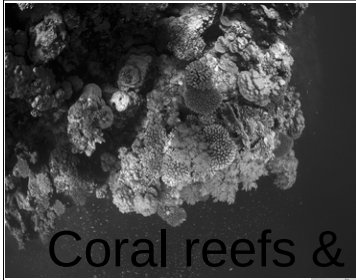


r&m_1



Coral reefs & mangroves

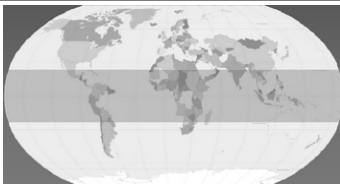
Wojciech Fiałkowski
wojciech.fialkowski@uj.edu.pl



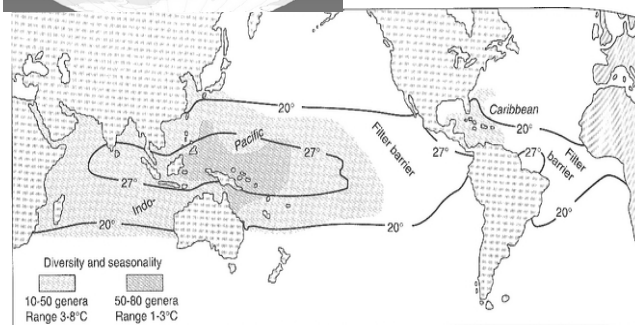
- Distribution
- Environmental factors
- Organisms
- Ecosystem structure
- Threats

r&m_2

r&m_3

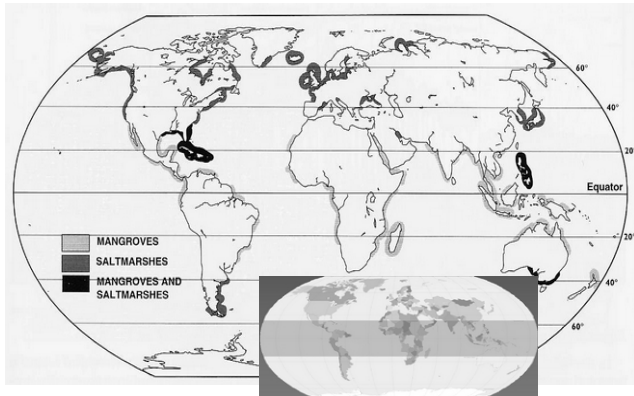


Reef distribution



r&m_4

mangrove/saltmarsh distribution

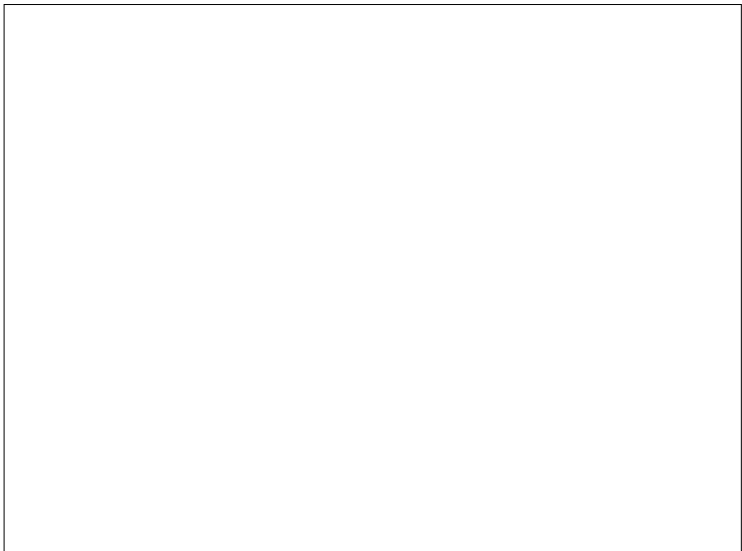
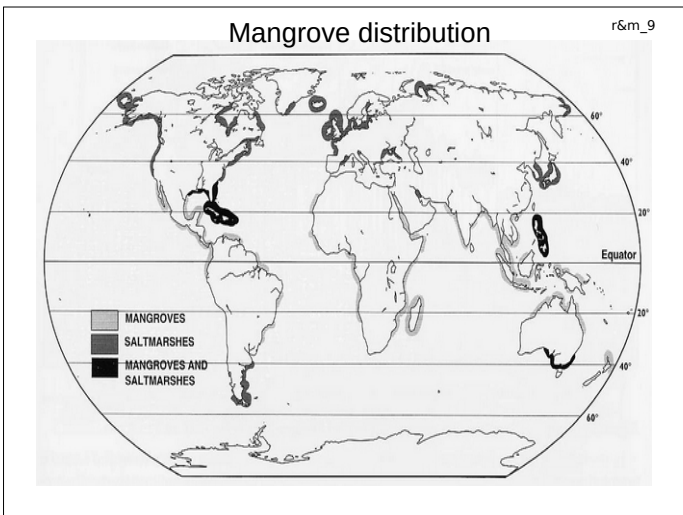
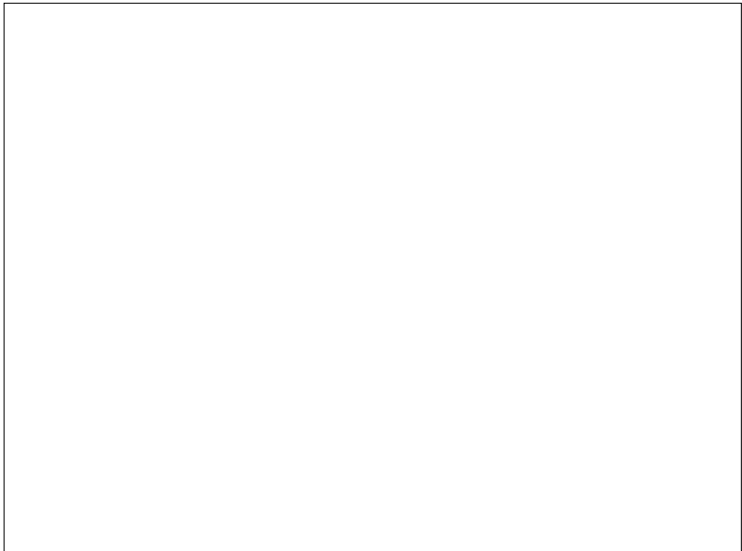
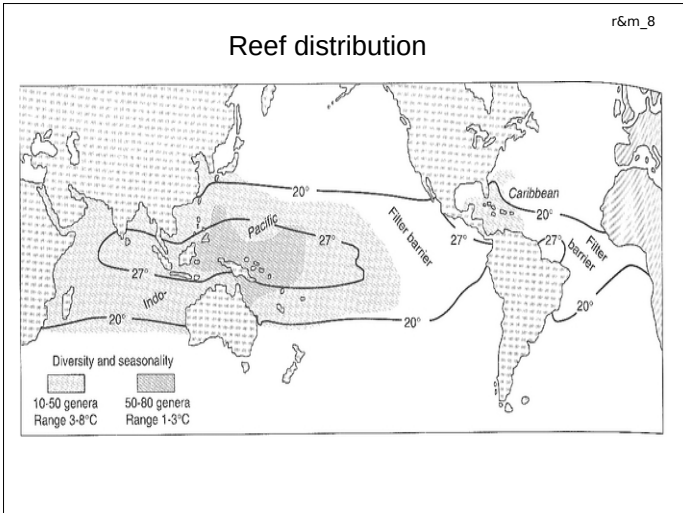
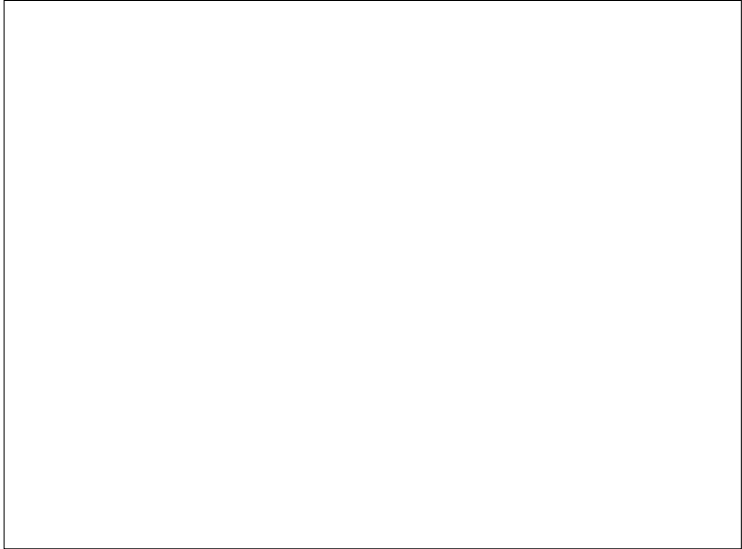
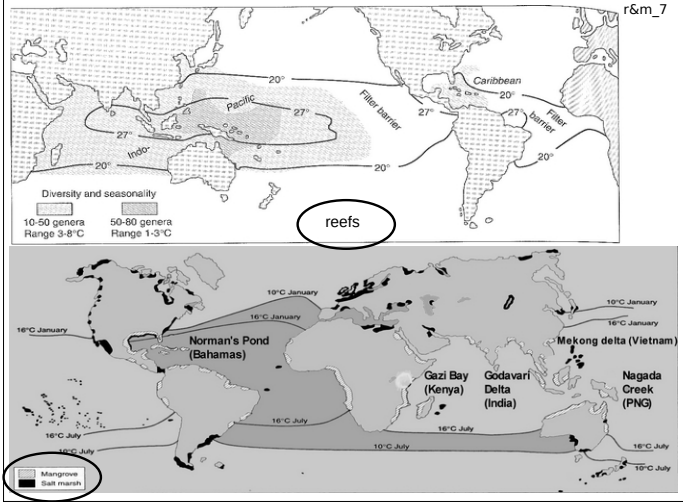


