

Preliminary Environmental Survey Report

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Abstract

This Preliminary Survey Report includes: 1) the baseline survey methodologies, 2) the balise placement methodologies, 3) all the collected data, 4) an updated marine seagrasses distribution map and 5) localization of sites, where activating concrete actions. This report aims to define the quality status of marine seagrass populations and related adjacent habitats and species in the three sites (Monfalcone, Kornati NP and RNP Dune Costiere).

No anomalies have been found considering the composition of benthic communities. As concern the marine seagrasses meadows, the main disturbances seem to be related to the presence of anchoring. However, the selection of sites potentially affected by this type of pressure was necessary to test the efficiency of safe anchorage systems and of the of the marine seagrass pilot transplantations.

1. Introduction

1.1. Aim and objectives

SASPAS (Safe Anchoring and Seagrass Protection in the Adriatic Sea) is an INTERREG project that aims to provide a proposal to develop and share actions and advanced policies for the conservation and sustainable use of the territory.

The common challenge of Project SASPAS is to preserve and get a better status of conservation of biodiversity of the Adriatic Sea ecosystem in order to decrease its vulnerability.

The overall objective is to improve seagrass preservation and restoration through laying safe anchorage systems, performing pilot transplantations, carrying out monitoring activities and by defining an integrated management system for seagrasses in Adriatic area. The change will result in an increased level of conservation status of habitat types and species in the involved Natura 2000 sites of the Project areas. To reach the foreseen change the project will take a scientific- applied approach, following the DPSIR (Driving force – Pressure – State – Impact - Response) causal framework, analyzing the interactions between society and the environment - the cause-effect relationships between interacting components of complex social, economic, and environmental systems. Doing so is possible to measure the effectiveness of responses put into place.

Since marine seagrasses and especially *Posidonia oceanica* beds (1120*) are widespread along coastal areas of Interreg Programme and their conservation status is similar in the two Member States, significant results can be achieved only by setting up a good cross-border cooperation within the Italian and Croatian key partners. The cross-border approach ensures coordinated and cooperative actions in planning and performing the protection and restoration activities, as well in developing the foreseen Marine Seagrass Safeguard Integrated Management Program (i.e., the proposed guidelines for the management and right behavior in protected areas). The innovative aspect that goes beyond the existing practices consists in joint cross-border biodiversity protection and restoration through the development of specifically-tailored innovative solutions, harmonized for the Adriatic area and applicable to other similar realities facing with the same biodiversity protection and restoration issues.

The project activities will be carried out within the three project study sites (Figure 1):

- Monfalcone (Bay of Panzano)
- Kornati National Park – (Nacionalni Park Kornati)
- Regional Natural Park of Coastal Dunes from Torre Canne to Torre San Leonardo.

This proposal is well suited to the Adriatic, in particular to the Apulia (Regional Natural Park of Coastal Dunes from Torre Canne to Torre San Leonardo) and Kornati National Park, characterized by widespread coverage of *P. oceanica*. In both sites, in summer, there is a notable flow of pleasure boat, and the development of the industry tourism cannot fail to come to terms with the need to preserve the quality of the territory, understood as a whole between land, coast and sea. In Monfalcone (Bay of Panzano), there is an important coverage of marine seagrasses (i.e., *Cymodocea nodosa*) too.



Figure 1. Location of the three project sites.

Both *P. oceanica* and *C. nodosa* play a crucial role in consolidating coastal sediments, slowing down erosive phenomena, thanks to their radical apparatus with which they anchor to the bottom; with the leaf they promote the capture of suspended sediments, helping to limit turbidity, not to mention a series of advantages for marine and lagoon organisms.

The main outputs of the project referred to the foreseen activities are:

- monitoring system with 2 data collections/monitoring campaigns (1 per year),
- placement of environmentally friendly anchoring systems (anchorage and simple signaling buoys),
- pilot transplantations of seagrasses,
- Integrated Management System for seagrasses in the Adriatic area, made by a GIS Digital Information Platform (DIP) and a Marine Seagrass Safeguard Integrated Management Program (MSSIMP).

Managers of protected areas, local, regional, and national public bodies, environmental associations and NGOs, as well as general public will mostly benefit from project activities.

1.2. Structure of Work Package 3

The objective of the Work Package 3 - *Integrate real-time monitoring system of marine seagrasses (phanerogamae) - in the involved Natura 2000 sites* – is to monitor and gather data on marine seagrasses in the three project sites, in order to improve the protection and to restore the biodiversity in the cross-border area.

The WP3 package consists of three activities:

- activity 3.1 - Preliminary Environmental Survey,
- activity 3.2 - Drivers and Pressures Identification and Assessment,
- activity 3.3 - Monitoring campaigns.

The preliminary survey has the purpose of characterizing the biodiversity of the project sites and gathering up-to-date information on the distribution and quality of seagrasses and their associated biota. The information gathered, will provide a starting point for an analysis of existing drivers and pressures, following the DPSIR (Drivers-Pressure-State-Impact-Response) procedures. Annual monitoring campaigns will be carried out to control the plants phenological life cycle and the spatial dynamics of marine seagrasses as a response to the concrete actions. Moreover, they will help to identify the potential impacts that the project could have on seagrasses meadows and other valuable habitat and species.

The analyses will include all monitoring data, especially those concerning the retreat or surface increase dynamics that will be related to the behavior of biodiversity at eco-friendly buoys.

Thus, the aim is to characterize and quantify, in time and space, the impacts measured and evaluate the biodiversity trends, as much is possible in the time frame of the Project. The results are fundamental to activate or strength different types of protection policies, to act with additional conservation measures or to differently manage recreational boat areas.

This document describes the activities planned and carried out in activity 3.1 (Preliminary Environmental Survey), reporting the preliminary field investigations results. They allowed the acquisition of basic knowledge on the state of the marine environment and seagrasses, as well as of the main drivers and pressures closely related to the project and Natura 2000 sites. The activity 3.1 aims to acquire all the information useful to carry out the monitoring foreseen in the activity 3.3 in the meadows and the environment surrounding the three project and Natura 2000 sites.

The purpose of the preliminary investigations is to refresh the knowledge of the biodiversity state in the project areas and to identify the various specific sites where concrete actions to protect the habitat *Posidonia* meadows and other marine seagrasses will be carried out.

All the activities have been conducted adopting updated safety protocols, to reduce the risks during underwater operations. Laboratory analyses on collected samples have been performed by expert marine and transitional waters biologists, according to standard operating procedures for the macrophytobenthos.

Preliminary investigations (*Ante operam*) consist of three sub-activities:

- 1) updating data on the biodiversity in the project areas (Monfalcone, Kornati NP, RNP of Dune Costiere and Natura 2000 sites);
- 2) balise placement, to monitor the dynamic of the marine seagrass meadows deeper limit;
- 3) identification of sampling sites and where concrete actions will be carried out.

In particular, this Preliminary Survey Report includes: 1) the baseline survey methodologies, 2) the balise placement methodologies, 3) all the collected data, 4) an updated marine seagrasses distribution map and 5) localization of sites, where activating concrete actions. This report aims to define the quality status of marine seagrass populations and related adjacent habitats and species.

The Monitoring Protocol included in chapter 3 defines the methodology to monitor the seagrass meadows and to assess their status in Natura 2000 sites within the actions planned in activity 3.1.

2. The three project areas and the Natura 2000 sites.

2.1. Monfalcone (Bay of Panzano)

The Bay of Panzano is a small bay of the Adriatic Sea (Friuli-Venezia Giulia), located in the northern part of the Gulf of Trieste, limited to the south-west by the Punta Sdobba, at the mouth of the Isonzo River. Inside the Panzano Bay are located two Natura 2000 sites: a Special Areas of Conservation (SAC) “Cavana di Monfalcone” and a Special Areas of Conservation (SAC) and Special Protection Area (SPA) “Foce dell’Isonzo - Isola della Cona” (Mouth of the Isonzo River and Cona Island) (Figure 2).



Figure 2. Location of the study areas in the Panzano Bay, positioned in two Natura 2000 sites.

Natura 2000 site: SAC IT3330007 - Cavana di Monfalcone

The SAC “Cavana di Monfalcone” extends over a surface of 133 ha, 12% out of which are marine, in the transition area between the flat land and the Adriatic Sea and it is important because it includes a set of ecological systems characterized by rare habitats in a good state of conservation. A complex system of

spring canals is still present, not modified by the land reclamation. It is a site that includes the ecological spring system closest to the coastline and therefore in direct contact with salty and marine waters. The aquatic surfaces with different state of trophic, water speed, depth and salinity preserve a rich and well-diversified aquatic vegetation. The site extends over a surface of 133 ha, approximately 12 within marine areas.

In the marine area of the site the habitat 1110 (*"Sandbanks which are slightly covered by sea water all the time"*). It consists mainly of sandy sediments (larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present). These habitats are permanently submerged and predominantly surrounded by deeper water. Above the sand-bank the water depth is seldom more than 20 m. In these sub-littoral sandbanks, seagrasses meadows can be present: *Zostera marina* (in brackish-salt waters), *Cymodocea nodosa* (in salt waters) and *Zostera noltei* in shallower salt waters.

The other Habitat identified is the 1140 (*"Mudflats and sandflats not covered by sea water at low tide"*) and it is characterized by sands and mud emerging during the low tides, partially covered by *Zostera noltii* and partly coated by green, blue, brown algae and diatoms.

