



Università  
Ca' Foscari  
Venezia



**ISPRA**  
Istituto Superiore per la Protezione  
e la Ricerca Ambientale



Magistrato alle Acque



Laguna Veneta  
ONLUS  
Associazione Ambiente  
per la salvaguardia, la tutela e la valorizzazione  
della Laguna veneziana, del bacino scolante e delle zone umide



# ECOLOGICAL STATUS AND HABITAT 1150\* CONSERVATION FOLLOWING THE SEAGRASS RESTORATION

Andrea Bonometto

*National Institute for Environmental Protection and Research*

**Coastal Lagoon Restoration – Life SeResto Final Conference**  
*Roma, Circolo Sottoufficiali della Marina Militare, 11<sup>th</sup> April, 2018*

# Monitoring Work Package

## 1. Monitoring of transplanting seagrass rooting

- ✓ Survival and rooting of transplanted specimens, growth rate, new meadow cover

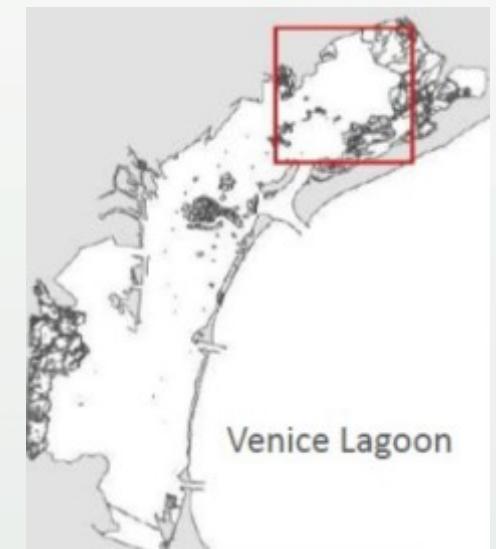
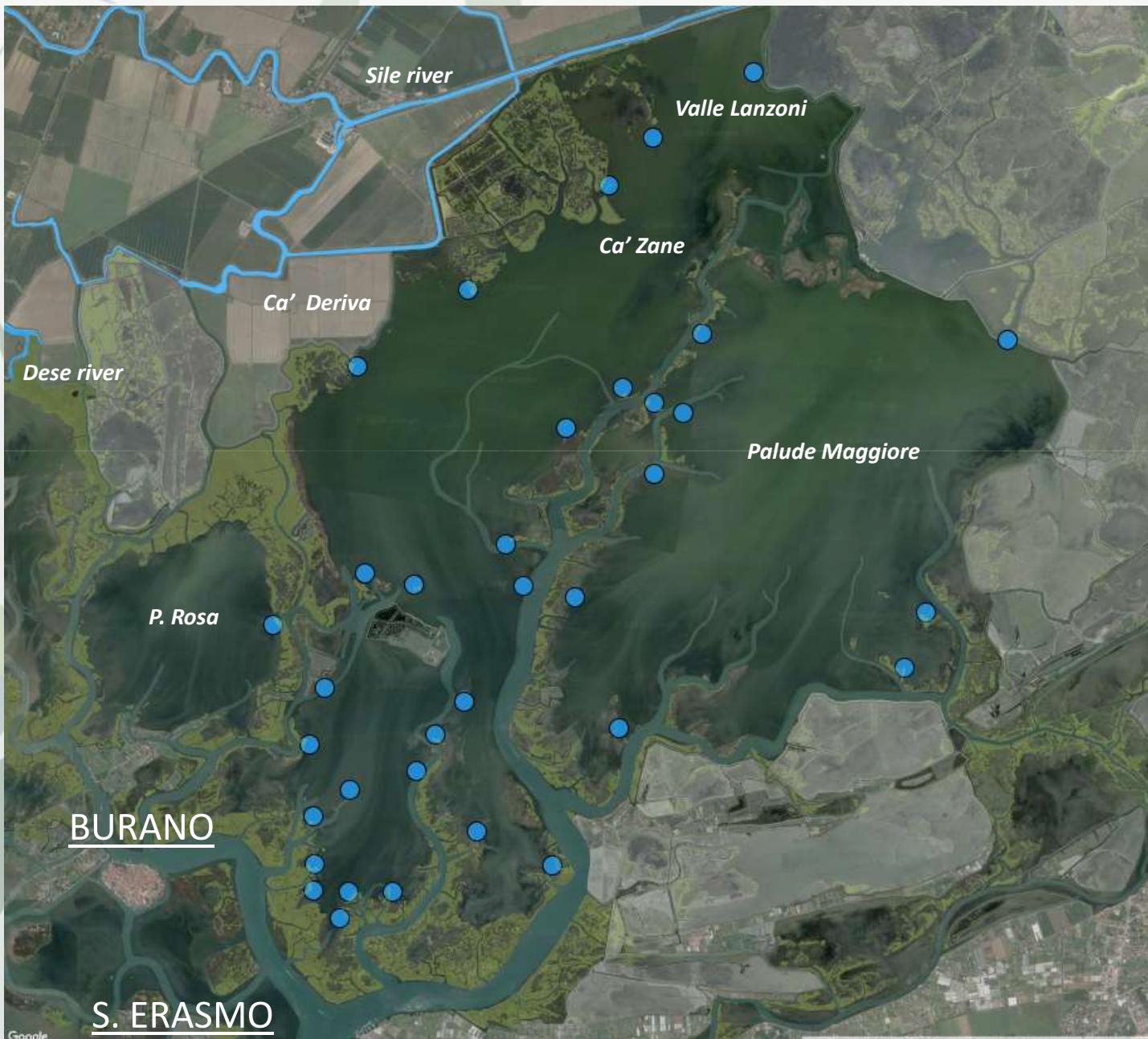
## 2. Monitoring of abiotic parameters and ecological indicators

- ✓ Analysis of factors controlling the transplantation success and failure
- ✓ Changes in Conservation degree of habitat 1150\* Coastal lagoon (Direttiva Habitat 92/43/CEE) following seagrass restoration;
- ✓ Changes in ecological status (WFD 2000/60/CE).

## 3. Monitoring of ecosystem services

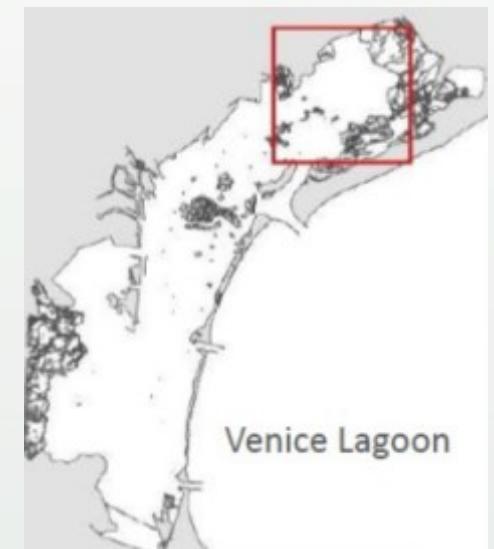
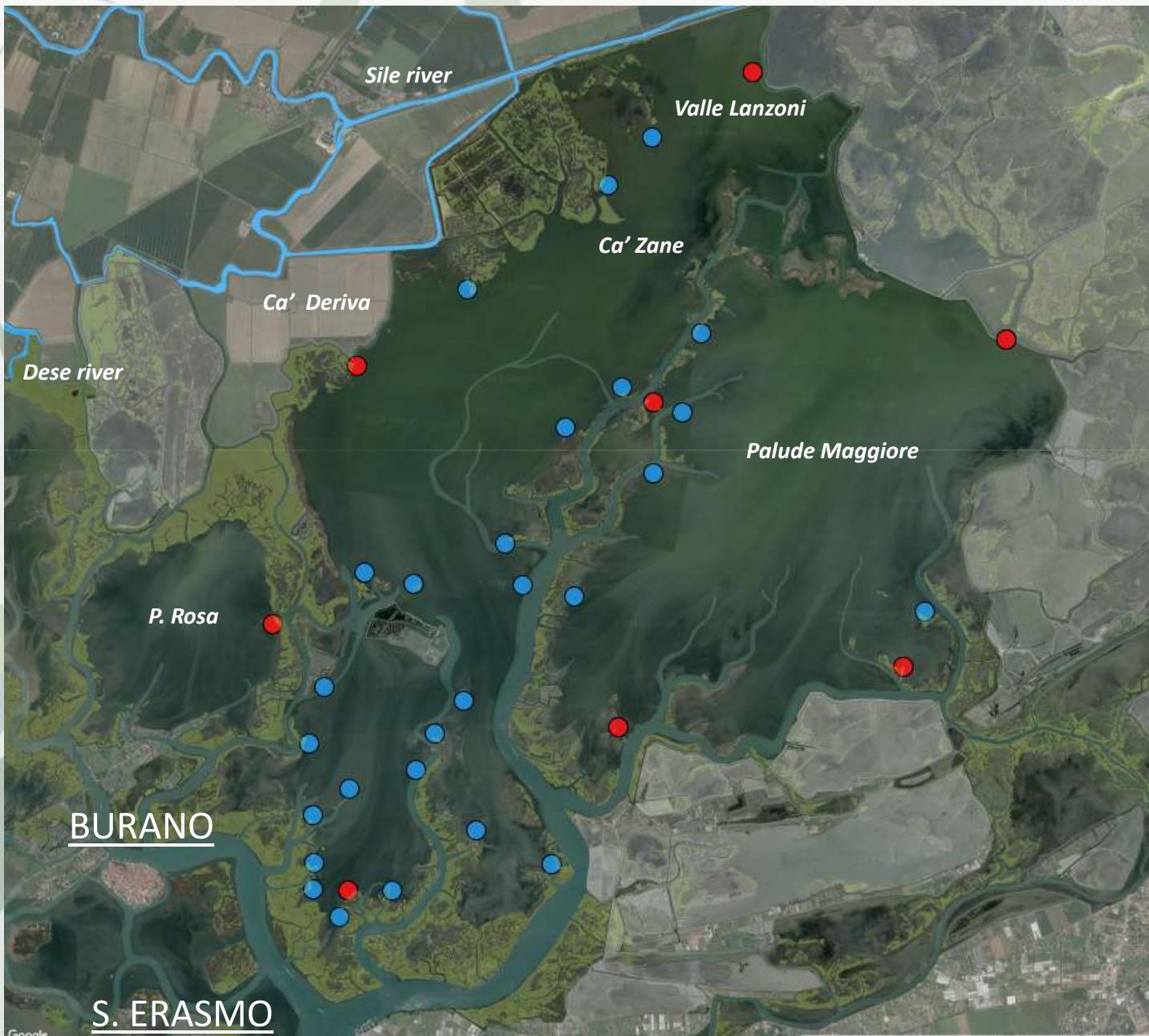
- ✓ Data elaboration, surveys, additional sampling (e.g. commercial fish species)

# MONITORING STRATEGY – STATIONS



Transplantation sites -  
monitoring stations

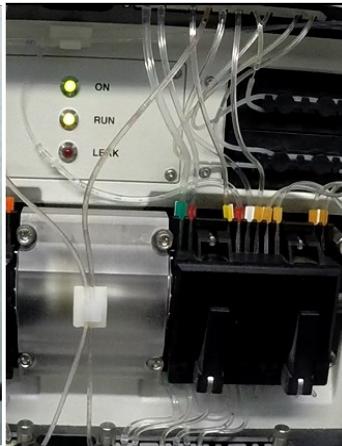
# MONITORING STRATEGY – STATIONS



● Transplantation site - monitoring stations

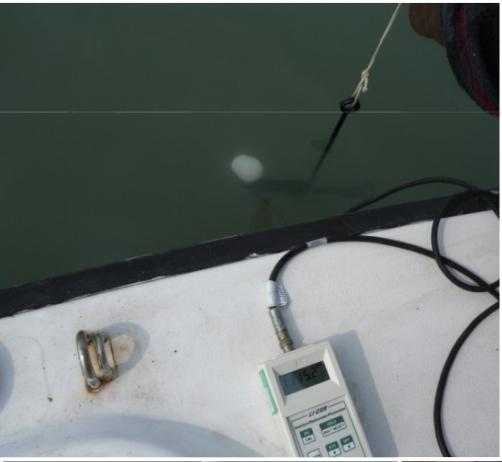
● Intensive ecological monitoring stations

# MONITORING STRATEGY – PARAMETERS



## WATER

Parametri:  
*nutrients; DOC; POC; light trasmission;  
dissolved oxygen; salinity; TSS, ecc.*



## SEDIMENTS

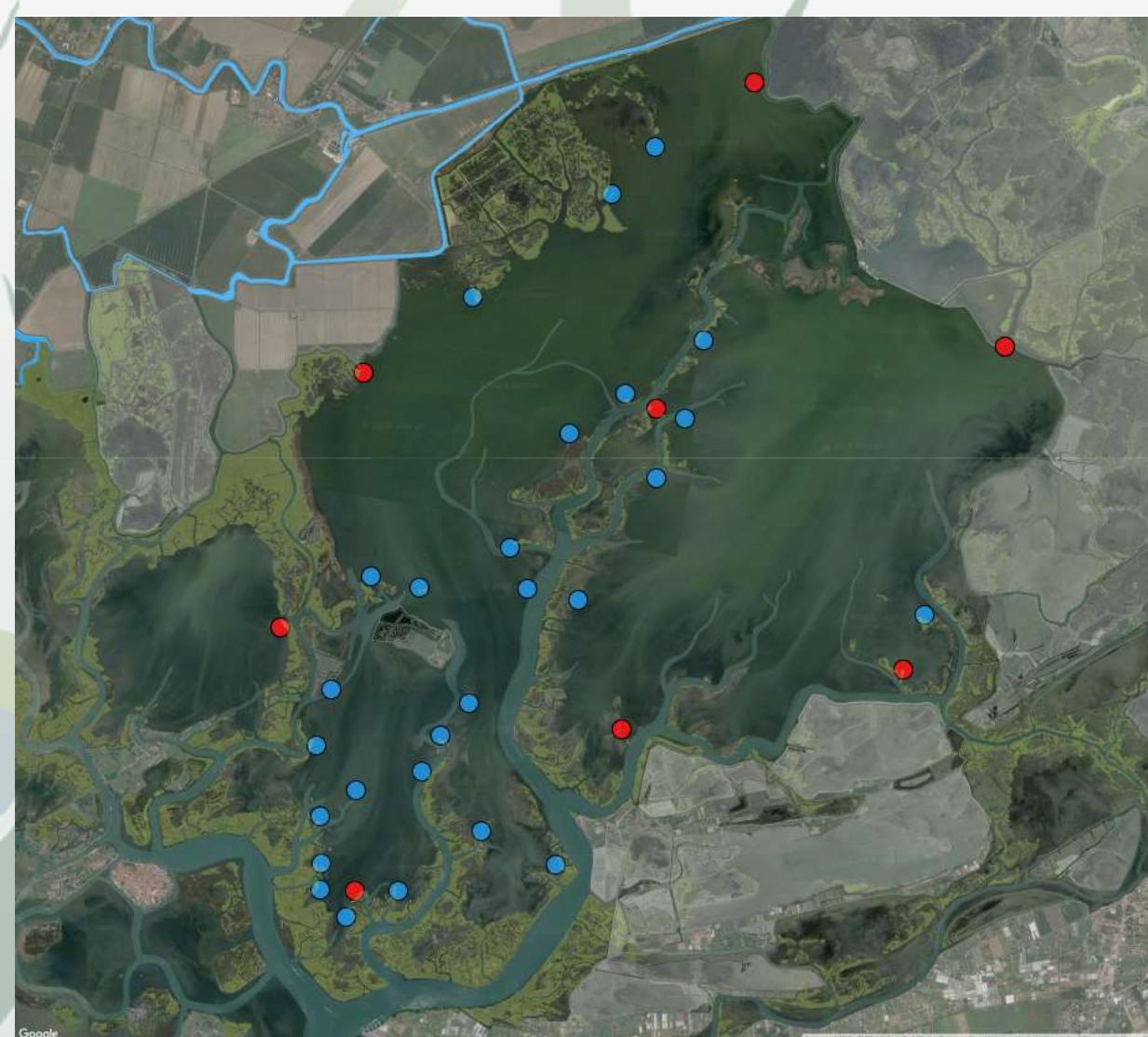
Parametri:  
*TOC; IC; TN; TP, OC, IC; density; % fine*



