

The Role Of Science In Coastal Lagoon Management



Thomas Chevalier

European Joint Master in Water And Coastal Management

Thesis Presentation

Faro – July 2007



Introduction

- Curricular part of the master: study the link between river basin and coastal area
- What is the role of science in lagoon management? How science can inform managers?
- Goal:
 - Study the role of science in an sustainable management of coastal lagoons

Outline

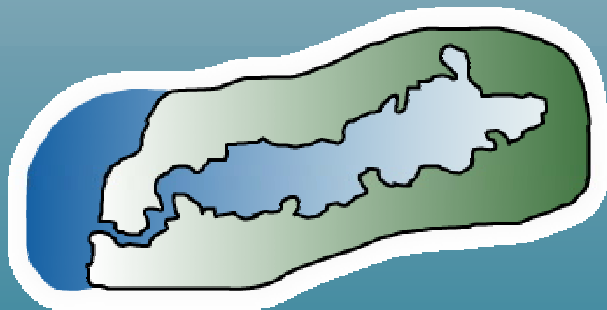
- What are Coastal lagoons?
- Best management practice? Why?
- Role of science in management Process?
- Study Case 1 (Patos lagoon, Brazil)
 - Contribution of science in the management
- Study Case 2 (Ria Formosa, Portugal)
 - How natural scientist can inform managers?
- Conclusions

Coastal lagoons

Definition

- 13% of World's continental Coast
- Shallow area of water separated from the ocean by a sandbank or by a strip of low land
- Width of marine entrances at high tide is less than 20% of total length of enclosing barrier
- Morphologically 3 types:

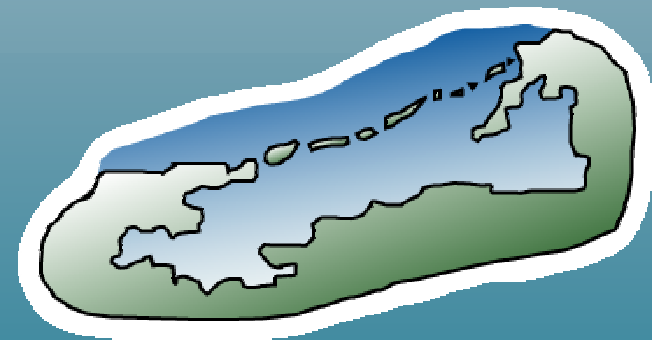
Choked Lagoon



Restricted Lagoon



Leaky Lagoon



Coastal Lagoons

Economic Value

Dutch Wadden Sea (WWF, 2004)

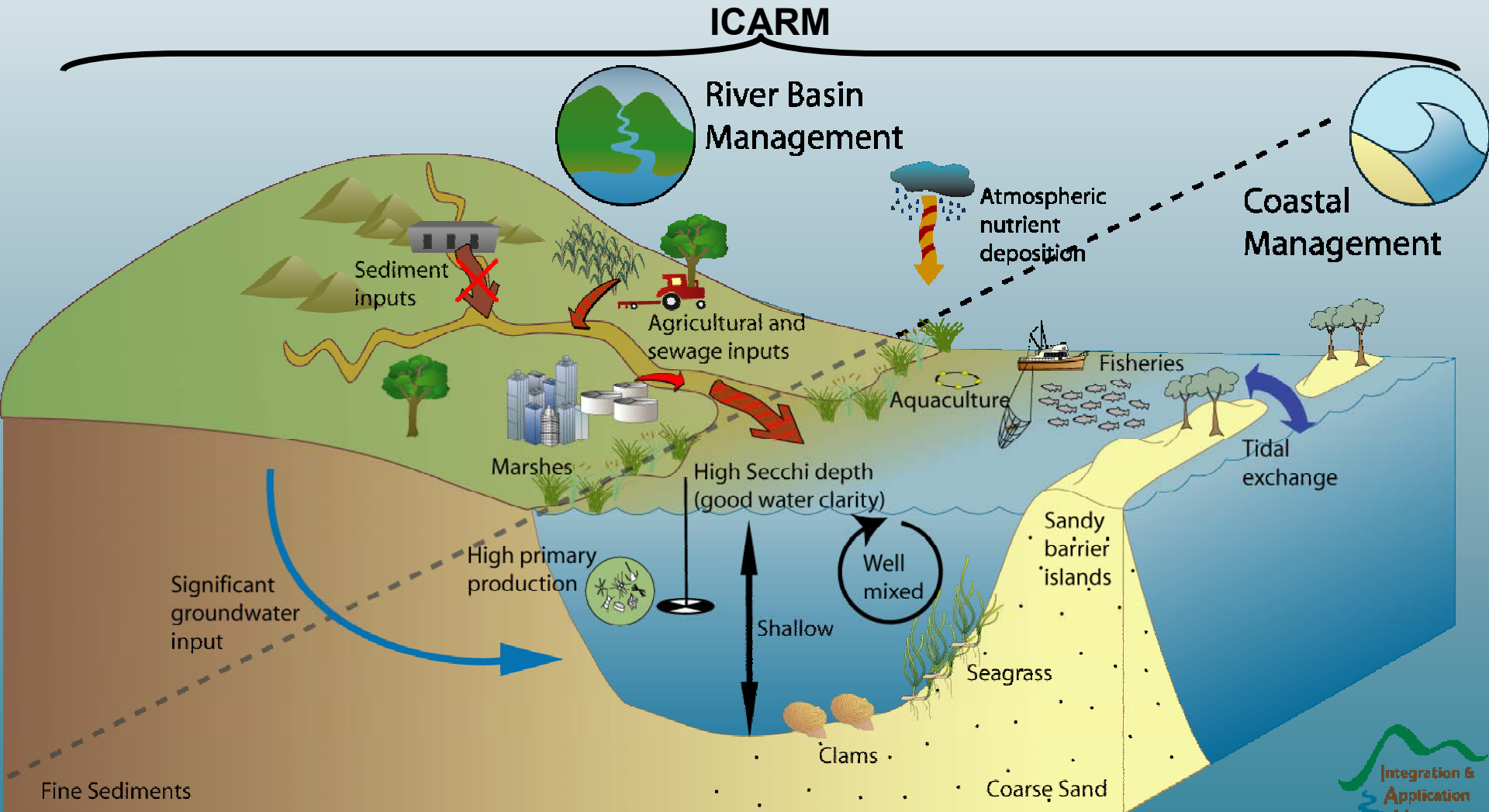
Economic Benefit	Economic Value per year (converted to 2003 US\$)
Flood prevention	189,000,000
Storage and recycling of organic matter	756,000,000
Storage and recycling of nutrients	945,000,000
Habitat and Nursery	45,360,000
Nature Protection	5,670,000
Aquaculture	8,316,000
Recreation	189,000,000
Food	170,100,000
Raw material for construction	9,450,000
Spiritual/Historical information	5,670,000
Education and scientific information	6,048,000
TOTAL ECONOMIC VALUE	2,329,614,000

