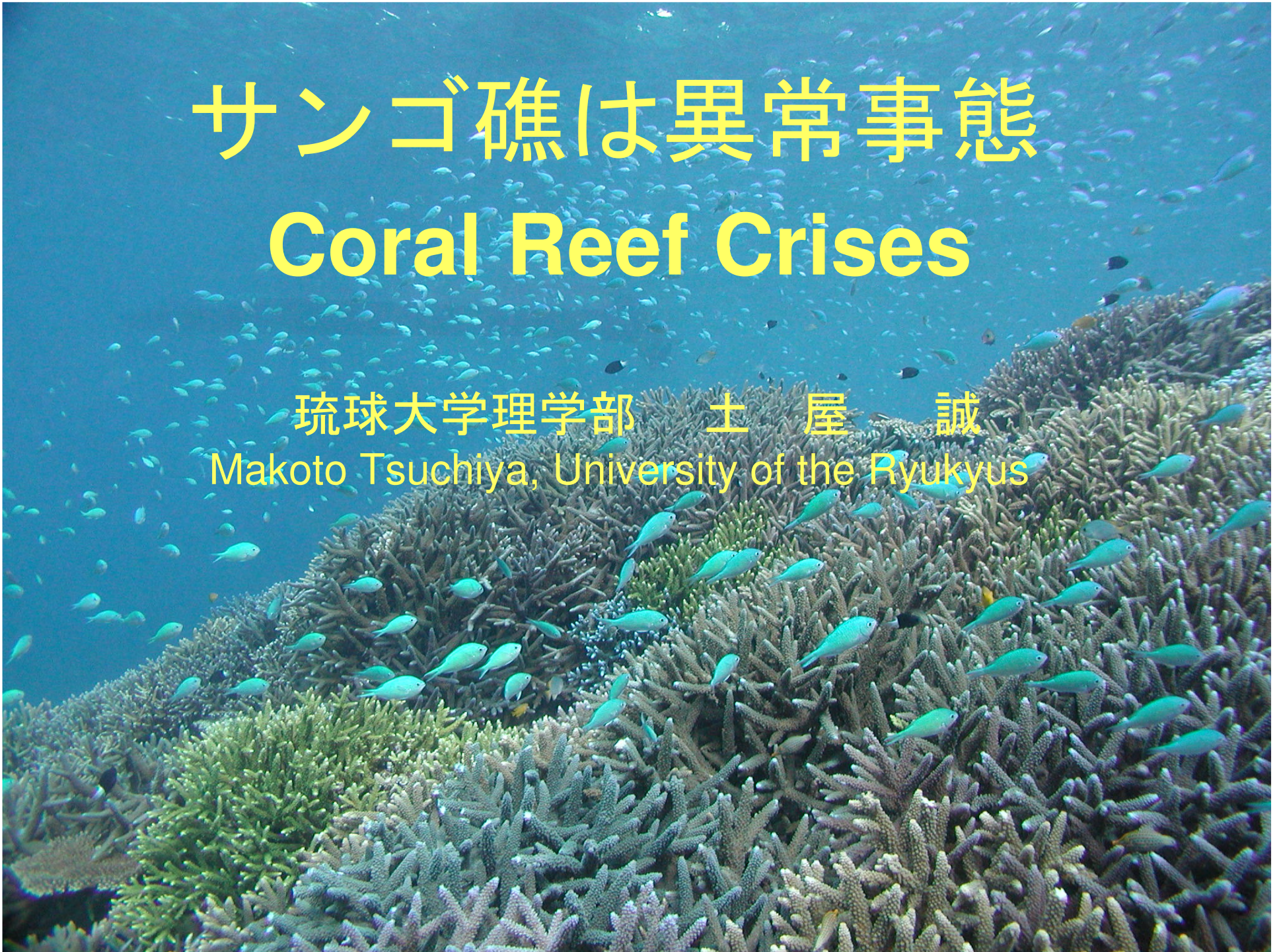


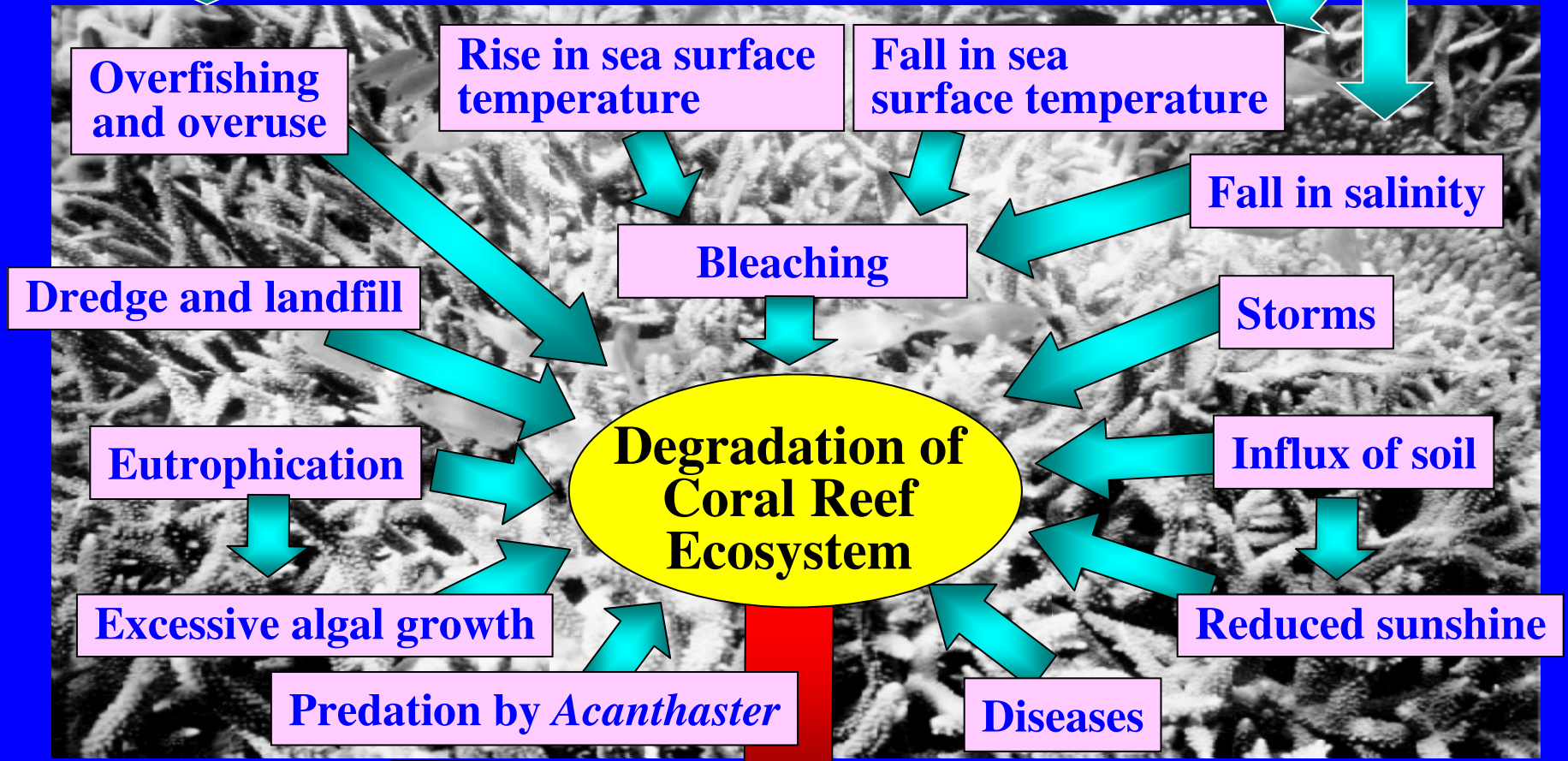
サンゴ礁は異常事態 Coral Reef Crises

琉球大学理学部 土屋 誠
Makoto Tsuchiya, University of the Ryukyus



Disturbances of coral reefs

Human activities → Increase in atmospheric CO₂ concentration → Climatic changes

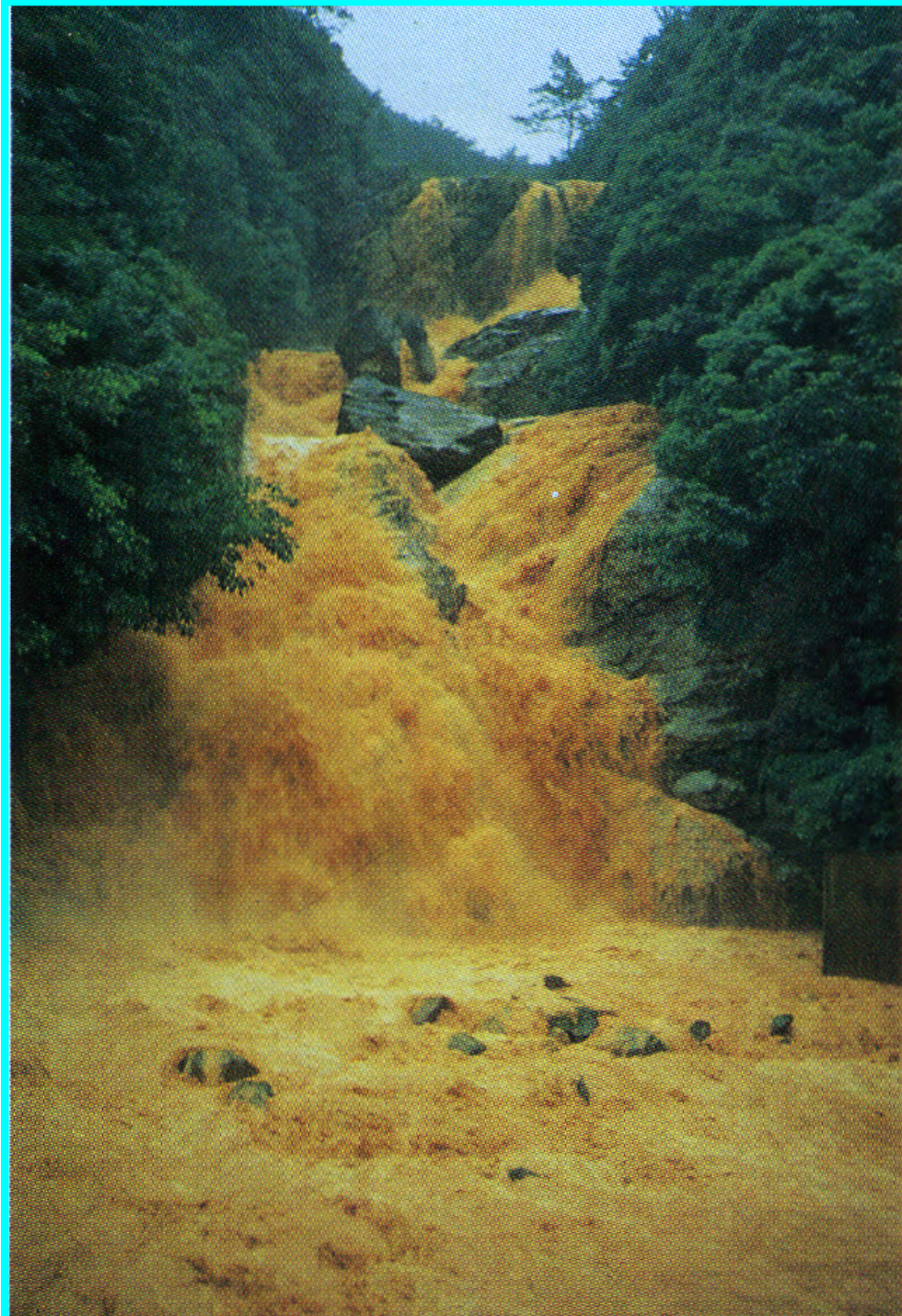


Decrease in living space

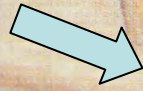
Decrease in marine products

Decrease in biodiversity

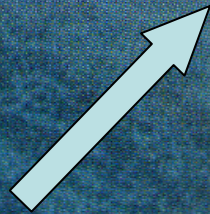
Decrease in tourist attractions



川 River mouth



サンゴ礁に流れ込んだ赤土
Terrigenous fine particles



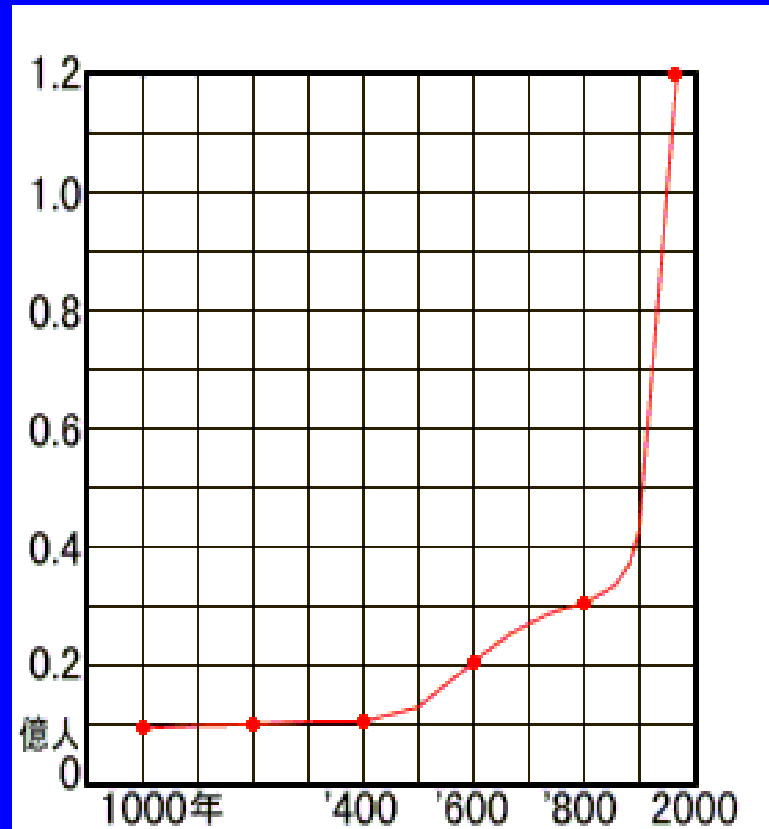


サンゴを食べるオニヒトデ
Acanthaster feeding on a coral



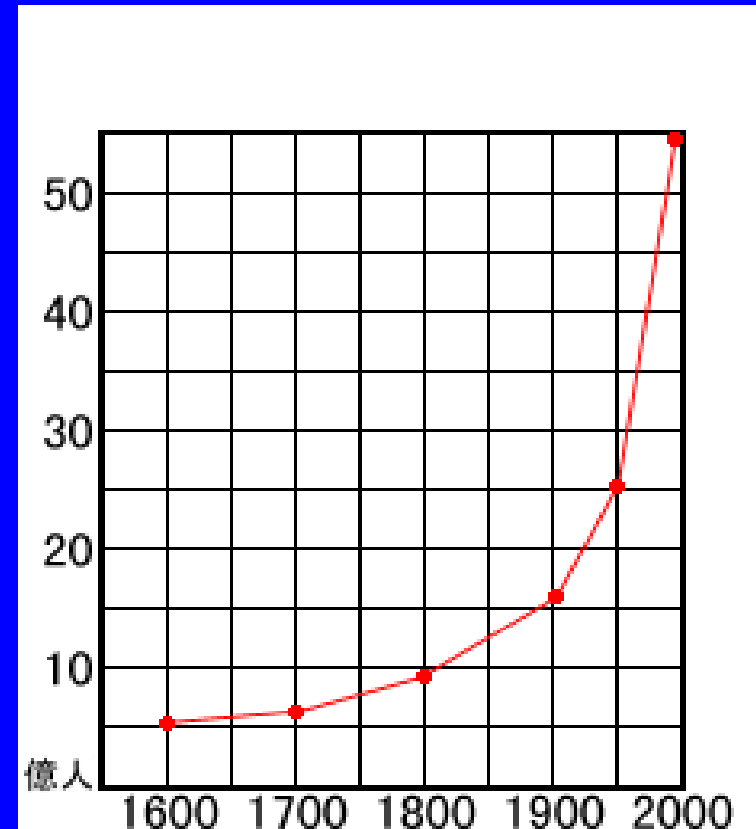
日本と世界の人口増加

Growth of the human population