## SETTLED PARTICOLATE MATTER

Parametri:  
*Sedimentation rates, TN, TP, TOC,...*

# MONITORING STRATEGY – FREQUENCY



## WATER

### ALL 35 STATION

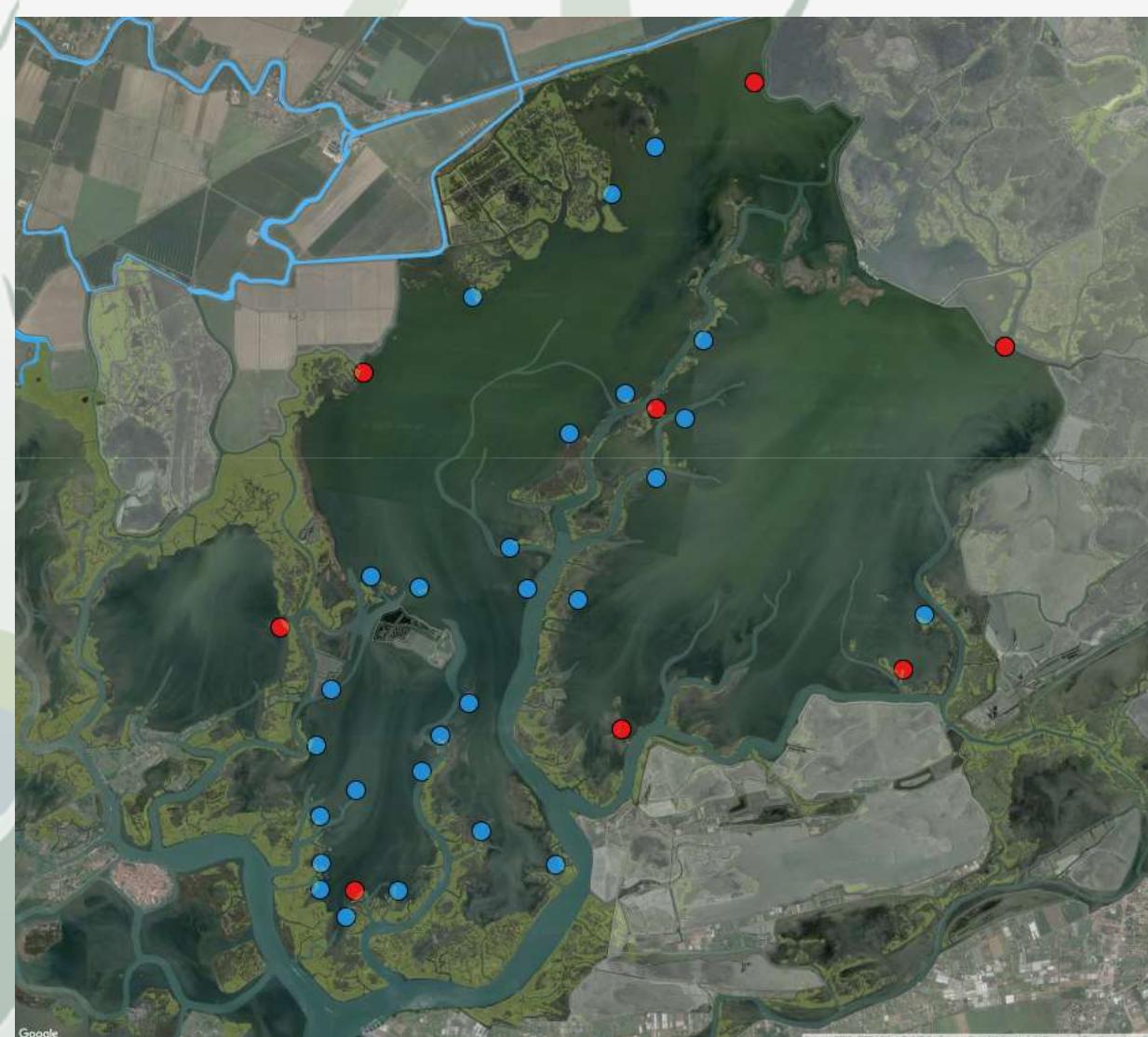
- Campaign at the beginnig of transplanting (2014/15);
- Campaign at the end of the project (2017)

### 8 STATIONS

- Monthly sampling during 1 project year (2014/15);
- Monthly sampling during last project year (2016/17)

**total 310 samples**

# MONITORING STRATEGY – FREQUENCY



## SEDIMENTS

### ALL 35 STATION

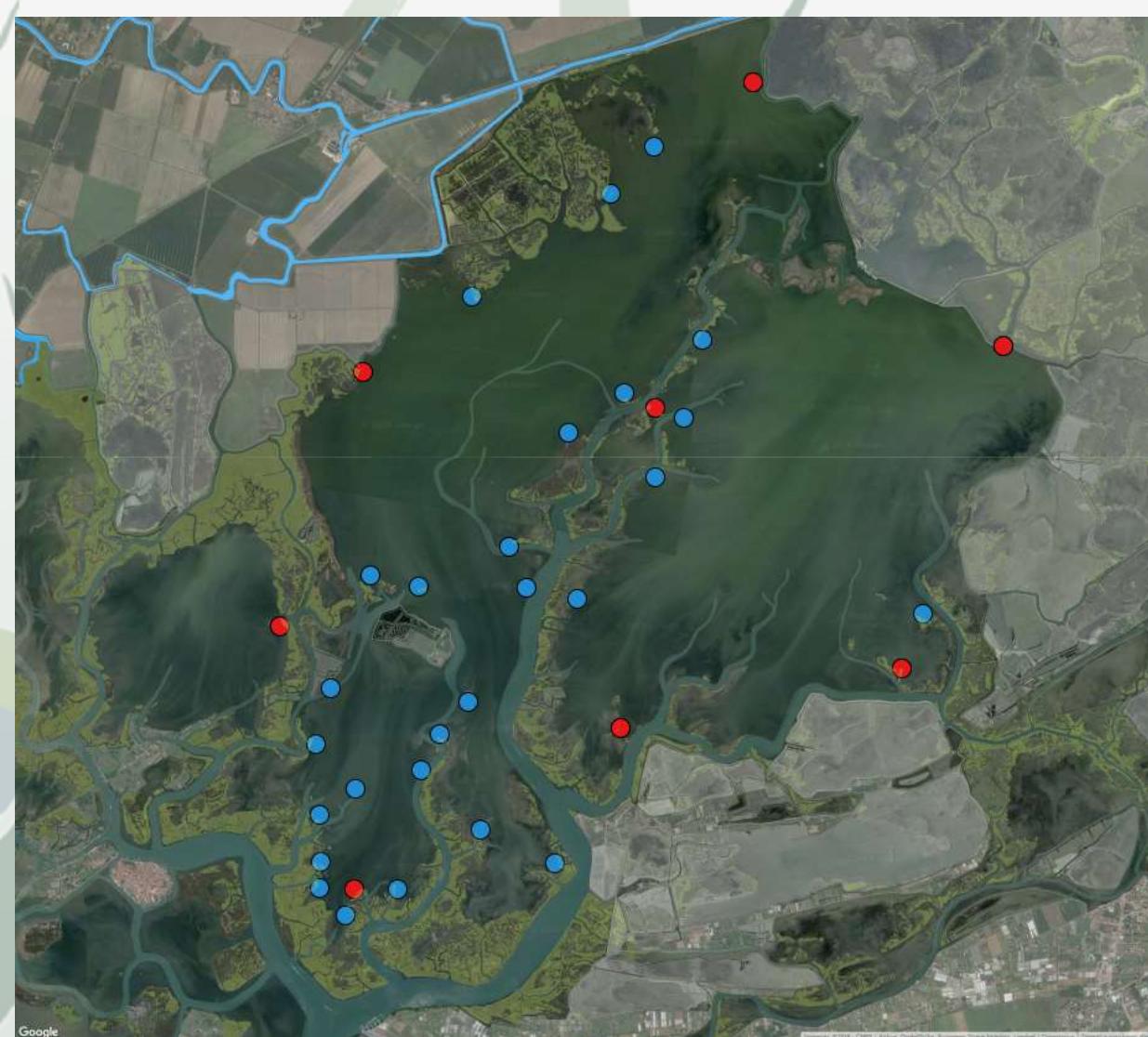
- Campaign at the beginnig of transplanting (2014/15);
- Campaign at the end of the project (2017)

### 8 STATIONS

- Twice a year (spring and Autumn), from 2014 to 2017.

**total 118 samples**

# MONITORING STRATEGY – FREQUENCY



## SETTLED PARTICULATE MATTER

### **8 STATIONS**

- *Monthly sampling during 1 project year (2014/15);*
- *Monthly sampling during last project year (2016/17)*

**total 96 samples**

# MONITORING STRATEGY – *BIOLOGICAL QUALITY ELEMENTS*

## WFD Indicators

Italian Law DM 260/2010; EU Decision 2013/480/EU; 2018/229/EU



### MACROZOOBENTHOS *M-AMBI and BITS indices*

1/year – 8 stations - 40 samples



### MACROPHYTES *Macrophyte Quality Index*

2/year – 35 stations (17 sts. In 2014)  
244 samples

### FISH FAUNA

*HFBI, Habitat Fish Bioindicator Index;  
Commercial species*

2/year – 8 stations

64 samples by beach seine net

64 samples by fixed net (*bertovelli*)

# MONITORING OBJECTIVES

- ✓ Characterization of transplanting sites
- ✓ Analysis of factors controlling the transplantation success and failure.

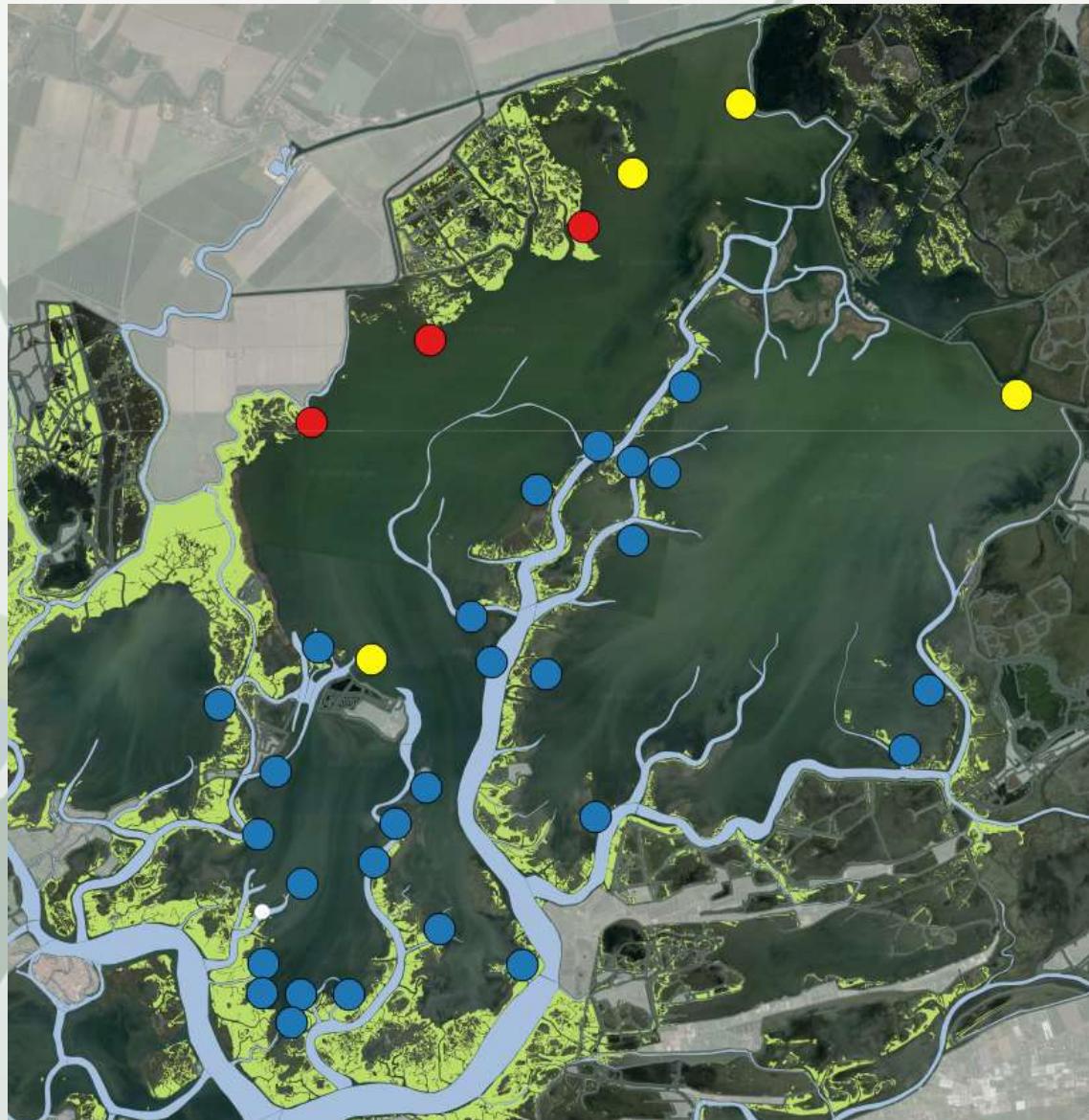


Indications for new transplanting activities  
**REPLICABILITY AND TRANSFERIBILITY** of project results

- ✓ Changes in Conservation degree of habitat 1150\* Coastal lagoon  
(Dir. Habitat 92/43/CEE) following seagrass recovery;
- ✓ Changes in ecological status  
(WFD 2000/60/CE).