r&m_5

- Distribution
- Environmental factors
- Organisms
- Ecosystem Structure
- Productivity
- Threats

r&m_6

- temperature
- light
- substratum
- access to water
- salinity
- nutrient availability
- oxygen availability

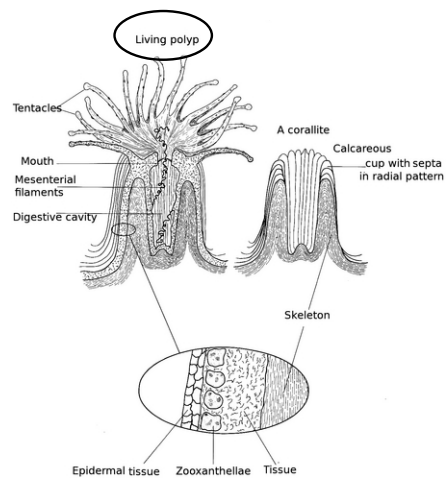


- Distribution
- Environmental factors
- Organisms
- Ecosystem structure
- Productivity
- Threats

r&m_10

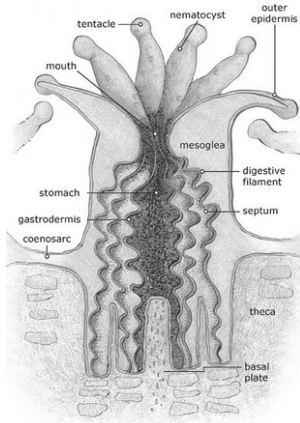
reef organisms

r&m_11



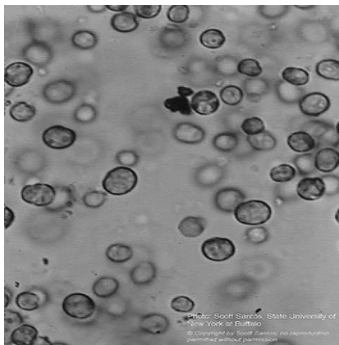
r&m_12

Coral polyp



r&m_13

zooxanthellae

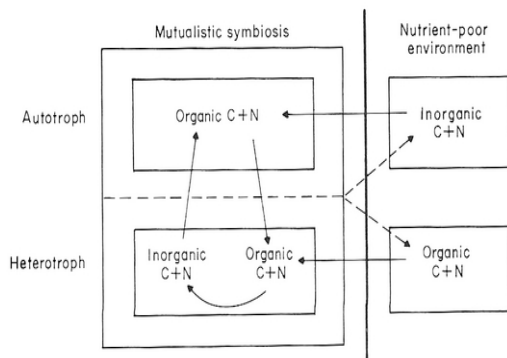


Symbiodinium sp.

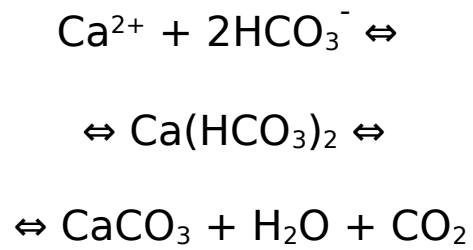
r&m_14

nutrient cycle: coral – symbiont – environment

r&m_15



r&m_16



Calcium carbonate excretion

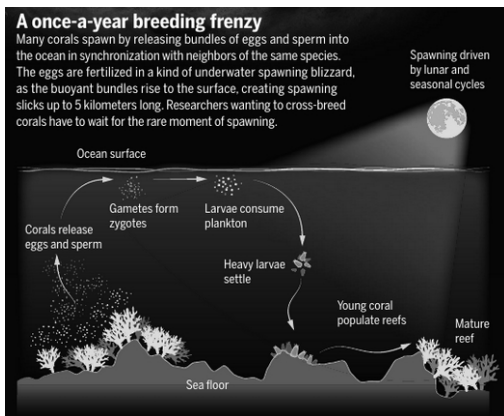
Feeding polyps

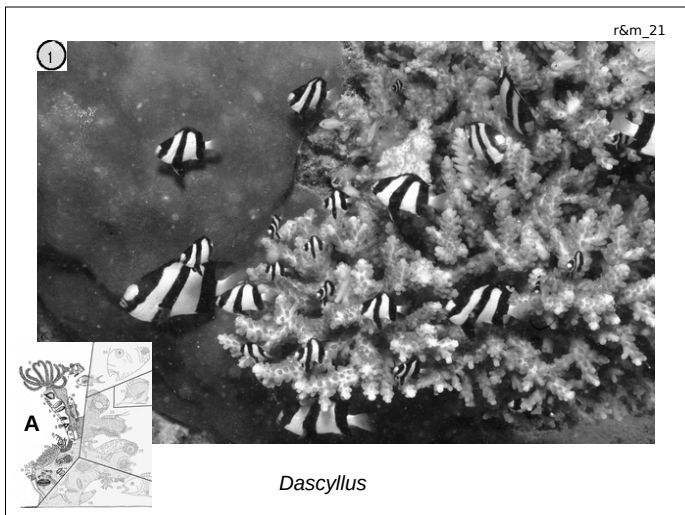
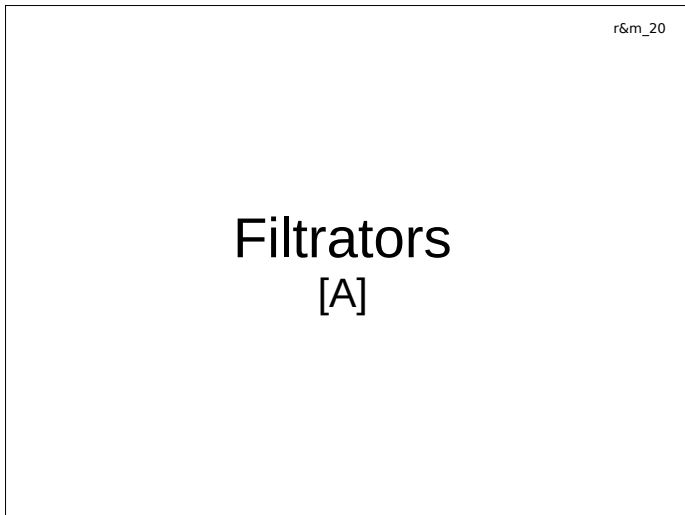
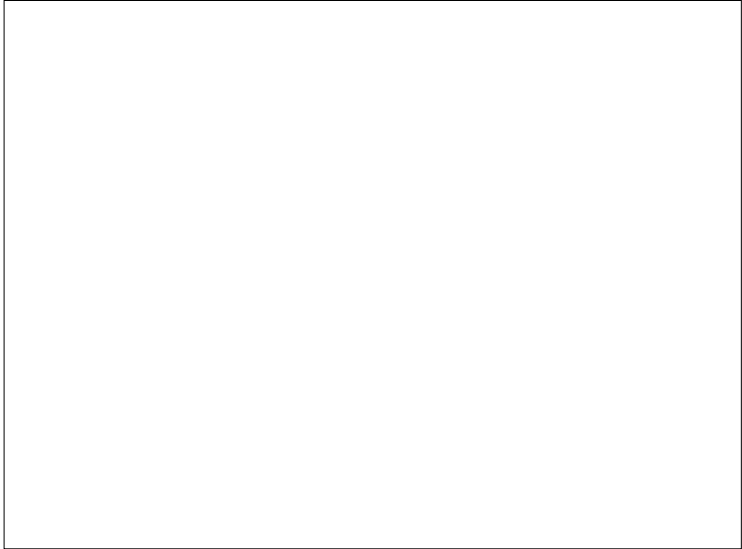
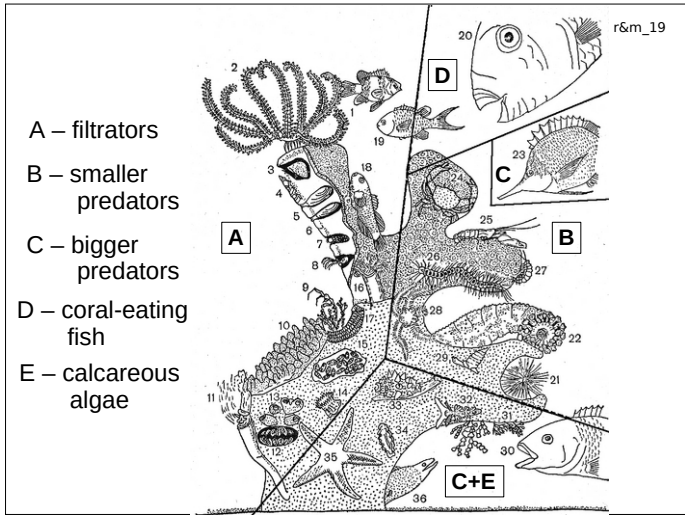
r&m_17