Natura 2000 site: SAC SPA IT3330005 - Foce dell'Isonzo - Isola della Cona

The SAC SPA "Foce dell'Isonzo – Isola della Cona" extends over a surface of 2.668 ha, 40% out of which marine. It is situated in the eastern side of the region Friuli Venezia Giulia along the last stretch of the Isonzo River and it largely coincides with the "Foce dell'Isonzo Regional Nature Reserve".

The marine part of the site covers about 1.100 ha of shallow waters with relevant extensions of seagrasses meadows; in the marine part of the site the Habitat 1110 (*"Sandbanks which are slightly covered by sea water all the time"*) and the Habitat 1140 (*"Mudflats and sandflats not covered by sea water at low tide"*) are present.

2.2. Regional Natural Park of Coastal Dunes from Torre Canne to Torre San Leonardo

The "Regional Nature Park Dune Costiere from Torre Canne to Torre San Leonardo" extends over 1.100 ha, along 8 km of coast, and it includes the inland agricultural areas occupied by centuries-old olive groves and ancient "masserie" (typical Apulian farms) (Figure 3). The perimeter follows the long course of the "lame" (55 km of erosion) which characterizes the Park's territorial morphology; they are linear clefts of the land perpendicular to the coastline, with flat bottom and slightly sloping sides originated by the erosive action of the surface water.



Figure 3. Location of the study area in the RNP Dune Costiere, positioned in a Natura 2000 site.

In the protected area, there are many habitats. Each habitat is the consequence of the geological, morphological and climatic features of the site that determine the presence of plant and animal species preferring those features. Some of those habitats are considered as priority ones, such the *Posidonia oceanica*. Starting at a depth of 10-12 m, *P. oceanica* meadows are present on sandy bottoms.

The park includes the Special Areas of Conservation (SAC) “Litorale brindisino”.

Natura 2000 site: SAC IT9140002 - Litorale brindisino

The SAC “Litorale brindisino” extends over a surface of 7.256 ha, 95% out of which is marine. The priority habitat 1120* (*P. oceanica*) affects 50% of its total area. It is also characterized by the presence of coastal wetlands, where rare or endangered migratory bird species stop or reproduce.

2.3. Kornati NP

The Kornati National Park is designated as Site of Community Importance SCI HR4000001 - Nacionalni park Kornati (Figure 4). The park¹ was established in 1980 and its management started in 1982. It currently comprises 89 islands and reefs, a total area of 217 km², from which almost 80% is marine territory (Land 50 km² / Sea 167 km²) and a total coastline of 238 km. Karst features dominate its geomorphology. It is estimated that at least 2.500 to 3.000 families of benthic and pelagic fauna live in the Kornati archipelago such as 22 species of corals, 177 species of mollusks, 127 species of polychaetes, 55 species of crustaceans, 64 species of Echinodermata and 160 species of fishes. Meadows of *P. oceanica* are also present in the Park, up to depths of 25-30 meters. The marine invasive species *Caulerpa cylindracea*² has been observed in the last years and is spreading in the entire Park.

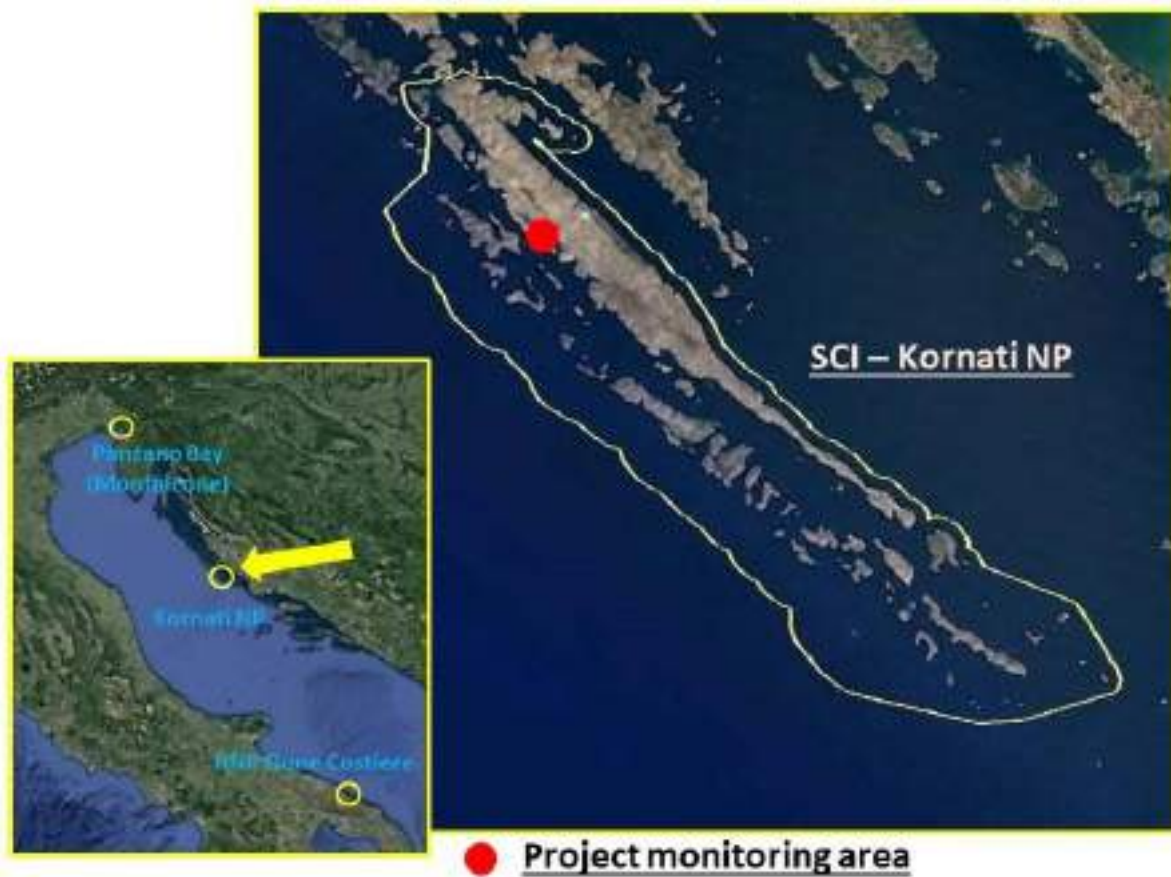


Figure 4. Location of the study area in the Natura 2000 site Kornati NP.

¹ The data cited in the following paragraphs are reported in the articles: Casier, 2011; Mihelcic and Ramov, 2018; Ivković N., 2015.

² *Caulerpa cylindracea* Sonder [previously known as *Caulerpa racemosa* var. *cylindracea* (Sonder) Verlaque, Huisman et Boudouresque]

Public Institution, under the competence of the Ministry of Environment and Energy, manages the Kornati National Park. The terrestrial part of the park is entirely under private ownership (around 620 owners).

There are four no-take zones where only scientific research is allowed. Sailing is allowed in the whole of the Kornati National Park except in the zones of strict protection. Anchoring and overnighting are permitted only at 16 locations (bays and coves). Autonomous diving is allowed only in organized groups, with a license for autonomous diving in the Kornati NP obtained in advance.

Professional fishing is forbidden in the Park, only artisanal fishing and recreational fishing are allowed.

3. SASPAS monitoring protocol

The SASPAS Monitoring Protocol aims to identify the best procedure to carry out both the field surveys and laboratory analyses in order to define a shared methodology to assess the status of seagrass meadows in Natura 2000 sites.

The following protocol selects useful indicators to monitor the status and possible changes in seagrass beds and to assess the effects on the ecosystem of the concrete actions that will be implemented in WP4: i.e., the pilot seagrass transplantations (activity 4.2) and the placement of environmentally friendly anchoring systems (anchorages and simple signaling buoys) (activity 4.1). The monitoring protocol allows to acquire the necessary and univocal information regarding the three project sites (Chapter 2).

The SASPAS Monitoring Protocol specifies the methodologies to carry out the activities as planned in activity 3.1 (Preliminary Environmental Survey) and activity 3.3 (Monitoring campaigns) and includes:

- a brief description of the seagrass species that can possibly be found in the three project sites. The knowledge of these species is useful for the choice of appropriate indicators because of, although similar, the species present differences that affect the applicability of the indicators;
- the best procedure to carry out the field surveys and laboratory analyses;
- the description of indicators measured during the field and laboratory activities, to assess seagrass meadows status, in several stations to be appropriately placed nearby the areas where concrete actions will be carried out.

3.1. Background information on monitoring methodologies

The monitoring methodologies adopted in SASPAS Monitoring Protocol refer to national and international protocols developed to evaluate the Ecological Status of seagrass meadows, with specific implementations in relation to taxa (e.g., *Posidonia* and other seagrass species) (OSPAR, 2009; ISPRA³, 2012; APAT-SIBM-ICRAM⁴, 2003; Buia *et al.*, 2004; Water Framework Directive 2000/60/EC; Marine Strategy Framework Directive 2008/56/EC; RAC/SPA - UNEP/MAP, 2014).

In particular, regarding the Italian guidelines, the considered parameters in this protocol also refer to the institutional methodological sheets of the Ministry of the Environment, drawn up in collaboration with ISPRA (Ministero dell'Ambiente and ISPRA, 2017).

Presently, more than 40 countries have developed monitoring systems for more than 30 seagrass species. Even the number of monitoring programs on *P. oceanica* meadows has increased in recent years but they are less developed than for other species and, in general, remain regional or national initiatives. The

³ ISPRA: The Italian Institute for Environmental Protection and Research. (ISPRA performs the duties of ex-APAT and ex-ICRAM).