日本の人口増加

(Imidas93日本総人口過去より)



世界の人口増加

(平成6年環境白書総説より)

World Population Growth

Did you know...?

World population did not reach one billion until 1804

It took; 123 years to reach 2 billion in 1927

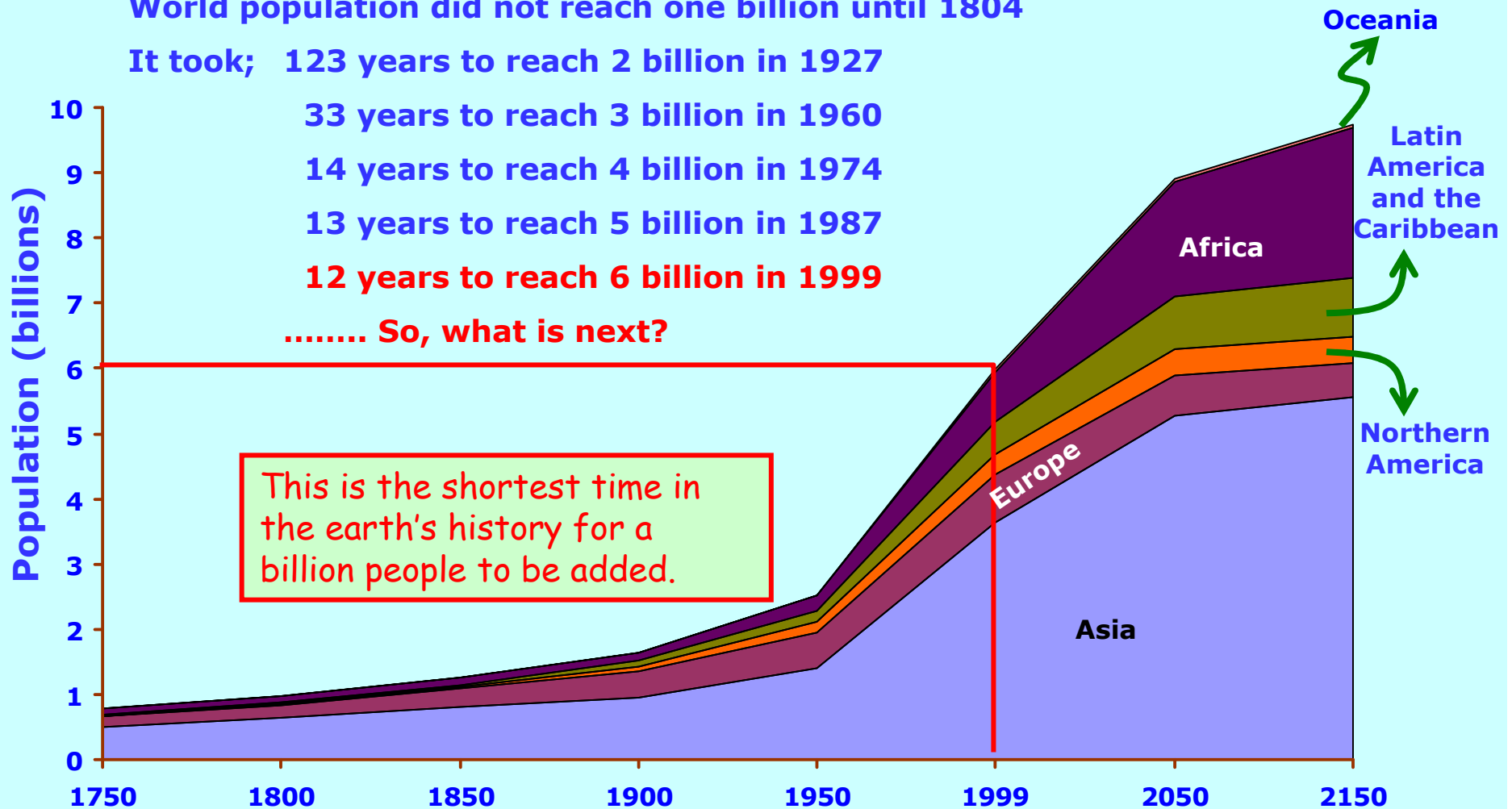
33 years to reach 3 billion in 1960

14 years to reach 4 billion in 1974

13 years to reach 5 billion in 1987

12 years to reach 6 billion in 1999

..... So, what is next?



Source : UN, The World at Six Billion

何が心配か？

Need to worry?

- 食料は十分か？ Enough amount of foods?
- 自然と人間のバランスは維持できるか？
Balance between nature and human activities
- つまり、人口はどこまで増えても大丈夫か？
How many people are living on the earth?

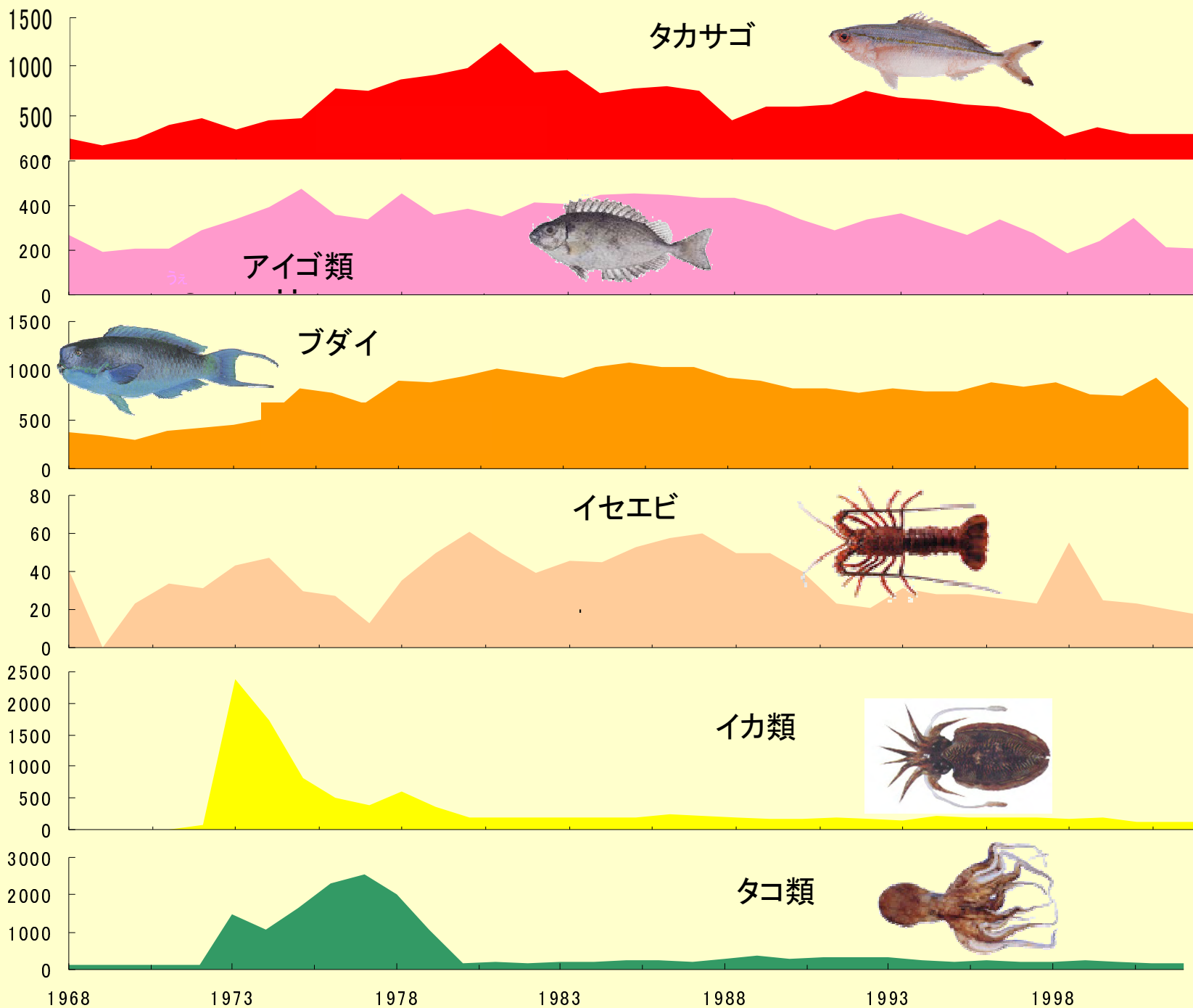
- 地域的な現象 Local phenomena
- 地球規模の現象 Global phenomena