# CHARACTERIZATION OF TRANSPLANTING SITES

## ABIOTIC PARAMETERS – WATER

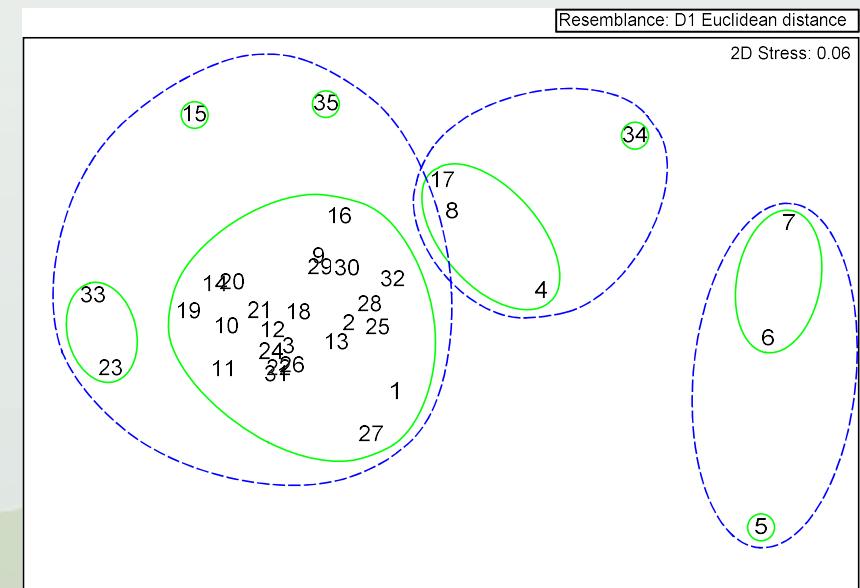


**3 groups of stations:**

**A and B – in inner lagoon area**

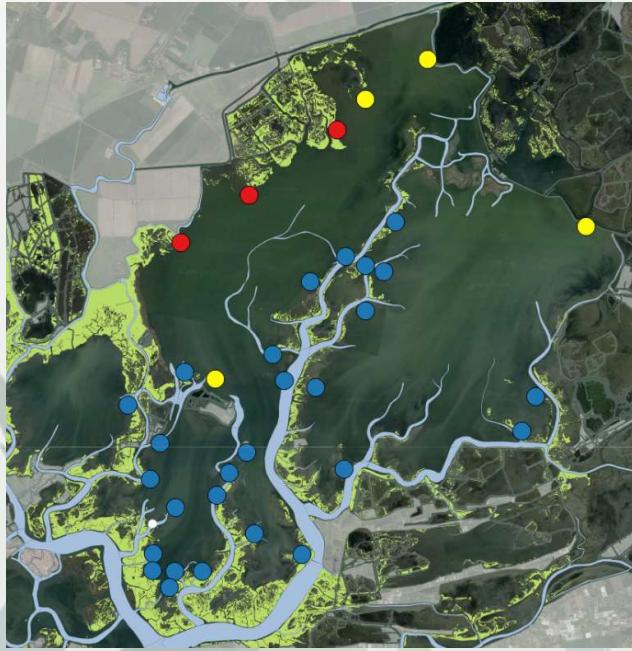
**C – along the main tidal channels**

### Analysis of Similarity



# CHARACTERIZATION OF TRANSPLANTING SITES

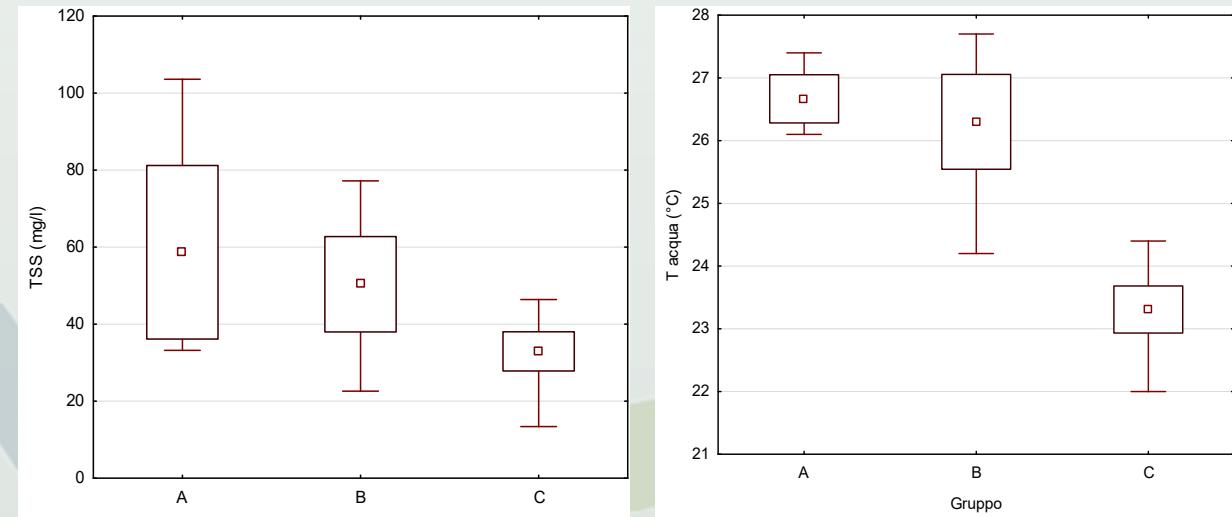
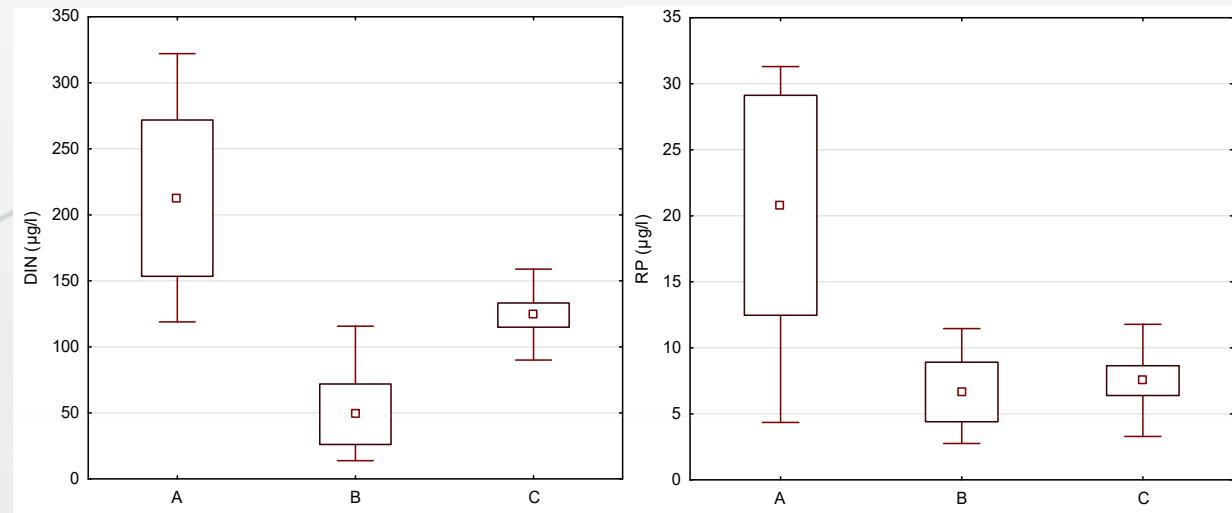
## ABIOTIC PARAMETERS – WATER



**A:** higher NUT and DOC conc.

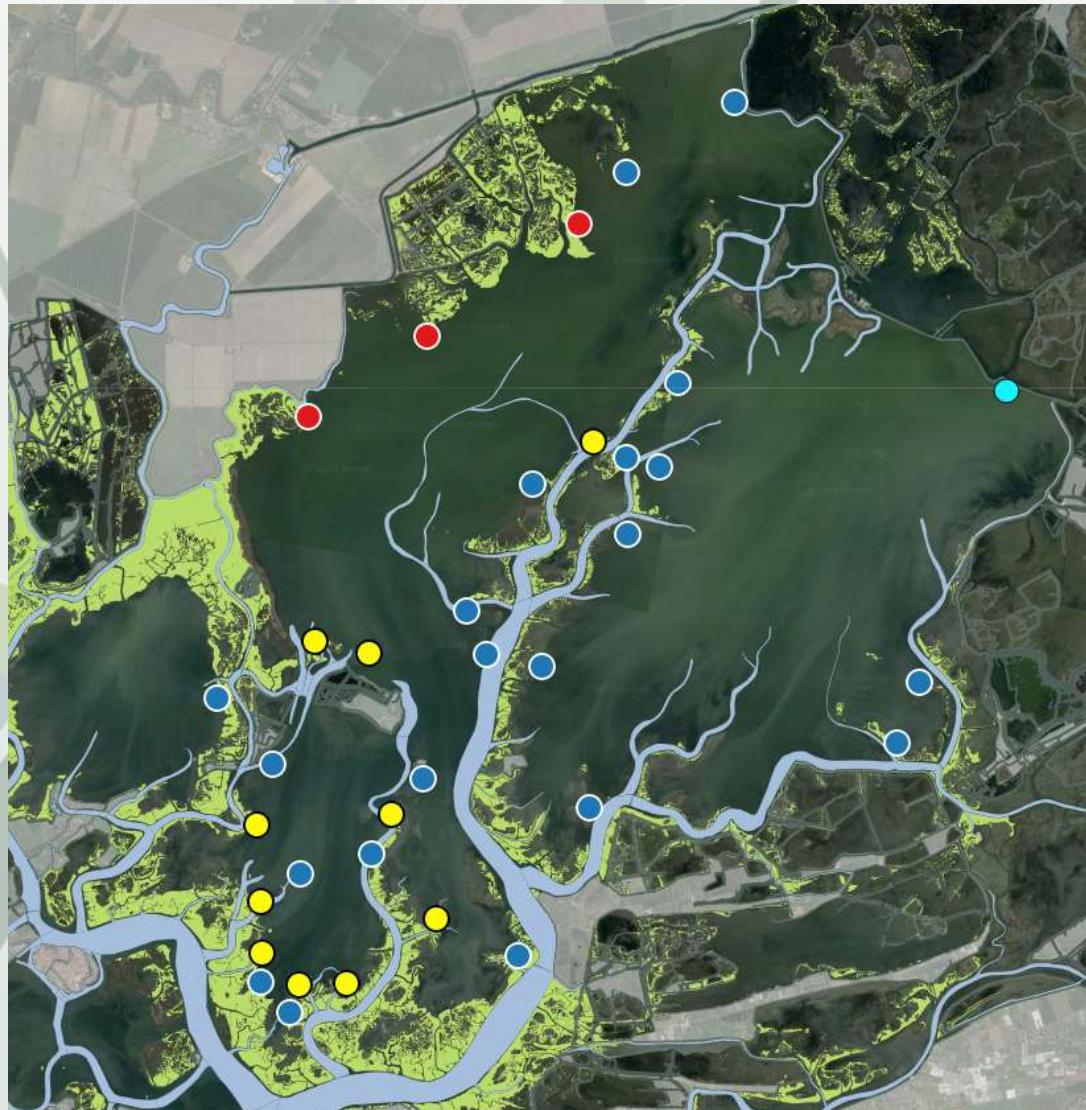
**B:** low NUT conc. :

**C:** low NUT conc., TSS and temp.



# CHARACTERIZATION OF TRANSPLANTING SITES

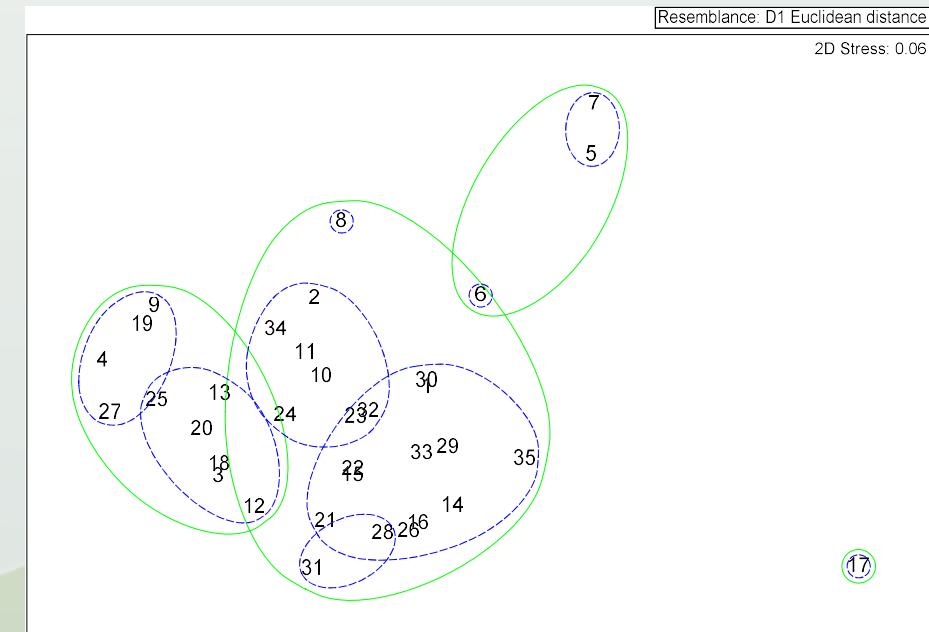
## ABIOTIC PARAMETERS – *SEDIMENTS*



**3 groups of stations:**

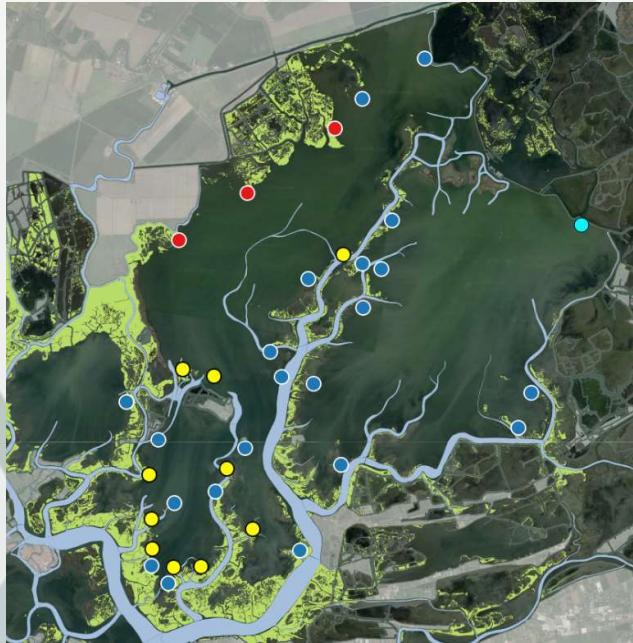
**A:** in inner lagoon area;

