MACROZOOBENTHIC ASSEMBLAGES AND LEAF EPIPHYTES ASSOCIATED WITH A POSIDONIA OCEANICA MEADOW RESTORED

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Problem

Posidonia oceanica (L.) Delile meadows are facing severe decline across the Mediterranean Basin, particularly in heavily urbanized coastal areas (Duarte et al. 2008). Over the past 50 years, coastal human activities have led to the loss of between 11% and 52% of the originally documented area occupied by *P. oceanica* (Marbà et al. 2014; Telesca et al. 2015). However, according to some authors, this decline is not generalized (de los Santos et al. 2019).
The restoration of marine phanerogams is one of the key points of the Italian Green Deal to promote the recovery of associated biodiversity and ecosystem services. However, long term studies on the effectiveness of restored meadows to recover the pristine conditions and to sustain the associated biological communities are still scarce.

Objectives Statement

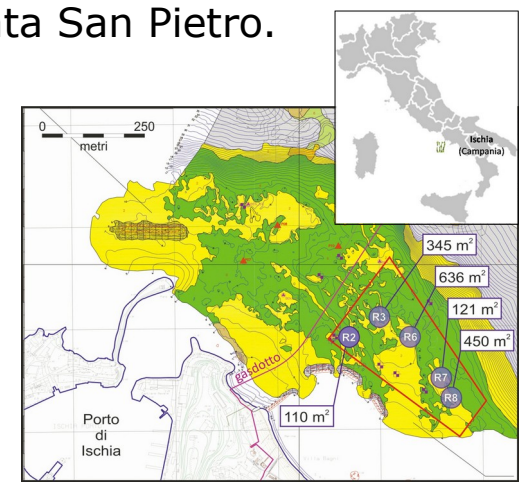
Macrozoobenthic assemblages and leaf epiphytes were investigated in a *Posidonia oceanica* (L.) Delile, 1813 meadow actively restored through transplantation in the Southern Tyrrhenian Sea. Our research aims to explore the long-term ecological response of transplanted *P. oceanica,* comparing the associated organisms of the meadow restored (TR) with those of the neighbouring natural *P. oceanica* meadow (NA).

Methods

The samplings were performed in the area R3 at 9 meters depth in 2018. Macrozoobenthic assemblages were collected using an air lift over a standardized area of 400 cm^2 and orthotropic shoots were sampled for the laboratory analyses (Buia et al., 2003). Macrozoobenthic samples were sorted (mesh 0.5 mm) into polychaetes, molluscs, crustaceans, and echinoderms and were counted and classified to the lowest possible taxonomic level. The groups as encrusting algae, erected algae, bryozoans, hydroids, foraminifers, spirorbids, and ascidians were analysed to describe the structure of assemblages of leaf epiphytes. In this regard, the percentage cover of algal and animal groups was estimated on the apical portion (last 15 cm) of the internal side of the two outer leaves of each shoot (Piazzi et al. 2015). Additional information, such as erosion of the apical portion of the leaves was acquired. Data were analysed by univariate and multivariate statistical methods.

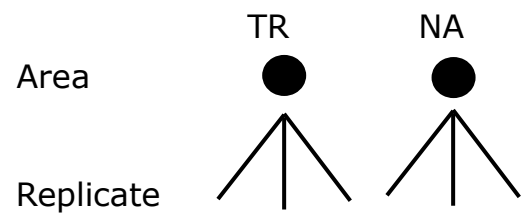
Context

- Transplant carried out in 2008-2009 using cement frames.
- Surface 1600 m^2, on sand (depth 7.5-9 m) about 50000 shoots transplanted.
- Compensatory measure: pipeline Lago del Fusaro - Punta San Pietro.