⁴ APAT: Italian Environment Protection and Technical Services Agency. ICRAM: Central Institute for Scientific and Technological Research applied to the Sea. SIBM: Italian Society of Marine Biology.

different methodologies also make it difficult to obtain a comprehensive view of the general status and trends of the underwater meadows across the Mediterranean (Díaz-Almela e Duarte, 2008).

At present, in accordance with the Water Framework Directive 2000/60/EC (WFD), *P. oceanica* is to be used as Biological Quality Element and several WFD-compliant biotic indices based on *P. oceanica* have been developed and applied in the Mediterranean Sea for the definition of the Ecological Status of coastal water bodies (Pergent-Martini *et al.*, 2005; Gerakaris *et al.*, 2017).

P. oceanica meadows is a good biological indicator because it is a benthic, long-lived species, widely present in the Mediterranean basin, and is susceptible to pollution and to environmental disturbance; is also a useful tool for assessing the environmental impact of human activities, thus being adequate for the purpose of determining the GES (Good Environmental Status) in accordance with the Marine Strategy Framework Directive 2008/56/EC (MSFD).

3.2. Species

In the OSPAR document (2009) it is reported the definition of seagrass meadow (the presence of a meadow of the genus *Zostera*): “to qualify as a *Zostera* ‘bed’, plant densities should provide at least 5% cover (although when *Zostera* densities are this low, expert judgement should be sought to define the bed)”.

According to MARBIPP commission (2006): “a seagrass meadow is defined when seagrass cover a bigger area than 2x2 meter, when patchy it is still a meadow if it is less than 10 meters between the patches, if bigger than 10 m between patches it should be counted as a new meadow”.

There are four species of seagrasses native of European waters:

- *Posidonia oceanica* (Neptune grass),
- *Zostera marina* (eelgrass),
- *Zostera noltei* (dwarf eelgrass),
- *Cymodocea nodosa* (little Neptune grass or slender seagrass).

These species are present in a number of classification systems adopted over the years by the European Union:

- Reference List of Marine Habitat Types for the Selection of Sites to be included in the National Inventories of Natural Sites of Conservation Interest (RAC/SPA - UNEP/MAP, 2016);
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitat Directive) – Annex I: Animal and plant species of community interest whose conservation requires the designation of special areas of conservation;
- CORINE biotopes;
- European Nature Information System (EUNIS) habitat classification.

They are also listed as threatened species in the Annexes of the following conventions and protocols:

- Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) - Annex II: List of Endangered or Threatened Species;
- Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD protocol)- Annex II: List of endangered or threatened species;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) - Appendix I: Strictly protected flora species.

Codes and Annexes for each species are reported in the Table 1.

Table 1. Reference codes for identification of each specie and annexes of threatened species

	<i>Posidonia oceanica</i>	<i>Zostera marina</i> , <i>Zostera noltei</i>	<i>Cymodocea nodosa</i>
RAC/SPA	III.5.1	III.5.1, III.1.1, III.3.1, I.2.1, III.2.3	III.3.1, III.5.1, III.1.1., III.2.3
EU Habitats Directive	Annex I: 1120*	Annex I :1110, 1120*, 1130, 1140, 1150*	Annex I: 1110, 1120*, 1150*, 1160
CORINE biotopes	11.34	11.34, 11.23, 13.2, 14, 21	11.23, 11.34, 21, 11.22
EUNIS Classification	A5.535	A2.613	A5.531
Barcelona Convention	Annex II	Annex II	
SPA/BD protocol	Annex II	Annex II	
BERN Convention	Appendix I	Appendix I (only <i>Z. marina</i>)	Appendix I

In the Habitat Directive, the only species of seagrass listed is the *P. oceanica*, but only as habitat in the Annex I and not as species in the other annexes.

Zostera marina, *Zostera noltei* and *Cymodocea nodosa* are not considered as species in the Habitat Directive, but they can be considered as community associated with the Annex I habitats reported in Table 1.

All these species are present in the Adriatic Sea and, in particular, in the project sites; brief descriptions are reported in the following paragraph.

3.2.1. *Posidonia oceanica*

Posidonia oceanica (Linnaeus) Delile meadows are characteristic of the Mediterranean Sea infralittoral zone (depth between a few dozen centimeters to 30-40 m) on hard or soft substrates and they are one of the most important climax communities (Figure 5). *P. oceanica* is generally found in well-oxygenated

waters, tolerates relatively large variations in temperature and hydrodynamics, and is sensitive to desalination, normally requiring a salinity of between 36 and 39 psu (it is not present in the areas in front of the river mouths). *P. oceanica* meadows are one of the most important Mediterranean habitats, and they play a key role in the marine ecosystem regarding primary production, biodiversity, nursery function and the balance of sedimentation dynamics. They are an excellent indicator of the quality of the marine environment.



Figure 5. Geographical distribution of *Posidonia oceanica* in European coastal waters (Borum et al., 2004).

P. oceanica is catalogued as a “priority habitat” in the Annex I of EU Habitat Directive 92/43/EEC and listed, as a protected species, at the Mediterranean level, in the Barcelona Convention Annex II (list of endangered or threatened species), in the SPA/BD - protocol Annex II (List of endangered or threatened species) and in the Appendix I (Strictly Protected Flora Species) of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (Table 1).

3.2.2. *Zostera marina*, *Zostera noltei* and *Cymodocea nodosa*

Zostera marina*, *Zostera noltei

Zostera marina Linnaeus is found from arctic waters along the northern Norwegian coast, where it can survive several months of ice cover, to the Mediterranean Sea (Figure 6). The species is very abundant in the Baltic Sea, the North Sea and along the Atlantic coasts down to northern Spain. Further south, *Z. marina* becomes rarer and in the Mediterranean Sea; the species is mostly found as small, isolated stands, but dense eelgrass beds do occur, especially, in transitional water systems (lagoons and ponds). In the Adriatic Sea, *Z. marina* forms dense beds, with trailing leaves up to 120-130 cm long in sheltered bays and lagoons from the lower shore to about 4-5 m depth. It is widespread in the northern Adriatic lagoons

where there are extensive meadows with 100% cover. *Z. marina* prefers muddy-sandy substrates and in intertidal environments tending towards emergence, it shows a range overlap with *Z. noltei*.

Z. marina is catalogued as a threatened species, at the Mediterranean level, in the Barcelona Convention Annex II (list of endangered or threatened species), in the SPA/BD protocol Annex II (List of endangered or threatened species) and in the Appendix I (Strictly Protected Flora Species) of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (Table 1).

Zostera noltei Hornemann is distributed from the southern coasts of Norway to the Mediterranean Sea, the Black Sea, the Canary Islands and has been recorded as far south as on the Mauritanian coast (Figure 6). In the Adriatic Sea, *Z. noltei* forms dense beds, typically in the intertidal region (although it can occur in the very shallow subtidal), on mud/sand mixtures of varying consistency. *Z. noltei* forms dense beds in the muddy sand of intertidal areas, where *Z. marina* is sparse due to its lower tolerance to desiccation.

Z. noltei is catalogued as a threatened species, at the Mediterranean level, in the Barcelona Convention Annex II (list of endangered or threatened species) and in the SPA/BD protocol Annex II (List of endangered or threatened species) (Table 1).

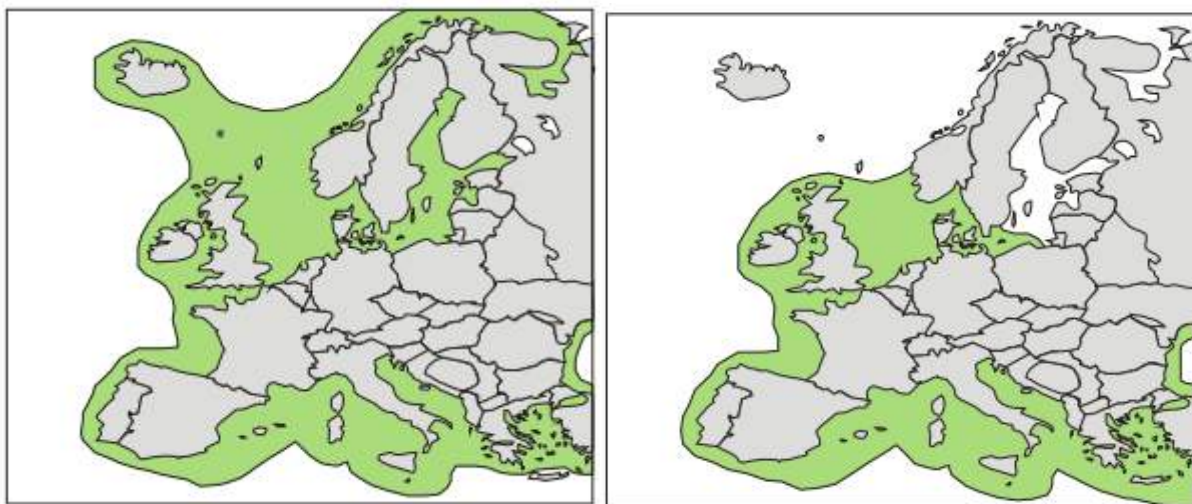


Figure 6. Geographical distribution of *Zostera marina* (on the left) and *Zostera noltei* (on the right) in European coastal waters (Borum et al., 2004).

Cymodocea nodosa

Cymodocea nodosa (Ucria) Ascherson is a warm water species and is widely distributed throughout the Mediterranean Sea, around the Canary Islands and down the North African coast. The species does not extend further north than the southern coasts of Portugal. *C. nodosa* can be found from shallow subtidal areas to very deep waters (50-60 m) (Figure 7).

