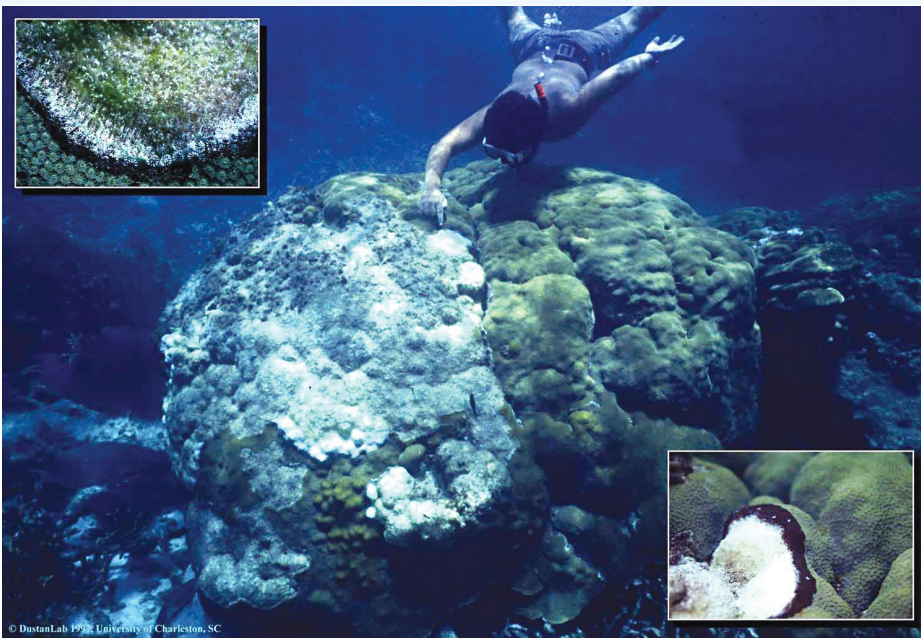
Courtesy of AIMS/NOAA

Fig. 9.16 The predatory sea star, *Acanthaster*, and (b) its major predator, the Pacific triton, *Charonia*.

<http://www.youtube.com/watch?v=60jof35WuAo>

Coral Reefs

Coral Diversity and Catastrophic Mortality.



Courtesy of Dr. Phillip Dustan, College of Charleston

Fig. 9.17 Black band disease overgrowing a coral head. This star coral, *Montastrea*, which could be as much as 500 years old, will probably be dead within one year.



Courtesy of David Burdick/NOAA

Fig. 9.18 Wide-spread bleaching on a Pacific coral reef.