



HAL
open science

Coral reef ecosystem and its threats

Pascale Chabanet

► **To cite this version:**

Pascale Chabanet. Coral reef ecosystem and its threats. École thématique. DIDEM program Regional thematic school on the Vulnerability of Reef heritage, University of Seychelles, Seychelles. 2024. hal-04740714

HAL Id: hal-04740714

<https://hal.science/hal-04740714v1>

Submitted on 17 Oct 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

DIDEM program

Regional thematic school on the Vulnerability of Reef heritage

Coral reef ecosystem and its threats

Pascale CHABANET

French National Institute of Sustainable Development (IRD)

June 10, 2024 – Blue Economy Research University of Seychelles



FONDS FRANÇAIS POUR
L'ENVIRONNEMENT MONDIAL

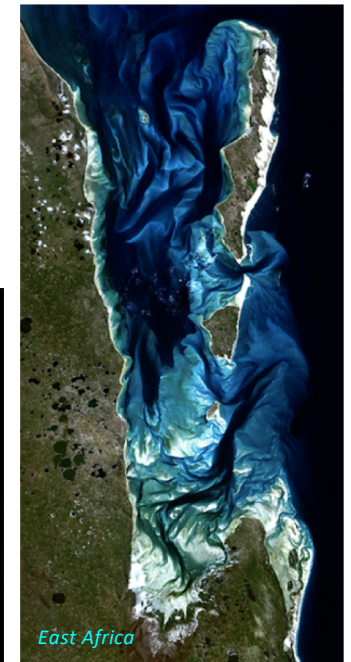
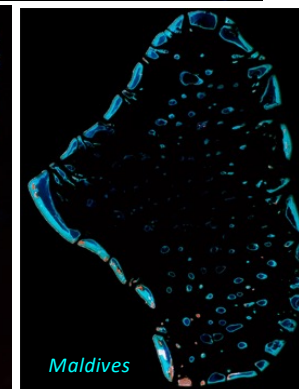
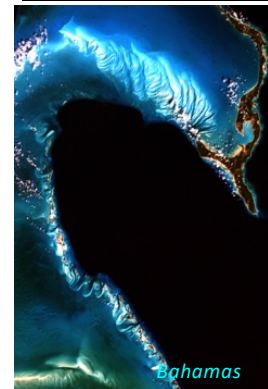
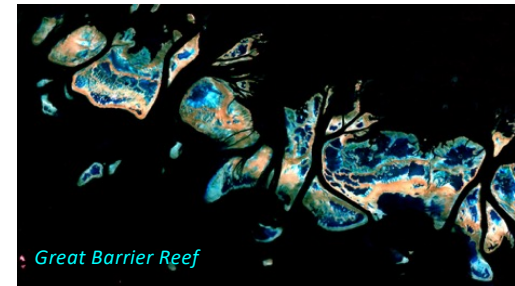
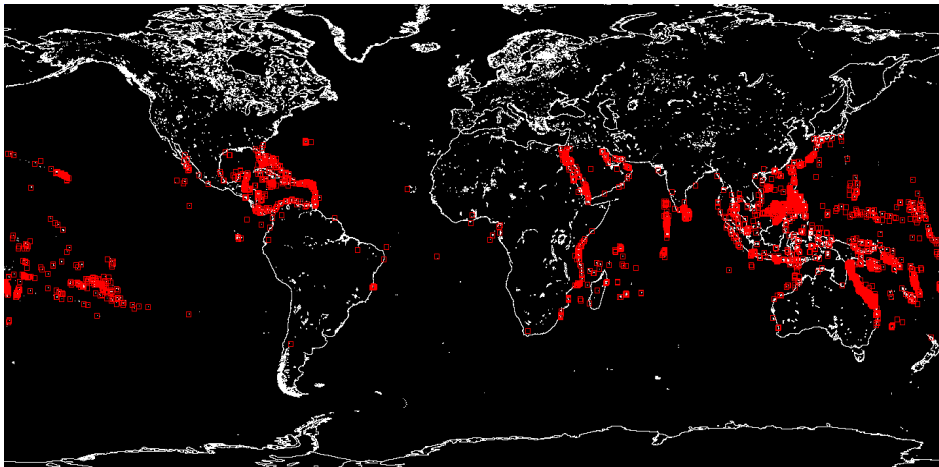