What is ICARM?

- ICARM = Integrated Coastal and River basin Management
- It is the adoption of goals, objectives and policies and the establishment of governance mechanisms which recognize the interrelationships between the coastal and river basin systems with a view for environmental protection and socio-economic development (Coccossis, 2004).

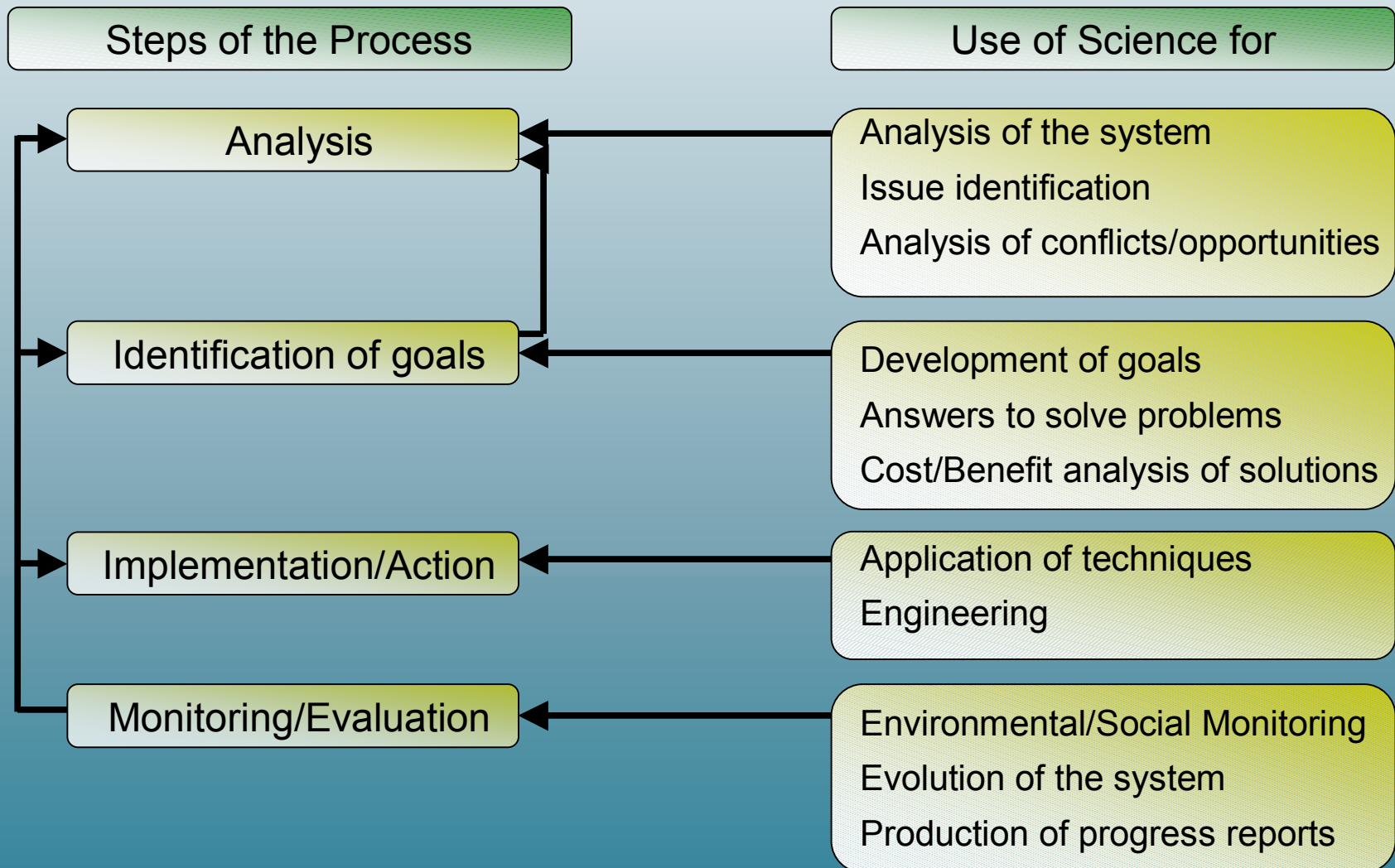
Why ICARM for coastal lagoons?

