Coastal Lagoon Properties in the Context of Global Change

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5th EUROLAG
EUROPEAN COASTAL LAGOONS SYMPOSIUM

Coastal lagoons as *"Sentinel Systems"*

What is a "***Sentinel System***"?

- One that **responds** to Change
- Change across **geographic gradients**
- Change in **ecosystem function**
- Change in response to particular **stressor(s)**

NOAA, 2009

Geographical gradient

- Lagoons are **transition zones** between land and sea
- Strong geographical gradient(s)

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Foto: 5th EuroLag website

Lagoons are treasured ecosystems

- Ecosystem function
- Ecologically valuable
- Economically valuable, ecosystem goods
- Valuable ecosystem services
- Societal and heritage value
- Aesthetic value
- Research value

Ecologically valuable

Foto: 5th EuroLag website

Economically valuable Ecosystem goods

Supercozza.it

Panoramio.com

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Valuable ecosystem services

Seagrasses provide a nursery environment for juvenile fish

IUCN

Societal value

algarvegolfllp.com

Heritage value

photokayaker.fit2paddle.com

Aesthetic value has commercial value

bestinportugal.com

Scientific and Research value

- Research projects
- Research Infrastructure
- Research salaries
- H.E. Fees
- Spin-offs
- Conferences...

Registration fee until May 8th:
300 € non-students
200 € students

Registration after May 8th:
350 € non-students
250 € students

Pressures on Lagoons

- Human development
- Consequences of climate change

Human pressures on lagoons

Include the disruption of:

- Sediment cycles
- Water cycle
- Nutrient cycles
- Land use and urbanization
- Overexploitation of biotic (biodiversity) and abiotic resources

Sediment cycles

Artificial inlet consolidation retains sediment on one side. The other side is subject to erosion.

Water cycle

A dyke retains freshwater

Nutrient cycles

S. Mudge:

Nitrophilic bloom in the Ria Formosa

Land use and urbanization

Pine forest replaced by golf course

Regional capital on land surrounding the Ria Formosa

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Overexploitation of biotic (biodiversity) and abiotic resources

faroefaro.blogspot.com

Global and Climate change?