**B** and **C:** not clear patterns



# CHARACTERIZATION OF TRANSPLANTING SITES

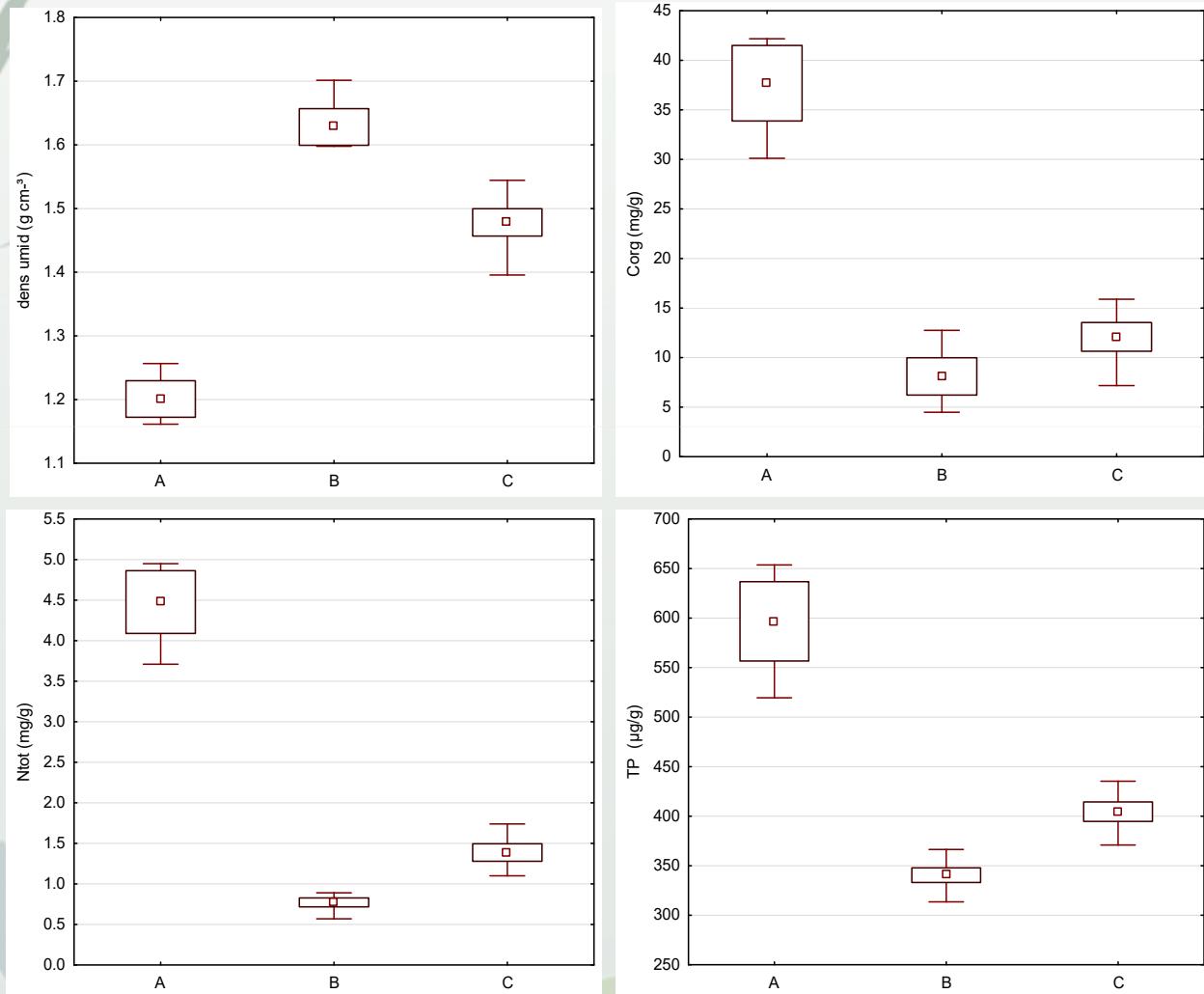
## ABIOTIC PARAMETERS – *SEDIMENTS*



**A:** high NUT and DOC conc., low sediment density

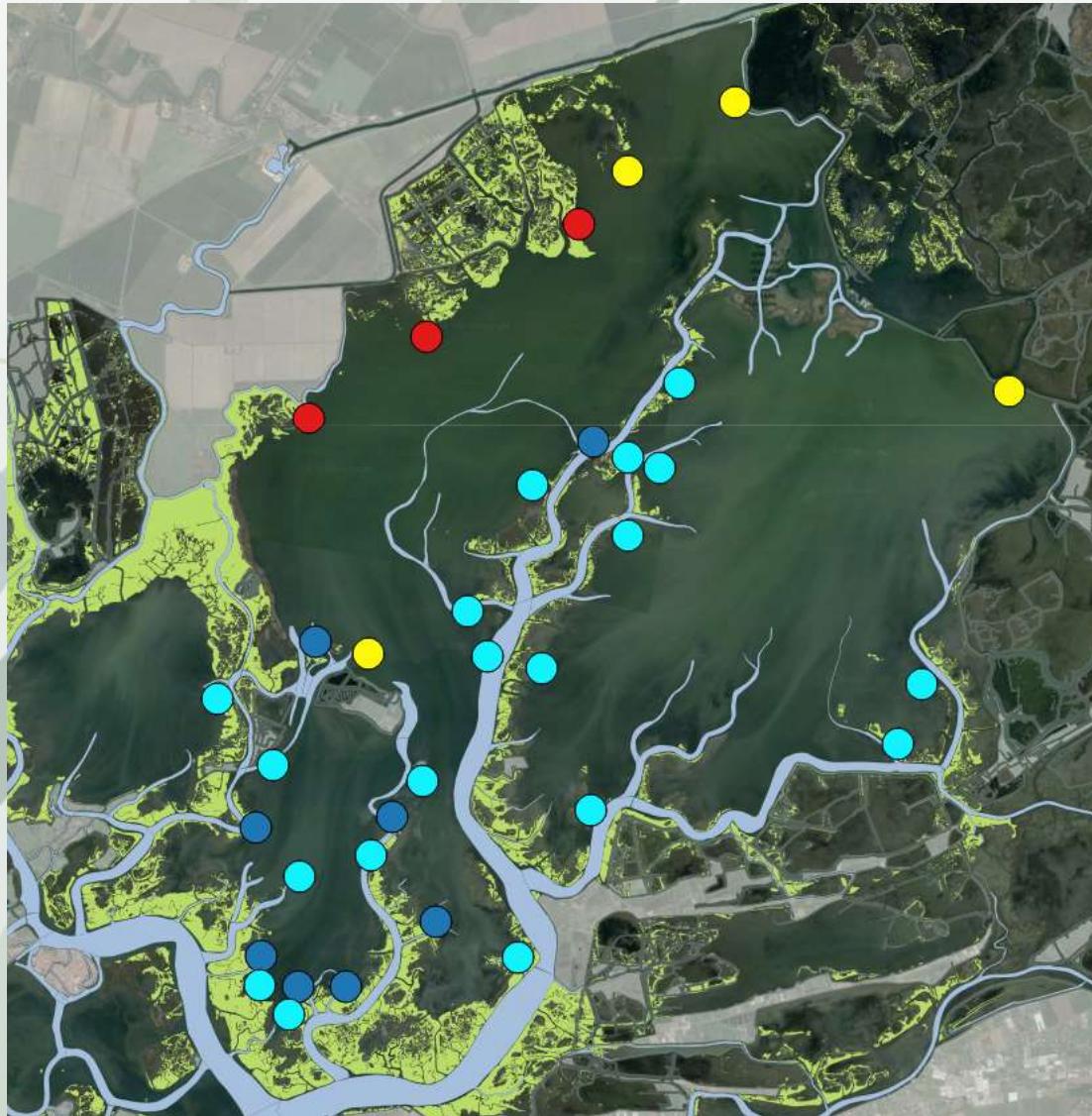
**B:** low NUT conc., higher dens.

**C:** intermediate conditions, similar to B.



# CHARACTERIZATION OF TRANSPLANTING SITES

## ABIOTIC PARAMETERS – WATER & *SEDIMENTS*



### Group A

Higher nutrient conc. In water and sediment

### Group B

Lower nut concentration in water and sediment; higher water temp.

### Group C

Low NUT conc. in water and sediment; low DOC; lower water temp.

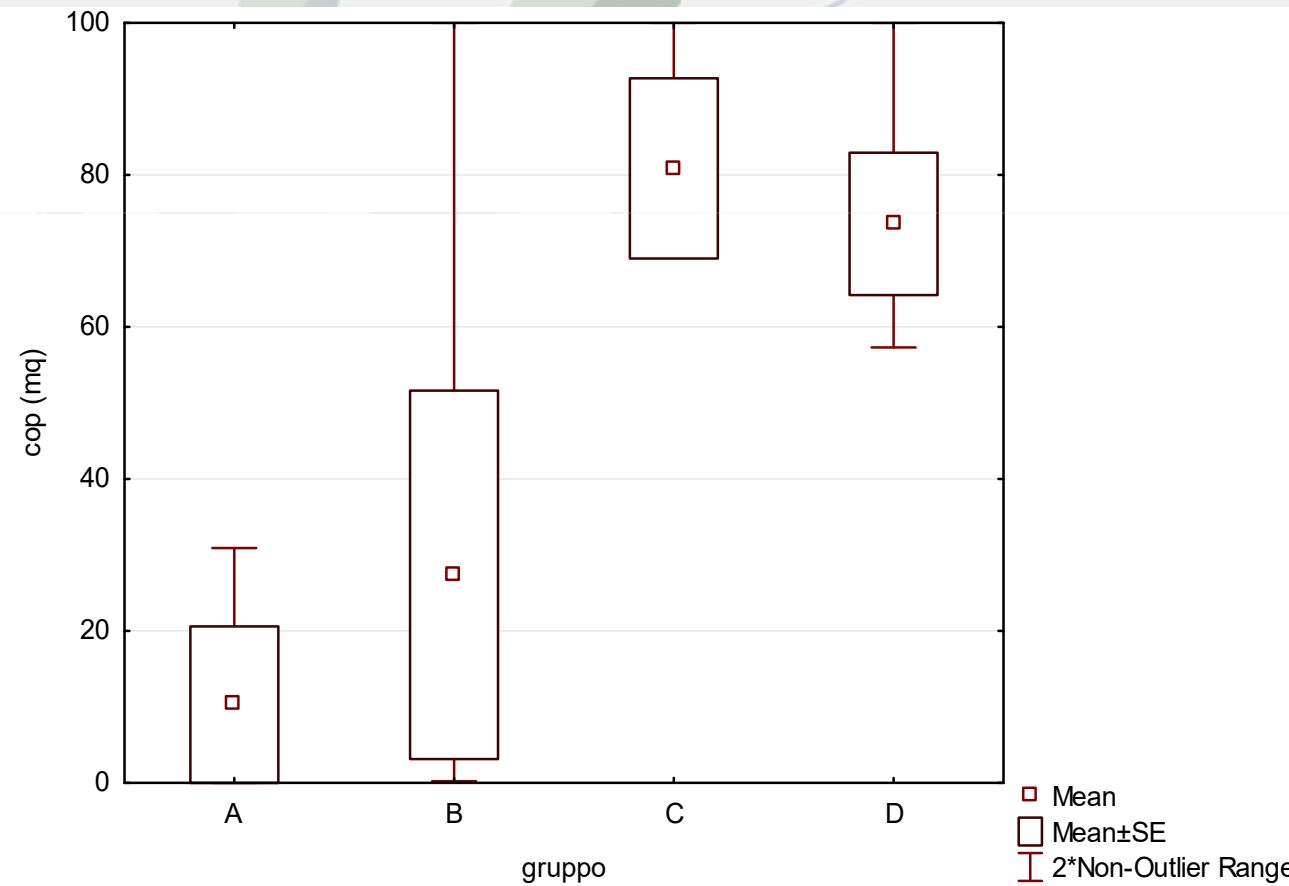
### Group D

Similar to «C», higher sed. density, lower NUT conc in sediment

# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS

Seagrass cover in transplanting site (area 10x10 m)  
(2017)



### Group A

Higher nutrient conc. In water and sediment

### Group B

Lower nut concentration in water and sediment; higher water temp.

### Group C

Low NUT conc. in water and sediment; low DOC; lower water temp.

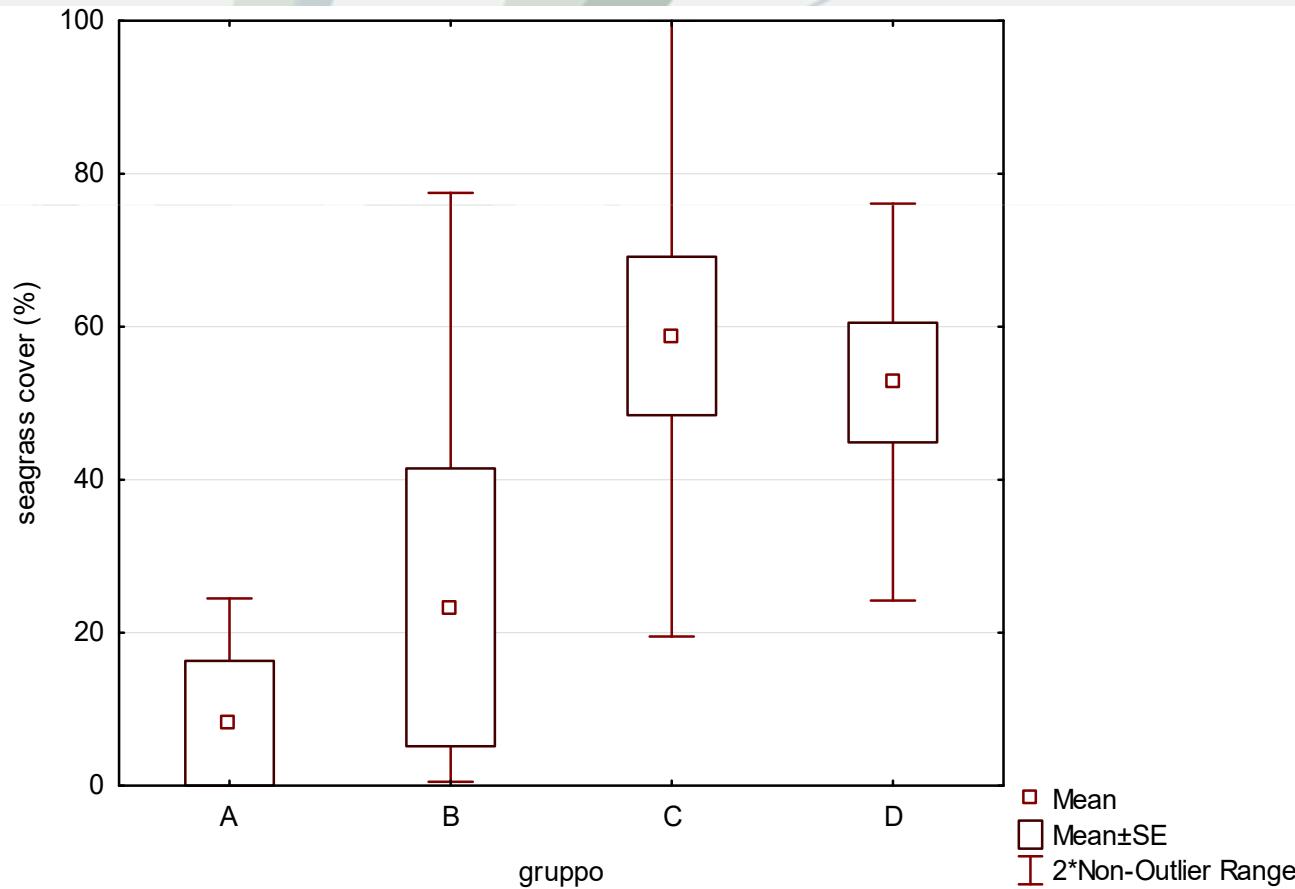
### Group D

Similar to «C», higher sed. density, lower NUT conc in sediment

# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS

Seagrass cover in transplanting area  
(2017)



### Group A

Higher nutrient conc. In water and sediment

### Group B

Lower nut concentration in water and sediment; higher water temp.