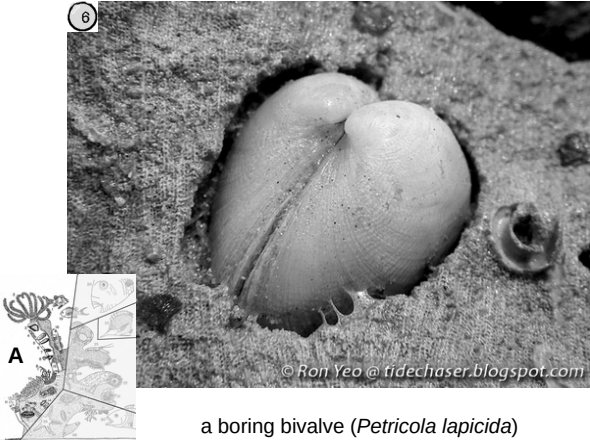
Coral reproduction

r&m_18

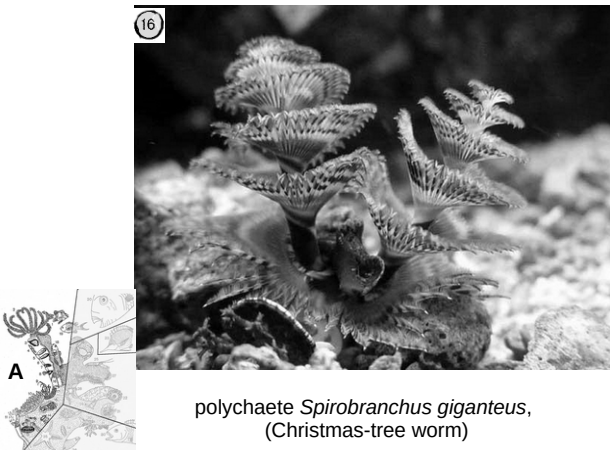




r&m_22



r&m_23



r&m_24

Small predators
[B]

r&m_25



prawn *Rhynchocinetes durbanensis*

r&m_26



brittle-star *Ophiothrix* sp.

r&m_27



free-roaming polychaete

r&m_28

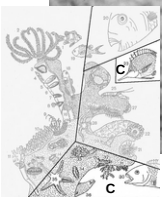
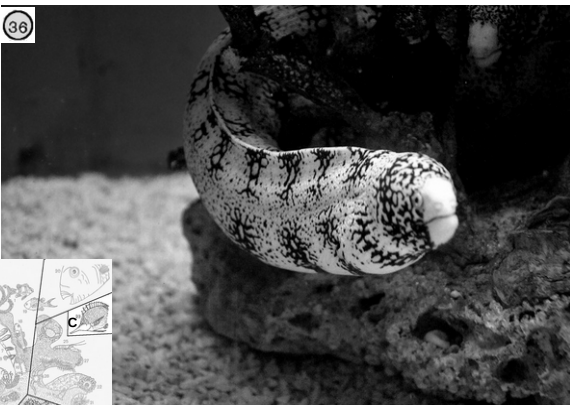
Big predators [C]

r&m_29



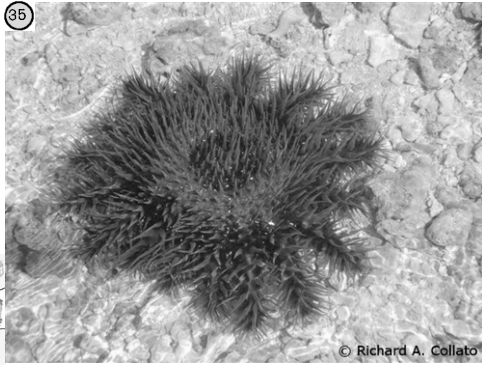
surgeon-fish

r&m_30

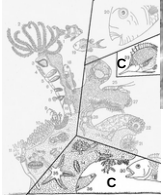


moray eel

r&m_31



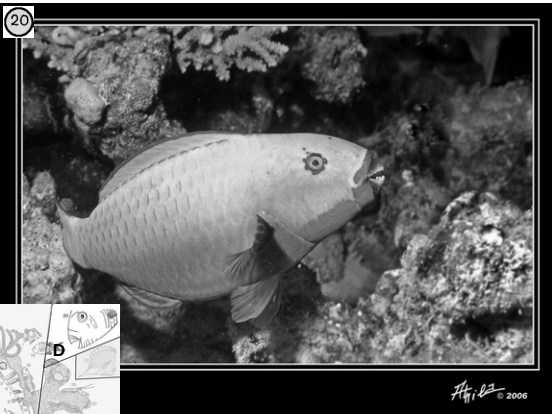
Crown-of-thorns starfish



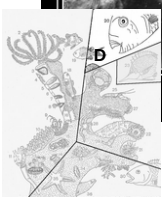
r&m_32

Coral-eating fish [D]

r&m_33

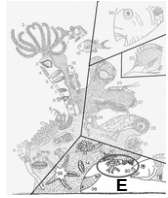


Parrot fish



Calcareous algae [E]

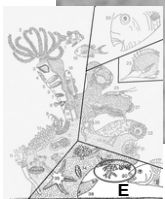
30



Halimeda (green alga)

r&m_35

31

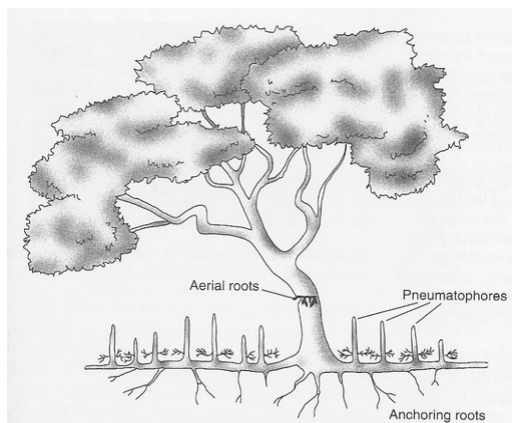


Coralline alga (red alga)