UNIVERSITY OF
SEYCHELLES
Knowledge hub of the Indian Ocean



INTRODUCTION

- Coral reefs found in **intertropical zone** (\approx between 33°N and 30°S) in > 100 countries and territories
- The **largest living structure** in the world -> Great Barrier Reef visible from space

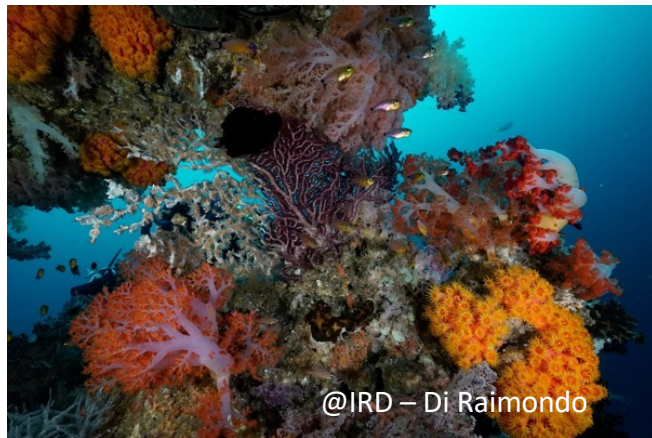


Millennium Coral Reef Mapping Project (USF, IRD), Images acquired by the Landsat 7 satellite, NASA and USGS.

INTRODUCTION

The **most diverse marine ecosystem** on Earth ($\approx 100\ 000$ sp recorded)
30% marine biodiversity $< 0.2\%$ of the seafloor