River basin influence on coastal area



Symbols courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science.

Role of science in ICARM planning Process



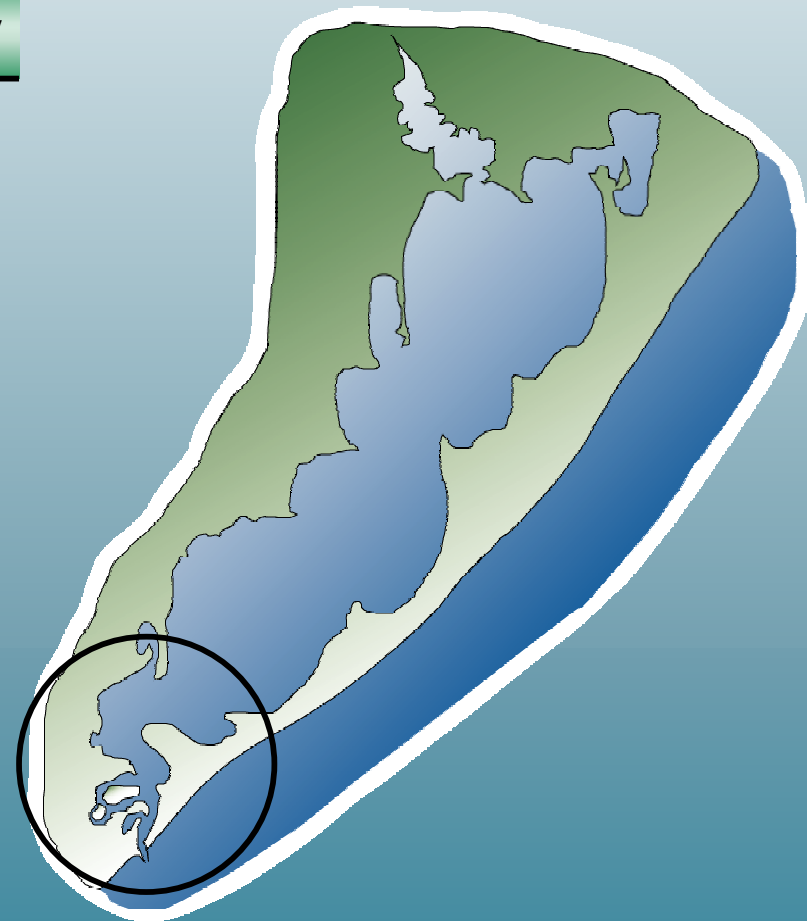
Case Study 1

Science input for the management
of the Patos Lagoon estuary

-Brazil-

Studied Area Patos Lagoon

Characteristics	Lagoon	Estuary
Latitude	30°55' – 32°30' S	-
Longitude	50°55' – 52°20' W	-
Typology	Choked	-
Drainage Area	201626 km ²	100 km ²
Lagoon Area	9300 km ²	971km ²
Tidal Range	0 m	0.1 m
Average depth	5 m	3 m
Typical salinity	0	18
Average temperature	20°C	20°C
Average rainfall	1.75 m.yr ⁻¹	1.20 m.yr ⁻¹



Policies affecting Patos Lagoon

- Water resources
 - River basin management
 - Water Resources National Plan (PNRH)
 - Water Resources Management System (SGRH)
- Coastal zone
 - National Coastal Management Policy (PGNC)

Role of science in P. lagoon management

- Development of an ICZM in the estuary
 - Preparation, training, maintain traditional fisheries, recovery & conservation
- Forum of P. Lagoon
 - Provide scientific information to fishermen community
 - Analyze community-based management process
- Environmental Impact Assessment of the Rio Grande harbor
 - Biota, geology, geomorphology, geochemistry, hydrochemistry & Ecotoxicology
 - Analysis, planning and recommendations

Case Study 2

Use of the OSPAR comprehensive procedure
to inform managers on eutrophication status
of the Ria Formosa
-Portugal-