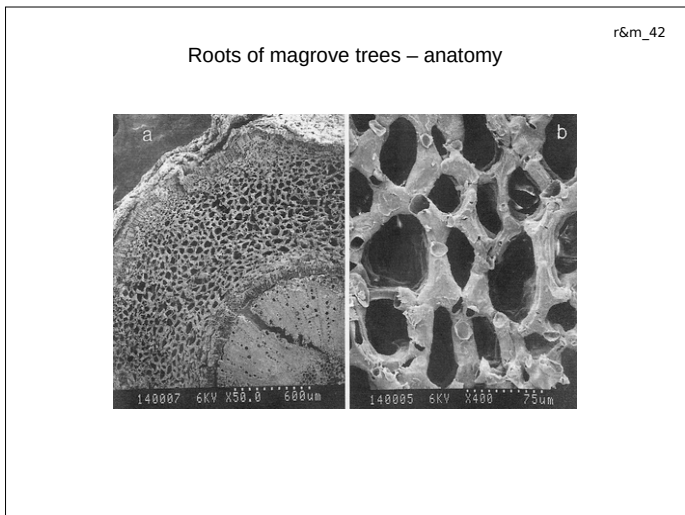
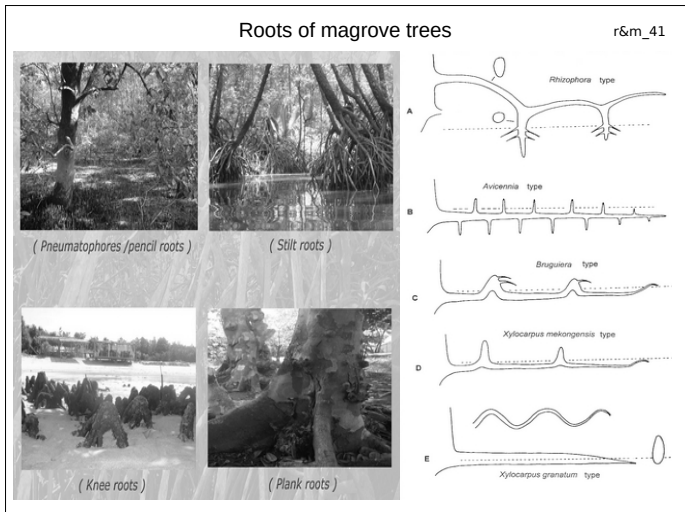
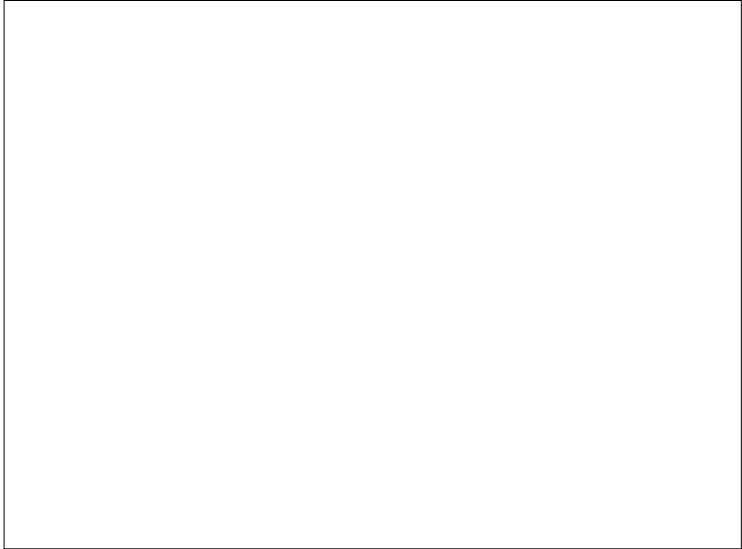
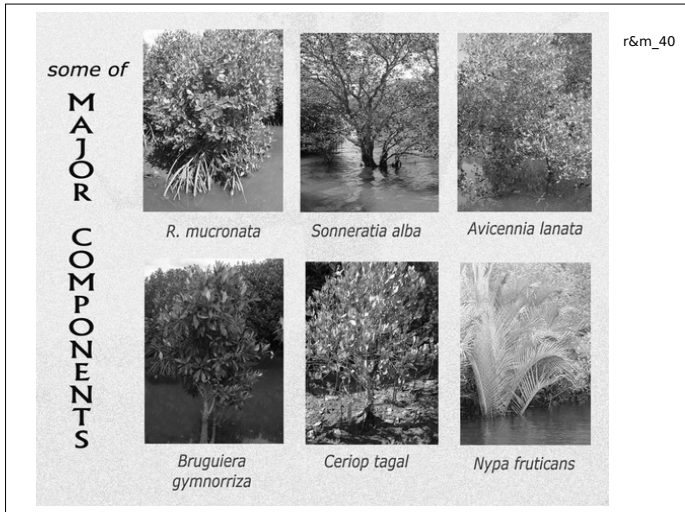
mangrove organisms

Families and genera of mangrove trees

Family	Genus	Number of species
Major components		
Avicenniaceae	<i>Avicennia</i>	8
Combretaceae	<i>Laguncularia</i>	1
	<i>Lumnitzera</i>	2
	<i>Nypa</i>	1
Palmae	<i>Bruguiera</i>	6
Rhizophoraceae	<i>Ceriops</i>	2
	<i>Kandelia</i>	1
	<i>Rhizophora</i>	8
	<i>Sonneratia</i>	5
Sonneratiaceae		
Minor components		
Bombacaceae	<i>Camptostemon</i>	2
Euphorbiaceae	<i>Excoecaria</i>	2
Lythraceae	<i>Pemphis</i>	1
Meliaceae	<i>Xylocarpus</i>	2
Myrsinaceae	<i>Aegiceras</i>	2
Myrtaceae	<i>Osbornia</i>	1
Pellicieraceae	<i>Pelliciera</i>	1
Plumbaginaceae	<i>Aegialitis</i>	2
Pteridaceae	<i>Acrostichum</i>	3
Rubiaceae	<i>Scyphiphora</i>	1
Sterculiaceae	<i>Heritiera</i>	3