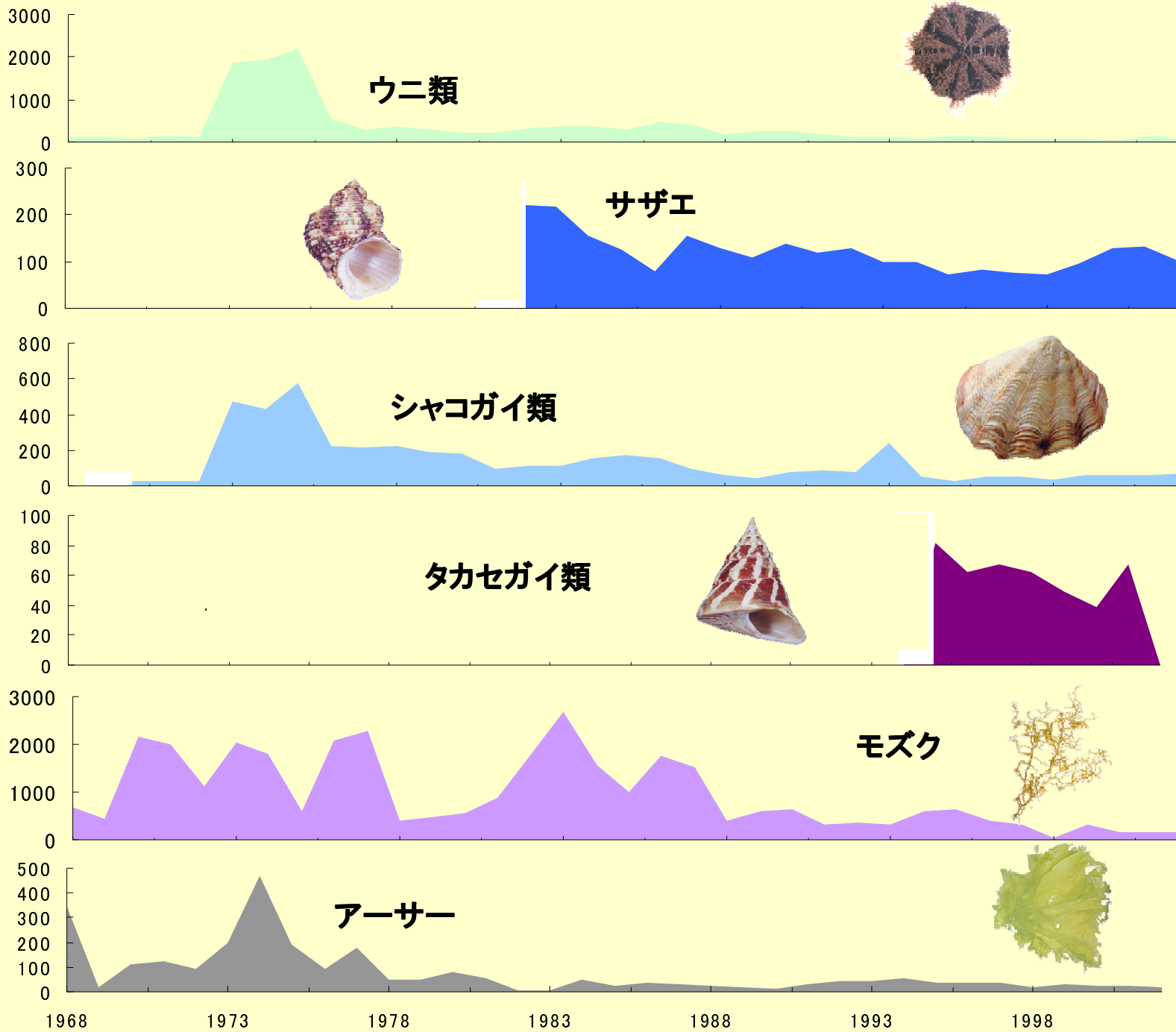
サンゴ礁で健康診断をする

Medical check of our planet using coral reefs

漁獲量(ぎょかくりょう)(トン/年)
Fish catch (ton/yr)



漁獲量(ぎょかくりょう)(トン/年)
Fish catch (ton/yr)



潮が良く引いたある日、多くのサンゴが顔を出した
Healthy coral community in the reef edge



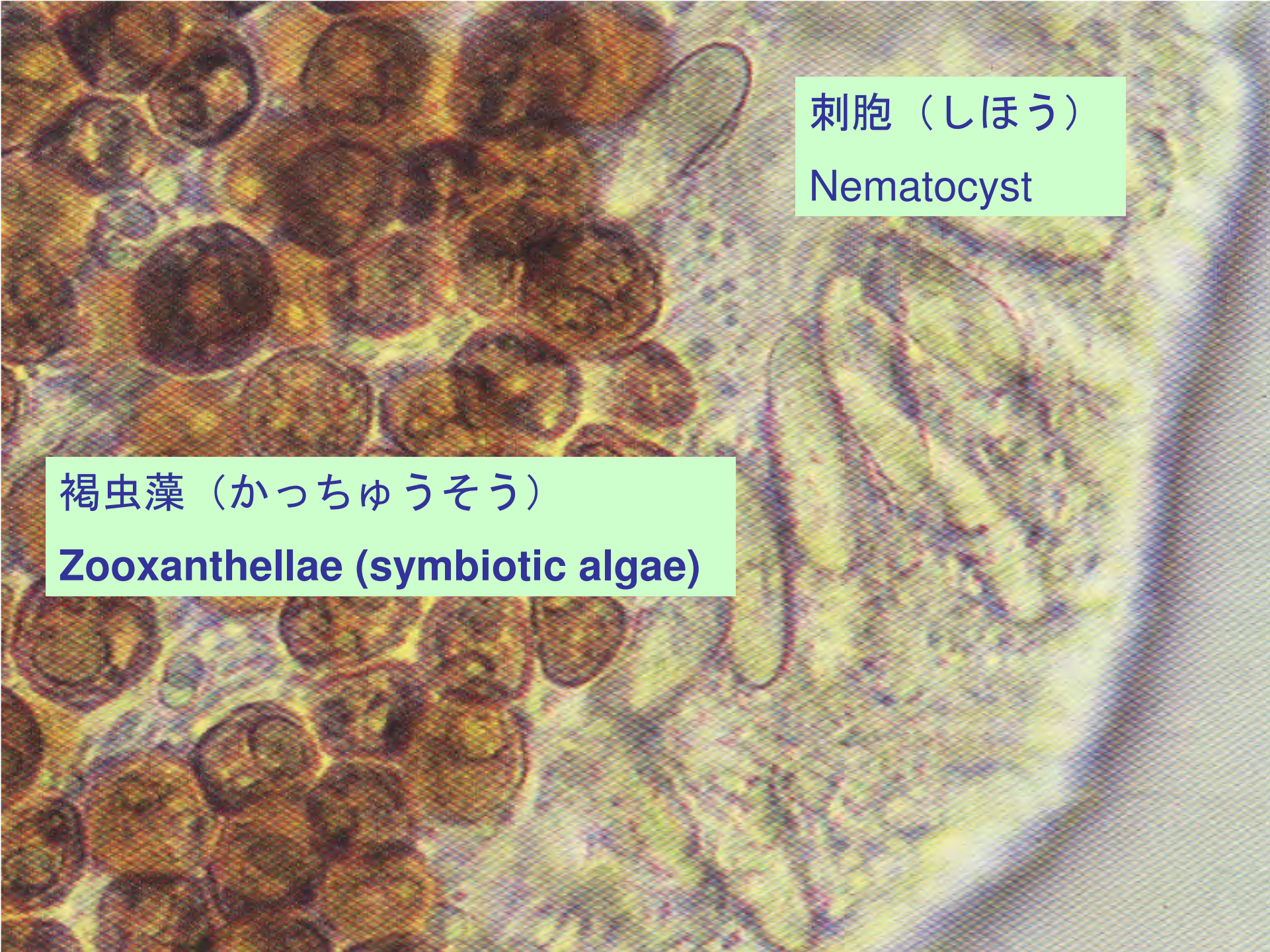
1998年の夏、世界中のサンゴ礁で白化が起こり、
多くのサンゴが死んでしまった

Mass coral bleaching occurred in 1998



A close-up photograph of a coral reef. The image shows a dense field of coral polyps with numerous tentacles extending from their surfaces. The colors are primarily brown, tan, and yellow, with some darker green and blue patches. A light blue callout box with a white border and a pointer is positioned in the upper left quadrant, containing the text '触手' and 'Tentacles'.