Introduction

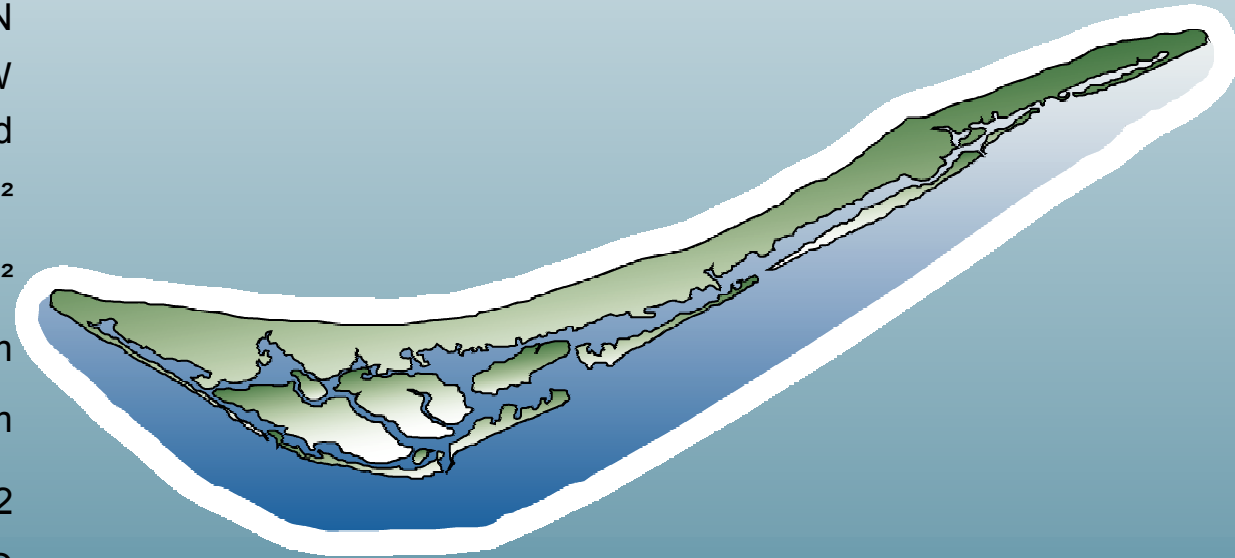
- Water Framework Directive (WFD) is the main legal framework in Europe toward a sustainable of fresh and coastal water resources
- Goal
 - Reach good ecological quality for European waters by 2015
- Eutrophication is a critical parameter to assess ecological quality

Studied Area

Ria Formosa

Characteristics

Latitude	36°58' – 37°03' N
Longitude	7°32' – 8°02' W
Typology	Restricted
Drainage Area	860 km ²
Lagoon Area	14.5 km ²
Tidal Range	0.7 – 3.5 m
Average depth	3 m
Typical salinity	>32
Average temperature	12°C (winter) – 27°C (summer)
Average rainfall	0.8 m.yr-1



OSPAR comprehensive procedure

- 3 main steps
 - Determination/Classification of the assessment parameters
 - Integration of the categorized assessment parameters (initial classification)
 - Appraisal of all relevant information (final classification)

Step 1

- Biological, chemical and physical assessment are organized in 4 categories
 - Category I: Causative factors including sources of nutrients
 - Category II: Direct effect of nutrients
 - Category III: Indirect effects of nutrients
 - Category IV: Other possible effects

Step 2

- Initial classification
 - Problem Area (PA)
 - Potential Problem Area (PPA)
 - Non-Problem Area (NPA)

Data available

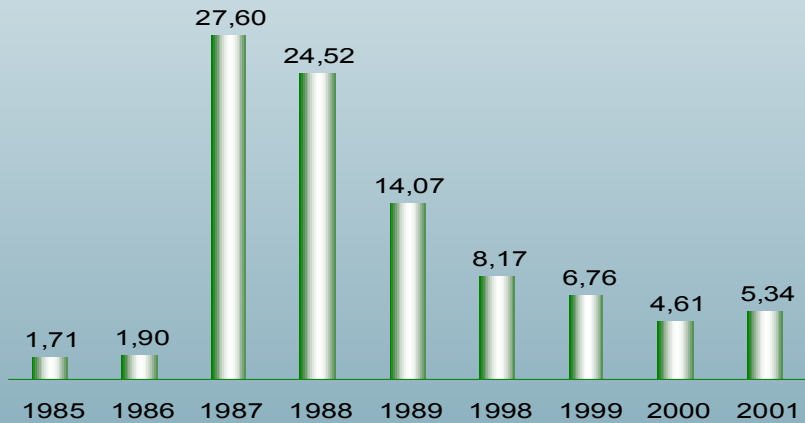
- Category I
 - Winter DIN, N/P, N/Si and P/Si ratios
- Category II
 - Chlorophyll a concentration
- Category III
 - Oxygen deficiency
- Category IV
 - No data available

Methodology

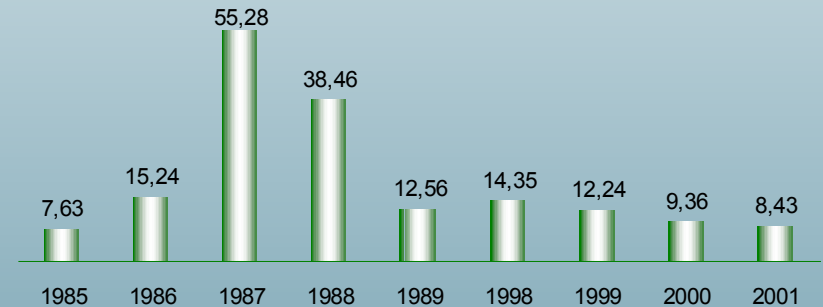
- Trend analysis
- Data taken from Barcawin 2000 relational database
- Data from 1985 to 2002