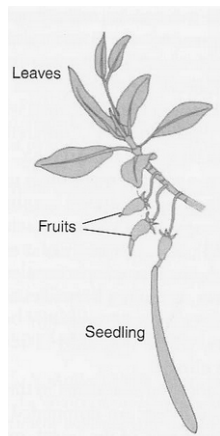


Mangrove tree



Mangrove tree – propagula

r&m_43

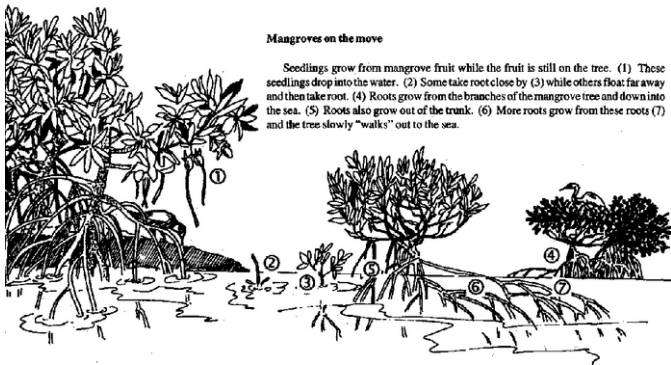


How mangroves propagate

r&m_44

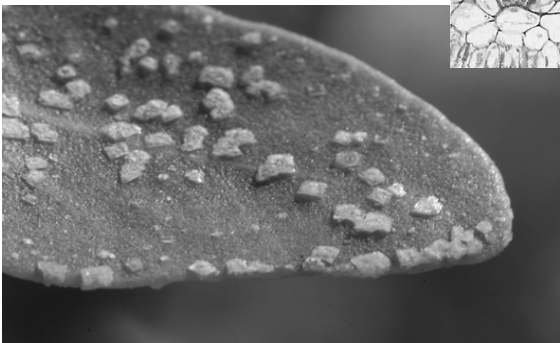
Mangroves on the move

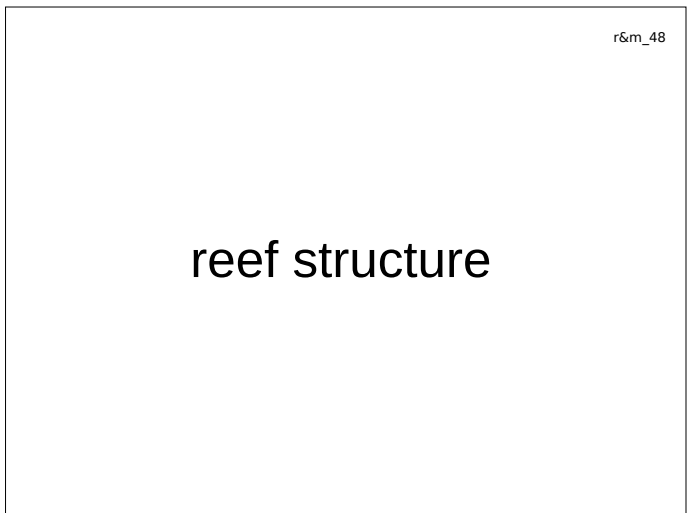
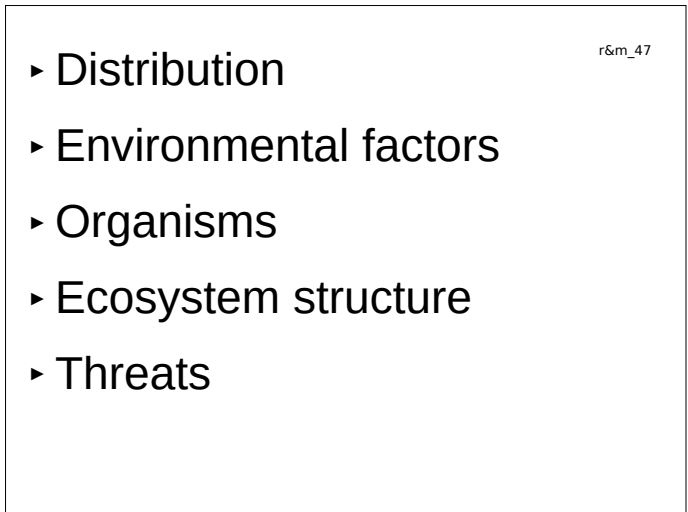
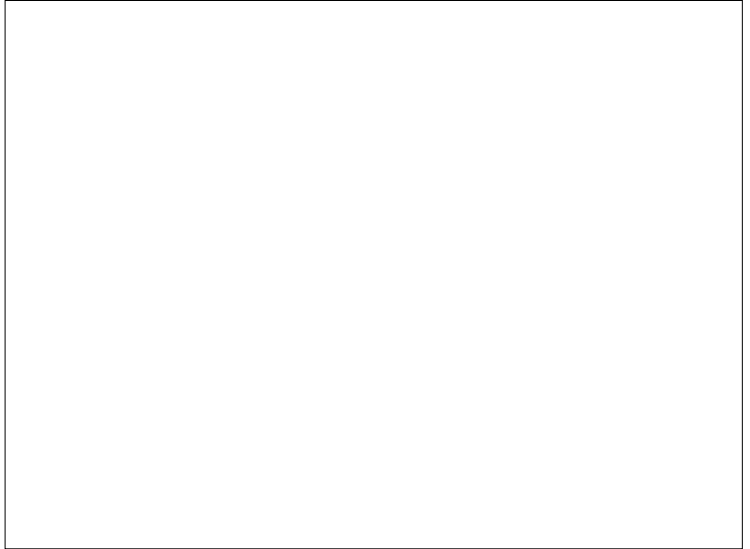
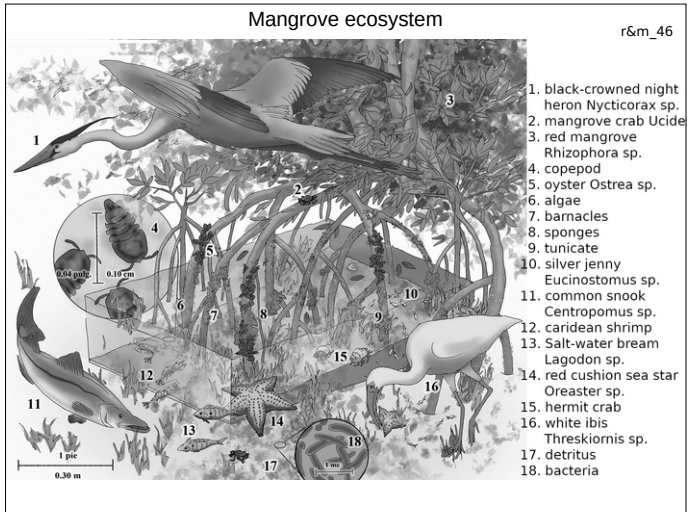
Seedlings grow from mangrove fruit while the fruit is still on the tree. (1) These seedlings drop into the water. (2) Some take root close by (3) while others float far away and then take root. (4) Roots grow from the branches of the mangrove tree and down into the sea. (5) Roots also grow out of the trunk. (6) More roots grow from these roots (7) and the tree slowly "walks" out to the sea.



Leaf exuding salt

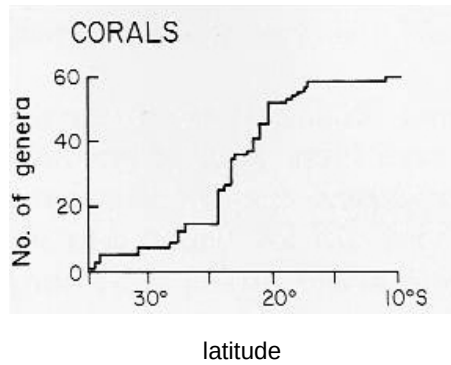
r&m_45





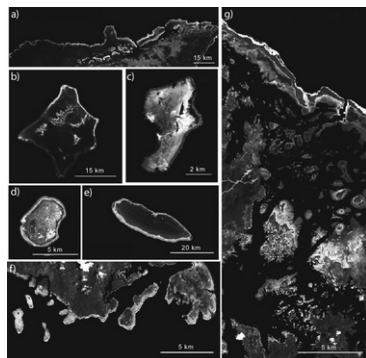
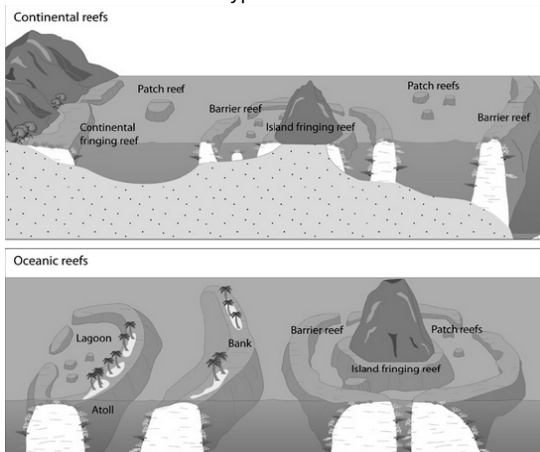
Latitudinal changes in coral diversity

r&m_49



Types of reefs

r&m_50



r&m_51

Examples of the main coral reef types in the tropical Pacific Ocean:
 (a) continental barrier reef, protecting lagoonal patch and fringing reefs; (b) oceanic barrier reef surrounding a lagoon with fringing and patch reefs; (c) oceanic reef island bank; (d) oceanic atoll that has been uplifted with a narrow fringing reef; (e) closed oceanic atoll; (f) fringing and patch reefs around an oceanic island; (g) lagoonal patch and fringing reefs.

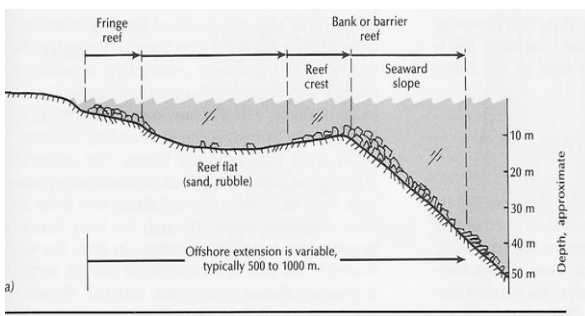
Fringing reef (Red Sea)