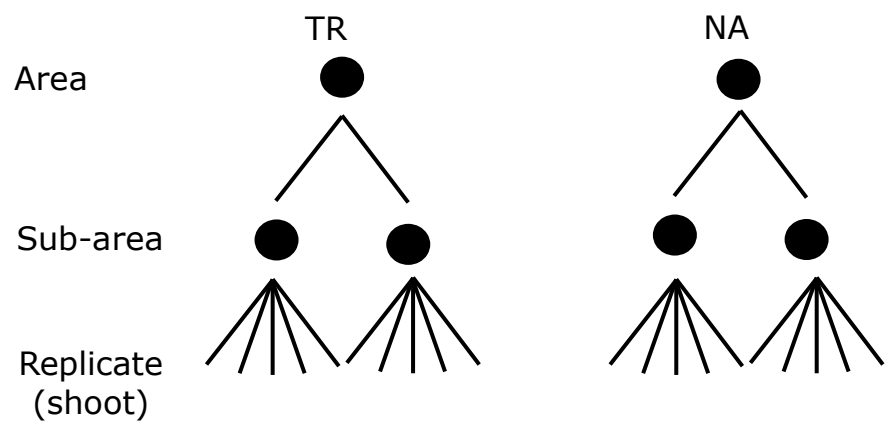


Samplings

Macrozoobenthic assemblages



Leaf epiphytes

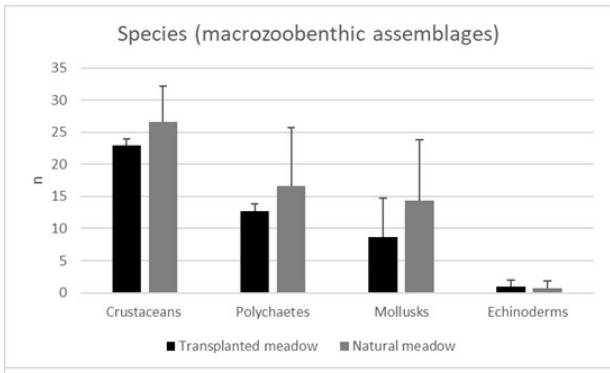


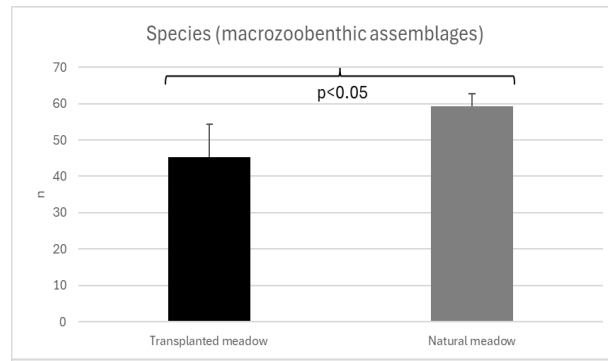
Results

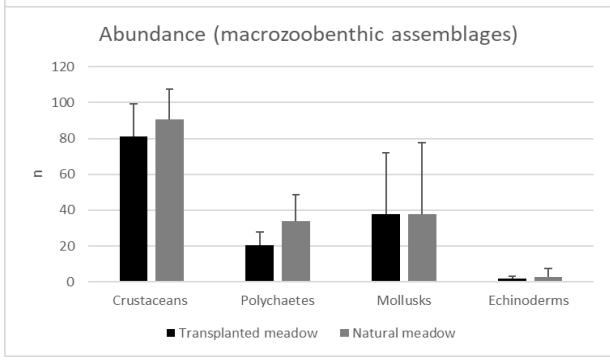
In the macrozoobenthic assemblages were detected 918 specimens in 175 taxa, most of these identified at the species level. Statistically lower values of species richness and abundance were observed in the restored area than in the natural meadow. The leaf epiphytes of *P. oceanica* transplanted shown statistically higher coverage of erected algal and lower coverage of spirorbids than in natural meadow.

