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GUIDE TO MACROPHYTES IN LANGUEDOC-ROUSSILLON LAGOONS:
IDENTIFICATION AND MONITORING

CONTEXT
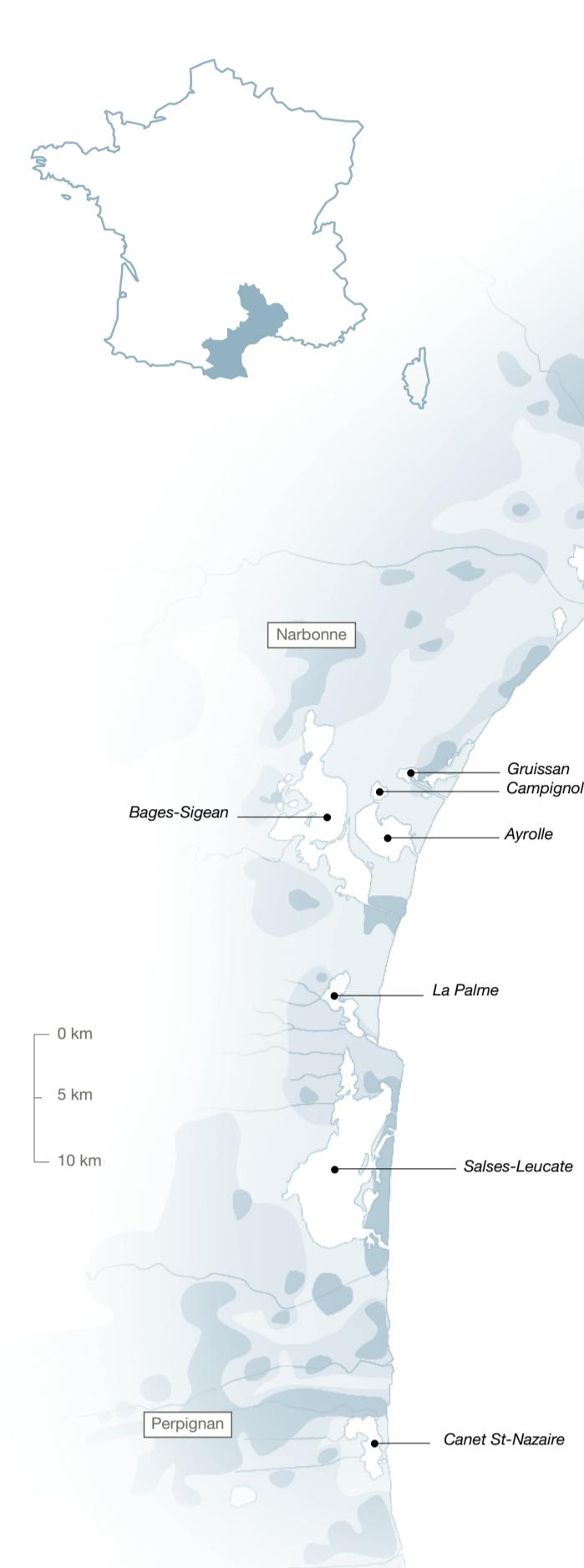
Languedoc-Roussillon lagoons (France, Western Mediterranean) are studied since 2000 by Ifremer Sète laboratory as part of the Lagoon Monitoring Network (LMN) (RSL; http://rsl.cepralmar.com).

LMN diagnostics

Several ecological compartments are monitored (sediments, water column, phytoplankton, macrophytes) to diagnose the level of eutrophication in the lagoons.