Results Category I Nutrient input

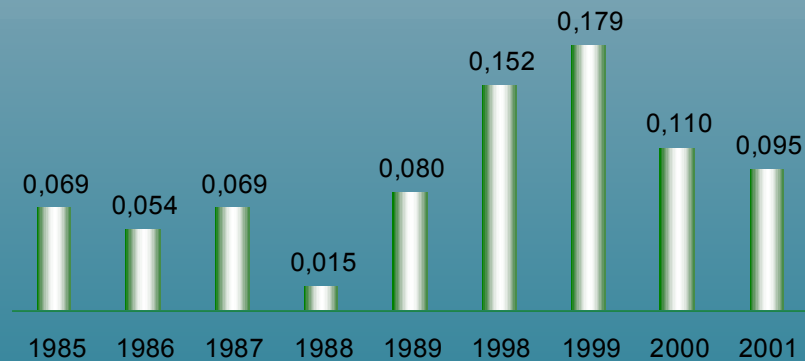
Winter DIN ($\mu\text{mol.L}^{-1}$)



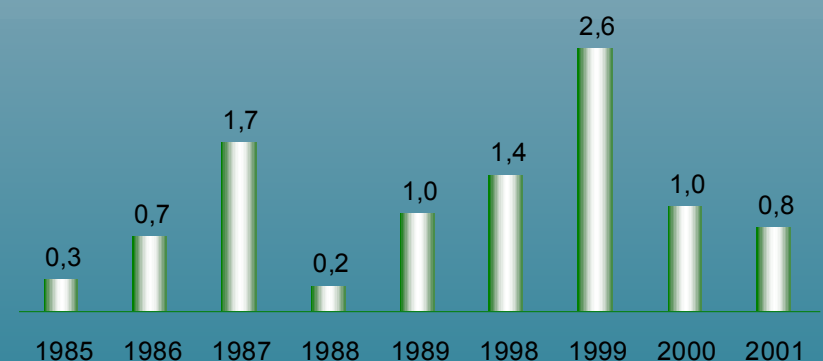
DIN/P Ratio



DIN/P Ratio

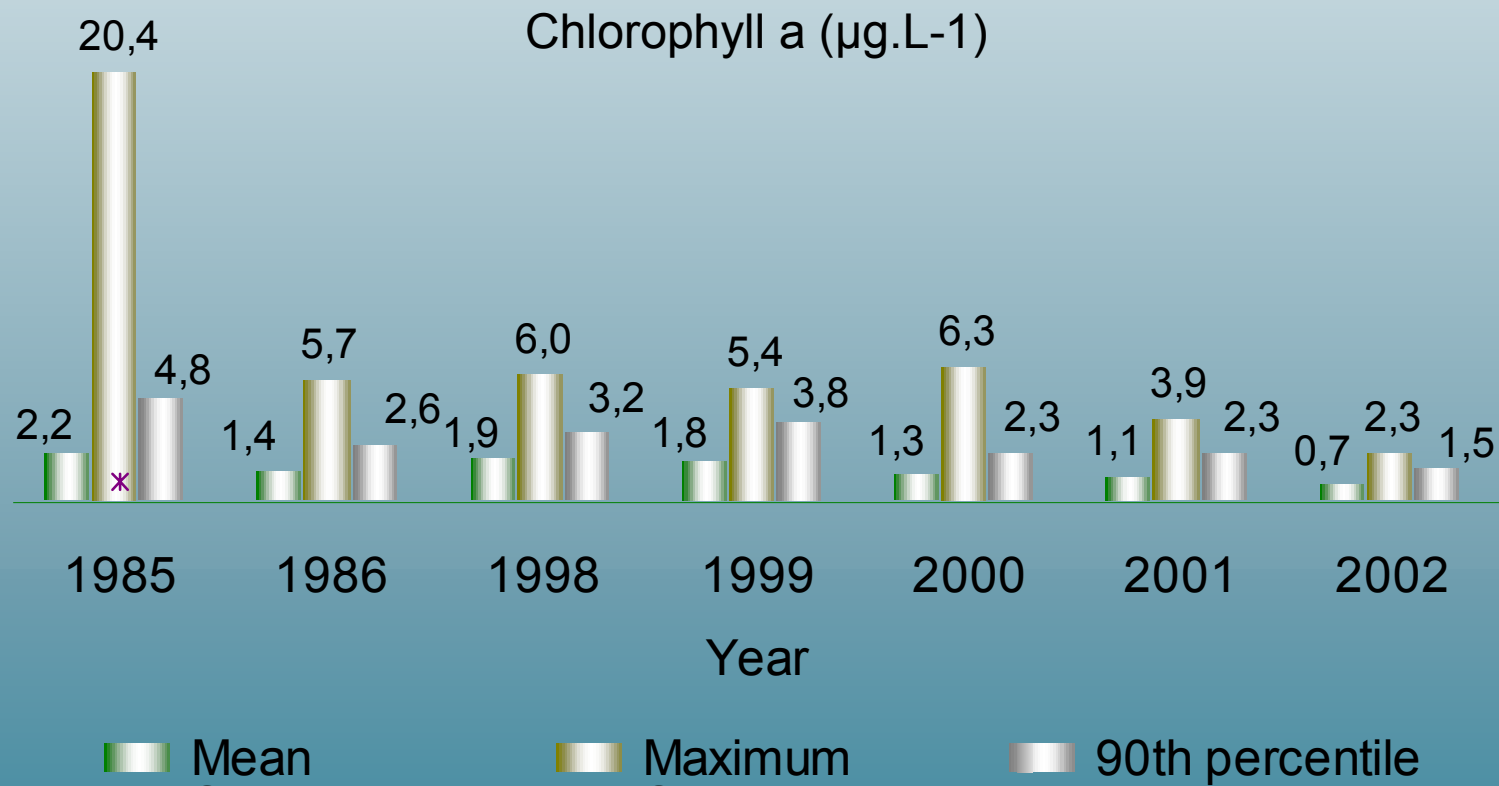


DIN/P Ratio

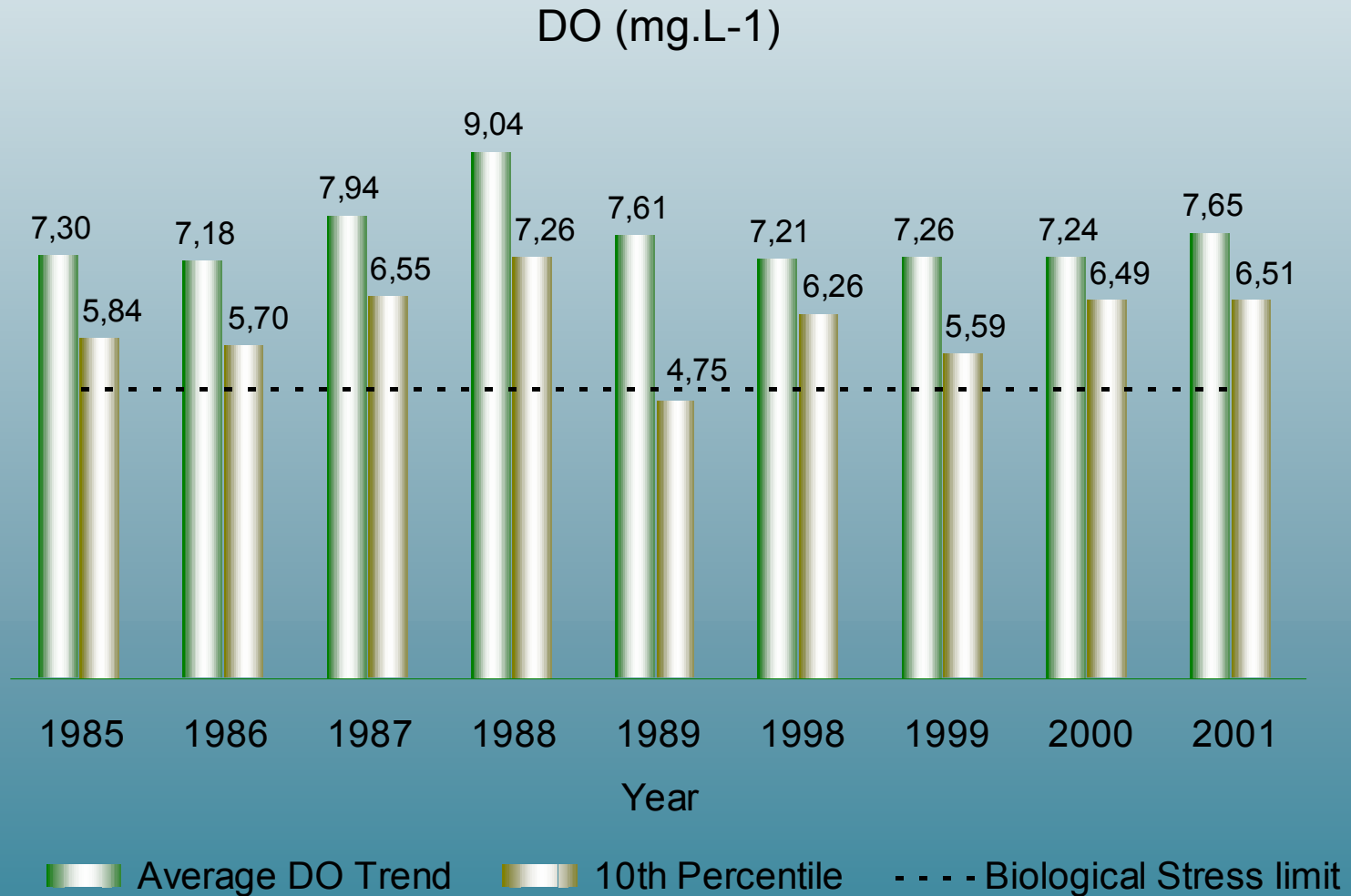


Results Category II Direct effect of nutrients

nutrients



Results Category III Indirect effect of nutrients



Classification

Category	Assessment Parameter	Description of results	Score (+ - ?)
Degree of Nutrient Enrichment (I)	Riverine input & direct discharge of total N & P	No data available	?
	Winter DIN and/or DIP concentrations	Decreasing trend – Lower concentration than assessment level	-
	Winter N/P, N/Si and P/Si ratios	Decreasing trend – Lower concentration than assessment level	-
Direct effect (II)	Maximum and mean Chlorophyll a concentrations	Decreasing trend – Lower concentration than assessment level	-
	Area-specific phytoplankton indicator species	No data available	?
	Macrophytes including macroalgae	No shift in species have been reported	-
Indirect effect (III)	Oxygen deficiency	No increase and concentrations lower than Biological stress	-
	Change/kills in zoobenthos and fish kills		?
	Organic carbon/matter	No data available	?
Other possible effects (IV)	Algal toxins (DSP/PSP mussel infection events)	No harmful algal bloom have been reported in the literature	-