### Group C

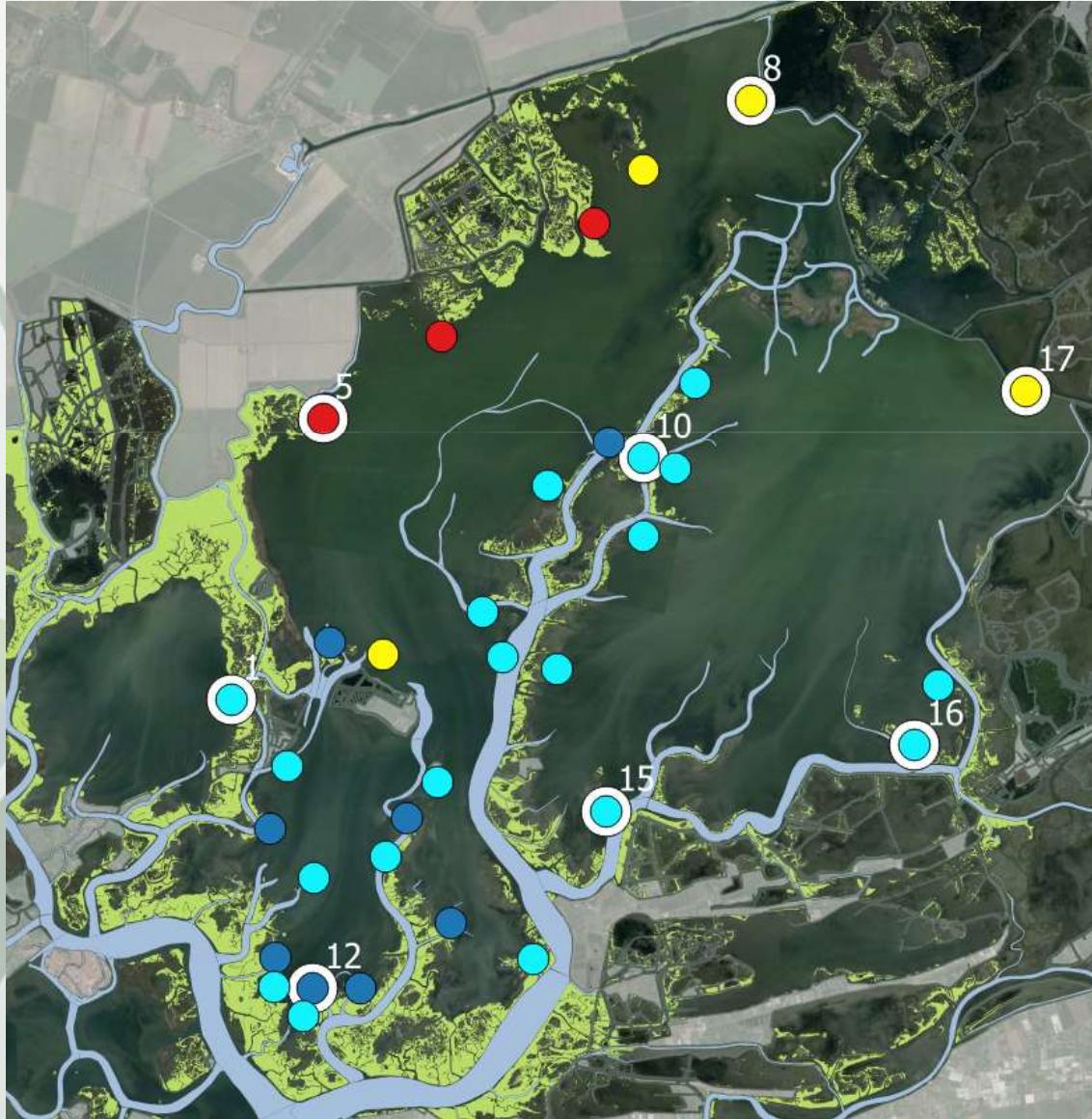
Low NUT conc. in water and sediment; low DOC; lower water temp.

### Group D

Similar to «C», higher sed. density, lower NUT conc in sediment

# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS



ALL GROUPS ARE REPRESENTED BY  
8 STATIONS SELECTED FOR INTENSIVE  
ECOLOGICAL MONITORING

**Group A**

St. 5

**Group B**

Sts. 8, 17

**Group C**

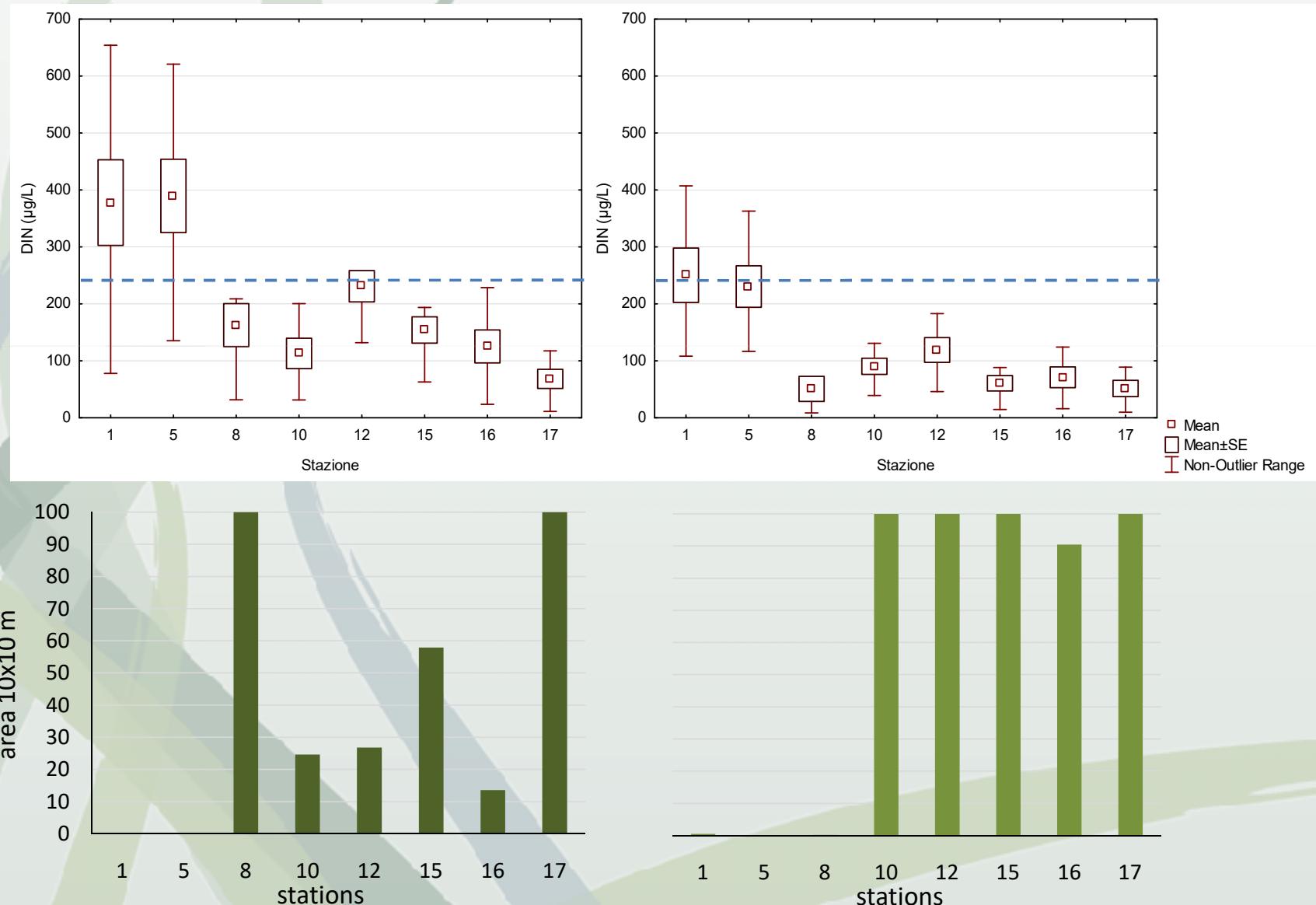
St. 12

**Group D**

St. 1, 10, 15, 17

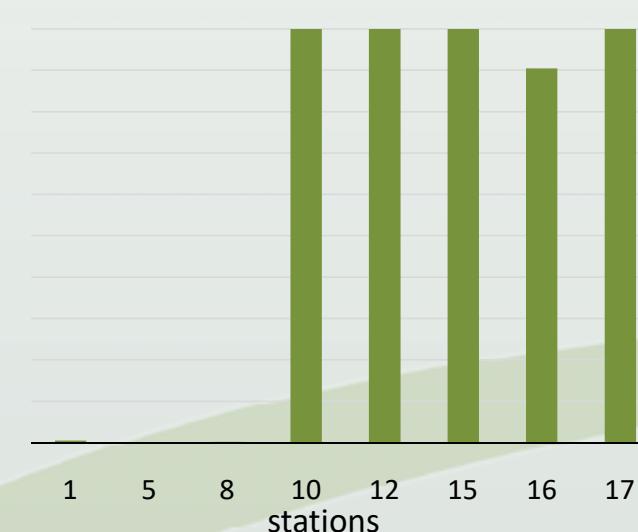
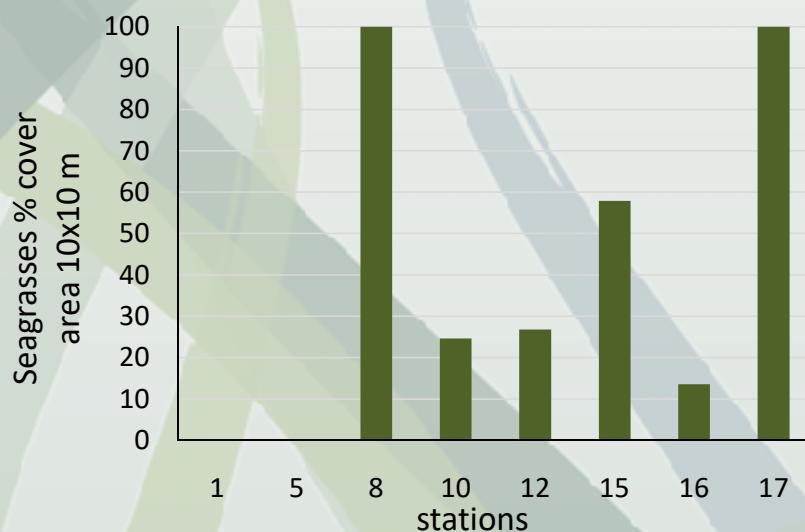
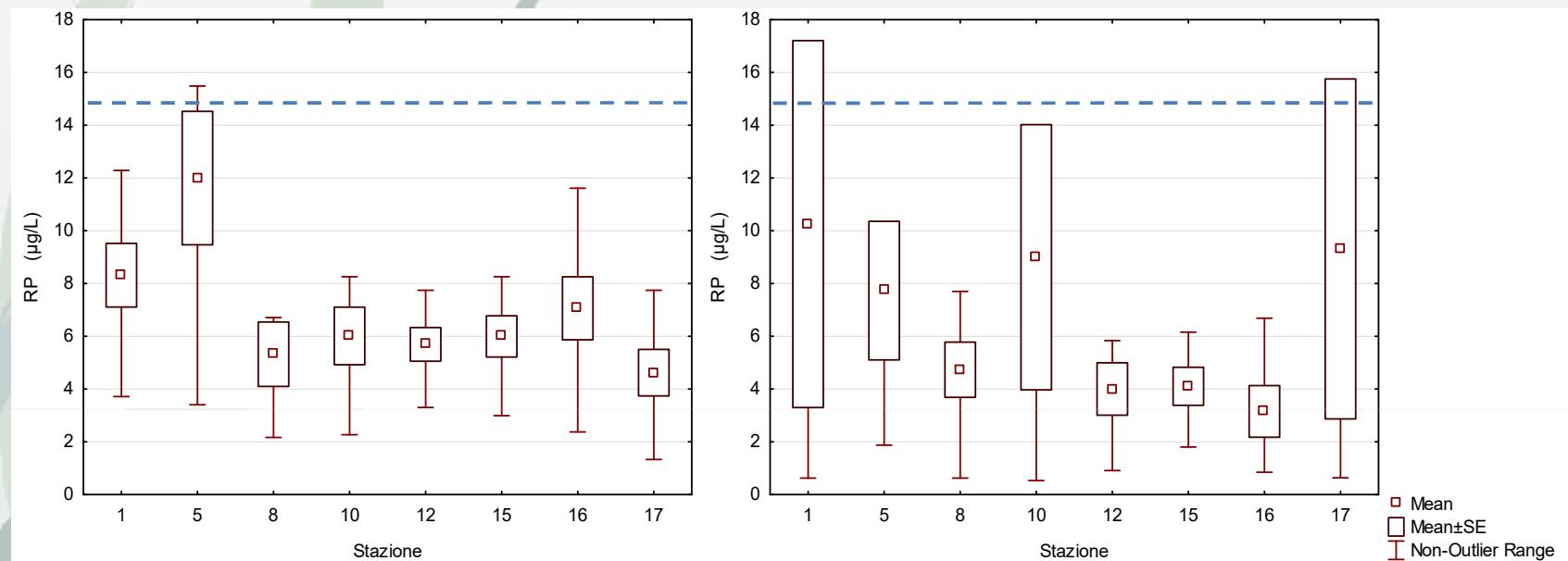
# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS



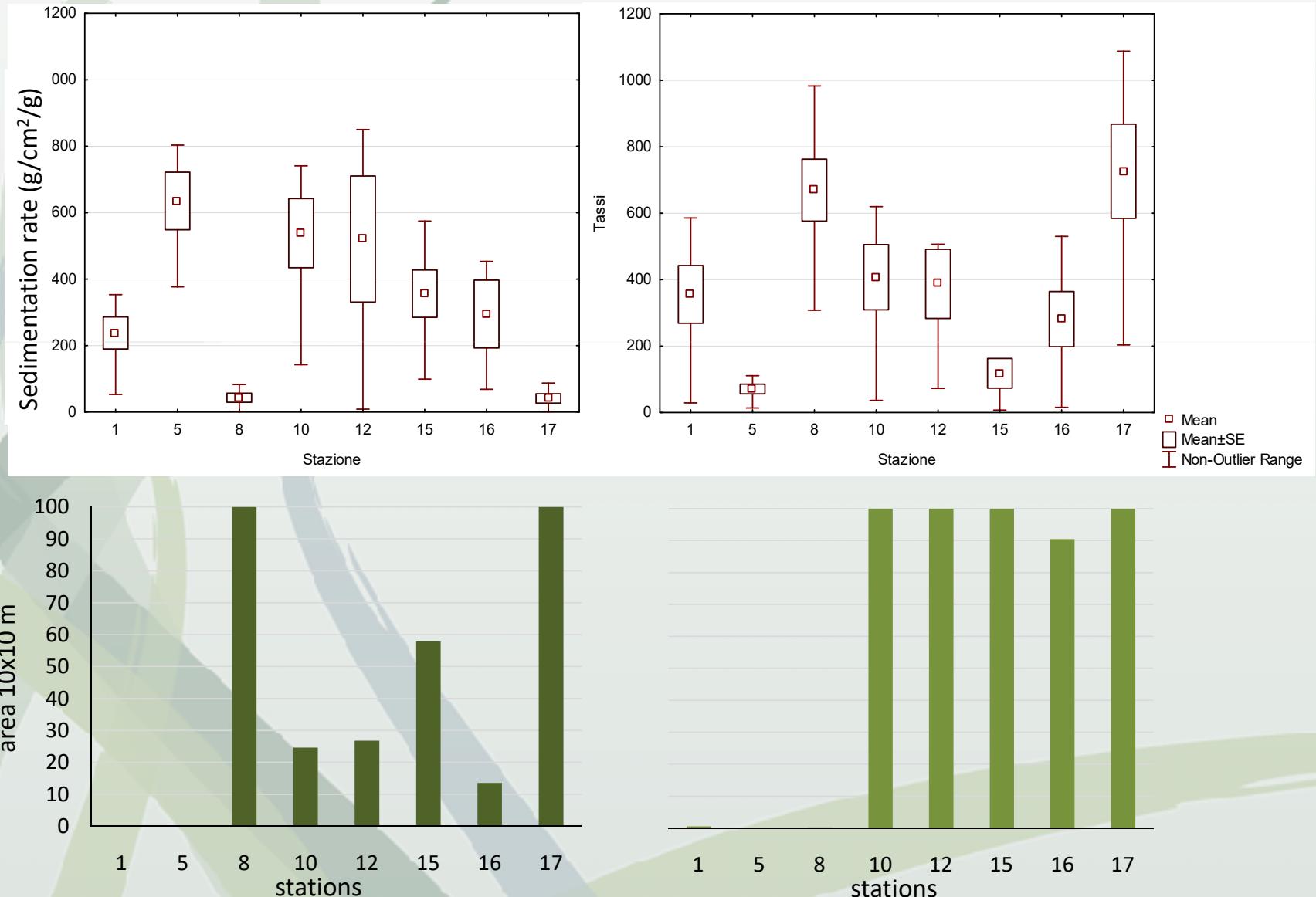
# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS



# FACTORS CONTROLLING TRANSPLANTING SUCCESS

## TRANSPLANTING RESULTS vs ABIOTIC PARAMETER PATTERNS



# REPLICATION & TRANSFERABILITY OF RESULTS



## TRAPIANTO DELLE PIANTE ACQUATICHE PER IL RIPRISTINO DELL'HABITAT "LAGUNE COSTIERE"

LINEE GUIDA DALL'ESPERIENZA DEL PROGETTO  
LIFE NATURA SERESTO

LIFE+NATURA SERESTO - NAT/IT/00031  
HABITAT 1150\* (COASTAL LAGOON) RECOVERY  
BY SEAGRASS RESTORATION.  
A NEW STRATEGIC APPROACH TO MEET HD & WFD OBJECTIVES

(TENTATIVE) GUIDE VALUE FOR  
SELECTION OF  
TRANSPLANTING SITES

# MONITORING OBJECTIVES

- ✓ Characterization of transplanting sites
- ✓ Analysis of factors controlling the transplantation success and failure.