↔ **underwater rainforests**



INTRODUCTION

Major importance in tropical environments

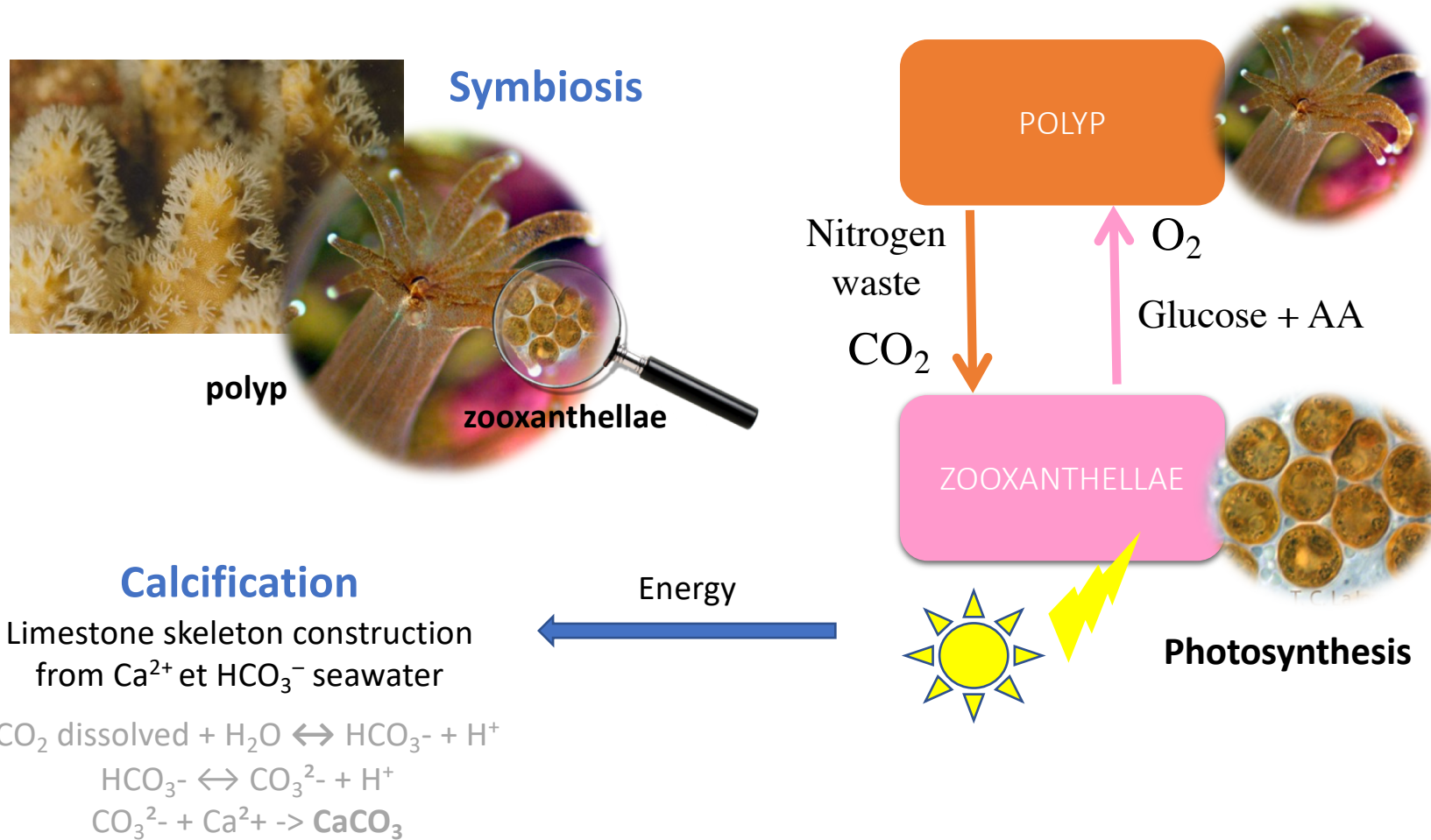
Ecosystem services

- Climate regulation
- Protection from storm surges
- Food source through subsistence fishing
- Income sources - commercial fishing, tourism
- Medical properties
- Cultural and patrimonial value



At the base of these underwater rainforests

a tiny animal, the **polyp** which associates with algae, the **zooxanthellae**



A successful association which requires a very stable environment

Temperature: 20° - 29° C (% sp range)
Illuminance: sufficient for photosynthesis
Depth: % transparency (1-50 m)
Salinity: normal (approx. 35/1000)
Turbidity: influences illuminance
Substrate: stable and solid

↔ Coastal environments

Stress

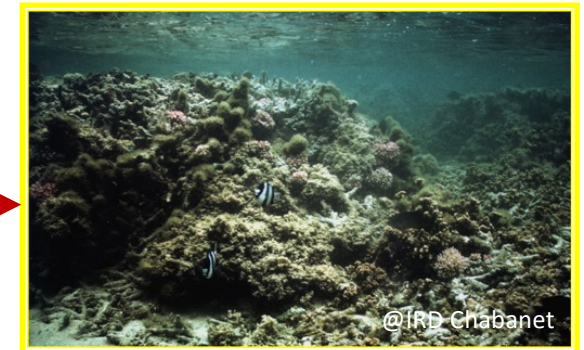
Any **environmental stress** ($T > 1^{\circ}\text{C}$) can break the symbiosis and cause zooxanthellae expulsion => **coral bleaching and death**



Live corals



Coral bleaching



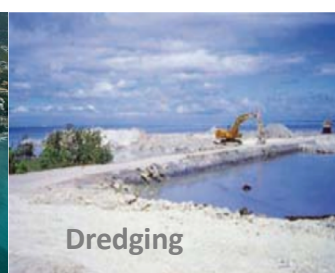
Dead corals – macroalgal-dominated

THREATS – LOCAL HUMAN STRESSORS

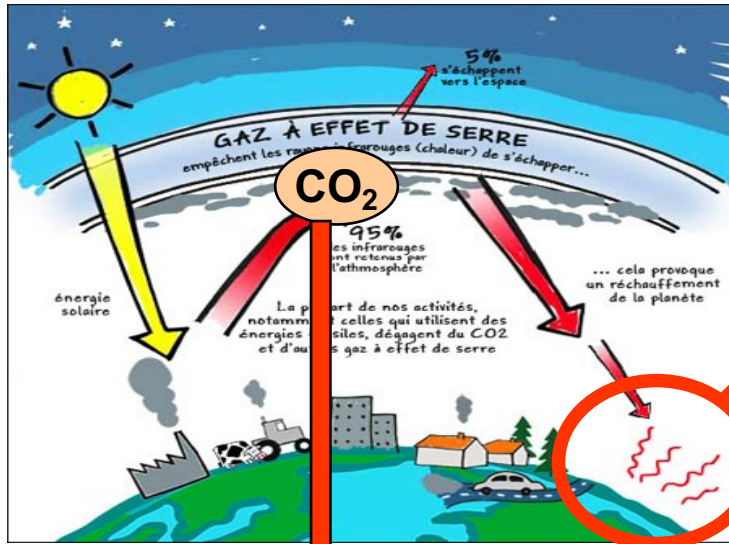
25% of coral reefs have disappeared, 50% are in critical condition (ICRI, 2021)