触手
Tentacles



刺胞（しほう）

Nematocyst

褐虫藻（かっちゅうそう）

Zooxanthellae (symbiotic algae)

なぜサンゴは白くなるか？ **Mechanism of coral bleaching**

- ← 骨の色が透けて見える
- ← サンゴの組織は透明
- ← 褐虫藻が排出される。なぜ？

白化 : サンゴと褐虫藻の共生関係の崩壊
Destruction of the relationship between corals and symbiotic algae



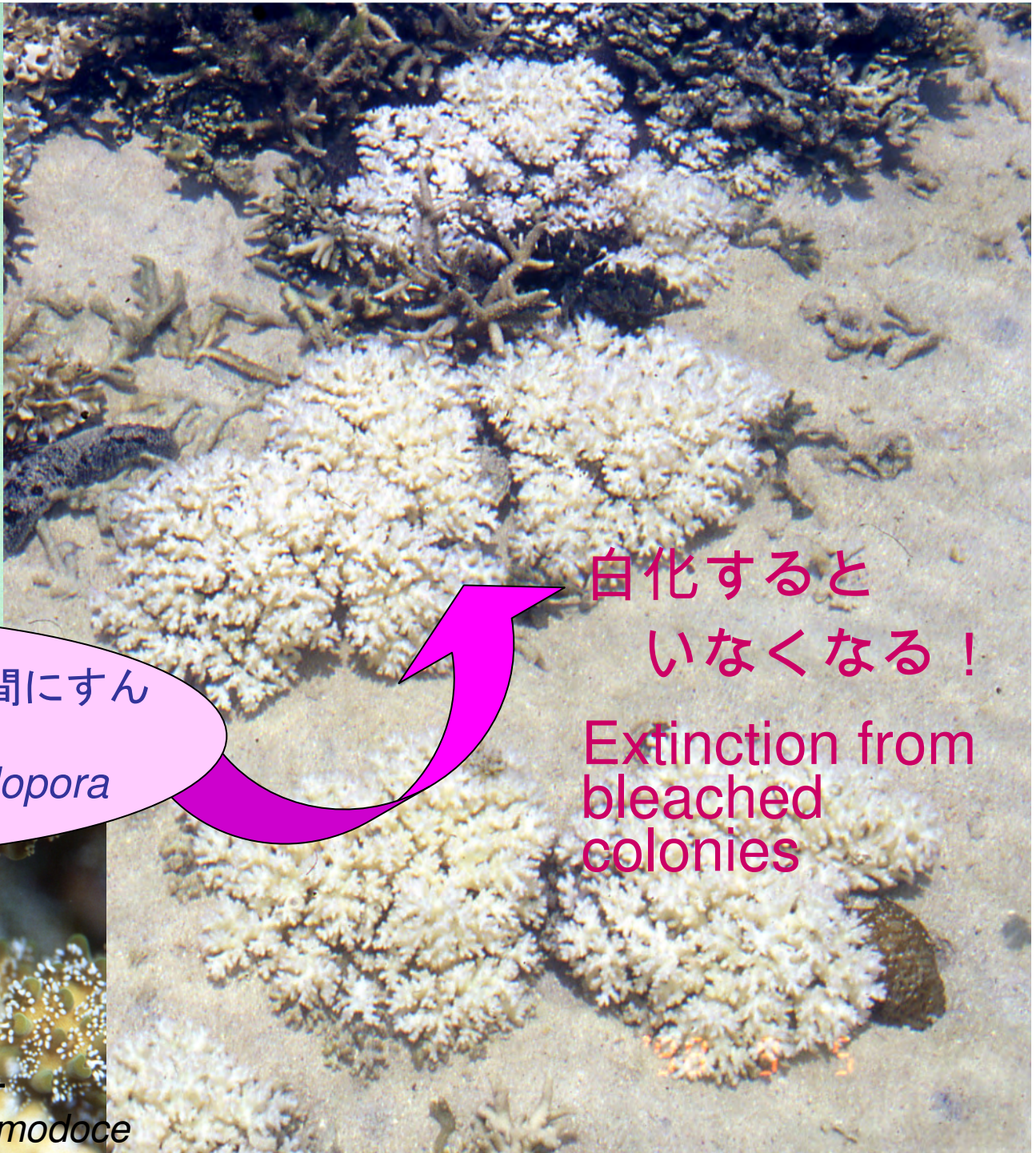
ハナヤサイサンゴの枝の間にすんでいる生き物たち

Coral associates on *Pocillopora*



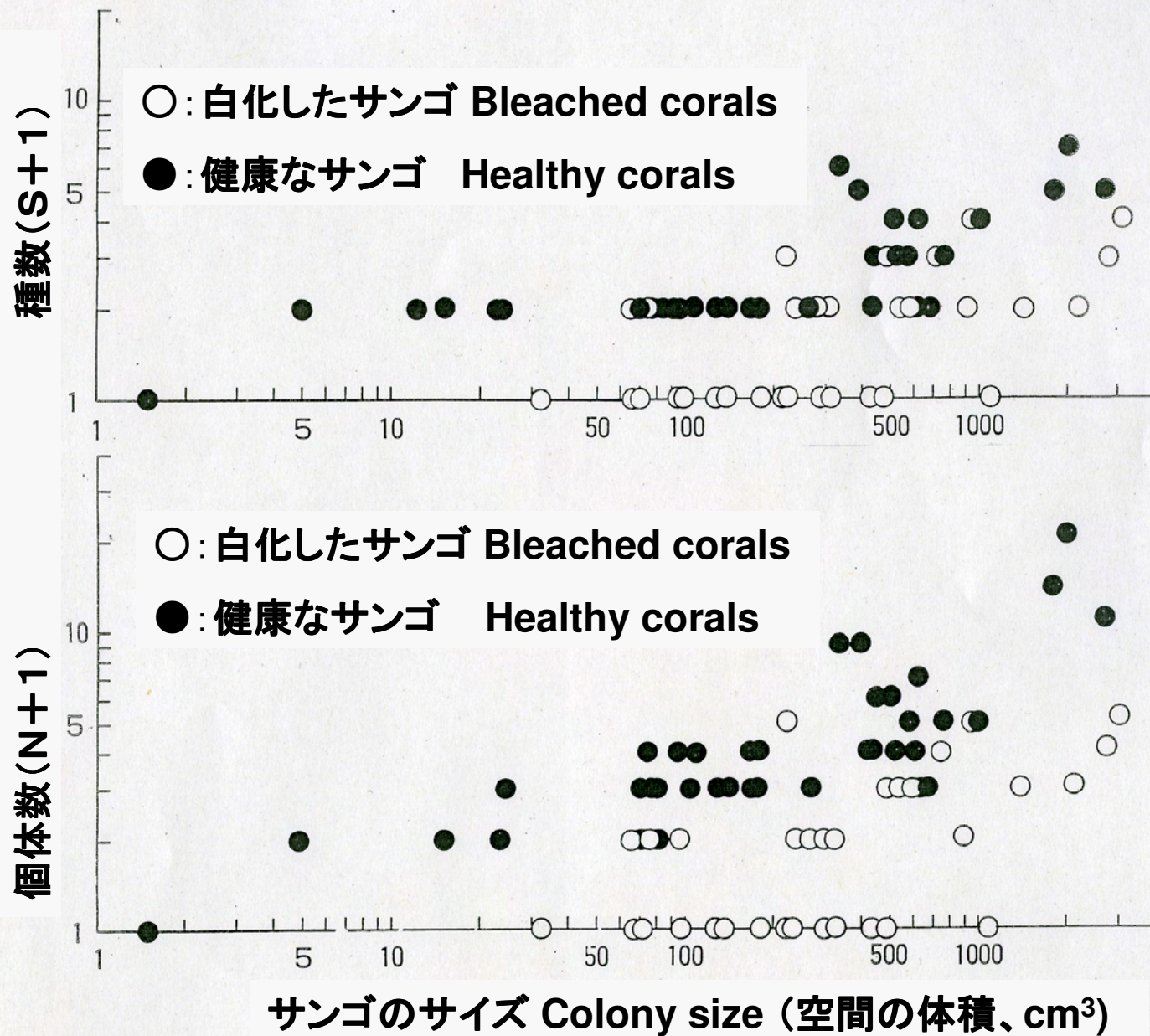
サンゴガニ

Trapezia cymodoce



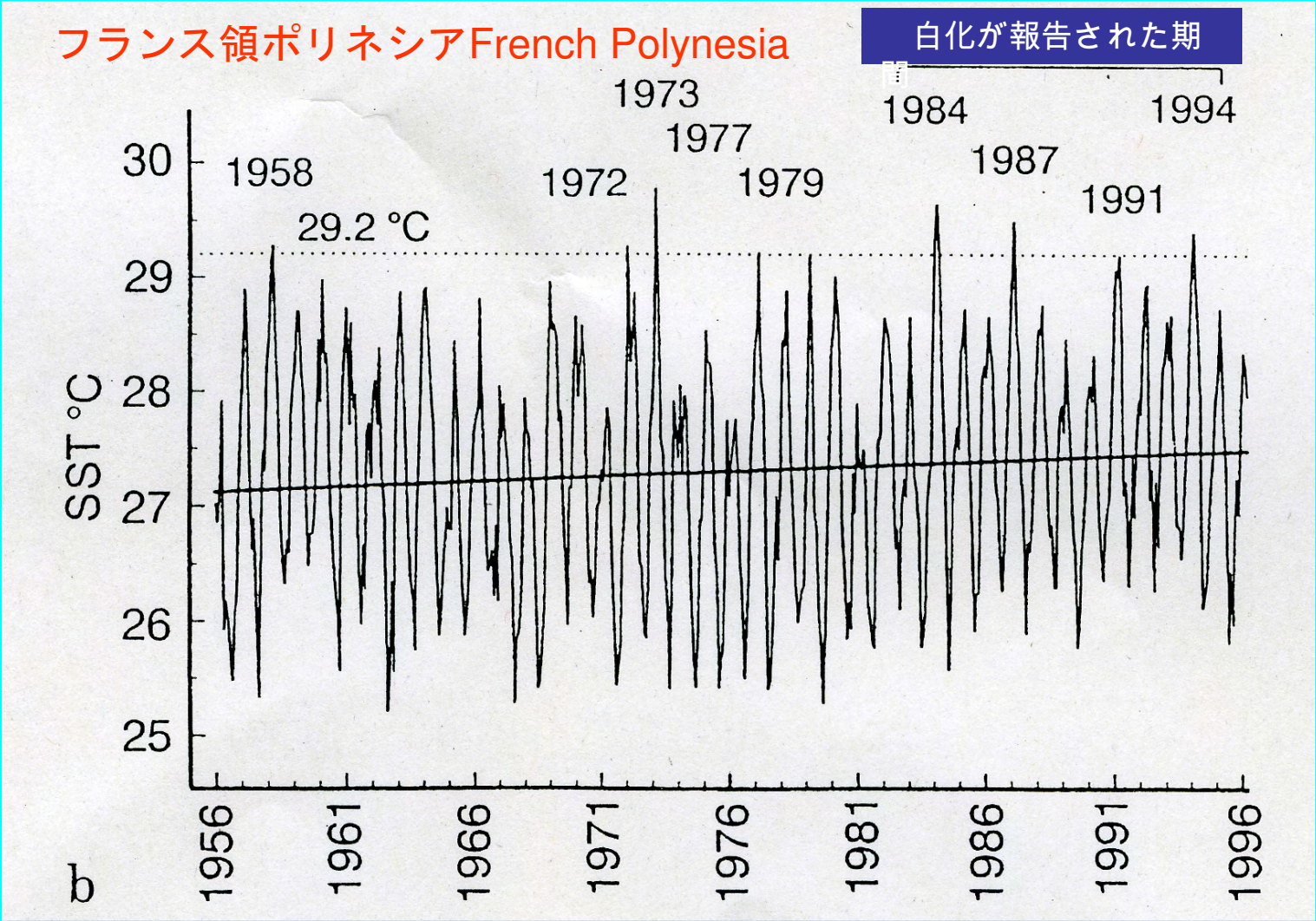