r&m_52



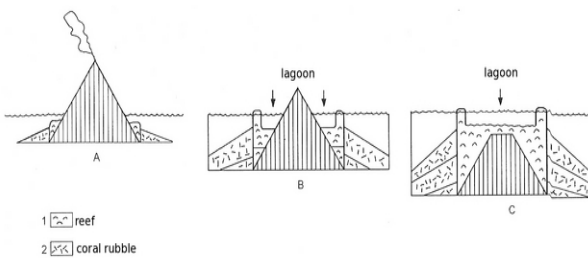
Reef cross-section

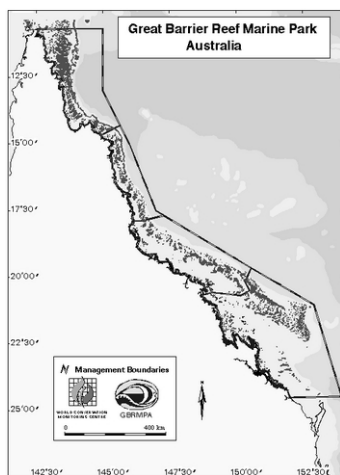
r&m_53



origin of an atoll

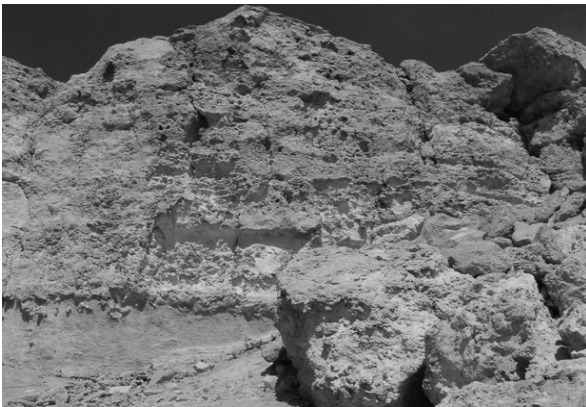
r&m_54





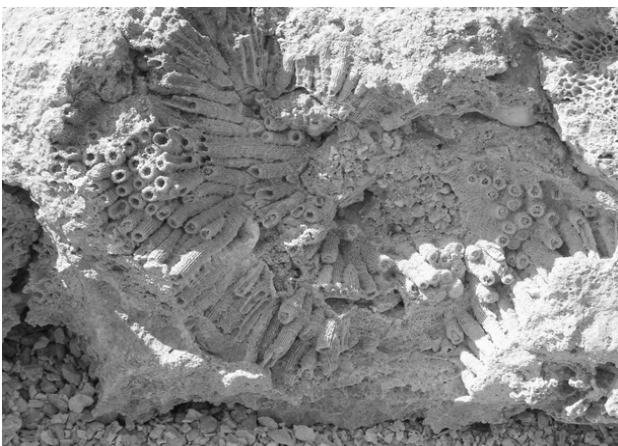
r&m_55

Old, uplifted reef

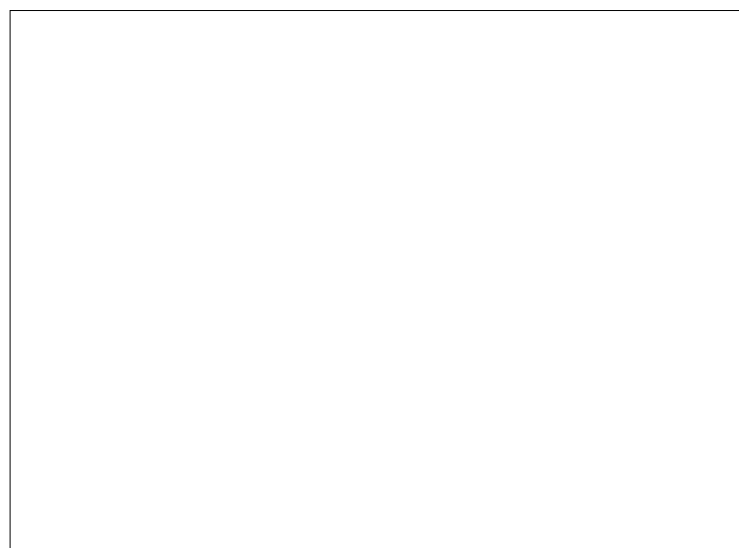
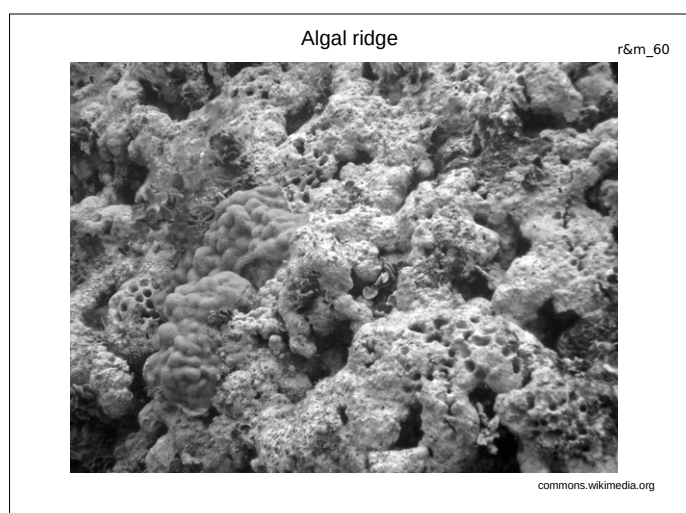
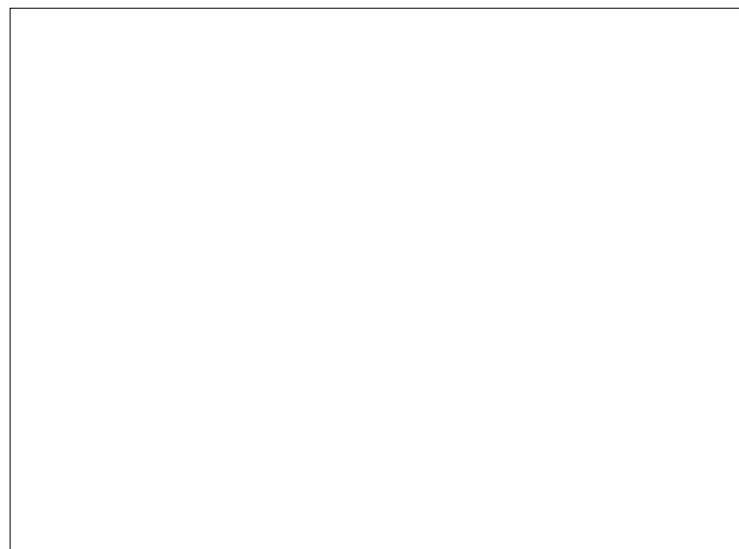
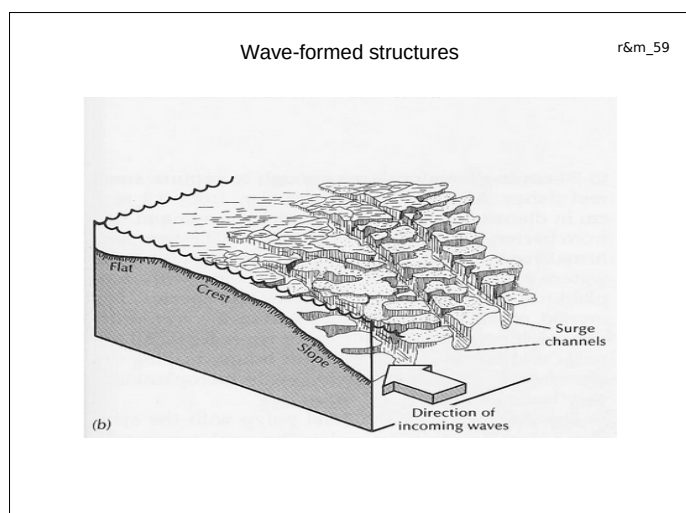
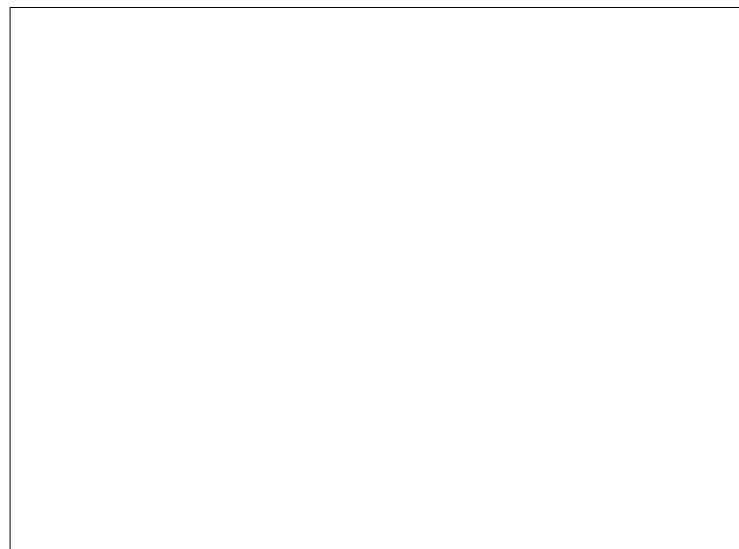
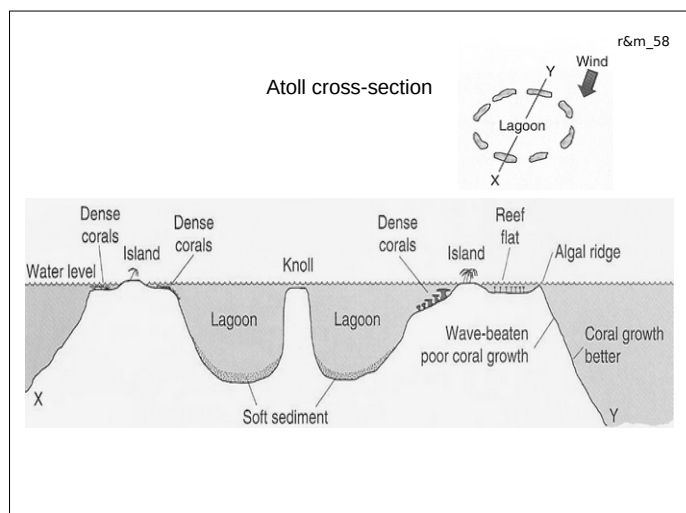