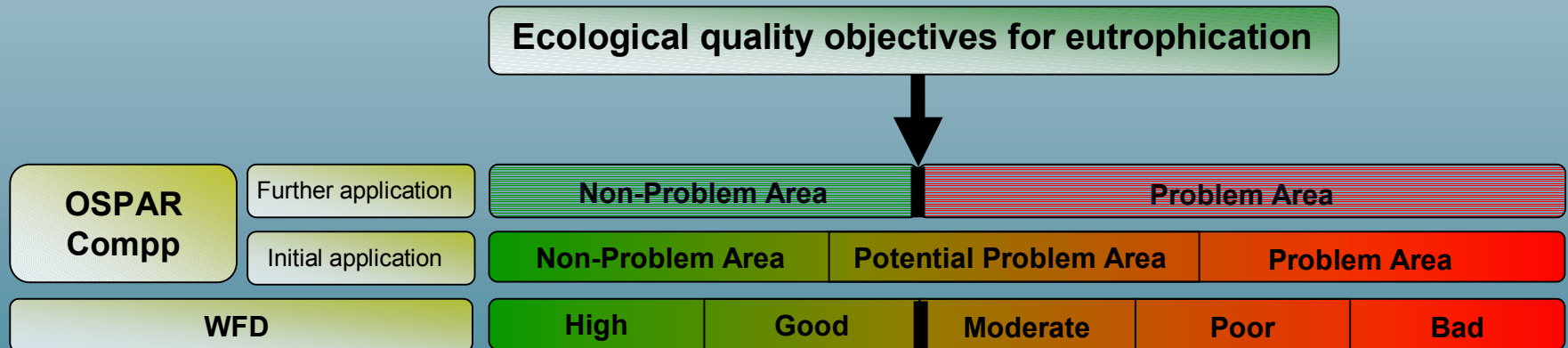
Ria Formosa = **Non-Problem Area**

Discussion

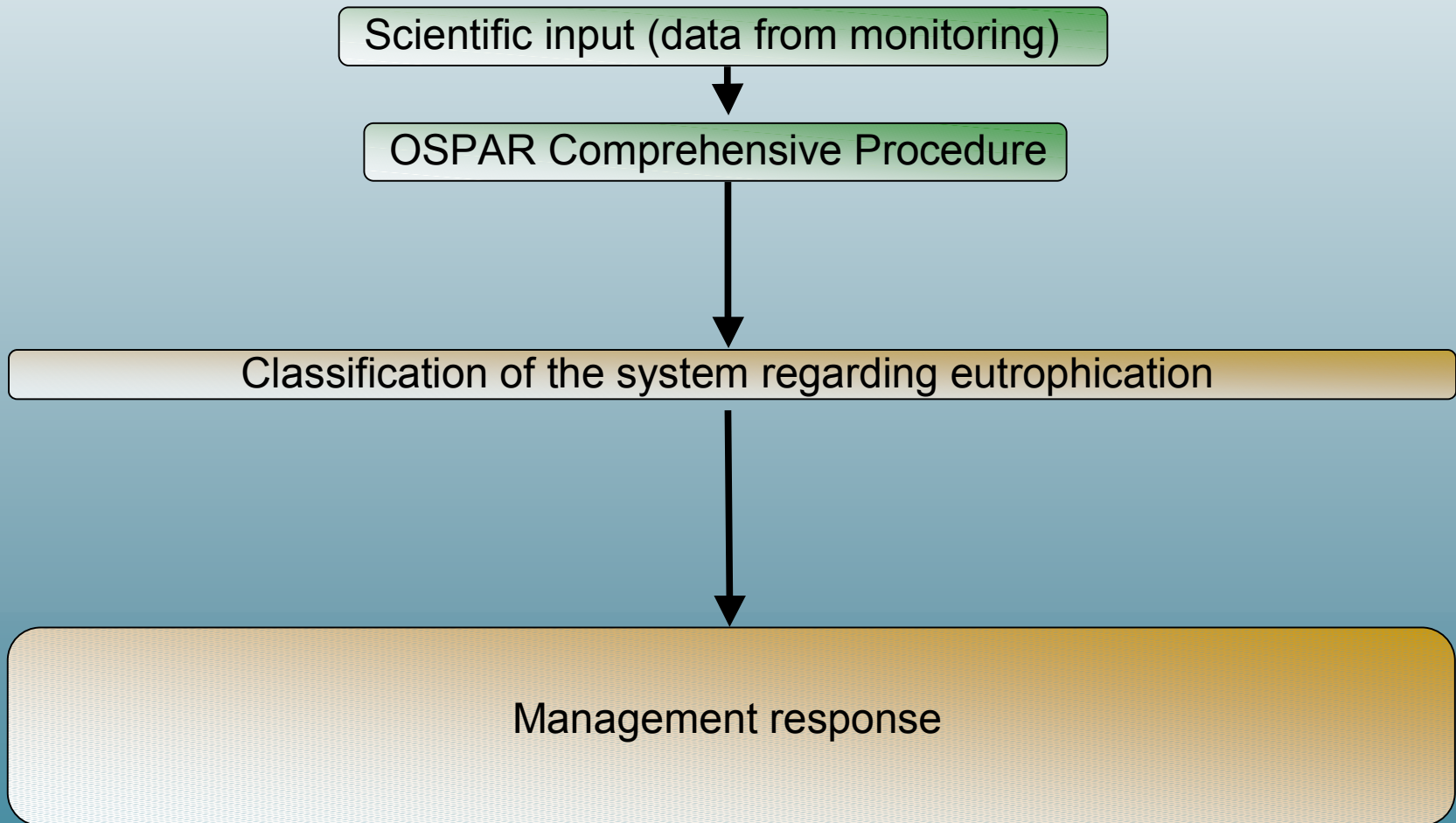
- Data available not necessarily representative of a comprehensive system survey
- Lack of continuous monitoring (at least 5 years using the same sampling station)
- No sampling DO in early morning when it has low concentrations
- Same results as the US National Estuarine Eutrophication Assessment (NEEA)

How the procedure is related to EU policy?