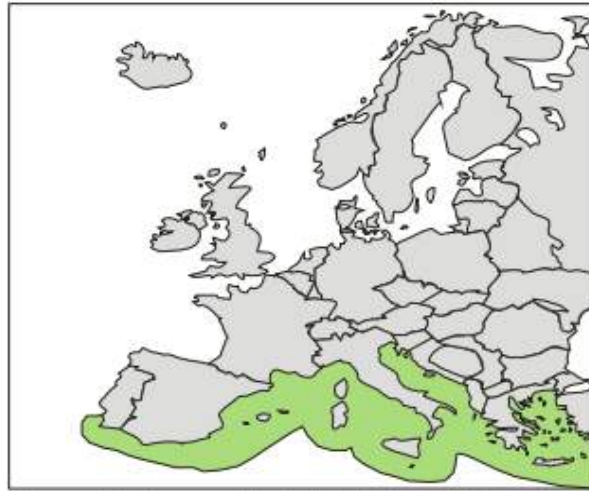


Figure 7. Geographical distribution of *Cymodocea nodosa* in European coastal waters (Borum *et al.*, 2004).

3.3. The ecological importance of seagrasses meadows

Marine seagrass meadows play an important role in the ecology of coastal areas performing numerous functions: 1) they provide food, shelter, and essential nursery areas to commercial and recreational fishery species, and to countless invertebrates living in seagrass communities and can be considered the perfect habitat for young fish who use the protection afforded by seagrass leaves to shelter from predator (den Hartog 1977, Thorhaug 1985, Fonseca *et al.*, 1998, Mazzella *et al.*, 1993); 2) their extensive root system (which extends both vertically and horizontally) help stabilize the sea bottom, protecting adjacent shorelines from erosion (Christiansen *et al.*, 1981; Fonseca and Fisher 1986; Ward *et al.*, 1984); 3) they help to trap fine sediments and particles that are suspended in the water column, increasing water clarity and also filtering nutrients that come from land and stormwater (Gacia *et al.*, 1999; Hemminga and Duarte, 2000).

3.4. Sensitivity and Threats

Sensitivity: nutrient concentrations and light attenuation in the water column are the most important water quality parameters affecting seagrass growth. Another habitat characteristic, salinity, may also play a role in the transitional waters. Deeper populations of seagrasses are characterized by high sensitivity to turbidity, as prolonged increases in this parameter can reduce light penetration and prevent adequate photosynthesis. Some species (especially *P. oceanica*) are indicators of the overall quality of coastal waters since they are very sensitive to pollution and can only grow in clean unpolluted waters.

Other species (such as *Zostera* spp.) are considered to have an “intermediate” sensitivity to other factors such as water temperature, contamination by synthetic compounds and hydrocarbons, increases in

nutrient levels and abrasion. Terrestrial herbicides can inhibit growth and cause decline in seagrass meadows. Eutrophication (high phosphorus and nitrate concentrations) may increase the cover of epiphytic algae and prevent photosynthesis of seagrass or the abundance of the slime mold *Labrynthula macrocystis* (pathogenic agent of wasting disease) (OSPAR, 2009).

Threats: physical disturbance, nutrient enrichment, marine pollution, disease, increased turbidity, aquaculture, introduction, and competition from *alien species* are all factors that affect seagrass beds and can threaten the extent and quality of these habitats.

Physical disturbance occurs on both intertidal and subtidal beds. It may be caused by trampling, dredging, use of mobile fishing gears, anchoring of boats, the laying of submarine cables, as well as land claim and adjacent coastal development.

Massive contributions or substantial depletion of the sediment and prolonged low light regimes (caused above all by anthropogenic factors – such as incorrect beach nourishment practices) can trigger a meadow regression. This is compounded considering the biological characteristics of the plant (slow growth rates) and the dynamics of the meadow (low resilience, i.e., very slow recovery after external disturbances).

Discharges of liquid effluents modify the chemical characteristics of the water column because they increase the contribution of pollutants and nutrients.

The invasion of alien rhizophytic species may enhance meadow decline since they compete for space and light and increase the contents of labile organic matter in the sediment.

Another threat is the increased turbidity caused by eutrophication, sand extraction and dredging activities, that are major factors in the decline of seagrasses (OSPAR, 2009).

3.5. Monitoring activities

The SASPAS Monitoring Protocol has been applied to field activities planned in activity 3.1 (Preliminary survey) and, more extensively, will be applied in activity 3.3 (Monitoring campaigns).

In activity 3.1, the protocol has been applied to wider areas to update the knowledge of the biodiversity status in the project sites (e.g., species, bathymetry, seagrass presence/absence, meadows extension, coverage) and to identify the specific areas where concrete actions will be carried out (as planned in activity 4.1 and activity 4.2) to protect the habitat *P. oceanica* beds and/or other marine seagrasses. Information has been also gathered regarding operative limits, general critical issues, prohibitions, local ordinances, etc.

The morphology, the typology and the composition of the meadows and the different anthropogenic impact to which the sites are subjected (administrative limitations, anthropogenic use, fishing, etc.) have been assessed considering the different geographical characteristics of the three monitored project sites.

The location and extent of the study areas, the number of transects, the sampling sites and the depth for balise placement have been also identified.

During the preliminary survey, information on the presence/absence and distribution of seagrass meadows has been gathered by 1) diver observations or survey using aqua scope and GPS and 2) integrating information from aerial or satellite images and previous maps. Presence and area distribution are commonly used as indicators of status and change in seagrasses at the landscape scale, important to overview the extent of decline (usually due to human impact) and recovery.

Based on this preliminary information, transects have been identified; visual survey by boat or by dive have been performed along these to identify the species present, the meadows continuity and structure, the extent and percentage of coverage. Along the transects, control sampling sites (i.e., metallic frames) have been positioned to measure indicators related to the seagrass status, such as seagrass shoots density, leaf height and damage to shoots.

The information gathered during activity 3.1 activities (by applying the monitoring protocol) will provide the basic knowledge on the environmental characteristics of the three sites and on the presence, distribution and quality status of the marine seagrass populations.

The same sampling methodologies and laboratory analyses on collected samples, used during the preliminary survey activities (activity 3.1), will be adopted during two annual monitoring campaigns (activity 3.3), to control efficiency and success of protection measure activities (activities 4.1 and 4.2).

In addition to the use of specific indicators, described in detail below, the monitoring protocol includes photographic surveys and underwater video to document activities.

During the field activities supported by boat, direct observations through scuba diving, video-photographic recordings and sampling of seagrasses have been done; all these activities have been carried out by Scientific Scuba Operators, and if necessary, in the case of particular operations, also considering any requests from the local Maritime Authorities.

All the activities have been implemented in accordance with the national laws, regulations, and permissions. Permits for diving to carry out the monitoring activities were obtained from the Ministry of Environmental and Nature Protection. For monitoring in sites inside protected areas, permission from management board of MPA or Park is needed.

All the activities have been conducted adopting updated safety protocols, to reduce the risks during the underwater operations. A safety plan has been set up for all field activities to profile and manage surface and underwater operations according to criteria to maintain a high safety standard (such as the use of a stand-by operator, underwater communicators, floating indicators, etc.).

Due to their wide distribution at national and European level and similar basic structure (leaves, roots, rhizomes), the monitoring protocols for *Zostera marina*, *Zostera noltei* and *Cymodocea nodosa* appear relatively similar.

Monitoring sites should be examined annually at approximately at the same time of year: late spring-summer for *C. nodosa* and *Zostera* spp. and late summer-early autumn for *P. oceanica*.

The sampling planned (in activity 3.1 and activity 3.3) according to the monitoring protocol has been conducted on selected stations. In each study site, three Zones have been selected where three monitoring stations has been positioned at different depths, for a total of nine stations (Figure 8).

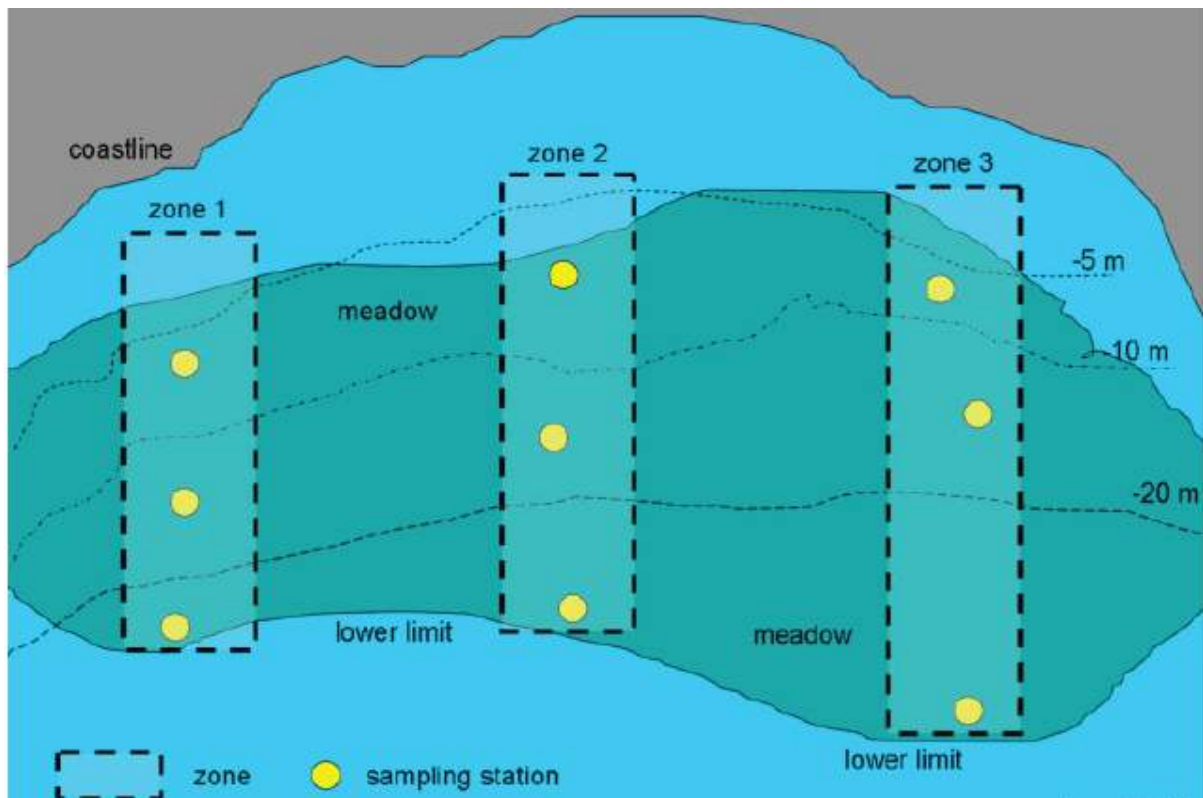


Figure 8. Example of distribution of sampling stations in the three zones and at three different bathymetric ranges (RAC/SPA - UNEP/MAP, 2014).