Indications for new transplanting activities  
**REPLICABILITY AND TRANSFERIBILITY** of project results

- ✓ Changes in Conservation degree of habitat 1150\* Coastal lagoon  
(Dir. Habitat 92/43/CEE) following seagrass recovery;
- ✓ Changes in ecological status  
(WFD 2000/60/CE).

# MONITORING OBJECTIVES

**Habitat 1150\* (Coastal lagoon) recovery by SEagrass RESTOration.  
A new strategic approach to meet HD & WFD objectives**

- ✓ Changes in Conservation degree of habitat 1150\* Coastal lagoon  
(Dir. Habitat 92/43/CEE) following seagrass recovery;
- ✓ Changes in ecological status  
(WFD 2000/60/CE).

# CONSERVATION DEGREE OF HABITAT 1150\*

## HABITAT DIRECTIVE REQUIREMENT

Dgr. RV 1066/2007

### STRUCTURE

I : excellent structure

II : structure well conserved

III : average or partially degraded structure

### FUNCTIONS

I: excellent prospects

II: good prospects

III: average or unfavourable prospects

		Funzioni		
		I	II	III
Struttura	I	A	A	A
	II	A	B	B se ripristino I/II C se ripristino III
	III	B se ripristino I/II C se ripristino III	B se ripristino I C se ripristino II/III	C

### Conservation degree

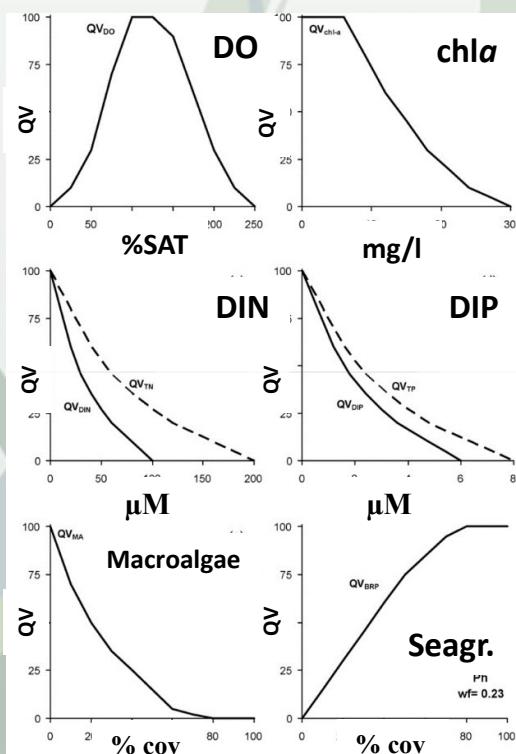
A: excellent conservation

B: good conservation

C: average or reduced conservation

# GRADO DI CONSERVAZIONE HABITAT 1150\*

## PRELIMINARY METHODOLOGY DEVELOPED FOR THE PROJECT



### STRUCTURE

		SEAGRASS COVER*		
		assenti	0-25%	>25%
TROPHIC STATUS (TWQI)	B-P	<50	III	II/III*
	M	50-60	II/III**	II
	G-H	>60	II/III*	I/II**

\* II/III trend of TWQI

\*\* I/II trend of seagrass cover

\*COPERTURA DI BIOCENOSI CONSIDERATE DI IMPORTANZA PRIORITARIA DAL PROTOCOLLO SPA/BIO

Nato da un lavoro in collaborazione tra ISPRA OOPP e RV nel 2012, ulteriormente sviluppato e messo a punto per valutare i risultati del LIFE SERESTO

# GRADO DI CONSERVAZIONE HABITAT 1150\*

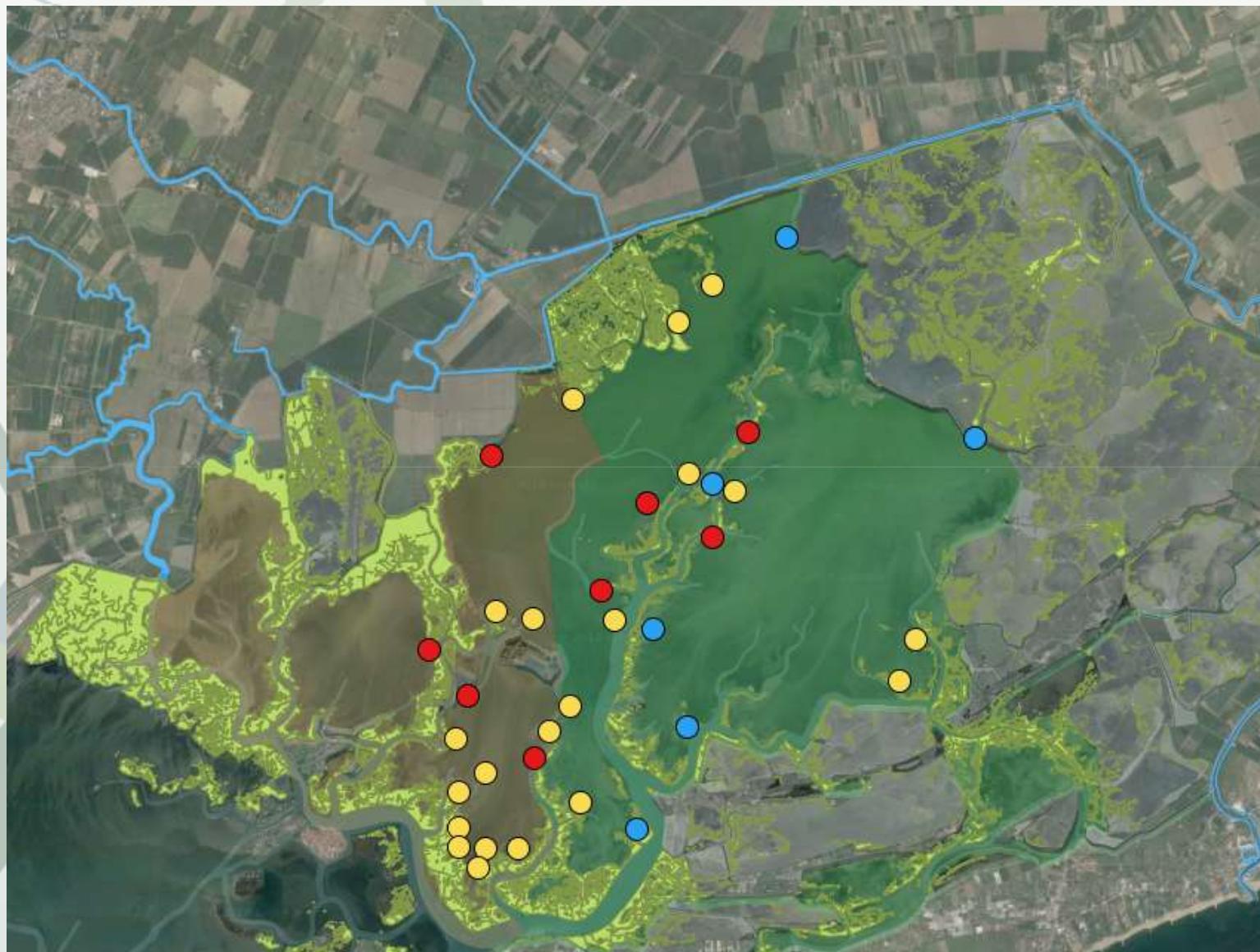
## *PRELIMINARY METHODOLOGY DEVELOPED FOR THE PROJECT*

### FUNCTIONS

		fauna ittica (HBFI)			
		H-B	M	P-B	
		I	II	III	
Benthos (M-AMBI)	H-B	I	I	I/II	III/II*
	M	II	I/II	II	III/II*
	B-P	III	III/II*	III/II*	III