Eutrophication is a nitrogen and phosphorus enrichment of aquatic environment due to anthropogenic inputs. It is the main pressure on the lagoons.
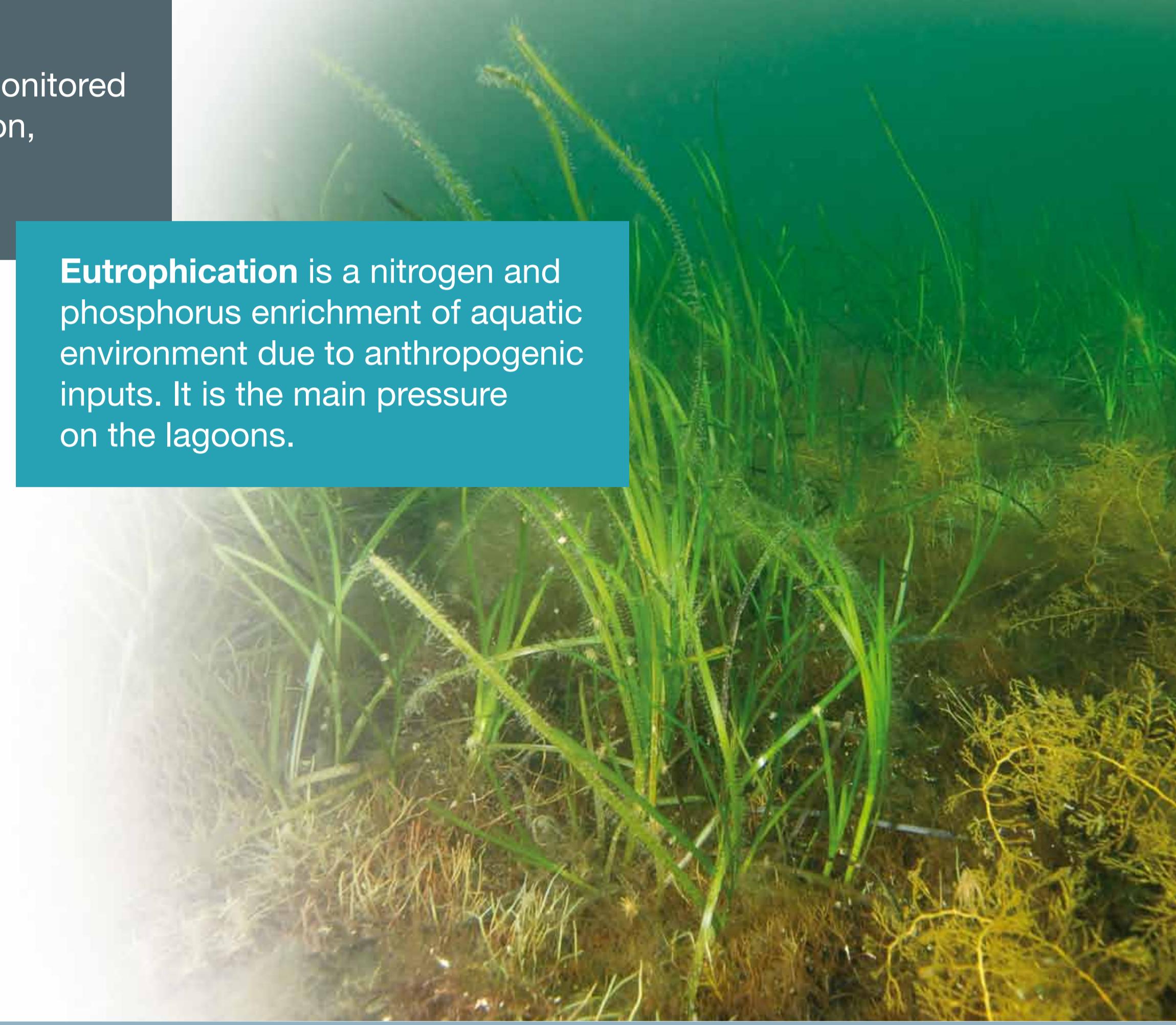
The LMN is a partnership between Ifremer, Cépralmar, Rhône Méditerranée - Corse Water Agency and the Region Languedoc-Roussillon.
It is a tool developed under strong cooperation between scientists and managers with the aim to help environmental management and decision making on lagoons. The advantage of LMN is to favorise exchanges: feedback from managers to scientists - reporting from scientists to managers and stakeholders. The LMN provides transfer of knowledge with various outputs: annual report, synthetic annual bulletin, annual seminar, management structure specific annual seminars, and web site.
The LMN plan for 2007-2013 aims to strengthen that transfer of knowledge with the addition of 3 technical guides dedicated to technicians and management structures:
• Technical note on monitoring N et P from Waste Water Treatment Plant and their impact on lagoons
• Guide to eutrophication assessment in lagoons
• Guide to macrophytes identification and monitoring.

GUIDE TO MACROPHYTE IDENTIFICATION AND MONITORING

Why this guide?

Macrophyte assemblages are a good indicator to assess the lagoon environmental quality linked to eutrophication. Macroalgae and phanerogams «reference species» disappear gradually when the nutrients increase in the environment, because of the competition with opportunistic species. The monitoring method developed by the LMN is based on the percent of coverage of reference species and the species richness. This method requires the identification of the species.

The guide to macrophytes is dedicated to the technicians and the managers of lagoons.
It aims to provide help to identify macroalgae and phanerogams of lagoons of Languedoc-Roussillon.

The guide is divided in two parts

1. GENERAL KNOWLEDGE ON MACROPHYTES

General elements of biology and ecology of the different species and some insights on the relationship with the environment quality.