3.6. Sampling methodology scheme and indicators

The sampling methodology scheme and the indicators proposed are reported below (Figure 9). The scheme, taken from the ISPRA *P. oceanica* monitoring protocol (ISPRA, 2012) for WFD monitoring, has been simplified to be adapted to the objectives and timing of the SASPAS project; the indications reported in the RAC/SPA - UNEP/MAP (2014) monitoring protocol for *P. oceanica* have also been considered to achieve the integration of the two protocols.

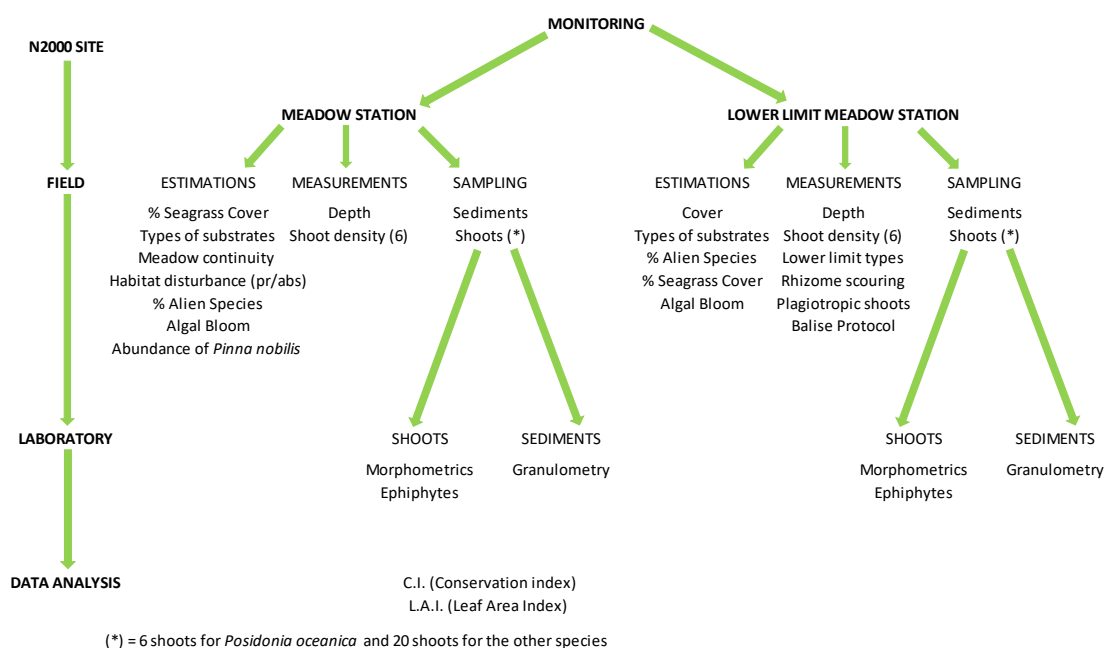


Figure 9. Sampling methodology scheme (ISPRA, 2012, modified).

Considering that:

- the activities scheduled by the SASPAS project (30 months) allow to carry out only two vegetative monitoring seasons,
- some status indicators have ecological significance only if collected for several years,
- the structure and phenology of *P. oceanica*, partially differ from the other seagrasses' ones;
- the species require different transplant and monitoring periods,
- seagrass meadows are characterized by large variation between years,

only status indicators able to provide meaningful and useful answers within the timeframe of the project have been selected for the monitoring protocol.

The following table (Table 2) shows the indicators selected for the protocol.

Table 2. List of indicators selected for the monitoring protocol.

Indicators	Seagrass Meadows		
	<i>Posidonia oceanica</i>	<i>Zostera</i> spp.	<i>Cymodocea nodosa</i>
Meadow Cover (%)	x	x	x
Continuos/discontinuos meadow	x	x	x
Dead matte (%)	x		
Depth limit (m)	x		
Substrate type	x	x	x
Shoot density (shoots/m ²)	x	x	x
Shoot morphometric measurement	x	x	x
Balisage protocol	x		
Blooms and filamentous algae	x	x	x
Epiphytes (phyto-zoobenthos)	x	x	x
<i>Pinna nobilis</i> Abundance	x	x	x
Alien species (e.g. <i>Caulerpa</i> spp.)	x	x	x
Presence/absence of habitat disturbance	x	x	x

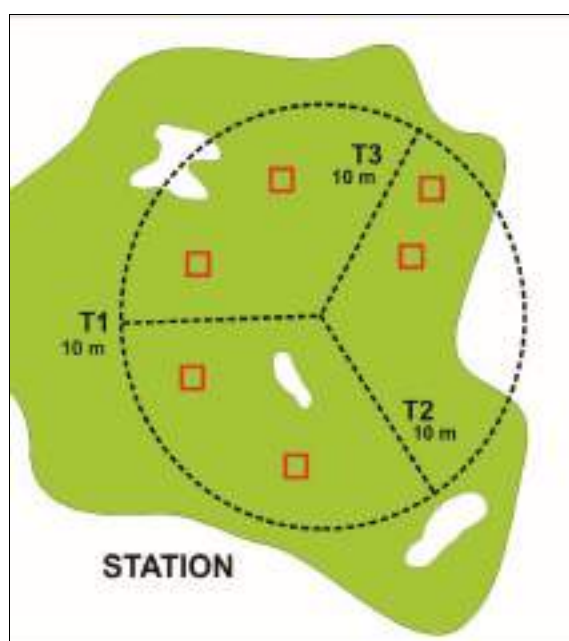


Figure 10. Sampling methodology scheme (Gerakaris *et al.*, 2017, modified).

The Figure 10 is an example of possible sampling design to test the spatial variability within each sampling site in different circular zones (Gerakaris *et al.*, 2017, modified). In each station, shoot density is measured in random quadrats and meadow cover is estimated along linear 10 m transects (T1, T2, T3). The green polygon is a part of a hypothetical meadow.

3.6.1. General data

At each station, different types of data have been collected. General information has been recorded at the meadow scale and the following data have been recorded at each site: date of monitoring; name/code of the site; name of the coordinator and of the operators; exposure.

3.6.2. Percentage Cover and meadow continuity

Seagrass cover and its continuity/discontinuity describe the sea floor fraction covered by seagrasses on a 0-100% scales and provides a measure of seagrass abundance. As cover is depth dependent, any measure of cover must be related to water depth. Both shoot density and shoot length affect the estimation of the meadow cover (e.g., short shoots may have the same cover as meadows of sparser but longer shoots). Seagrass cover may reflect the patchiness of seagrass stands or the cover of seagrass within the patches, or both aspects.

The percentage of seagrass cover is usually estimated visually by a diver as the fraction of the bottom area covered by seagrass. The cover can be estimated directly in percent or assessed according to a cover scale. For *P. oceanica* the cover of the dead matte is also evaluated.

SASPAS protocol: all percentage cover values have been assessed using the Line Intercept Transect (LIT) technique (Bianchi *et al.*, 2004) (Figure 11). Three transects, each of 10 m length, have been positioned for each station (transects will extend radially from a fixed middle point). The coverage measures of the key elements (Lx), along the transects (live seagrass; unvegetated muddy/sandy patches; unvegetated rocky patches; dead matte) have been collected and referred for each transect, in the nine stations.

Along the transects, each change in the key elements have been noted and recorded. In such a way, the presence of the marine seagrass has been referred as a percentage of the transect length. As an approximation, this linear pattern can be also reported to m² and averaged.

The key element percent cover (R%) along a transect of 10 m length is calculated by the following formula:

$$R\% = \sum(Lx/10*100)$$

where Lx is the length of the key element 10 is the length of transect (Figure 12).