- Increase Storminess
- Sea Level Rise

Micore project

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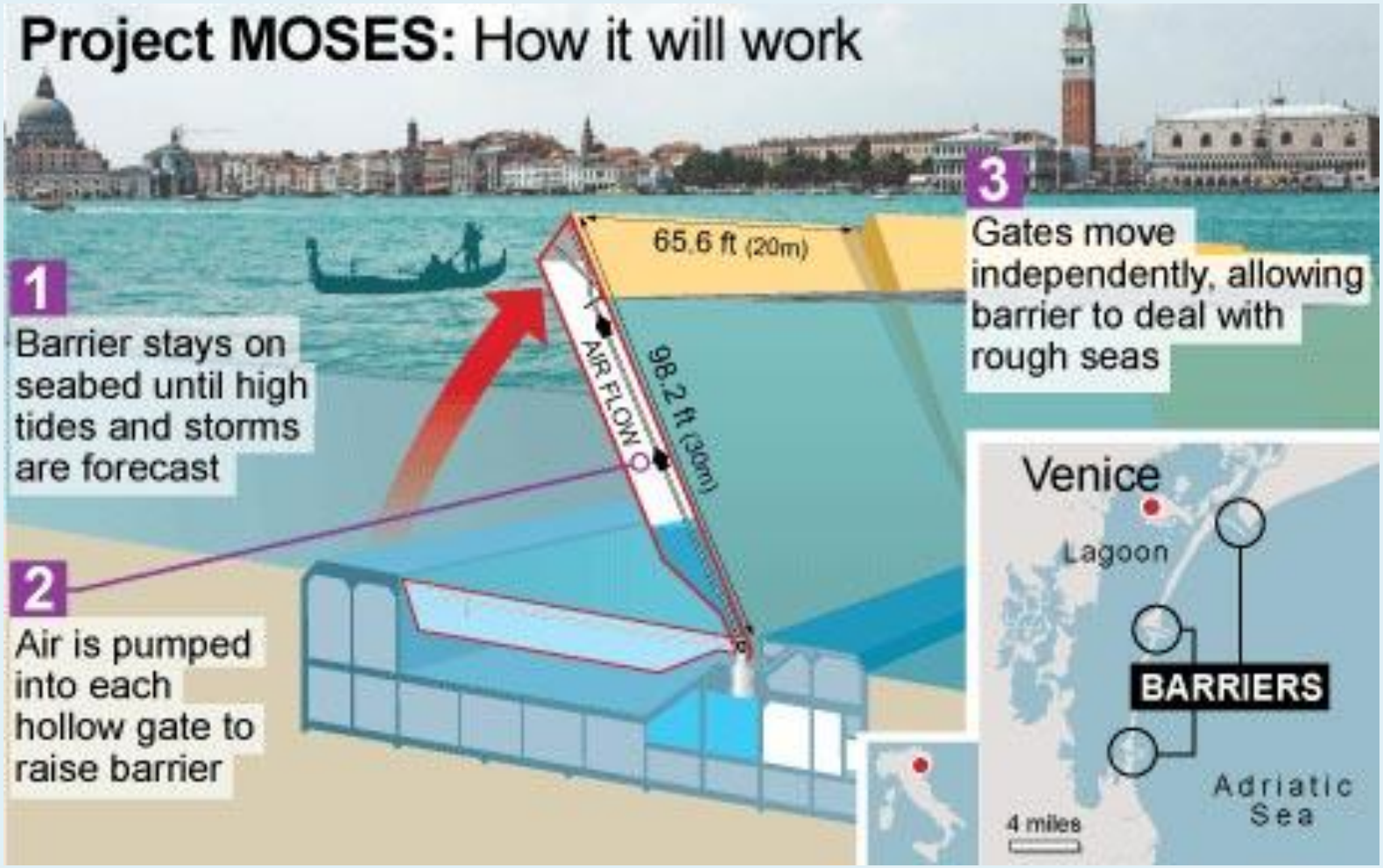
SLR- sea level rise



http://www.telegraph.co.uk

Fundamental environmental variables

- **Temperature**: sea surface warming
- **Salinity**: changes in hydrology and evaporation
- **pH**:ocean acidification
- **Eh**: increase of hypoxic zones

Consequences the fundamental state variables of the lagoonal environment

- Chemical equilibria
- State of the lagoonal ecosystem.

Chemical equilibria

Disrupted by changes in variables such as:

- Temperature,
- pH
- Eh
- Metal sorption/desorption equilibria
- Phosphate equilibrium at the sediment interface.