The biology

Elements on morphology, cellular organization of the tissues, cellular structure of macroalgae, pigment composition and the life cycle.

Gracilaria gracilis cystocarps

Zostera marina fruits during maturation

The ecology

Factors that influence the state of macrophyte assemblages are both abiotic (salinity, temperature) and anthropogenic (eutrophication).

Response to increasing eutrophication:

I — *Zostera* bed
II — Red macroalgae bed of *Halopytis incurva*
III — *Ulva rigida* bed
IV — Phytoplankton proliferation

Reference species
Epiphytes
Phytoplankton
Opportunistic annual macrophytes
Relative abundance
Increasing eutrophication

Vegetal succession in lagoons related to eutrophication level (modified from Schramm, 1999)
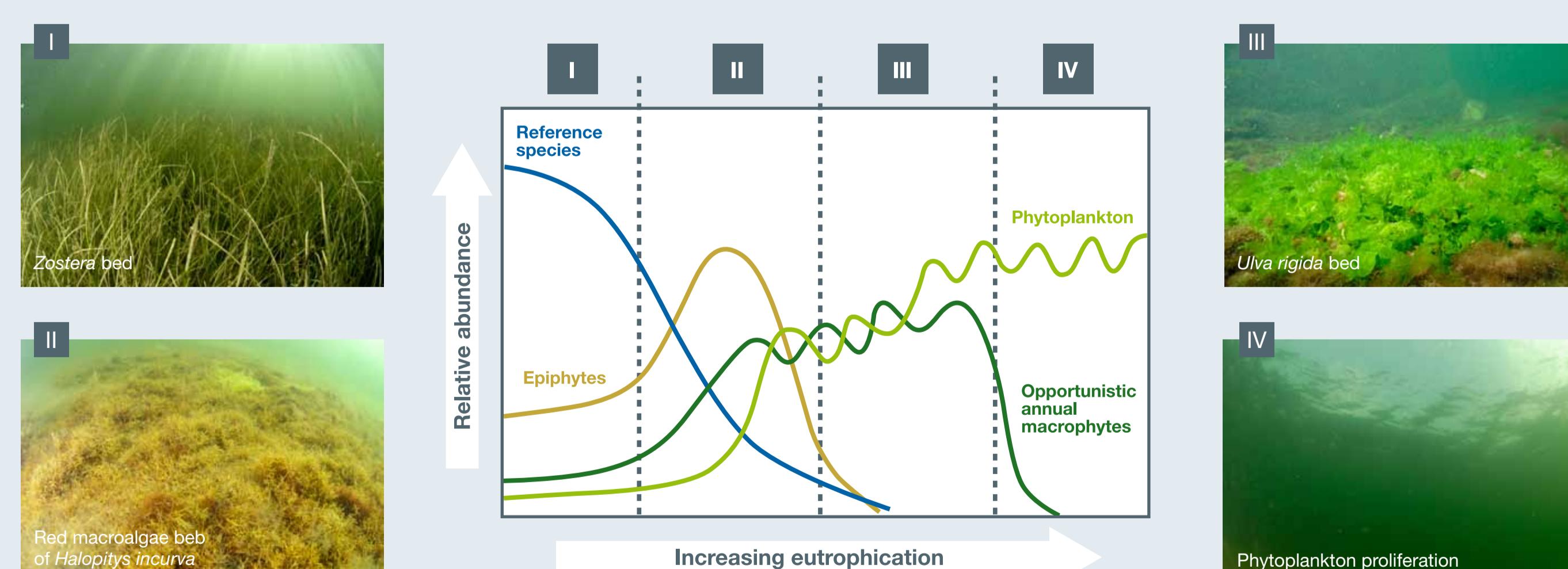
When the quantity of nutrient load by the watershed is important and induce an increase of their concentration in the lagoon, the reference species (essentially seagrass) deplete, the species richness decreases, the red seaweeds bed develop, then the phytoplankton and the opportunistic macroalgae (generally *Ulva* genus) develop. The proliferation of the phytoplankton leads to an increase of water turbidity of lagoons, unfavourable to phanerogams and to other macroalgae.

The different methods of macrophyte monitoring

Reference species	Species richness	
	nb sp ≥ 3	nb sp < 3
Dominant RC ≥ 75 %	Very good	
Dominant 50 % ≤ RC < 75 %	Good	
Present 5 % ≤ RC < 50 %	Medium	
Rare RC < 5 %	Poor	
Absent	Poor	Bad

Quadrat sample

Diagnostic grid of eutrophication based on macrophytes. Used when the percent coverage of macrophytes is above 5%

RC: relative coverage of reference species (% of vegetal coverage occupied by reference species)
nb sp: total number of observed species

Synthetic review of the different methods applied to macrophyte monitoring: vegetal census, cartography and monitoring (example of the LMN method) of assemblages.