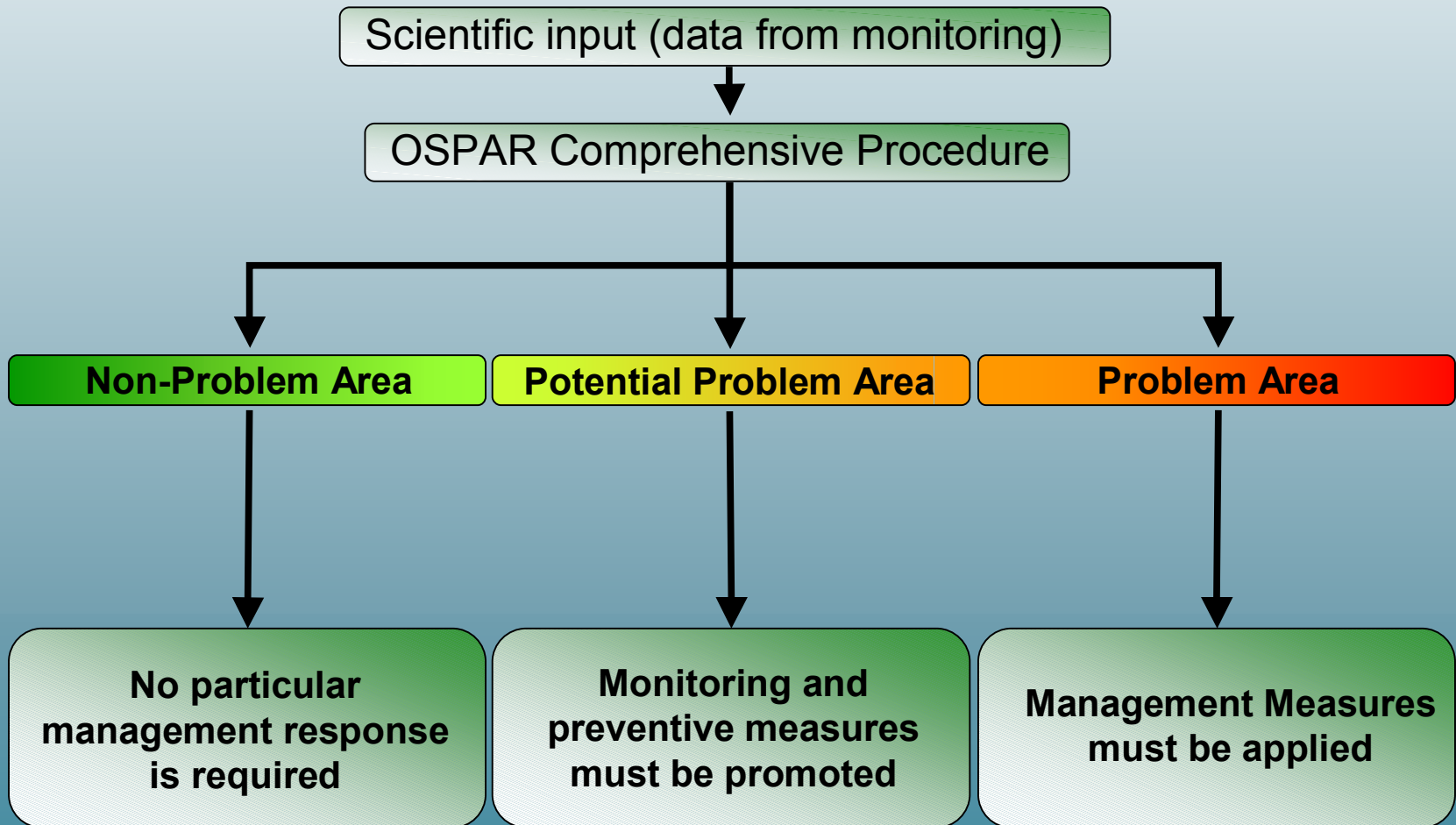
- OSPAR Comprehensive Procedure is related to European Directives:
 - UWWT (Sensitive or Non-Sensitive area)
 - Nitrate (Nitrate Vulnerable Zone)
 - WFD:



Why is it a good tool to inform managers?



Why is it a good tool to inform managers?



Conclusions

- Science is the required basis toward a sustainable management of coastal lagoons
- Surveillance monitoring is a key element in natural sciences toward the implementation of an ICARM
- Tools such as OSPAR Compp can be developed and used by natural scientist to inform managers

References

- WWF, 2004. The Economic Values of the World's Wetlands.
- Coccossis H. 2004. Integrated coastal management and river basin management. *Water, Air, and Soil Pollution: Focus 4*: 411–419.

Acknowledgment

- My supervisors, my parents and all the people who supported me along the thesis
- The integration and application network



ian.umces.edu

Thank You!

Questions?