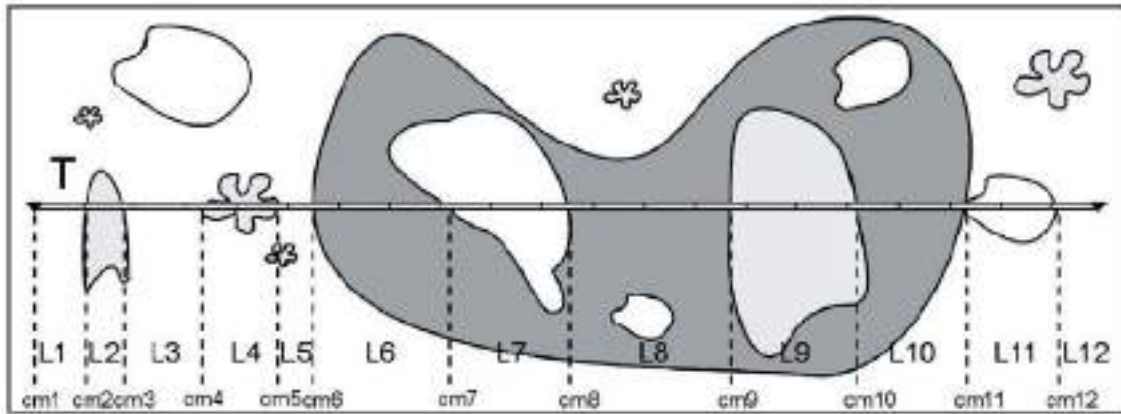


Figure 11. Line Intercept Transect (LIT) technique (Bianchi et al., 2004).

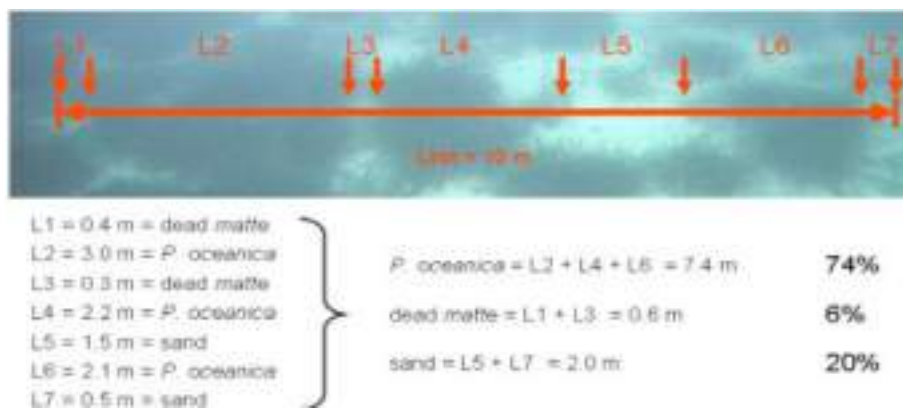


Figure 12. Example of LIT technique for the assessment of percentage cover (RAC/SPA - UNEP/MAP, 2014).

3.6.3. Shoot density

Shoot density is the number of seagrass shoots/m² and thereby provides a measure of seagrass abundance along depth gradients. The decline in density with depth suggests that shoot density responds faster than other indicators (e.g., biomass and cover) to environmental changes and may be early indicator of change or negative trends that are happening in the habitat type (Borum *et al.* 2004).

SASPAS protocol: shoot density has been measured in a non-destructive manner by counting the number of shoots within sampling unit (six replicated quadrats) launched randomly at a distance of at least one meter from the other at each sampling station. As shoot density is depth dependent, any measure of shoot density has been related to water depth.

When the shoot density is high (e.g., 2500 shoots/m²) the counting of dense stands is only feasible if small sub-areas are used. Duarte and Kirkman (2001) suggest different size of the frames depending on the anticipated shoot density: 0,5 m x 0,5 m for less than 300 shoots/m², 0,25 m x 0,25 m for 300-3000 shoots/m² and 0,1 m x 0,1 m for more than 3000 shoots/m².

For *P. oceanica* the number of shoots per m² is one of the most used descriptors to assess the ecosystem health (Pergent-Martini *et al.*, 2005; UNEP/MAP-RAC/SPA, 2011) because it provides information on vitality and dynamic of the meadows, also revealing changes due to human influence when measured on a multiyear time scale. Since the meadow density is strongly affected by the depth, Pergent *et al.* (1995) identifies four classes, which are a function of the theoretical average densities calculated for each depth, and that reflect the ecological conditions of the meadow (Buia *et al.*, 2004). Recently this classification has been updated for the interpretation of monitoring data (UNEP/MAP-RAC/SPA, 2011) (Table 3).

Along the lower limit of *P. oceanica* meadows, rhizome scouring (laying bare of the rhizomes) and plagiotropic shoots (plagiotropic to orthotropic rhizome ratio) have also been considered.

Table 3. Meaning of shoot density (shoots/m²) for *P. oceanica* (UNEP/MAP-RAC/SPA, 2011 modified).

Depth (m)	High	Good		Moderate		Poor		Bad				
1	> 1133	1133	to	930	930	to	727	727	to	524	<	524
2	> 1067	1067	to	863	863	to	659	659	to	456	<	456
3	> 1005	1005	to	808	808	to	612	612	to	415	<	415
4	> 947	947	to	757	757	to	567	567	to	377	<	377
5	> 892	892	to	709	709	to	526	526	to	343	<	343
6	> 841	841	to	665	665	to	489	489	to	312	<	312
7	> 792	792	to	623	623	to	454	454	to	284	<	284
8	> 746	746	to	584	584	to	421	421	to	259	<	259
9	> 703	703	to	547	547	to	391	391	to	235	<	235
10	> 662	662	to	513	513	to	364	364	to	214	<	214
11	> 624	624	to	481	481	to	338	338	to	195	<	195
12	> 588	588	to	451	451	to	314	314	to	177	<	177
13	> 554	554	to	423	423	to	292	292	to	161	<	161
14	> 522	522	to	397	397	to	272	272	to	147	<	147
15	> 492	492	to	372	372	to	253	253	to	134	<	134
16	> 463	463	to	349	349	to	236	236	to	122	<	122
17	> 436	436	to	328	328	to	219	219	to	111	<	111
18	> 411	411	to	308	308	to	204	204	to	101	<	101
19	> 387	387	to	289	289	to	190	190	to	92	<	92
20	> 365	365	to	271	271	to	177	177	to	83	<	83
21	> 344	344	to	255	255	to	165	165	to	76	<	76
22	> 324	324	to	239	239	to	154	154	to	69	<	69
23	> 305	305	to	224	224	to	144	144	to	63	<	63
24	> 288	288	to	211	211	to	134	134	to	57	<	57
25	> 271	271	to	198	198	to	125	125	to	52	<	52
26	> 255	255	to	186	186	to	117	117	to	47	<	47
27	> 240	240	to	175	175	to	109	109	to	43	<	43
28	> 227	227	to	164	164	to	102	102	to	39	<	39
29	> 213	213	to	154	154	to	95	95	to	36	<	36
30	> 201	201	to	145	145	to	89	89	to	32	<	32
31	> 189	189	to	136	136	to	83	83	to	30	<	30
32	> 179	179	to	128	128	to	77	77	to	27	<	27
33	> 168	168	to	120	120	to	72	72	to	24	<	24
34	> 158	158	to	113	113	to	68	68	to	22	<	22
35	> 149	149	to	106	106	to	63	<	63			
36	> 141	141	to	100	100	to	59	<	59			
37	> 133	133	to	94	94	to	55	<	55			
38	> 125	125	to	88	88	to	52	<	52			
39	> 118	118	to	83	83	to	48	<	48			
40	> 111	111	to	78	78	to	45	<	45			

3.6.4. Shoot morphometric measurement

The study of the phenological characteristics of marine seagrasses allows describing the state of vitality of plants through the analysis of vegetation turnover and cyclic phases that characterize the species and the meadow.

SASPAS protocol - The following parameters have been measured in laboratory: shoot length (cm/shoot), shoot width (cm/shoot), average number of leaves (leaves/shoot), leaf necrosis (% leaves/shoot) of the shoots collected randomly in each station (for *P. oceanica* only orthotropic shoots will be sampled). For each station, we collected 6 shoots for *P. oceanica* and 20 shoots for the other species (that have been also used for epiphyte analyses).

The limited number of *P. oceanica* shoots (6) collected compared to those planned by other monitoring protocols (6-18) (ISPRA, 2012) is justified by the fact that the monitoring operations aim to preserve the meadows as much as possible, considering how they are already damaged by trawling or anchoring.

3.6.5. Leaf Area Index (LAI) and Conservation Index (CI)

To assess the conservation status and ecosystem substitution in the *P. oceanica* meadows, the monitoring protocol plans to apply two indices, the Leaf Area Index (LAI) and the Conservation Index (CI):

Leaf Area Index (LAI):

The photosynthetically active surface (m^2/m^2) is determined by multiplying the mean surface of one-shoot leaves (only one face) by meadow shoot density.

Conservation Index (CI): (only applicable to *P. oceanica*)

$$CI = P/(P+D)$$

where: P= % of alive *P. oceanica*; D= % of dead matte

Based on the values of CI, meadows have been classified according to the criterion proposed by Montefalcone (2009) that follow the WFD requirements:

Bad	Poor	Moderate	Good	High
CI<0.3	0.3≤CI<0.5	0.5≤CI<0.7	0.7≤CI<0.9	CI≥0.9

3.6.6. Algal blooms and filamentous algae

Macroalgal blooms may vary markedly over time both because they grow fast and because they are regulated by wind exposure and can be decimated after a storm. The presence and quantity of filamentous algae (especially the genera *Ulva* and *Cladophora*) can be used as an indicator of nutrient richness in coastal waters and of deterioration of sediment quality for seagrass growth.

SASPAS protocol: the presence/absence of macroalgal blooms has been measured by general visual estimations from boat using aqua scope.