\* II/III status of MAQI

# CONSERVATION DEGREE - STRUCTURE

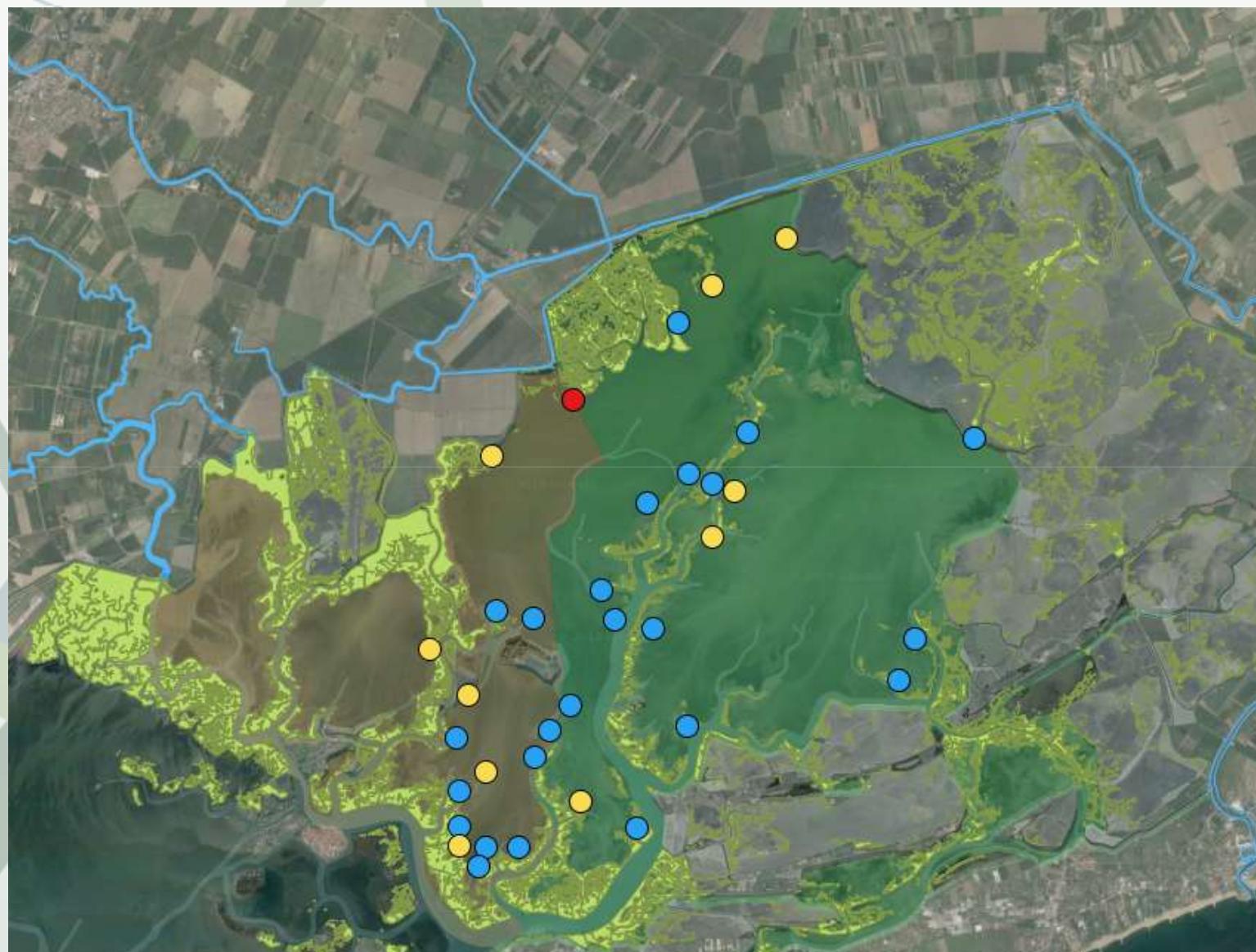


**INITIAL STATE**  
2014/2015

**GdC STRUTTURA**  
**Habitat 1150\***

- I - excellent
- II - good
- III – degradaed

# CONSERVATION DEGREE - STRUCTURE

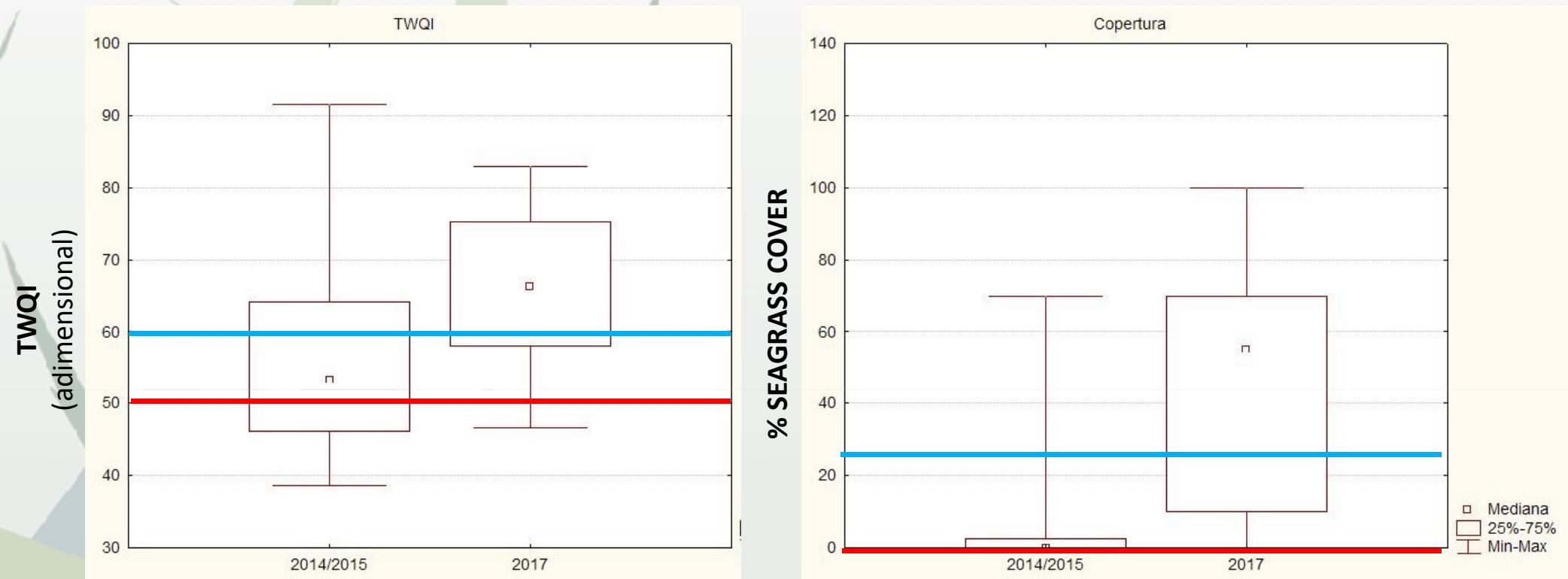


AFTER 4 YEAR FROM FIRST TRANSPLANTING  
2017

**GdC STRUTTURA**  
**Habitat 1150\***

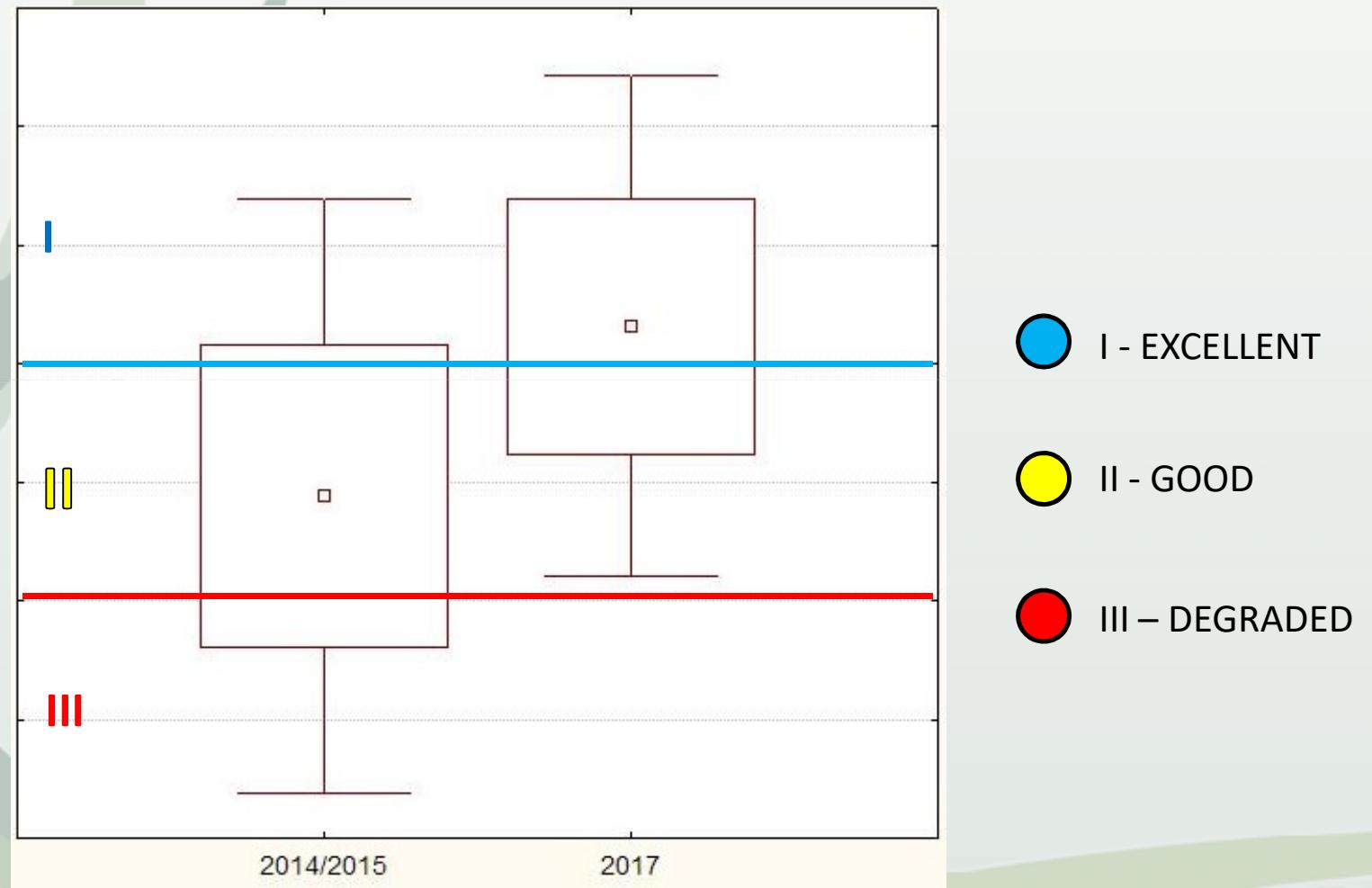
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# CONSERVATION DEGREE - STRUCTURE

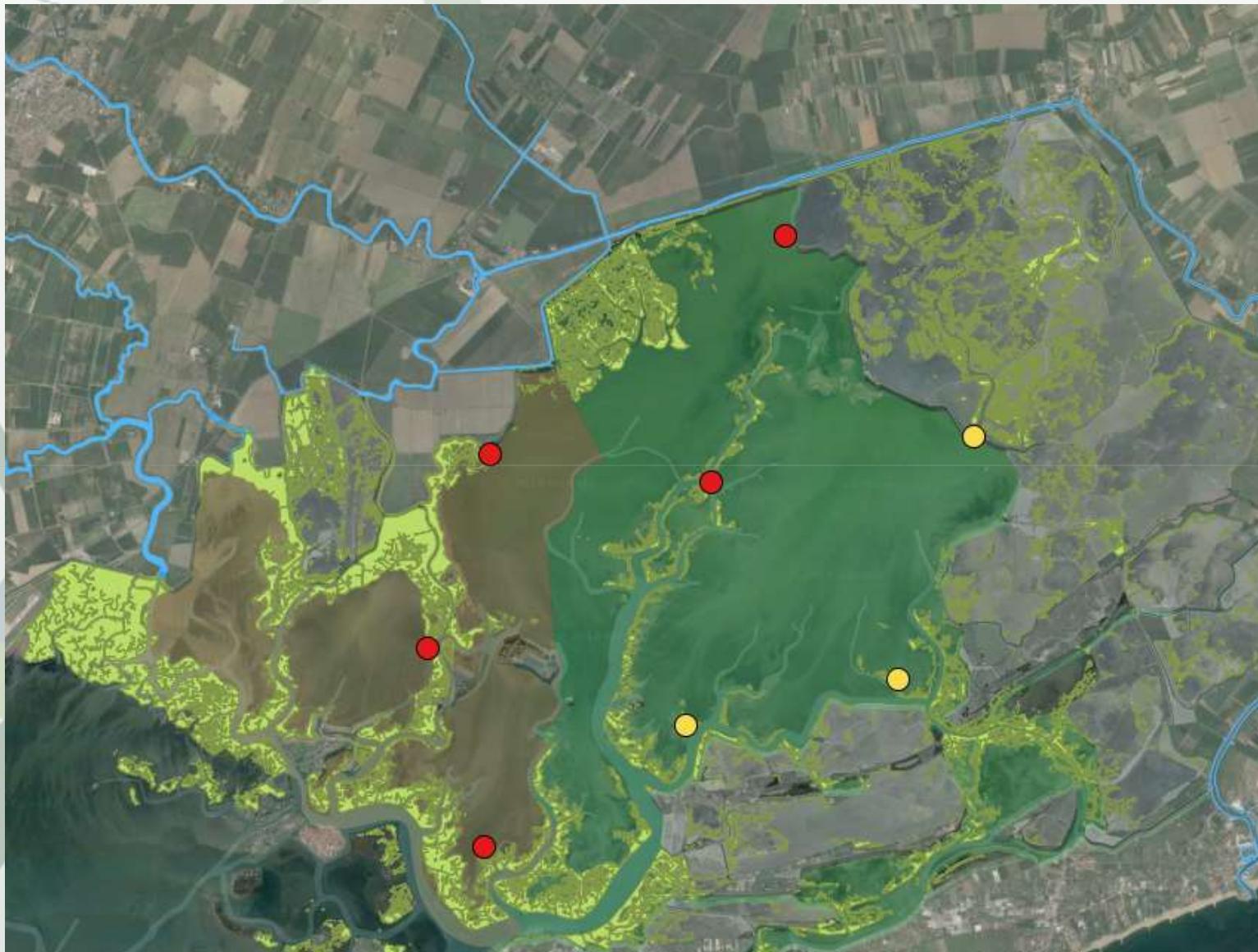


			fanerogame		
			assenti	0-25%	>25%
TWQI	B-P	<50	III	II/III*	II/III*
	M	50-60	II/III**	II	I/II*
	G-H	>60	II/III*	I/II**	I

# CONSERVATION DEGREE - STRUCTURE



# CONSERVATION DEGREE - FUNCTIONS

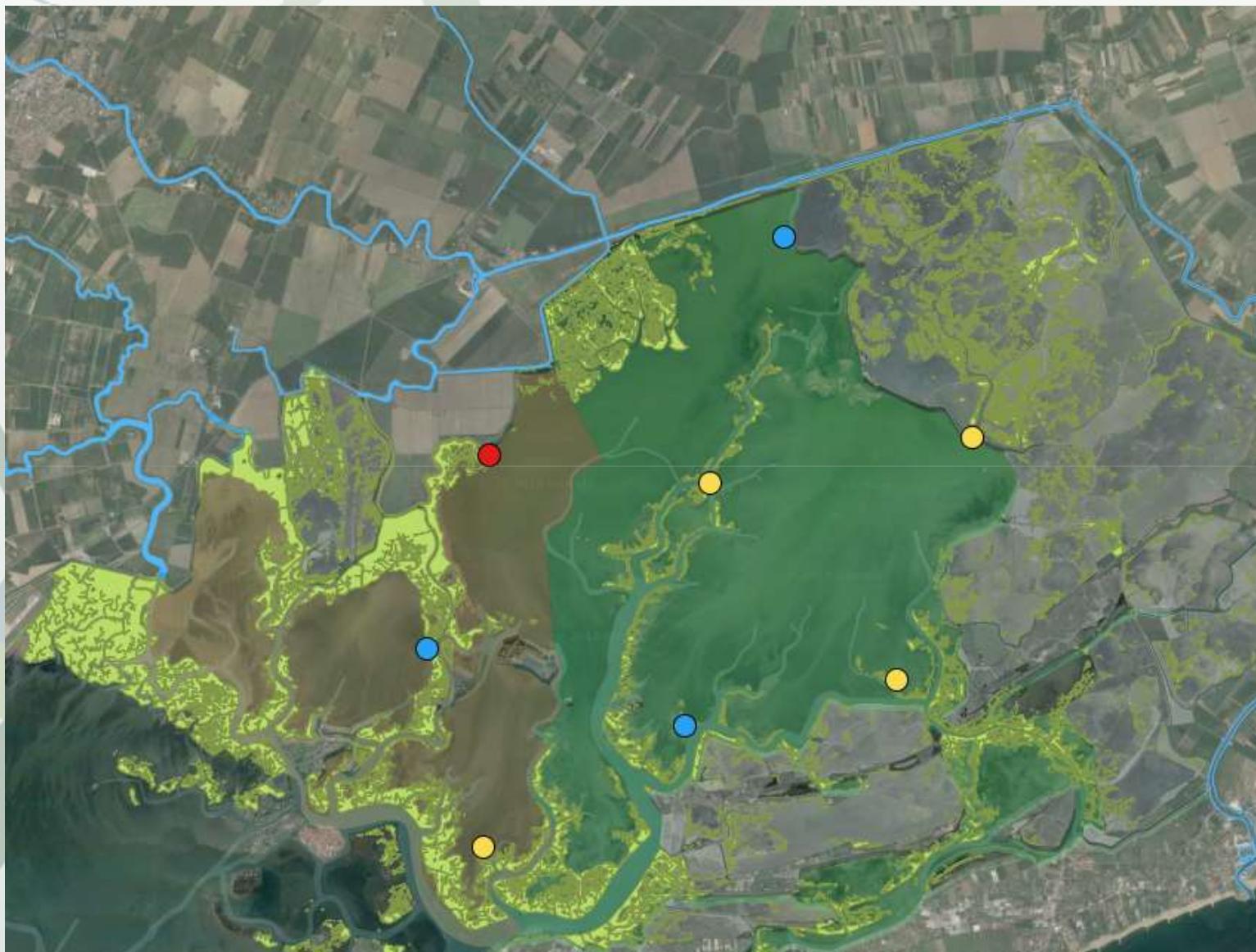


**INITIAL STATE  
2014/2015**

**GdC FUNZIONI  
Habitat 1150\***

- I - EXCELLENT
- II - GOOD
- III – UNFAVOR.