Species Changes

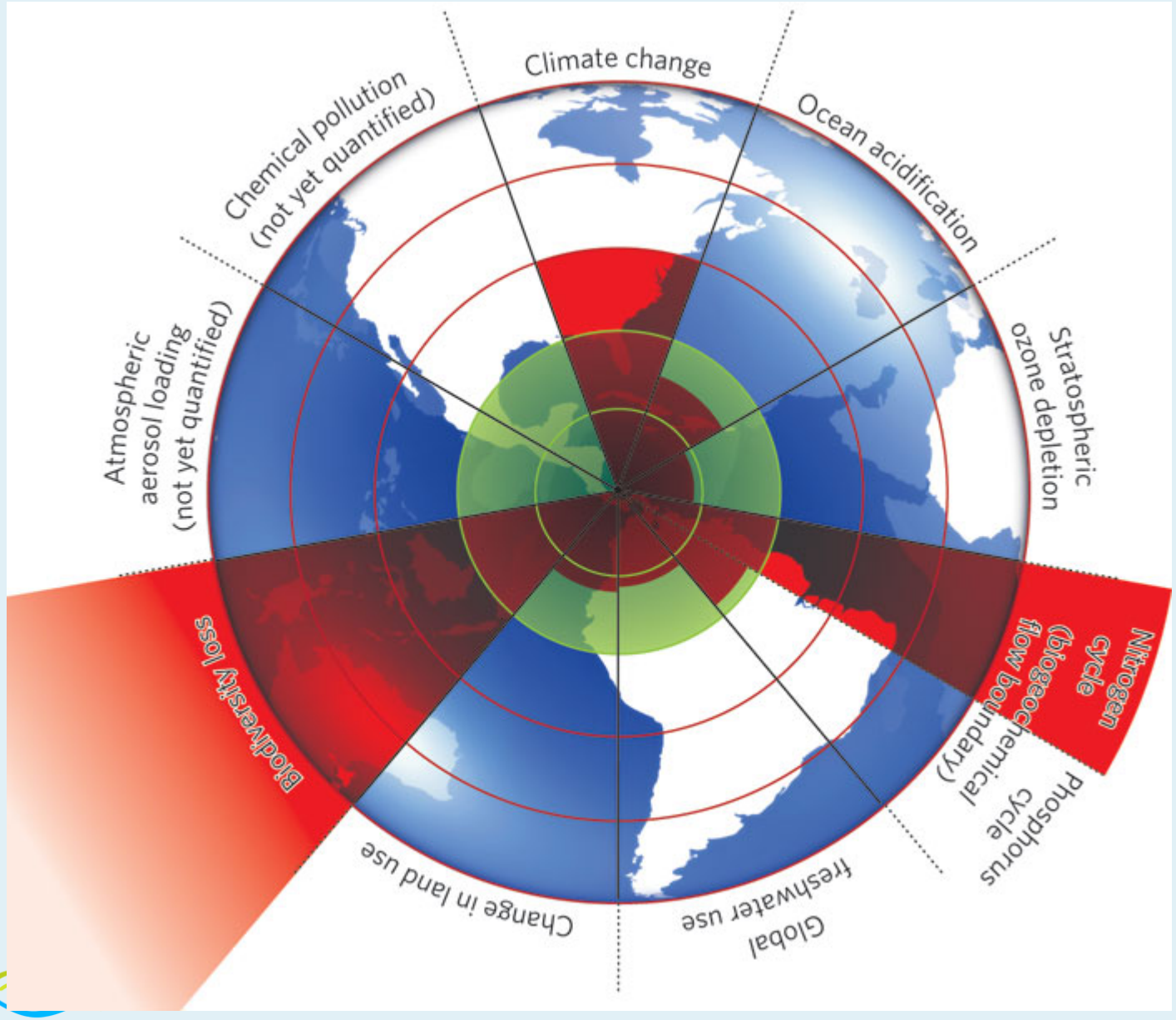
- Changes in **temperature** may also affect the distribution of species so that lagoons may be colonized by species expanding their geographical domain at the expense of species that cannot cope with the changes.
- Salinity: affects **osmotic pressure** and the survival of halotolerant species.

An Index of State of Lagoons?

- Adapted from the Rockstrom et al "*Planetary Boundaries*"

- Develop an index of global and climate change using coastal lagoons as "*Sentinel Systems*".

Rockstrom's Rosette



How to adapt for lagoons?

Rockstrom et al 2009	Proposed lagoon index
Climate change (T)	Climate change (T)
Ocean acidification (pH)	Ocean acidification (pH)
Ozone	**Oxygen system metabolism?**
N and P cycles	N and P cycles
Freshwater use	Freshwater use
Land use	Land use
Biodivesity loss	Biodivesity loss
Atmospheric aerosols	**Storminess SLR and erosion?**
Chemical pollution	Chemical pollution

Proposed Lagoon State Index

Climate change (T)

Ocean acidification (pH)