白化すると
いなくなる！

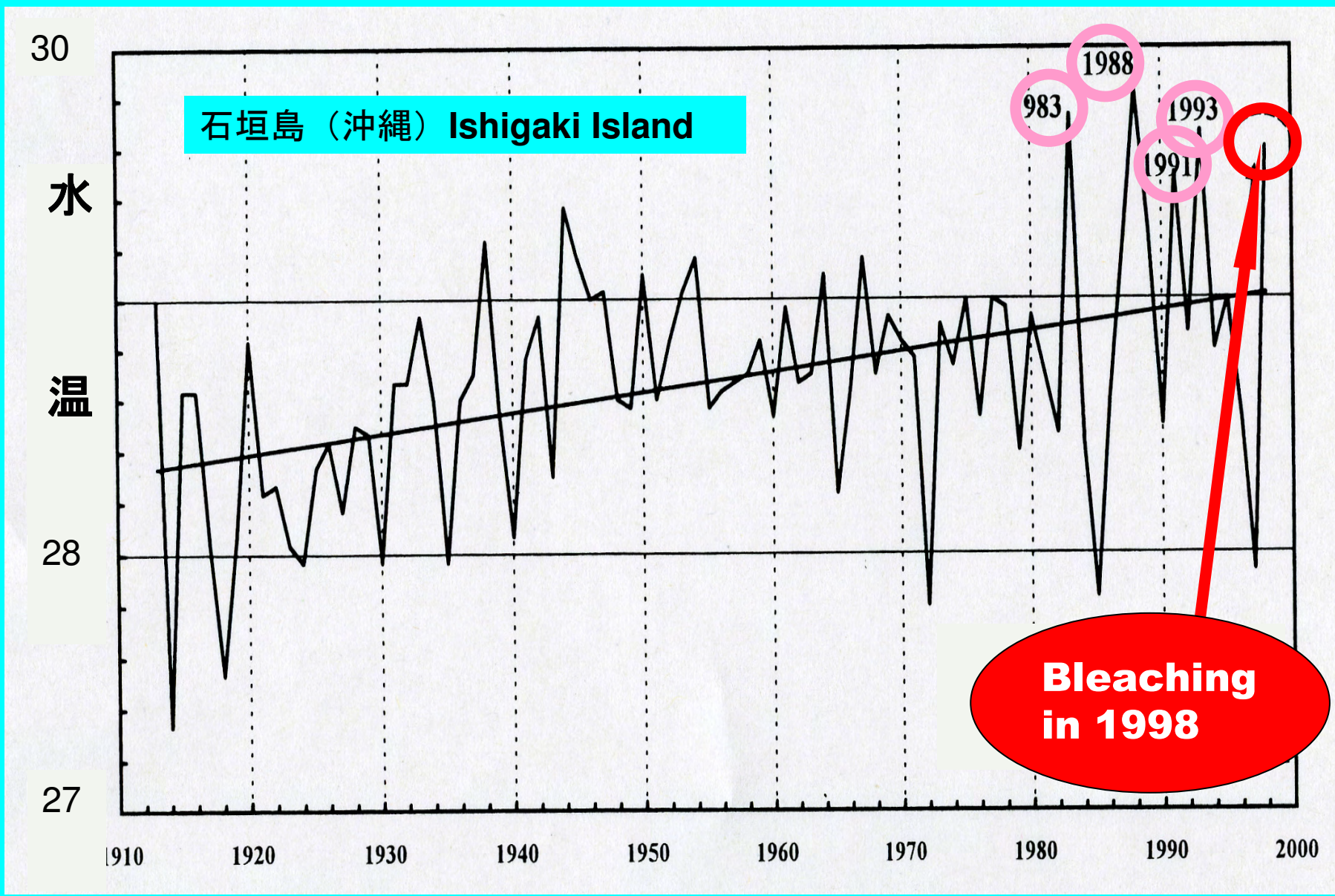
Extinction from
bleached
colonies



ハナヤサイサンゴのサイズとサンゴガニ類の種数（上）と個体数（下）の関係
Relationship between colony size and species richness and abundance in *Trapezia*

31
プケット (タイ) Phuket
1991 1995





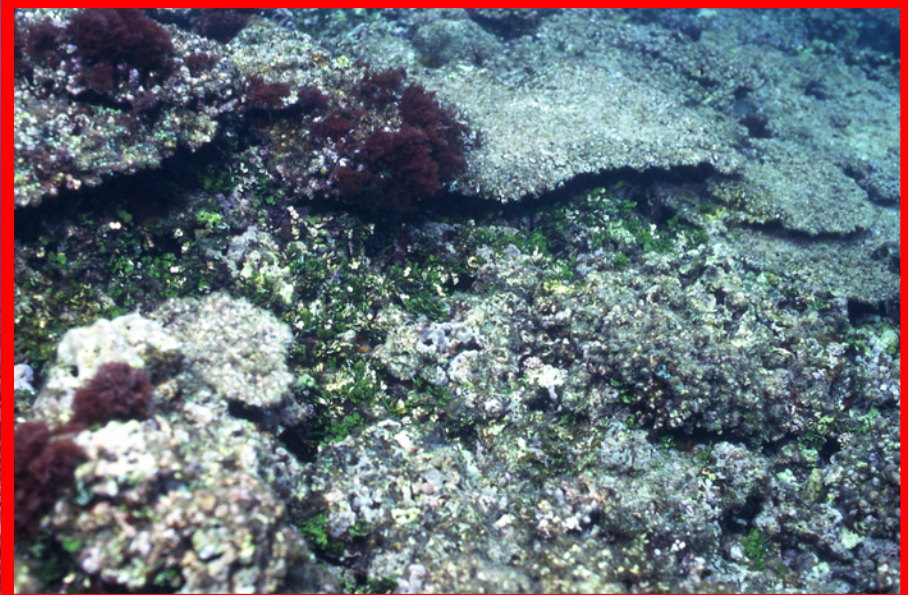
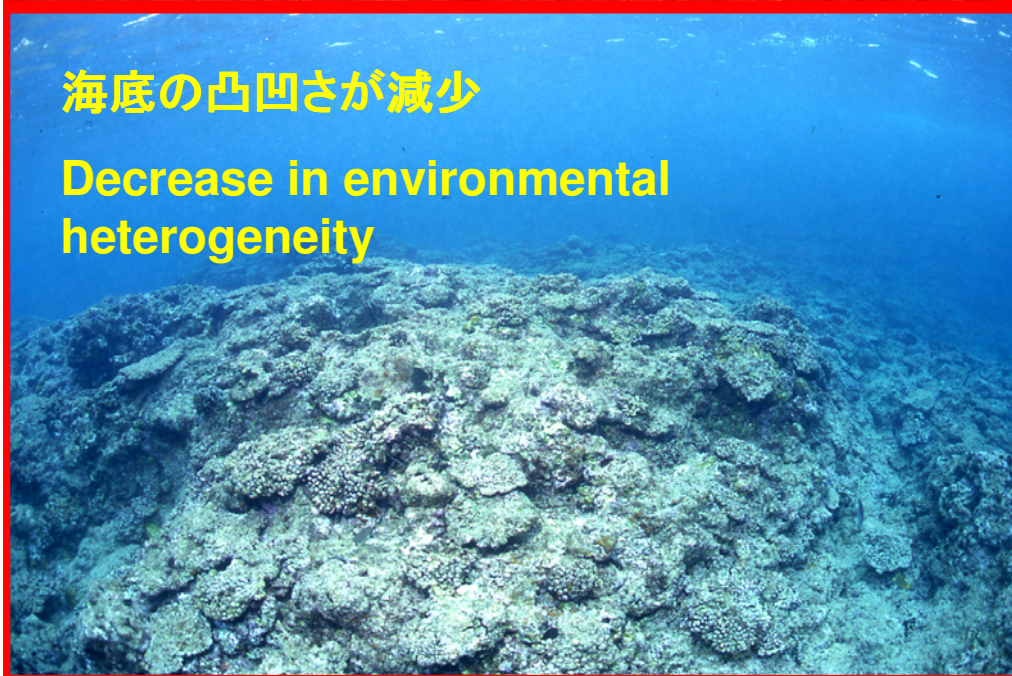
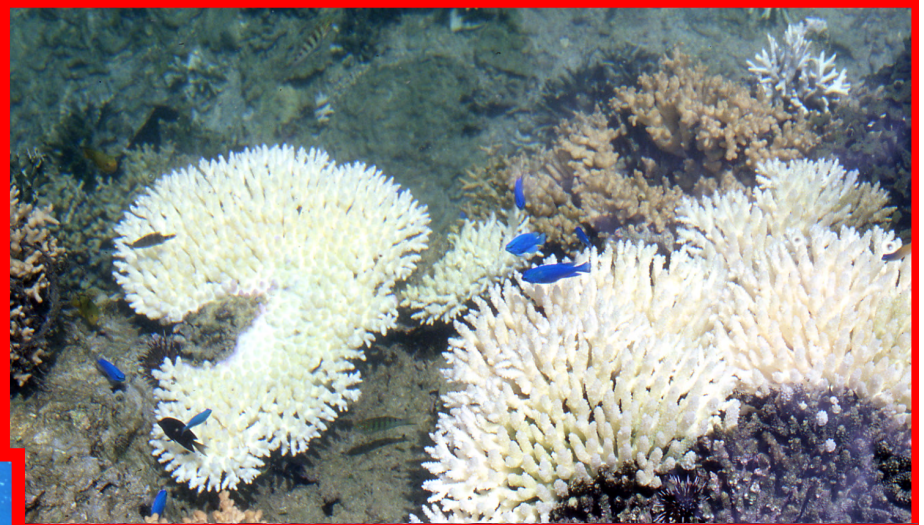
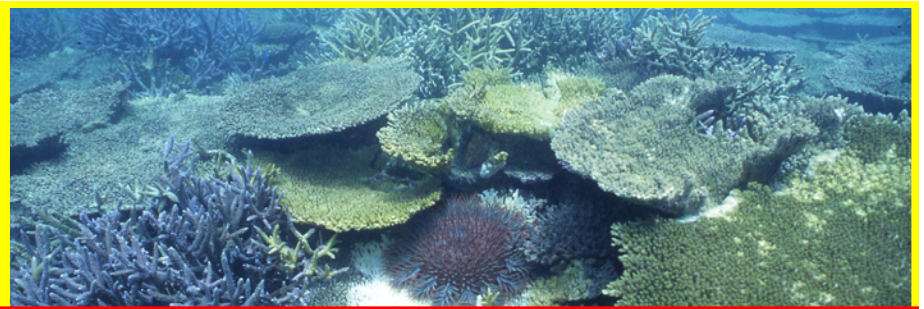
夏期 (7~9月) の水温変化 Change in SST during July to September