Main threats come from human activities

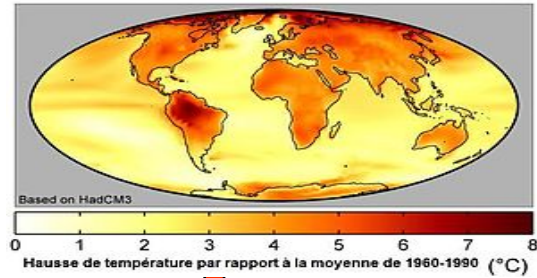
- **Land-based sources of pollution** ⇔ coastal development, deforestation, agriculture => sedimentation, pollution, eutrophication, pathogens ...
- **Marine pollution** ⇔ sewage, oil spills, anti-fooling, ...
- **Overfishing** => declines in fish populations and disrupting the food web of the ecosystem + coral habitat alteration due to destructive fishing practices
- **Invasive species** => competition with native reef species / *Pterois volitans*, *Xenia sp*
- **Unsustainable tourism and development** and recreative activities



THREATS – CLIMATE CHANGE



Prévisions des hausses de températures pour 2070-2100



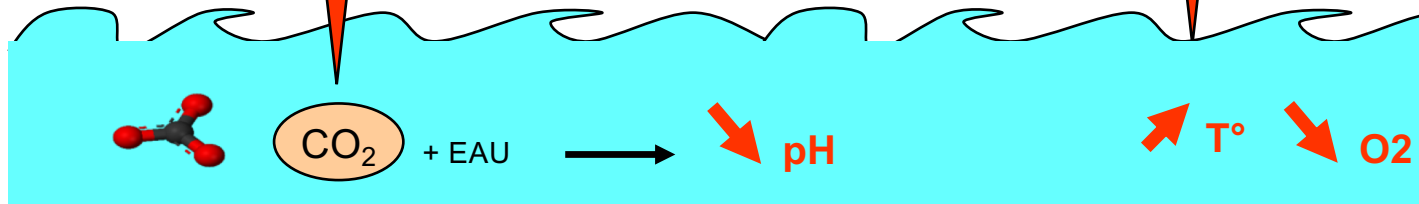
≥ 2°C ?

Ocean acidification

25%

Global warming

93%



1850- 2020

2020-2100

pH +30%

+150%

1850- 2020

2020-2100

T° +0.9°

+2 to +5°

(IPCC, 2022)

THREATS – CLIMATE CHANGE

Local human impacts make coral reef less resilient to global change

- **Rising temperature** => massive coral bleaching
- **Changing weather**
 - stronger extreme events (cyclones, typhoon) => physical destruction of coral reefs
 - stronger precipitation => increased runoff of freshwater, sediment & land-based pollutants to reefs
 - more frequent El Niño events => ↑ heat waves (intensity and frequency) and massive coral bleaching
- **Sea level rise** => increased marine submersion and coastal vulnerability to wave energy
- **Ocean acidification**
=> increases water acidity and decreases the concentration of carbonates => reduction of coral growth, reproduction and overall coral reef calcification



Coral reef degradation

⇒ **destruction and fragmentation of habitats and loss of biodiversity**

- Reduced resilience
- Decline in keystone species (parrotfish, sea urchins, ...)
- Disruption of trophic interactions and cascading effects => ecosystem instability
- Altered ecosystem function as well as goods and services provide to people
- Cascading effects on fisheries, tourism, coastal protection, human security

Protecting coral reef is essential to maintain ecosystem resilience, their functioning and services they provide