2. SPECIES IDENTIFICATION CARDS

The most occurent species in lagoons are presented in cards with photographs to facilitate the description.

Cladostephus spongiosus

Identification card example
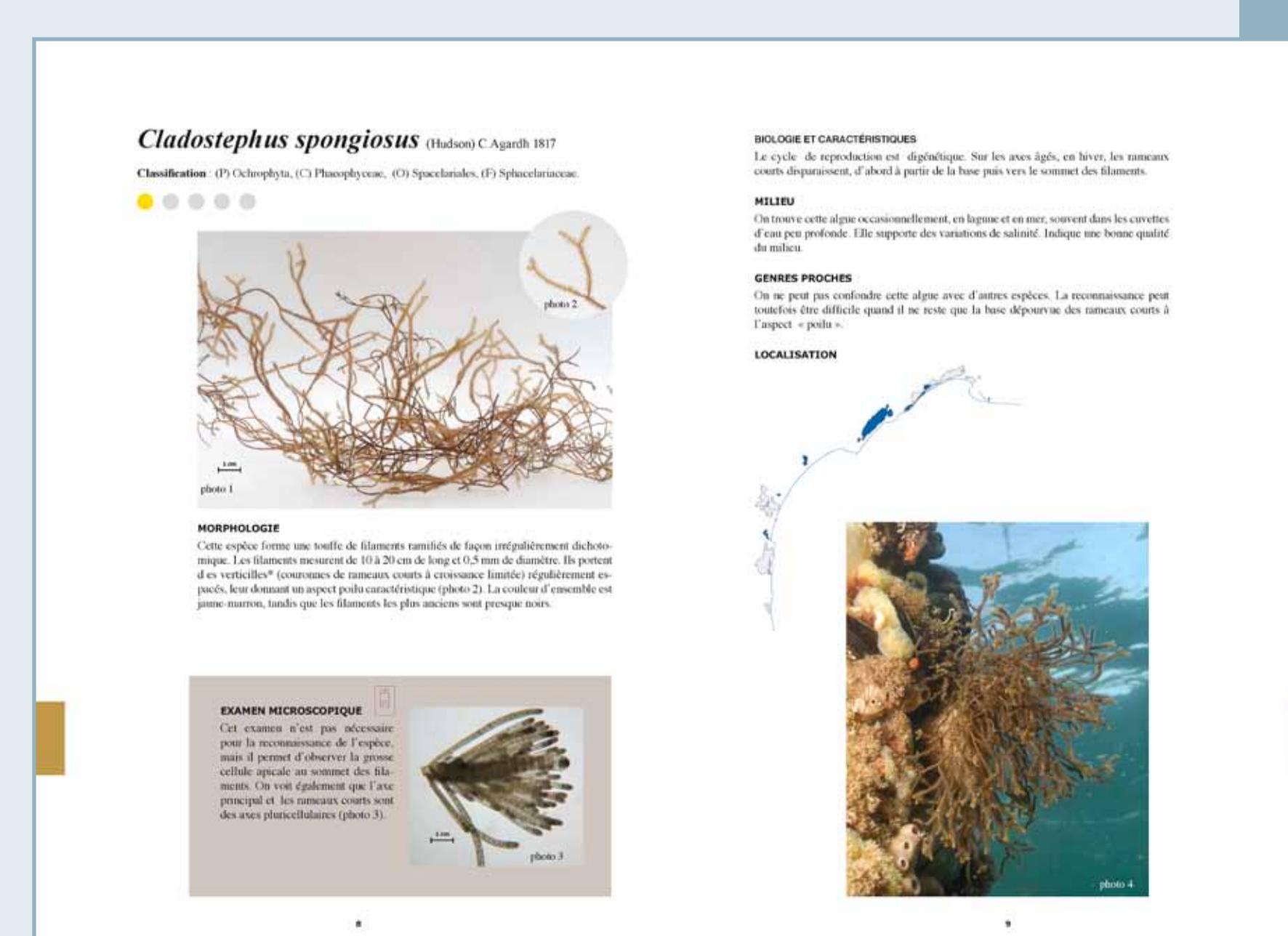
Species identification cards include: morphology, biology and characteristics, microscopic examination, habitat and the morphologically close species. Cards are illustrated with underwater photographs, detailed photographs, important elements and microscopic photographs often necessary for identification.

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Ifremer   Cépralmar   la Région Languedoc Roussillon