r&m_56

remnants of organisms in an uplifted reef



r&m_57



Sea urchins in hideouts

r&m_61



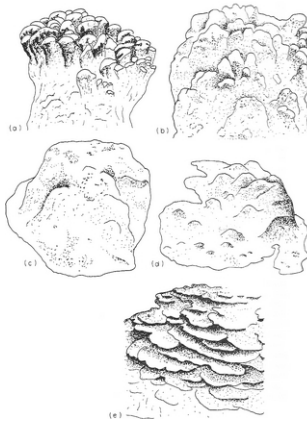
Flat coral colonies

r&m_62



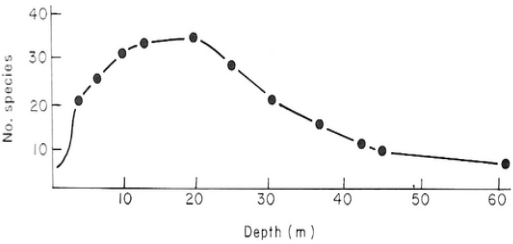
Change of colony form with depth
(5, 13, 18, 25, 35 m)

r&m_63



Changes in coral diversity with depth

r&m_64

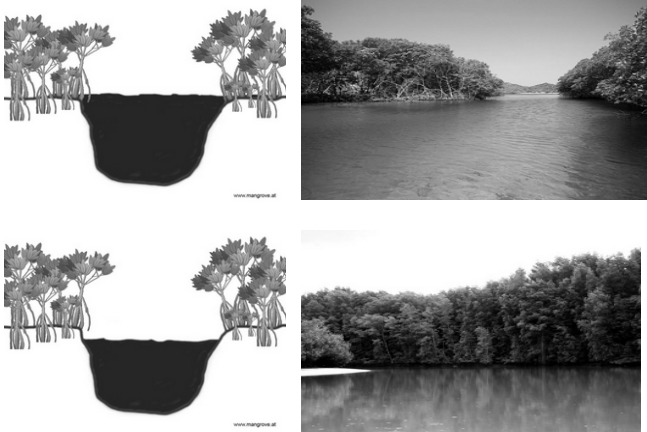


mangrove structure

r&m_65

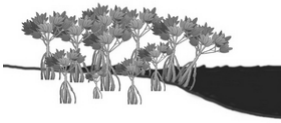
riverine

r&m_66



tide-dominated (fringe)

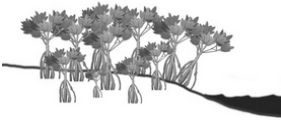
r&m_67



www.mangrove.at



www.mangrove.at



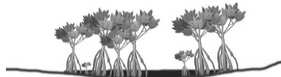
www.mangrove.at



www.mangrove.at

basin

r&m_68



www.mangrove.at

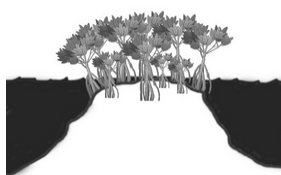


www.mangrove.at

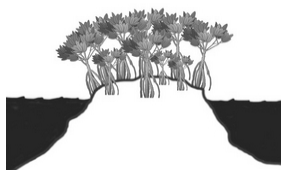


overwashed

r&m_69



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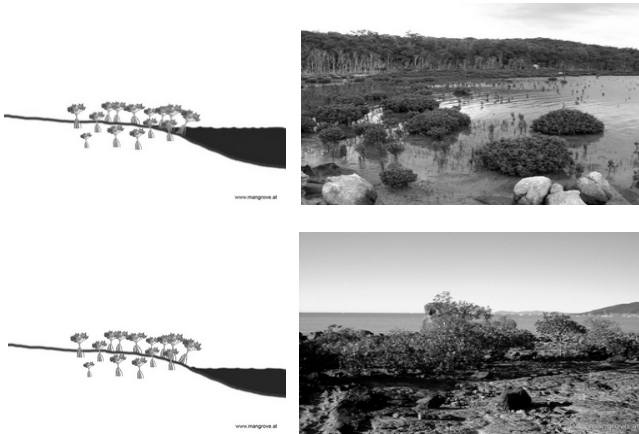


www.mangrove.at



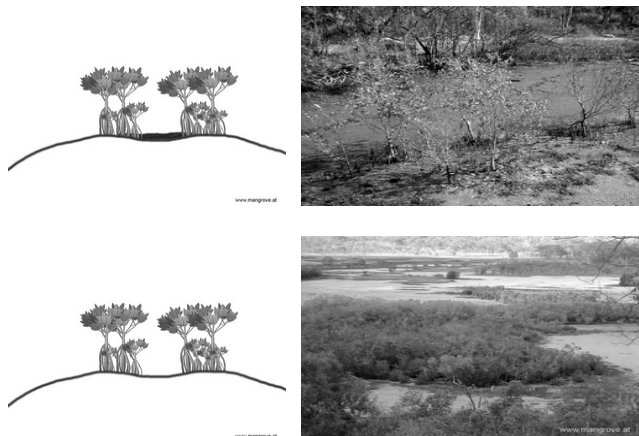
dwarf

r&m_70



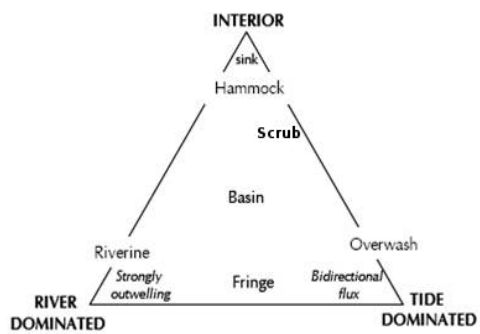
hammock

r&m_71



Ordination of mangrove types

r&m_72



r&m_73

r&m_74

r&m_75

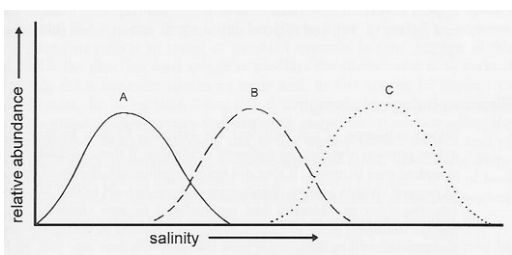
Propagulae at a shore

r&m_76



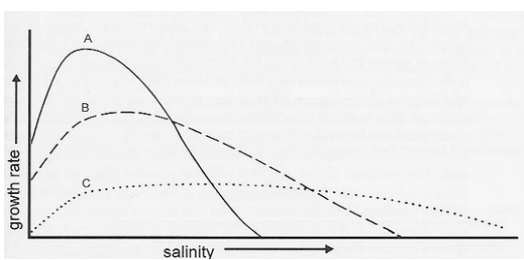
Observed zonation (theoretical example)

r&m_77



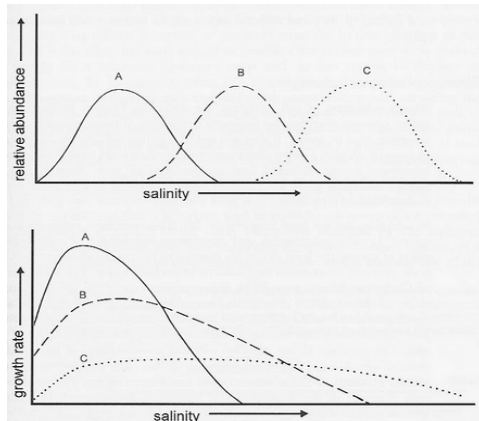
Mechanism underlying observed zonation (theoretical example)