3.6.7. Abundance of epiphytes

Epiphytes (phyto- and zoo-) may be a prominent component of seagrass ecosystems when ambient nutrient concentrations are high. Both composition and abundance are important. Sampling with associated epiphytic assemblages will be collected in immersion and stored frozen or in a preserving liquid until the laboratory analysis.

SASPAS protocol: for each station we collected 6 shoots for *P. oceanica* and 20 shoots for the other species (that will also be used for morphometric measurements).

Each shoot collected in the field has been carefully examined under the microscope to determine the organisms present. They have been classified into three morpho-functional categories: *encrusting* (encrusting or prostrate algae), *turf* (algae less than 10 mm long) and *erect* (algae greater than 10 mm) (Airoldi and Cinelli, 1997; Irving and Connell, 2002a, 2002b). The zoobenthos species has been reported, only when their presence was significant. Then, the covering has been calculated, i.e., the percentage of surface area occupied by the organisms on the leaf surface, dividing it between the three morpho-functional categories.

3.6.8. Associated communities

The abundance of *Pinna nobilis* is considered an indicator of meadow health (Díaz-Almela e Duarte, 2008). The bivalve *P. nobilis* (listed in the Annex IV of HD) is almost exclusively dependent on the seagrass presence and is therefore affected by physical impacts on the meadows (e.g., boat anchoring). The presence of *P. nobilis* is a characteristic of *P. oceanica* meadow health (Borum *et al.*, 2004).

SASPAS protocol: *Pinna nobilis* density has been measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long (see “Belt Transect” technique in Bianchi *et al.*, 2004; Figure 13) and evaluating their status (dead or alive).

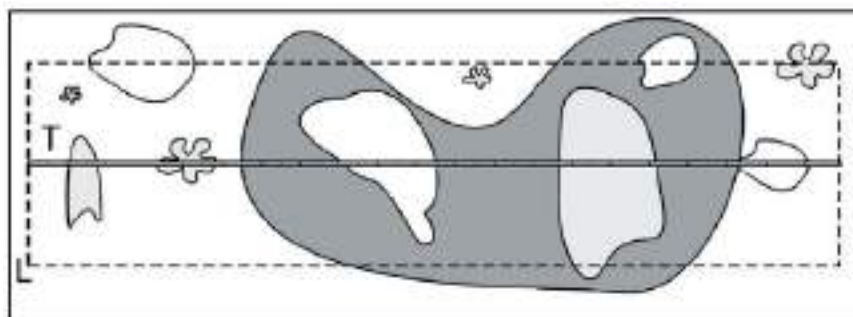


Figure 13. “Belt Transect” technique (Bianchi *et al.*, 2004).

A rapid assessment of the benthic communities has been also carried out and the main species have been listed in tables.

3.6.9. Lower limit of meadows and balise placement (only for *P. oceanica*)

The lower depth of the meadow extension is ecologically more fragile than the upper one and can be considered as an indicator of the dynamics of the entire meadows. In addition, its identification from the bathymetric point of view will be performed by the technique called “balisage” which will allow to verify its evolution in the time-scales envisaged by the project. It consists in the installation of marking points (balises), dead bodies to be placed on the bottom by the edge of the meadow and to control in time possible retreat or increase of the contour.

SASPAS protocol: considering the schedule of the project, the protocol adopted by the Réseau de Surveillance Posidonies (Charbonnel *et al.*, 2000) in a simplified form with the laying of three balises and a photographic survey has been applied.

Three sections of the lower limit have been selected to position the three balises (1 balise in every section); these sections have been characterized by degraded/risk conditions of the meadows. If only one section was identified, all three balises have been placed along this one. The divers took photographic pictures: n. 3 frontal pictures (central, lateral right side and lateral left side) from 0,5 m from the seabed, using a picket installed at 1,5 m from the balise, downward to the *P. oceanica* meadow.

Because of the different characteristics of the two study areas (NP Kornati and Litorale Brindisino), two different versions of the monitoring protocol for two typology of meadows cover have been considered (Figure 14):

1) Continuous meadow

In stations placed in areas characterized by the presence of a continuous meadow (see figure below), the balise technique is not applicable because the proper lower limit of the meadow is positioned far from the monitoring areas (potentially subject to anthropogenic impacts where boats are anchored, at a depth of probably 4-8 meters) and at greater depth.

2) Discontinuous meadow

In stations placed in an area characterized by the presence of a discontinuous meadows (patches of seagrasses), the balise technique can be applied, selecting three sections of limit of patches (characterized by degraded/risk conditions of the meadows) where to place one balise for section. The limit selected will not correspond to the proper lower limit of the meadow (as represented in the example in the figure below), as we only consider possible endangered contours by anchoring.

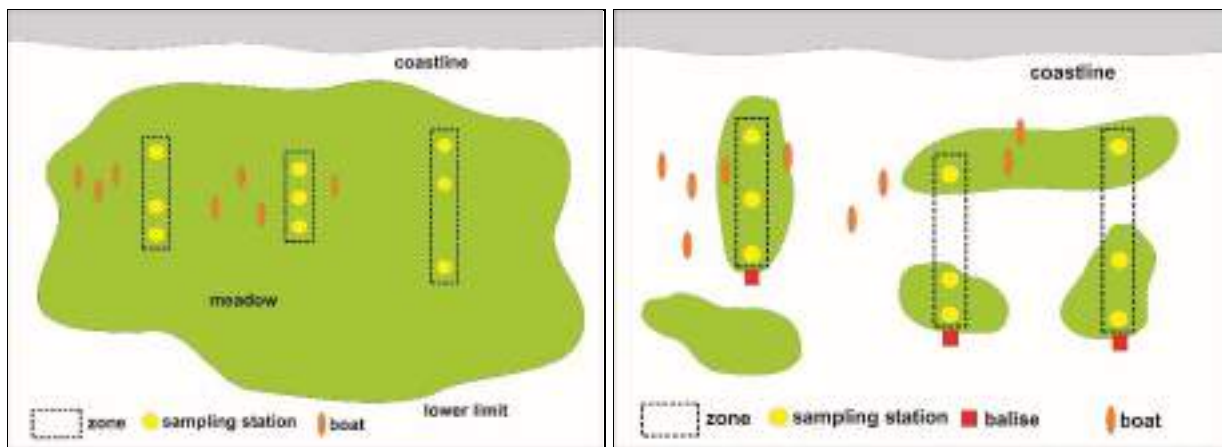


Figure 14. Example of a continuous meadow where balise placement is not necessary (on the left). Example of balise placement in a discontinuous meadow (on the right).

The typology of lower limits is based on the description of Pergent *et al.* (1995) integrated by Montefalcone (2009) and UNEP/MAP-RAC/SPA (2009):

- progressive limit: with plagiotropic (horizontal) rhizomes beyond the limit oriented toward the bottom, the absence of mat, coverage decreasing regularly (it indicates colonization of the meadow in the depth);
- sharp limit: the meadow stops abruptly with the presence of vertical rhizomes but in the absence of mat; it is characterized by high (>25 %) or low (<25 %) cover (these limits usually indicate a status of equilibrium, but the low percent cover may indicate deterioration of the environment and an early imbalance);
- erosive limit: the meadow stops abruptly with the presence of a pronounced step of mat and cover > 50 %;
- sparse limit: density is lower than 100 shoot per m² and cover lower than 15 % (in general it reflects degraded conditions);
- regressive limit: the presence of dead mat beyond the limit, within the dead mat a few isolated shoots or residual patches of *P. oceanica* alive may persist, with or without step of mat, isolated or connected to the meadow (it testifies a decline of the meadow).

Recent classifications of the status of the meadow in function of lower limit depth, typology and % cover are reported below (UNEP/MAP-RAC/SPA, 2009, 2011) (Table 4, Table 5 and Table 6).

Table 4. Status of the meadow in function of the lower limit depth (UNEP/MAP-RAC/SPA, 2011, modified).

	High	Good	Moderate	Poor	Bad
Depth (m)	> 34,2	34,2 to 30,4	30,4 to 26,6	26,6 to 22,8	< 22,8

Table 5. Status of the meadow in function of the lower limit typology (UNEP/MAP-RAC/SPA, 2011, modified).

	High	Good	Moderate	Poor	Bad
Lower limit	progressive	sharp (cover > 25 %)	sharp (cover < 25 %)	spare	regressive

Table 6. Status of the meadow in function of the lower limit cover (UNEP/MAP-RAC/SPA, 2011, modified).

	High	Good	Moderate	Poor	Bad
% cover at lower limit	> 35 %	35 % to 25 %	25 % to 15 %	15 % to 5 %	< 5 %

3.6.10. Type of substrate

The type of substrate, by means of visual and tactile observation, has been evaluated. Sediment samples have been collected for laboratory grain-size analyses.

3.6.11. Alien species

The presence of *alien species* is included among the anthropogenic threats. *P. oceanica* is particularly threatened by some algal species: three species of the genus *Caulerpa* (*C. taxifolia*, *C. prolifera* and *C. cylindracea*) and the turf-forming red alga *Womersleyella setacea*. For this reason, their reporting and estimating coverage are required by the WFD protocols applied in the Mediterranean.

SASPAS protocol: the abundance of *alien species* has been evaluated as cover using the same methods as described for seagrass cover (along three transects in each station).

3.6.12. Presence/absence of habitat disturbance

Evidence of mechanical pressures (e.g., mooring systems, concrete blocks, piers, chains, ropes, trash) and signs of impacts (e.g., detached shoots, detached plates of matte, damages due to trawling or anchoring) has been identified by means of visual observation.