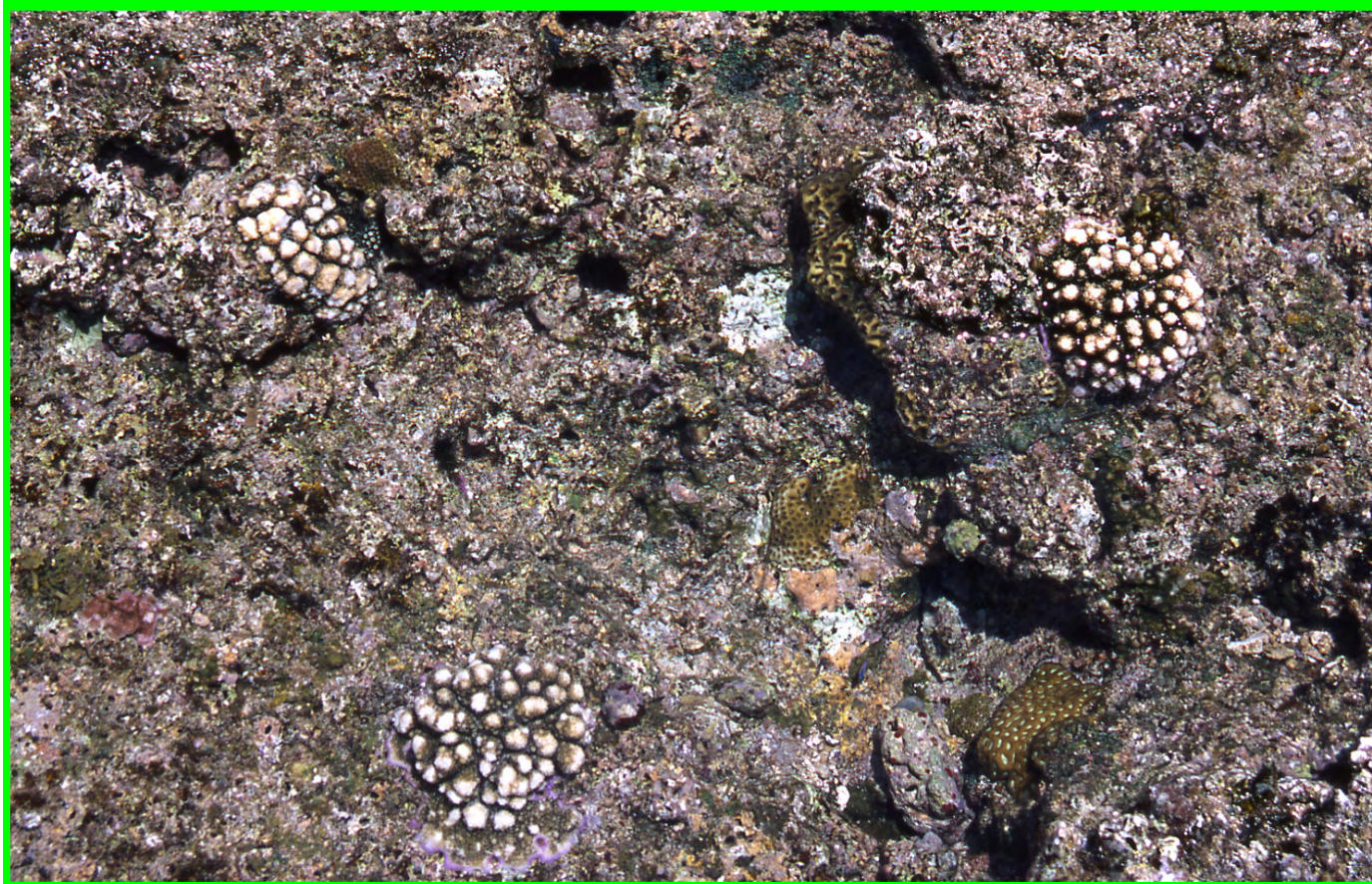
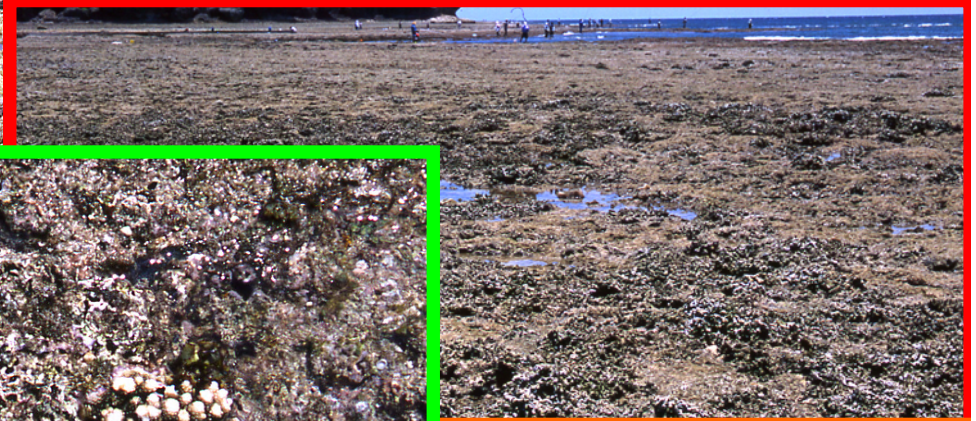
ハマサンゴが褐虫藻を放出

Porites releasing symbiotic algae

July 28, 2007





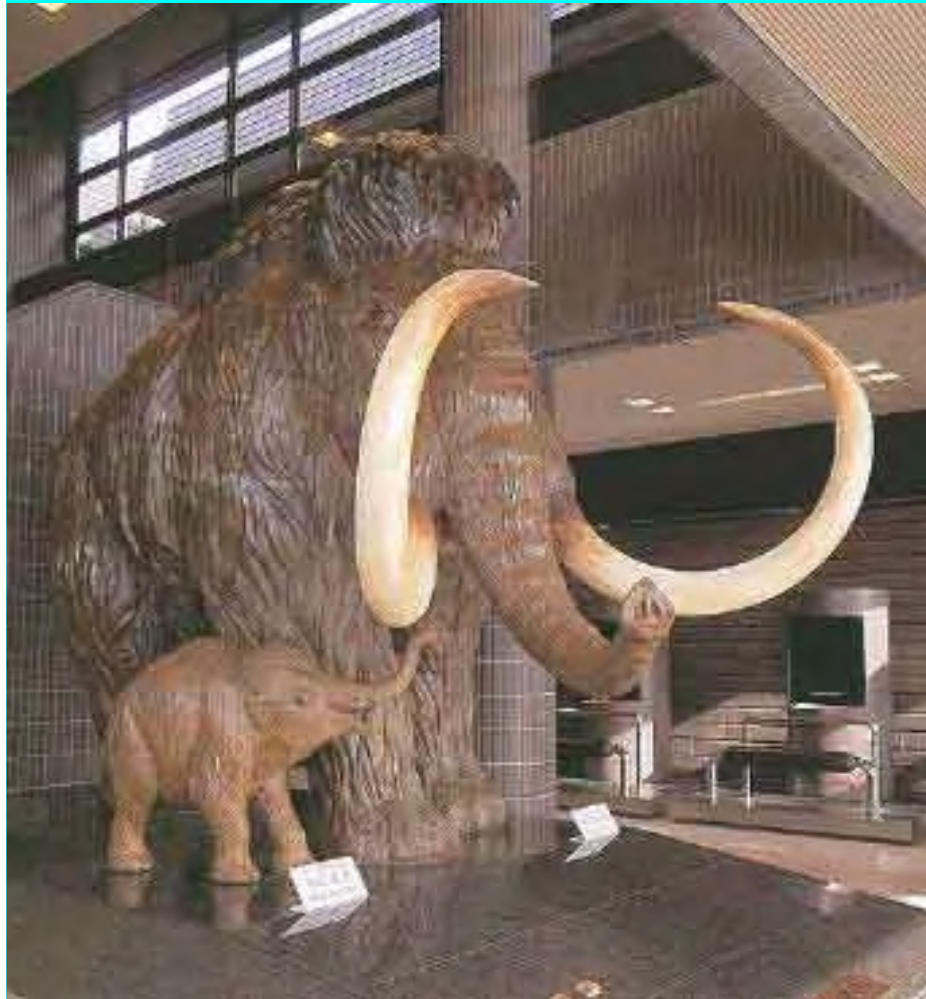


July, 2007



動物や植物は地球環境の変化
を教えてくれる

Plants and animals as indicators for
global change



e

(北半球の場合)