Storminess and erosion

N and P cycles and **Oxygen system metabolism**

Freshwater use

Land use and urbanization

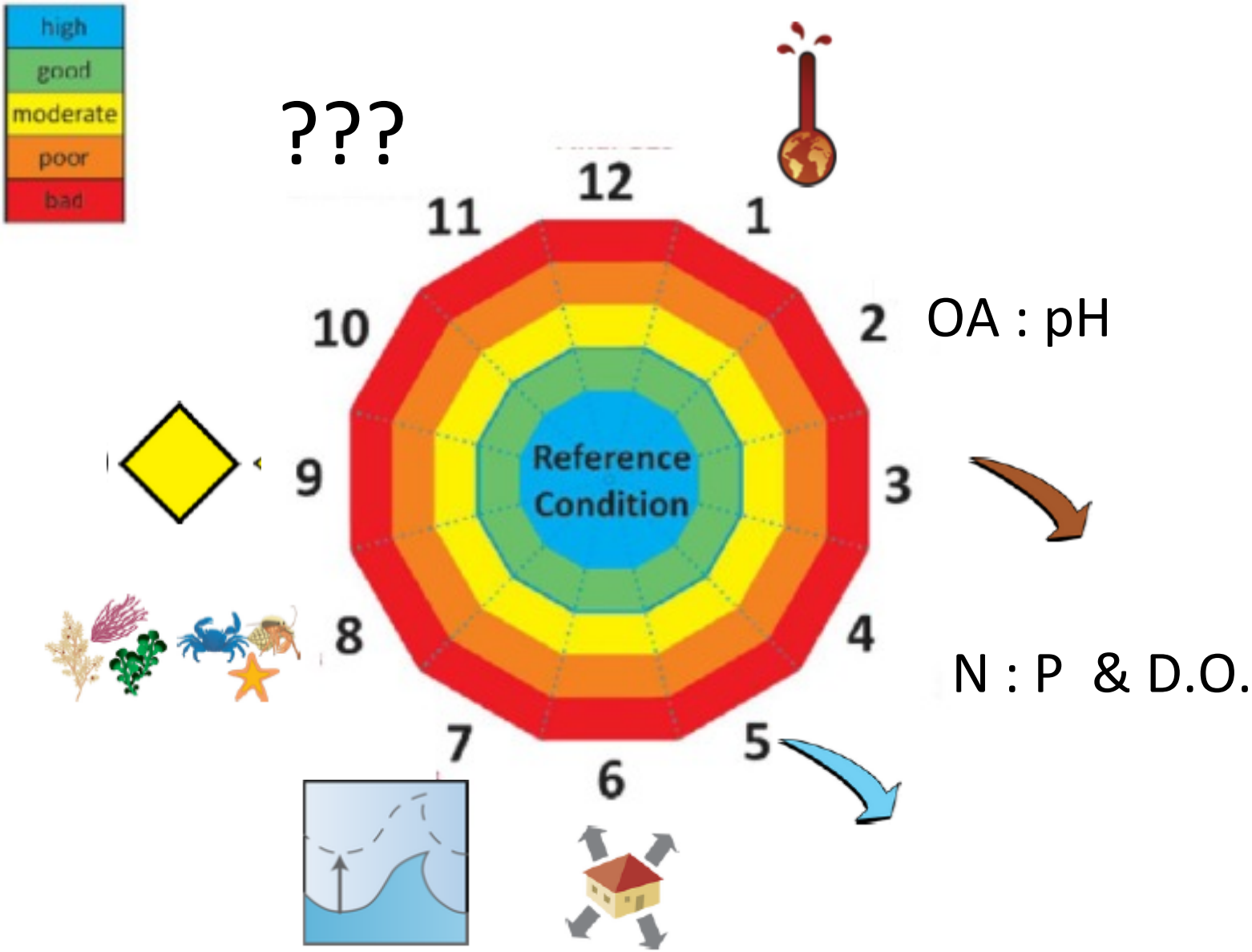
Biodiversity loss

Sea level rise and sinking

Chemical pollution

Others?