# CONSERVATION DEGREE - FUNCTIONS

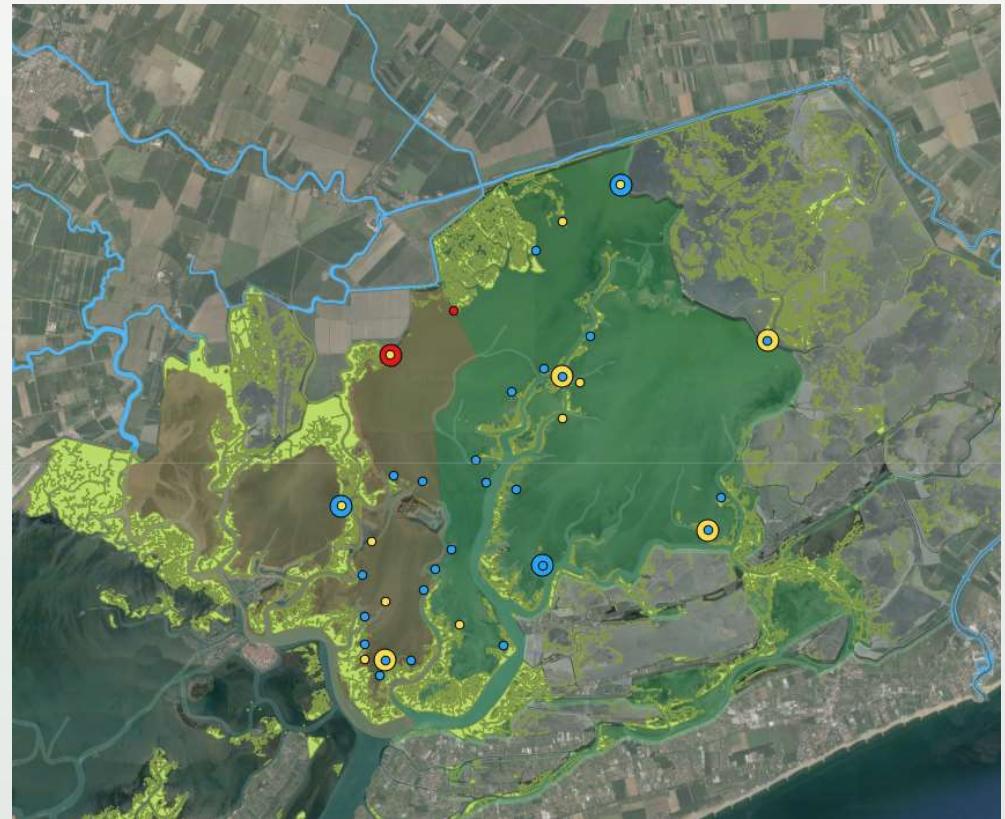
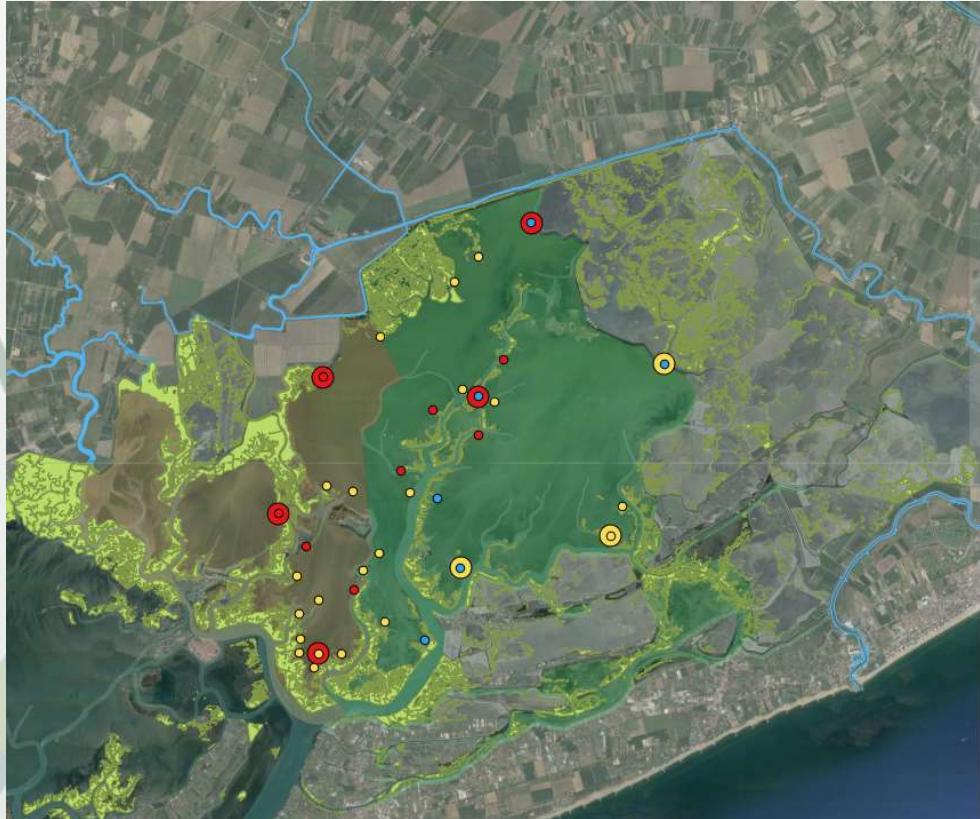


AFTER 4 YEAR FROM FIRST TRANSPLANTING  
2017

**GdC FUNZIONI**  
**Habitat 1150\***

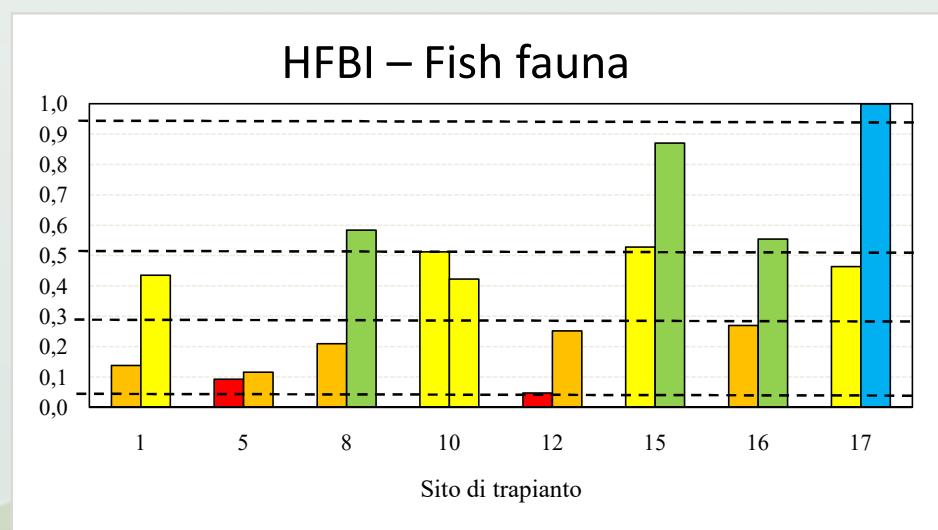
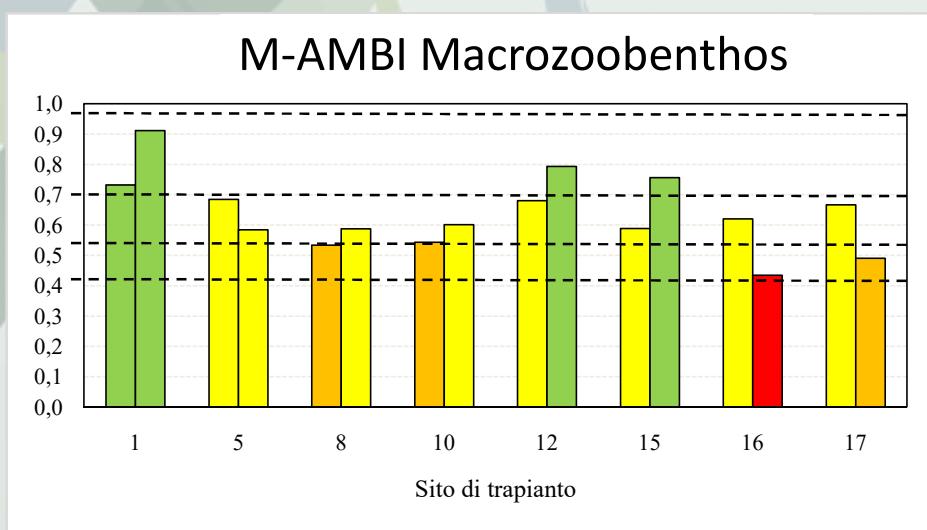
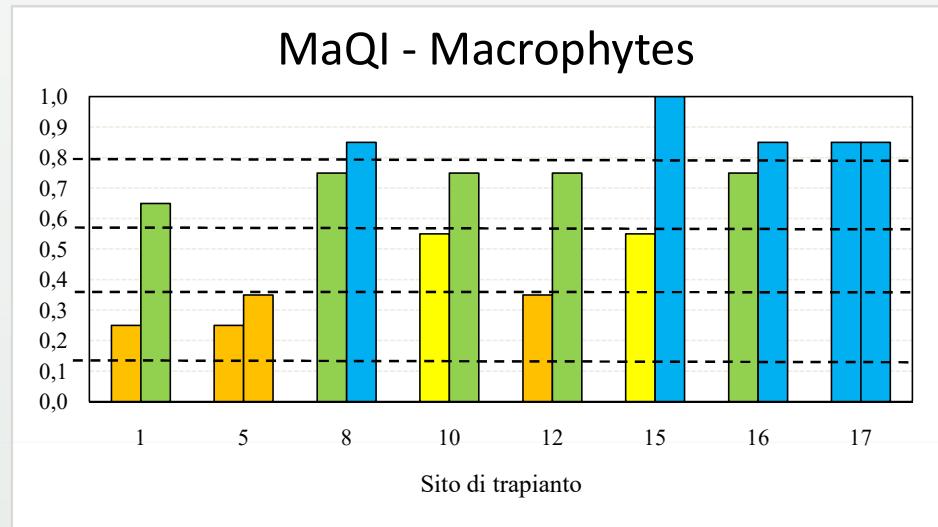
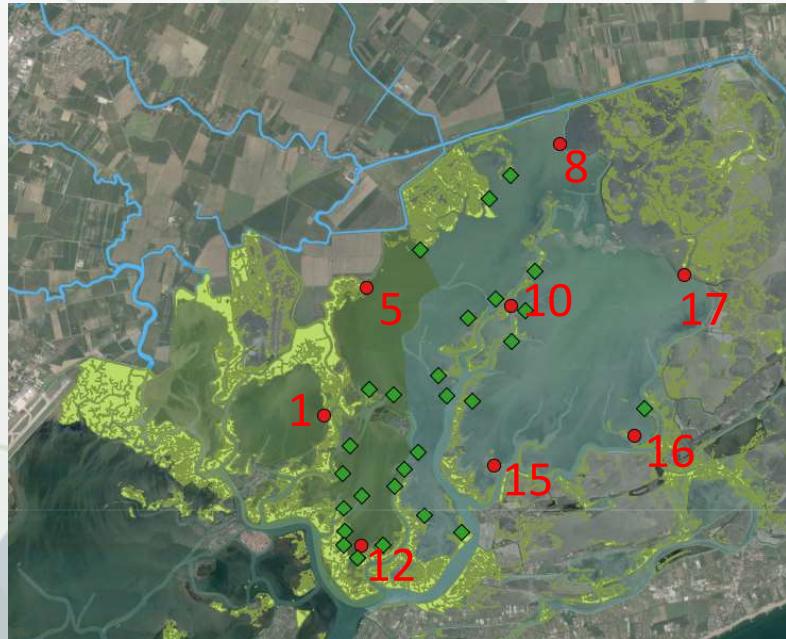
- I - EXCELLENT
- II - GOOD
- III – UNFAVOR.

# CONSERVATION DEGREE



	STR	FUN	GdC
2014/15	II	II/III	B
2017	I	II	A

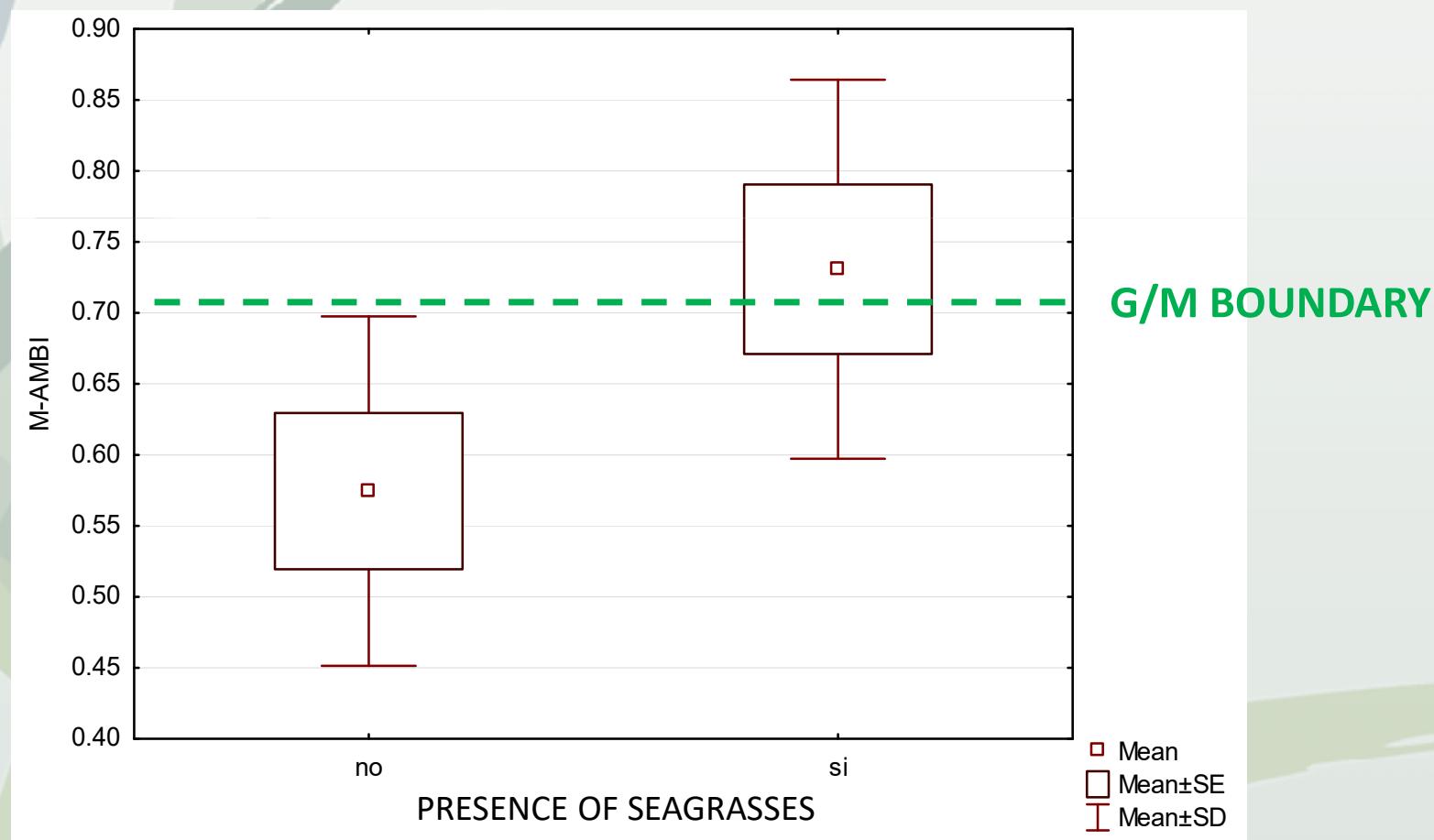
# ECOLOGICAL STATUS – 2000/60/CE BQEs



# ECOLOGICAL STATUS – 2000/60/CE BQEs

## MACROZOOBENTHOS

In 2017 two different sampling (3 replicates for each sampling) were carried out in sites characterized by the presence of seagrass meadow: **Seagrass station** and **Unvegetated station**



# CONCLUSION

## PROJECT'S OBJECTIVES HAVE BEEN MET

Conservation degree of habitat 1150\* and ecological status improved in most of transplanting sites

## REPLICABILITY & TRANSFERABILITY

- ✓ Relevant controlling factors were investigated;
- ✓ Guide values (still site-specific) have been proposed



**preliminary selection of site suitable for seagrass restoration activity**

# CONCLUSION

## PROJECT'S OBJECTIVES HAVE BEEN MET

Conservation degree of habitat 1150\* and ecological status improved in most of transplanting sites

- ✓ **Transplanting is not a magic solution!**
- ✓ Seagrass restoration could have success only where abiotic conditions are suitable
- ✓ Where they are not, previous measures are required to improve the pressure affecting the aquatic environment
- ✓ **Transplanting is the final mile, following long efforts aiming at reducing pressures (at River Basin scale and at lagoon scale)**

## Staff ISPRA

**Rossella Boscolo**

*supporto al coordinamento attività ISPRA  
e alle scelte di indirizzo tecnico-scientifico*

**Federica Oselladore**

*Full time sul progetto – coordinamento monitoraggio ecologico e analisi benthos*

**Emanuele Ponis e Michele Cornello**

*analisi dei risultati, elaborazioni statistiche, campionamenti*

**Federico Rampazzo, Daniela Berto, Claudia Gion**

*analisi di laboratorio e campionamento*

**Andrea Bonometto**

*Responsabile di progetto per ISPRA*