r&m_78



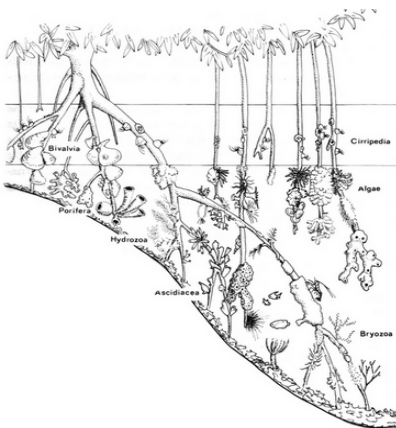
r&m_79

Mechanism underlying observed zonation



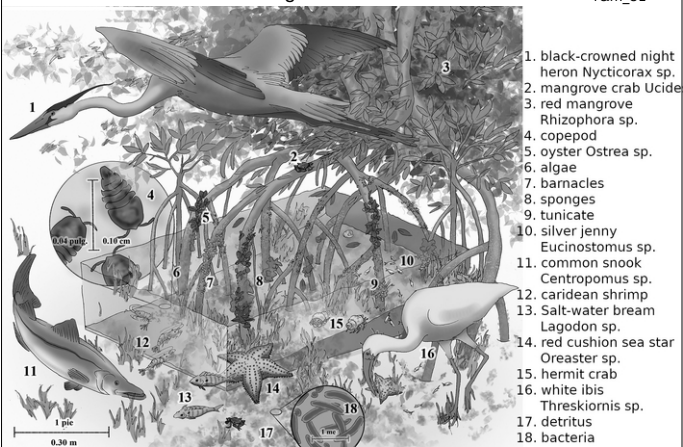
r&m_80

Assemblage inhabiting mangrove roots



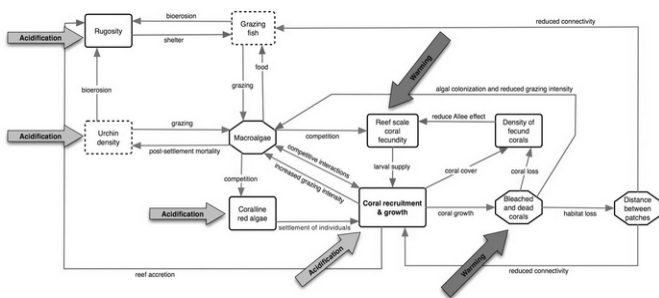
r&m_81

Mangrove biocenosis

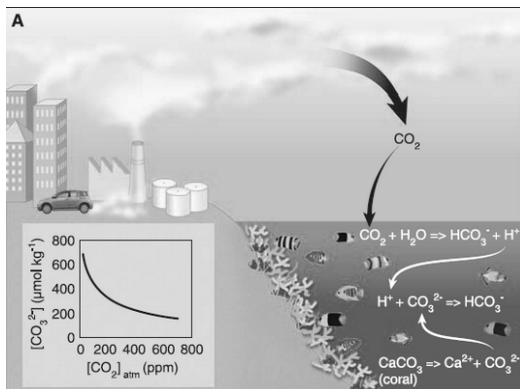


- Distribution
- Environmental factors
- Organisms
- Ecosystem structure
- Threats

acidification & warming



Acidification



Acidification

r&m_85

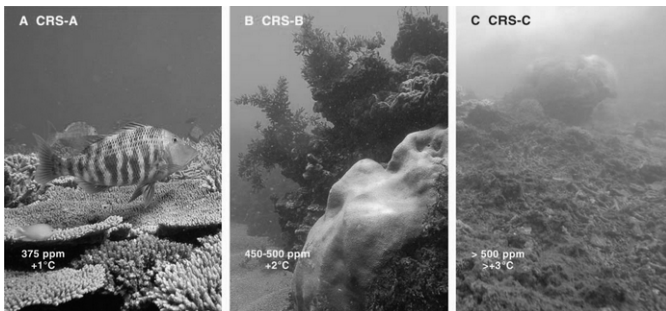
Possible coral responses

- decreased linear extension rate and skeletal density of coral colonies.
- maintaining physical extension or growth rate by reducing skeletal density.
- maintaining skeletal growth and density by investing greater energy in calcification.

Acidification

r&m_86

Possible scenarios



CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

r&m_87

HEALTHY CORAL 1

Coral and algae depend on each other to survive.



Coral have a symbiotic relationship with microscopic algae called zooxanthellae that live in their tissues. These algae are the coral's primary food source and give them their color.

STRESSED CORAL 2

If stressed, algae leaves the coral.



When the symbiotic relationship becomes stressed due to increased ocean temperature or pollution, the algae leave the coral's tissue.

BLEACHED CORAL 3

Coral is left bleached and vulnerable.



Without the algae, the coral loses its major source of food, turns white or very pale, and is more susceptible to disease.

WHAT CAUSES CORAL BLEACHING?

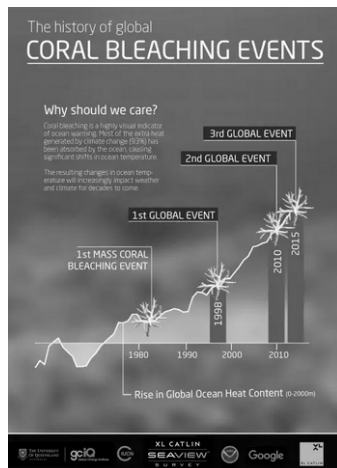
- Change in ocean temperature: Increased ocean temperature caused by climate change is the leading cause of coral bleaching.
- Runoff and pollution: Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants — these can bleach near shore corals.
- Overexposure to sunlight: When temperatures are high, high solar irradiance contributes to bleaching in shallow water corals.
- Extreme low tides: Exposure to the air during extreme low tides can cause bleaching in shallow corals.



Coral bleaching – causes

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- increased, or reduced water temperatures
- oxygen starvation caused by an increase in zooplankton levels as a result of overfishing
- increased solar irradiance
- increased sedimentation (due to silt runoff)
- bacterial infections
- changes in salinity
- herbicides
- low tide and exposure to air
- cyanide fishing



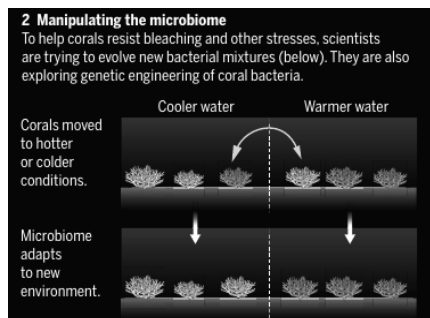
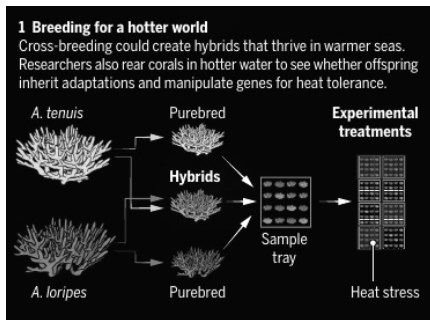
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	GROWTH FORM	CORAL FAMILY	EXAMPLES
LOW RESISTANCE	Fine branching	Pocilloporidae	<i>Seriatopora</i> <i>Stylophora</i> <i>Pocillopora</i>
	Branching, tabulate, encrusting/foliose	Acroporidae	<i>Acropora</i> <i>Montipora</i>
MEDIUM	Massive, brain	Favidae	<i>Favia</i> <i>Favites</i> <i>Leptoria</i> <i>Goniastrea</i> <i>Platygyria</i>
	Massive, boulder	Poritidae	<i>Porites</i> <i>Goniopora</i>
HIGH	Various	Various	<i>Turbinaria</i> <i>Cyphastrea</i>

A generalised hierarchy of coral susceptibility to bleaching

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What can be done to prevent further loss of coral reefs?



3 Adapting algae

Raising symbiotic algae in hotter conditions could create heat-tolerant strains that help prevent bleaching. Researchers are also altering algae DNA, a potential step toward genetic engineering.