Proposed Lagoon State Index



Proposed Lagoon State Index

Global change modifications
- Temperature
- Ocean acidification
- Sea level rise

Geomorphology and hydrology
- Storminess and erosion
- Freshwater use

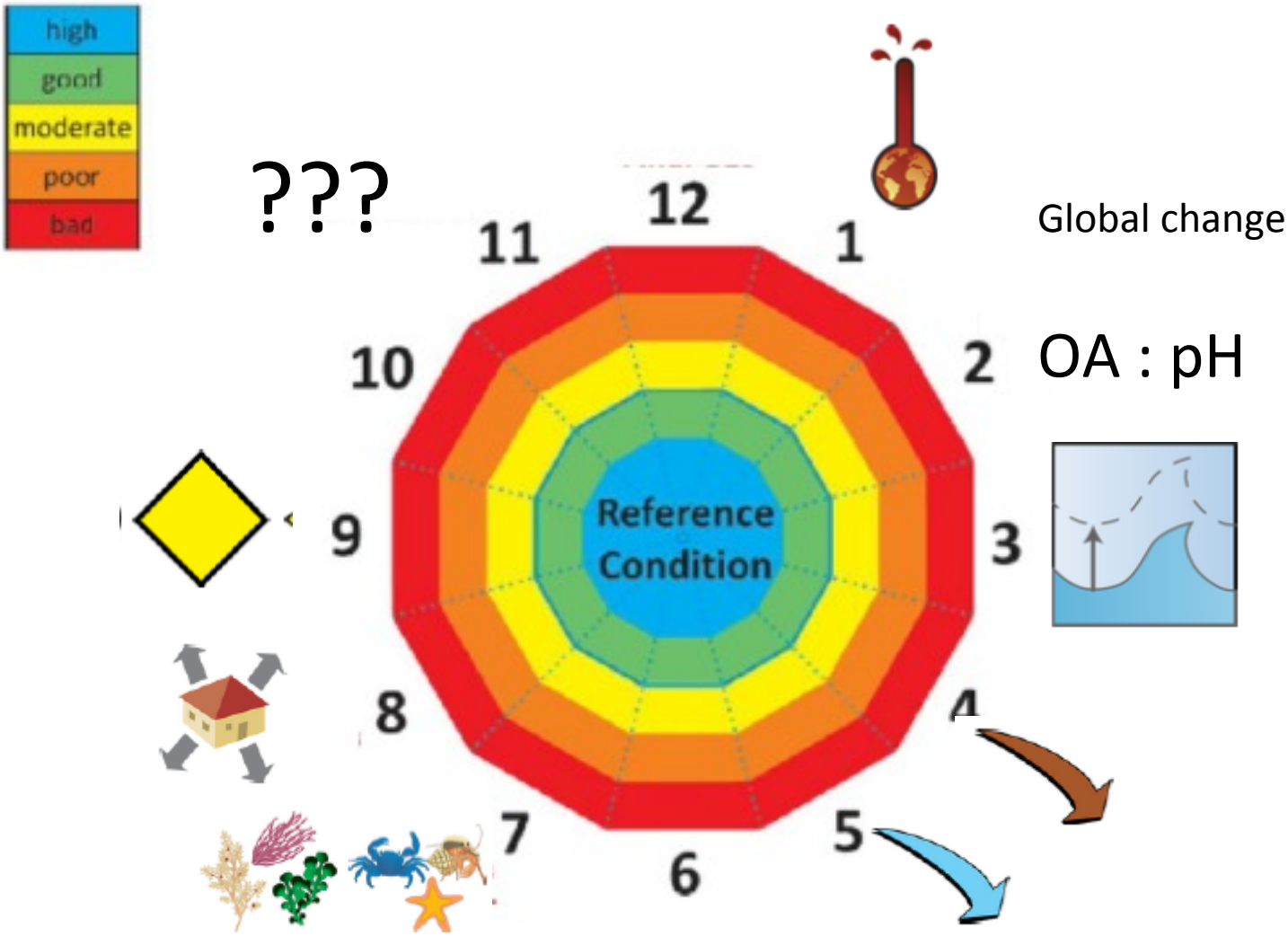
Biogeochemical cycles
- N and P cycles
- Oxygen system metabolism

Biodiversity loss

Human use of lagoon
- Land use and urbanization
- Chemical pollution

Others?

Proposed Lagoon State Index



? Goods and service
? Economic and jobs
? Social-Cultural

Acknowledgements

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Obrigada! Thank you!

...and questions?

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