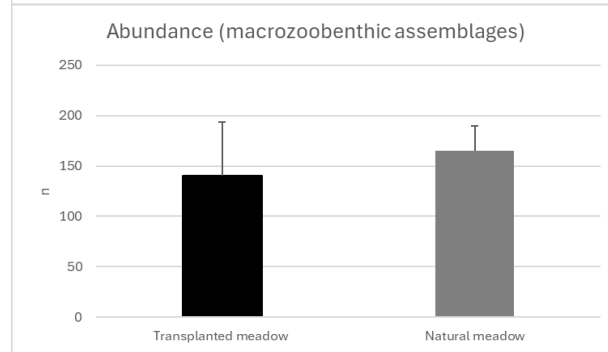
Results _macrozoobenthic assemblages

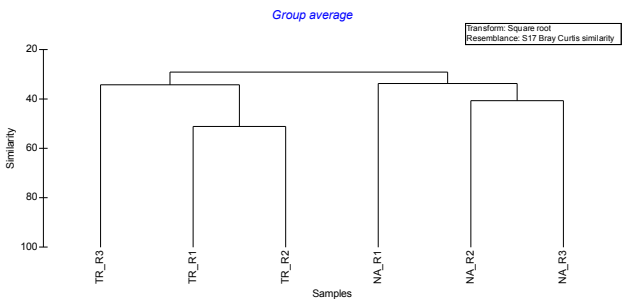
Structural indeces

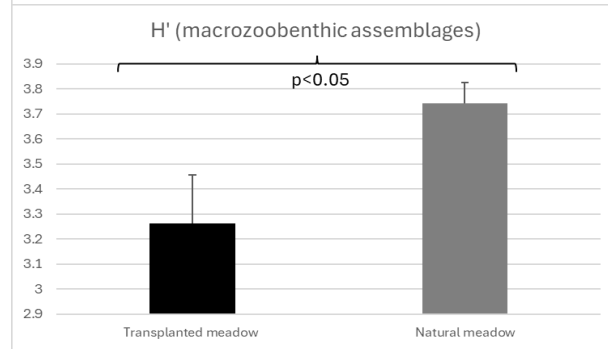












SIMPER

Groups NA & TR

Average dissimilarity = 70,91

Species	Group NA Av.Abund	Group TR Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Quadrimaera inaequipes	2,92	0,00	1,84	2,79	2,60	2,60
Athanas nitescens	1,55	4,41	1,79	2,54	2,52	5,12
Hippolyte leptocerus	2,57	0,47	1,35	1,93	1,91	7,03
Janiridae ind.	2,16	0,00	1,35	3,57	1,90	8,93
Gammarella fucicola	0,47	2,15	1,20	1,48	1,69	10,62
Bittium latreillii	1,29	1,37	1,09	1,44	1,53	13,70
Eualus cranchii	1,73	0,00	1,08	2,87	1,52	15,22
Rissoa auriscalpium	1,00	1,58	1,01	1,15	1,43	16,64
Ostracoda ind.	0,75	1,82	0,90	1,92	1,27	17,91
Hesiospina aurantiaca	2,20	1,24	0,89	1,29	1,25	19,16
Chrysopetalum debile	2,35	1,47	0,88	1,13	1,24	20,40
Musculus costulatus	1,55	2,93	0,88	1,88	1,24	21,64
Tricolia pullus	1,32	1,58	0,86	1,40	1,21	22,85
Gregariella petagnae	1,33	0,00	0,83	2,91	1,17	24,01
Cymodoce truncata	1,76	2,20	0,82	1,19	1,15	25,16
Tricolia speciosa	1,58	0,91	0,79	1,24	1,12	26,28
Microdeutopus ind.	1,22	0,00	0,79	1,21	1,12	27,40
Gammaropsis palmata	0,00	1,24	0,78	1,32	1,10	28,50
Hippolyte inermis	1,22	2,09	0,76	1,48	1,07	30,65
Nannastacus ind.	1,14	0,00	0,73	1,27	1,04	31,69
Apanthura tyrrhenica	1,14	0,00	0,72	4,45	1,01	32,70