from south to north

れる

es

serve



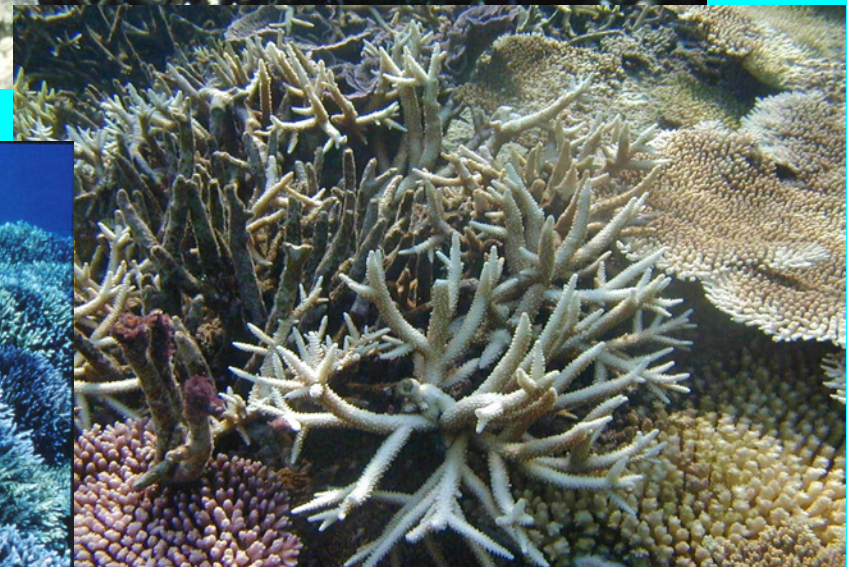
オカヤドカリ類

Nature restoration project at Sekisei Lagoon

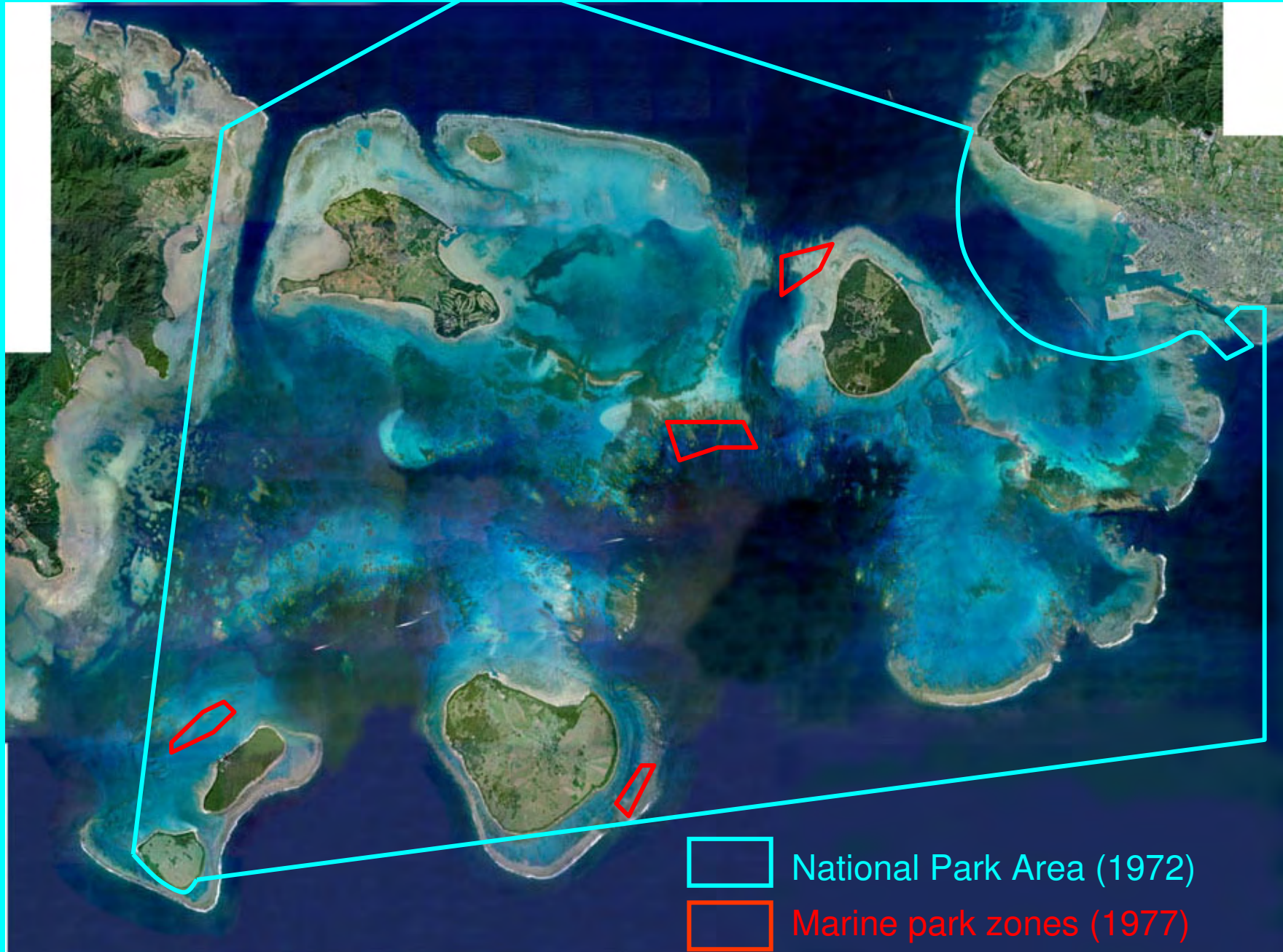
石西礁湖自然再生事業



Hermatypic corals count 360 species

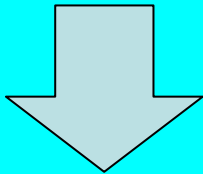


Iriomote Narional Park

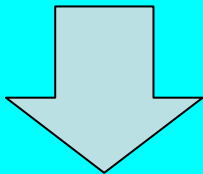


Nature restoration project

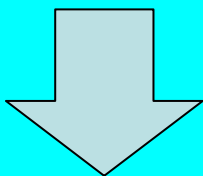
1) Survey of the natural environment (2002-2004)



2) Master Plan for Nature restoration (2005)



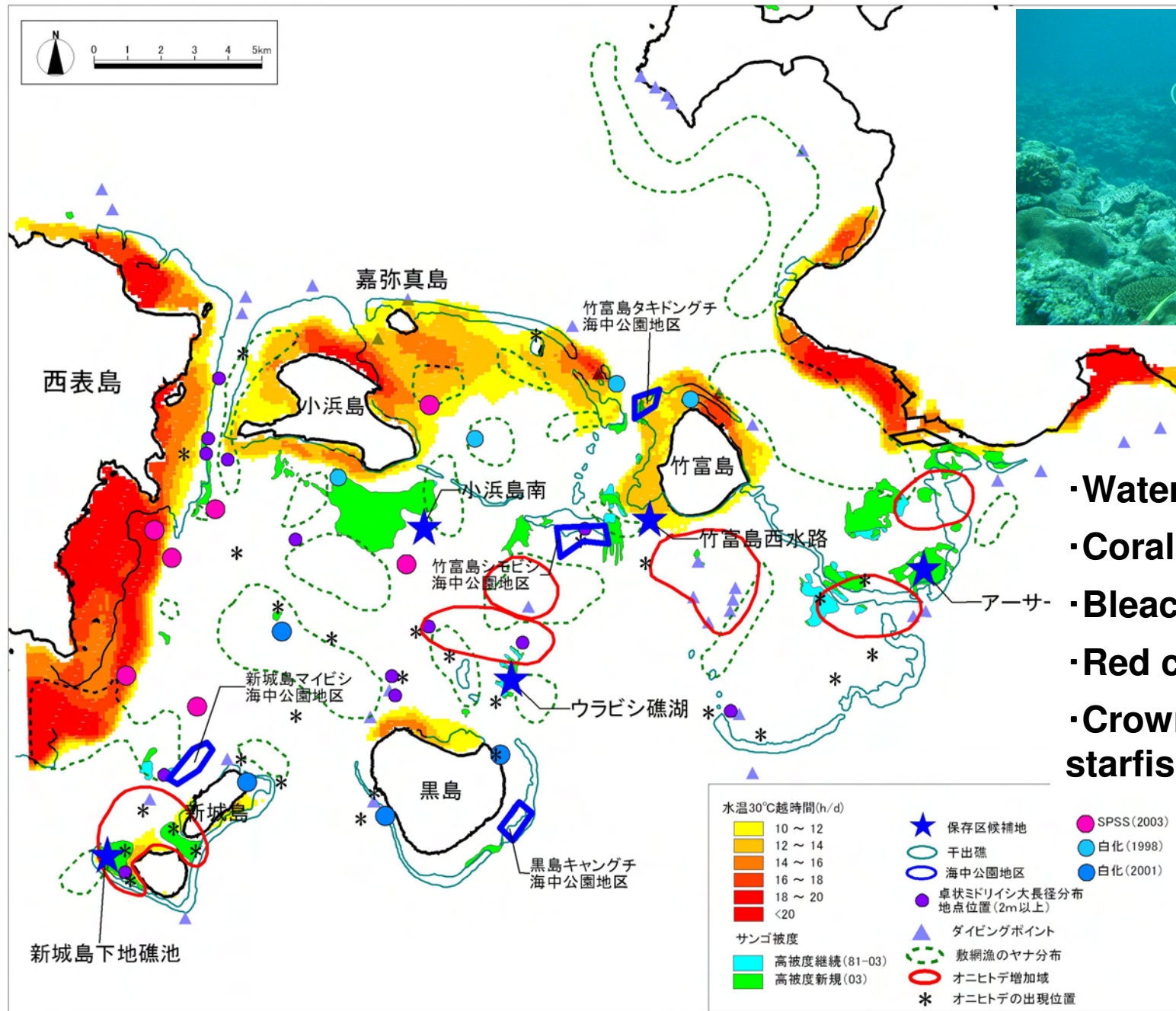
3) Nature restoration committee (2006)



Action



Survey of the natural environment (2002-2004)



- Water temperature
- Coral cover
- Bleaching
- Red clay pollution
- Crown-of-thorns starfish

Survey of the natural environment (2002-2004)

-Structure, growth, and settlement rate of Coral

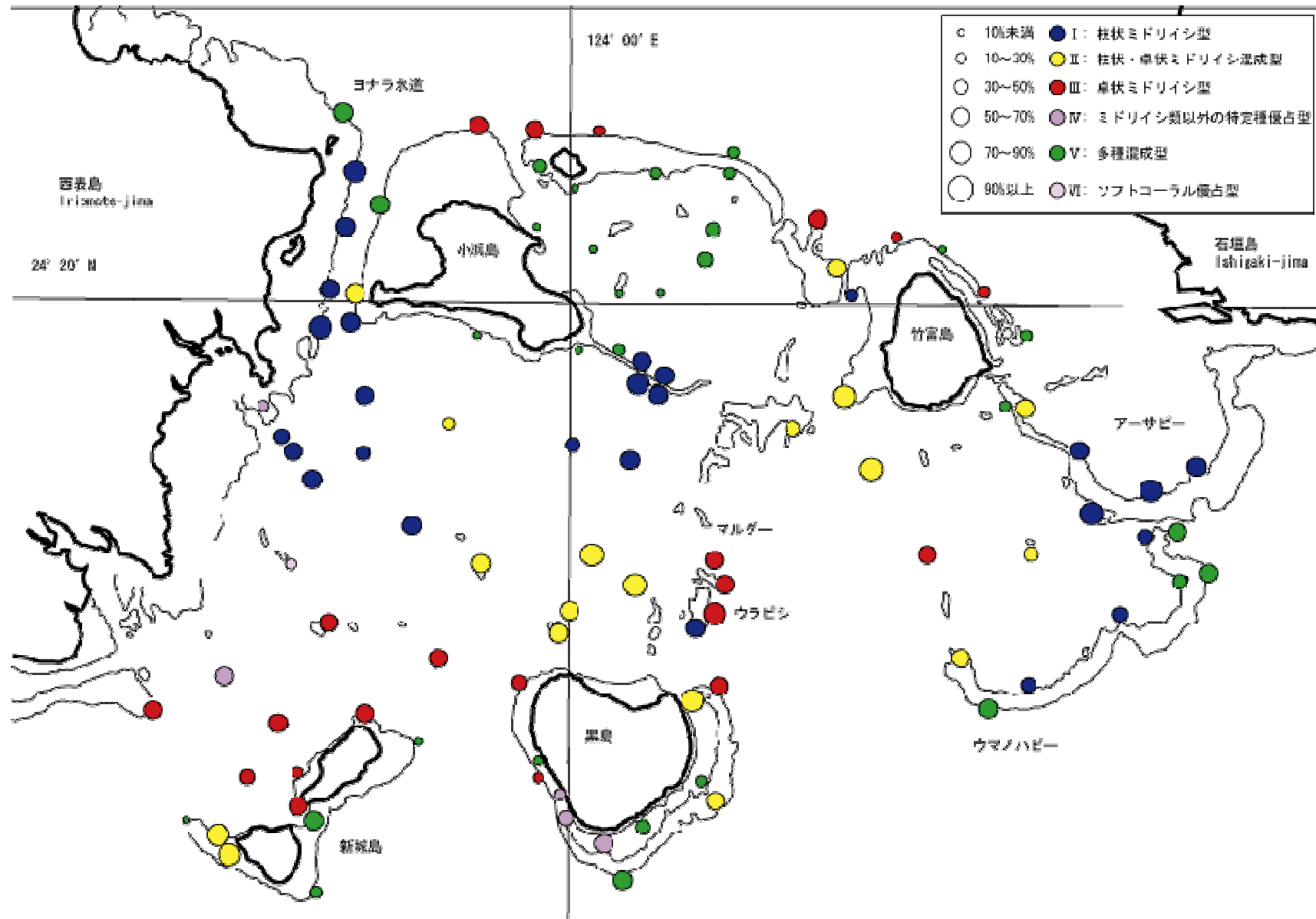
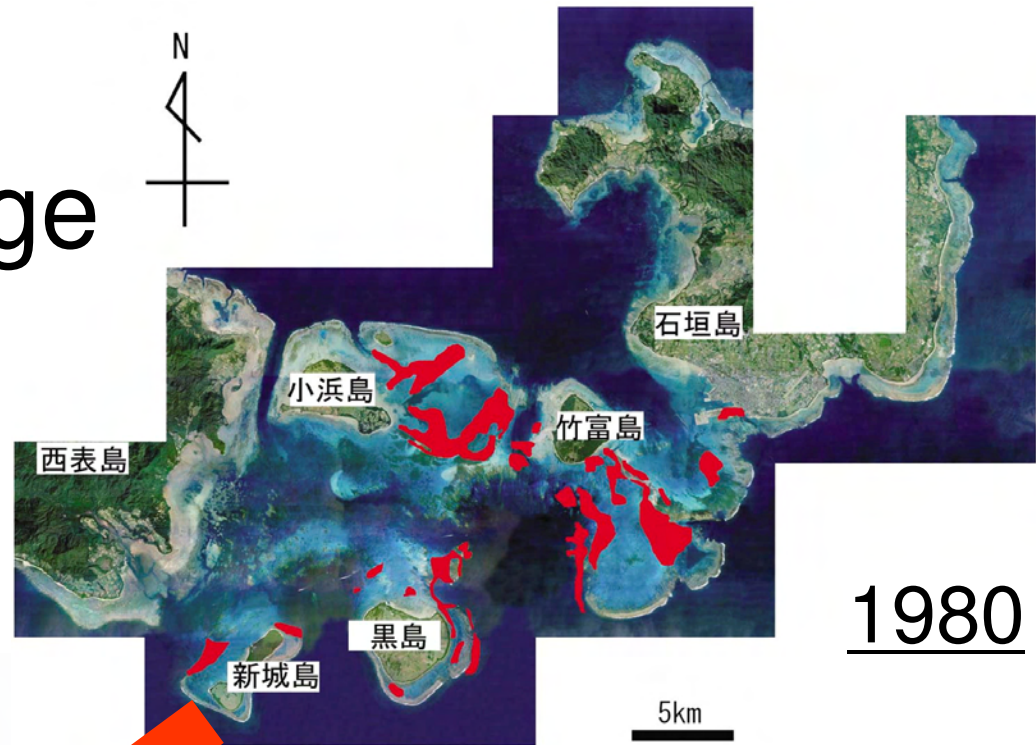
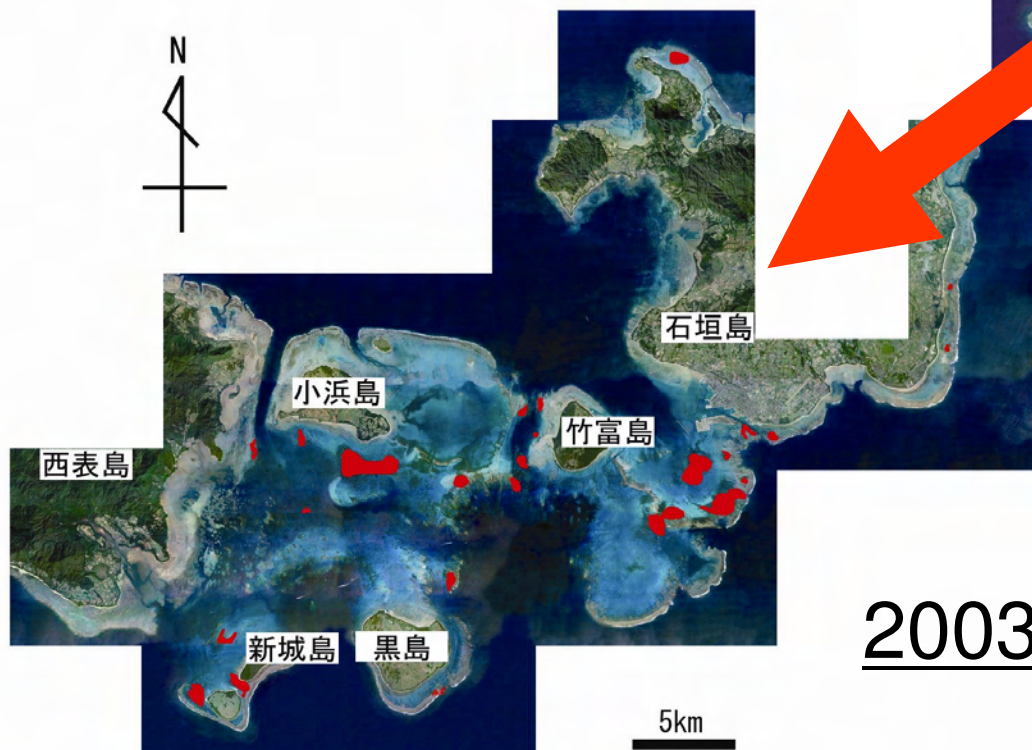