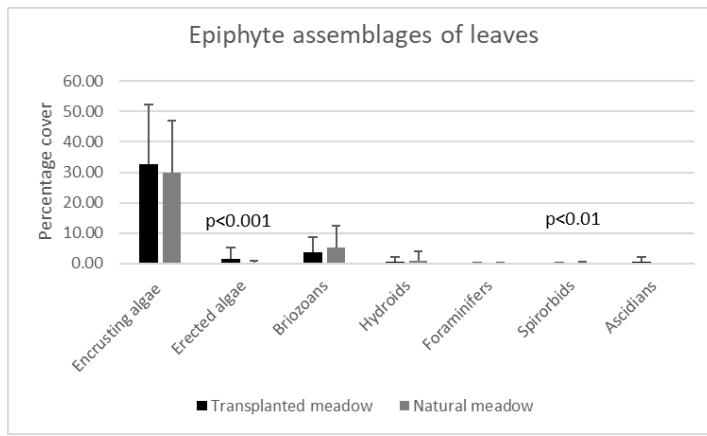
Cluster Analysis & PERMANOVA

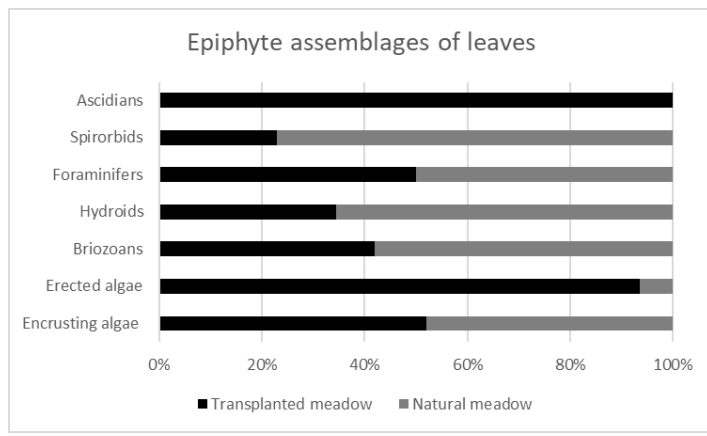
PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms	P(MC)
NA	1	3687,8	3687,8	1,894	0,0989	10	0,1521
Res	4	7788,5	1947,1				
Total	5	11476					

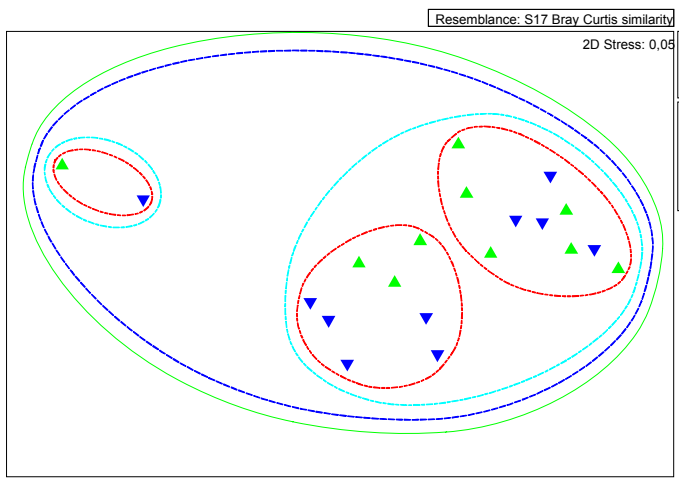
Results _leaf epiphytes

Structural indeces





MDS & PERMANOVA



PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms	P(MC)
Area	1	317,46	317,46	0,80819	0,449	994	0,454
Su(Area)	0	0		No test			
Res	18	7070,4	392,8				
Total	19	7387,8					

Discussion

Slight differences of the macrozoobenthic assemblages associated to *P. oceanica* transplanted could be related to the higher patchiness at small spatial scales (i.e. in the 10^0–10^2 cm range) detected in the transplanted areas if compared to the natural meadow (Bacci et al., 2017). No difference of the leaf epiphytes was detected between *P. oceanica* transplanted and natural meadow. Erected algae and spirorbids are an exception. The highest values of erected algae in the leaves transplanted could be related to the lower erosion of the apical portion of these leaves (5%) than the leaves of the natural meadow (20%). In the long term, after 10 years from the transplantation, the assemblages associated to restored meadow are very similar but still not like to those of the natural meadow. Further research on these issues will be able to confirm our preliminary results.

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