図3 各調査地点におけるサンゴ類被度・サンゴ生育型 (石西礁湖周辺海域)

>50% branching *Acropora* coverage



1980

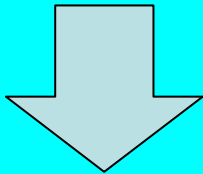


2003

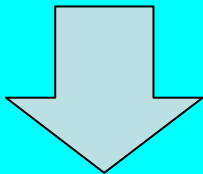
**80%
decreased**

Nature restoration project

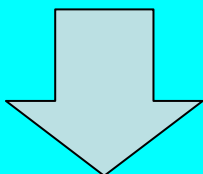
1) Survey of the natural environment (2002-2004)



2) Master Plan for Nature restoration (2005)



3) Nature restoration committee (2006)



Action

The goal image of Nature restoration project



Master Plan for Sekisei Lagoon Nature Restoration

Management

- Zoning
- Crown of thorn starfish
- Red clay



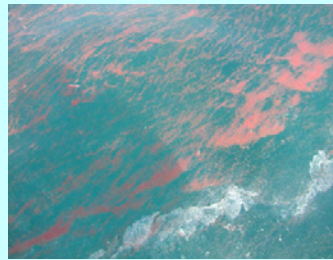
Sustainable utilization

- Fishery
- Sightseeing



Restoration of coral

- Settlement devices
- Transplant



Environmental Education

- Education program
- Information



Research

- Monitoring
- Monitoring network

Restoration of coral

Methods of the coral transplant

Asexual
reproduction
techniques

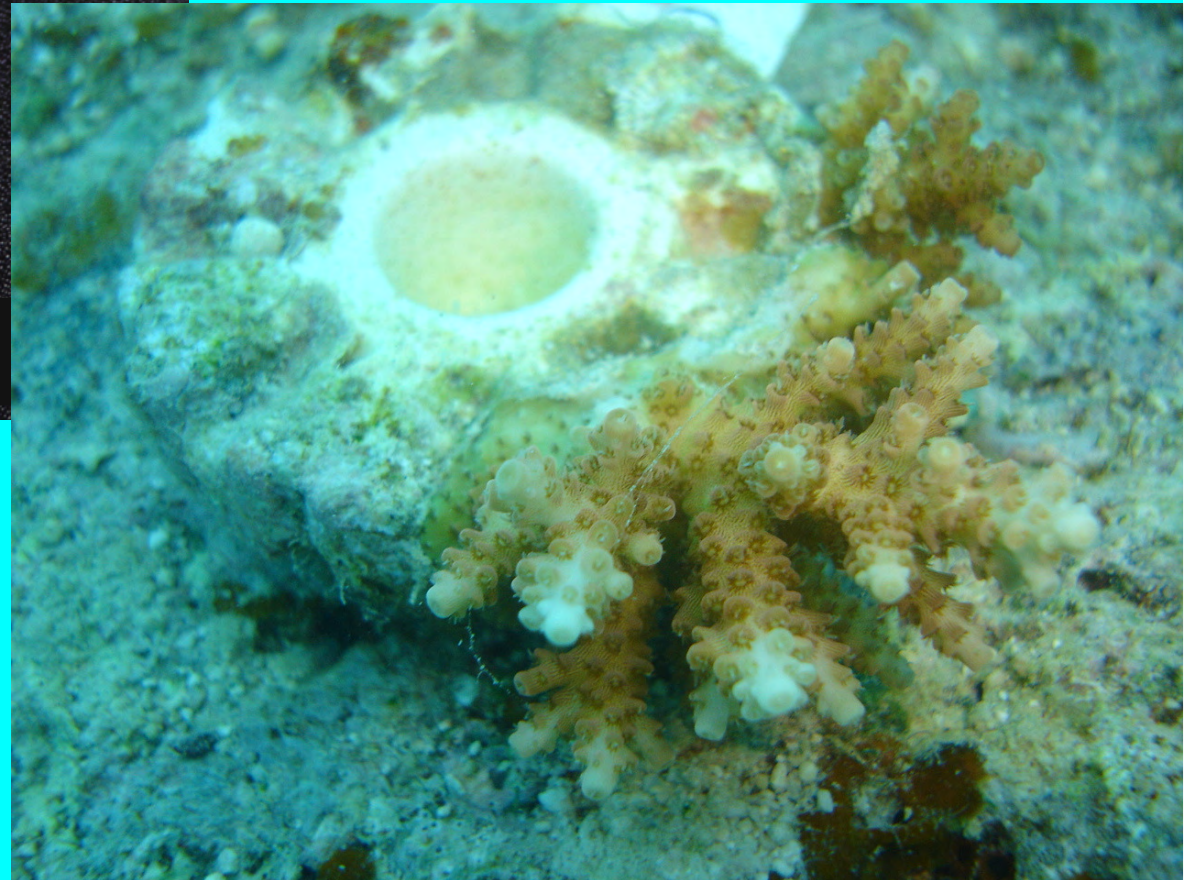


Sexual
reproduction
techniques



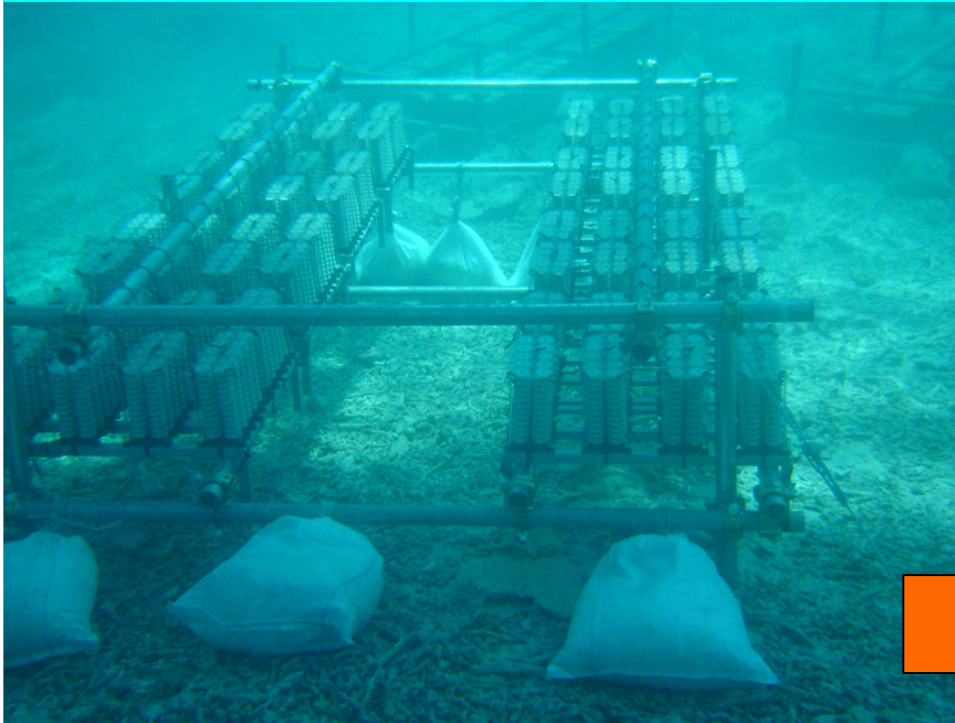
Restoration of coral

Settlement device for coral transplant

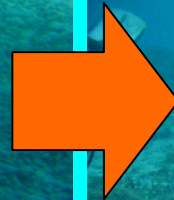


Restoration of coral

Settlement devices



Transplant

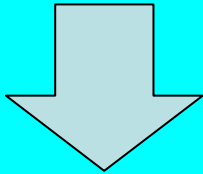


One and half year later

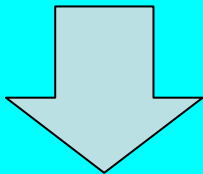


Nature restoration project

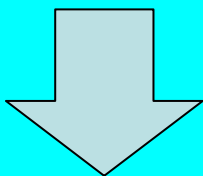
1) Survey of the natural environment (2002-2004)



2) Master Plan for Nature restoration (2005)



3) Nature restoration committee (2006)



Action



Nature restoration committee (2006)

Committee members

- Local residents
- Individuals with specialized knowledge of the natural environment
- Fishermen's association
- NPOs
- Travel agents
- Concerned governmental agencies
- Concerned local governments

Committee's work

Formulation of the **Overall Plan for Nature Restoration** and **the Implementation Plans for Nature Restoration Projects**