4. Monitoring results

The results of the preliminary surveys carried out in the three project sites are reported in the following paragraphs. In the project sites, in each station, general information, such as date of monitoring, name/code of the site, name of the coordinator and of the operators, exposure and coordinates have been recorded in the field sheets (see annexes). Also, laboratory data have been reported in special sheets that are collected in the annexes.

The coordinates of the monitoring stations in the three study sites are reported in the following table:

Table 7. Coordinates of the monitoring stations in the three study sites.

Monfalcone (Bay of Panzano)			Kornati NP		RNP Dune Costiere			
	Latitude (N)	Longitude (E)	Latitude (N)	Longitude (E)	Latitude (N)	Longitude (E)		
Z1 A	45 46' 45,81"	13 32' 12,51"	Z1 A	43 49' 29,24"	15 16' 30,15"	Z1 A	40 48' 59,81"	17 31' 25,11"
Z1 B	45 46' 45,47"	13 32' 19,19"	Z1 B	43 49' 29,91"	15 16' 31,08"	Z1 B	40 48' 59,83"	17 31' 24,42"
Z1 C	45 46' 37,97"	13 32' 27,58"	Z1 C	43 49' 30,94"	15 16' 31,85"	Z1 C	40 48' 59,81"	17 31' 23,78"
Z2 A	45 45' 34,13"	13 31' 36,79"	Z2 A	43 49' 28,80"	15 16' 31,08"	Z2 A	40 49' 00,32"	17 31' 25,01"
Z2 B	45 45' 28,69"	13 31' 54,76"	Z2 B	43 49' 29,21"	15 16' 31,50"	Z2 B	40 49' 00,39"	17 31' 24,38"
Z2 C	45 45' 23,05"	13 32' 32,63"	Z2 C	43 49' 29,97"	15 16' 33,45"	Z2 C	40 49' 00,43"	17 31' 23,51"
Z3 A	45 45' 06,27"	13 31' 54,88"	Z3 A	43 48' 32,69"	15 15' 18,93"	Z3 A	40 49' 00,91"	17 31' 24,93"
Z3 B	45 45' 09,33"	13 32' 06,01"	Z3 B	43 48' 32,23"	15 15' 18,24"	Z3 B	40 49' 00,87"	17 31' 24,10"
Z3 C	45 45' 11,00"	13 32' 35,82"	Z3 C	43 48' 32,03"	15 15' 17,54"	Z3 C	40 49' 00,92"	17 31' 23,17"
			<i>Balise</i>	43 49' 31,09"	15 16' 32,59"	<i>Balise</i>	40 49' 00,08"	17 31' 23,99"

4.1. Monfalcone (Bay of Panzano)

4.1.1. Monitoring area

In the Monfalcone site, the preliminary survey was carried out at the end of May in the two Natura 2000 sites in the Panzano Bay: SAC - *Cavana di Monfalcone* and SPA-SAC - *Foce dell'Isonzo - Isola della Cona*.

In the area placed in the northern part of the Panzano bay, in the site "Cavana di Monfalcone", the Zone 1 (Z1) was located on a *Cymodocea nodosa* meadow, where anchoring pressures occur, due to the presence of medium boats (sailboats). Within this Zone, three monitoring stations have been positioned at different depths (Stations Z1-A, Z1-B and Z1-C) (Figure 15).

The Zone 2 (Z2) and Zone 3 (Z3) were placed in the "Foce dell'Isonzo – Isola della Cona". These Zones are characterized by shallow depth and are positioned on *Cymodocea nodosa* meadows mixed with other species (i.e., *Zostera noltei* in Z2 and *Zostera marina* in Z3). In these areas anchoring pressures occur, due to the presence of small boats. As in Zone 1, three monitoring stations were positioned, within each Zone, at different depths, for a total of six stations (Z2-A, Z2-B, Z2-C, Z3-A, Z3-B and Z3-C) (Figure 16).



Figure 15. Sampling scheme applied to the Zone 1 in the in the site "Cavana di Monfalcone".

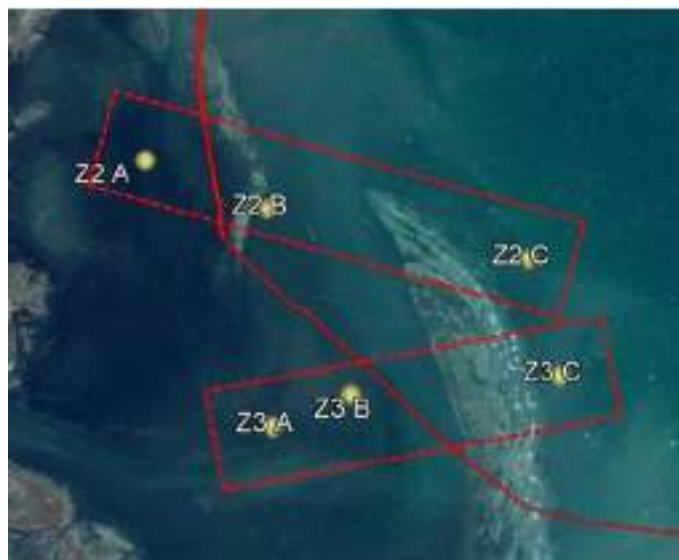


Figure 16. Sampling scheme applied to the Zones 2 and 3 in the in the site "Foce dell'Isonzo, Isola della Cona".

4.1.2. Distribution of seagrass meadows

In the Bay of Panzano, *Cymodocea nodosa* is the most abundant seagrass species, which sometimes forms mixed meadows together with *Zostera marina* and / or *Zostera noltei*. Concerning the sampling areas, as previously mentioned, Zone 2 and Zone 3 were positioned on *Cymodocea nodosa* meadows, with limited presence of other species (*Zostera noltei* in Z2 and *Zostera marina* in Z3) (Figure 17).

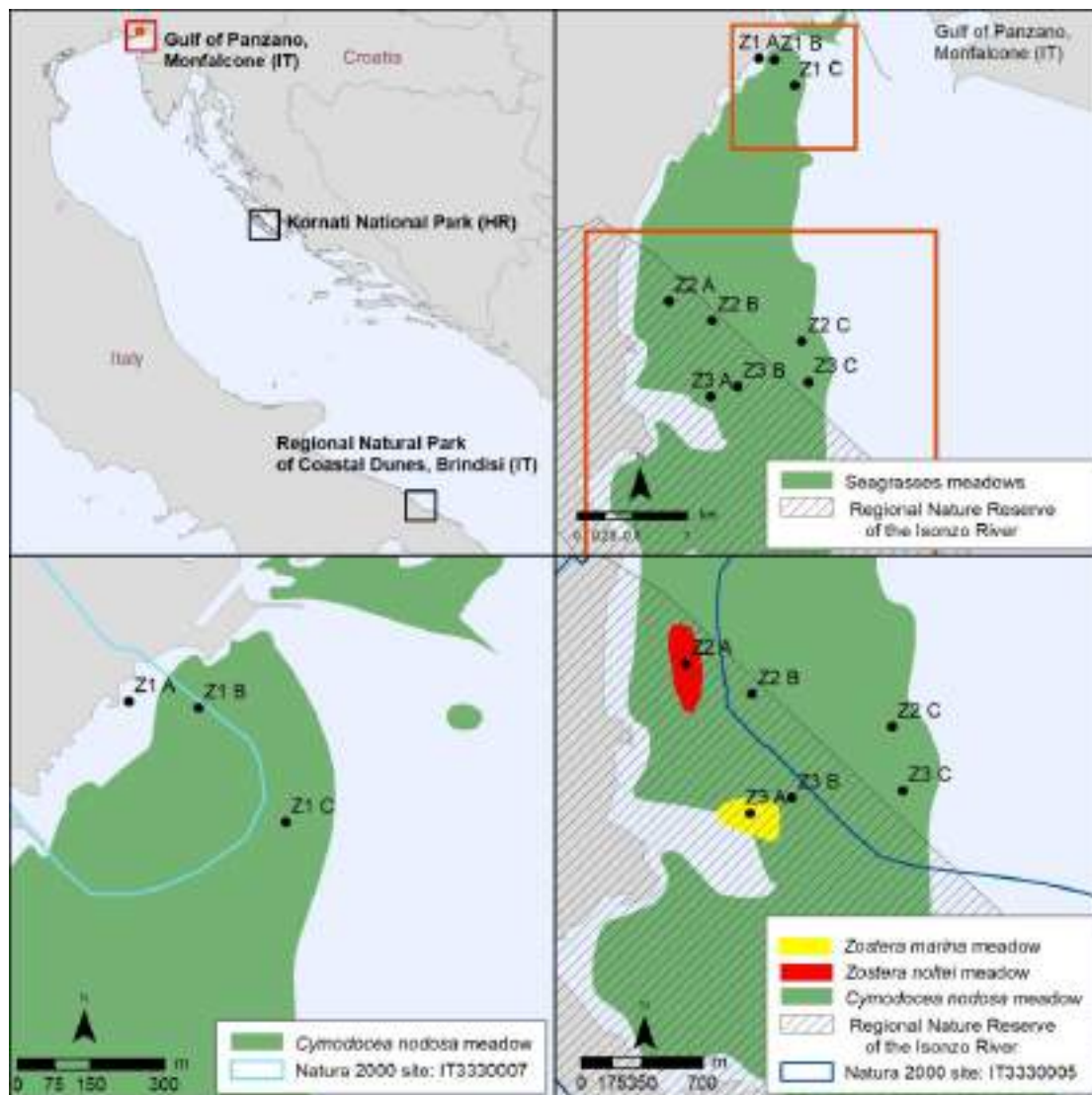


Figure 17. Seagrasses distribution and monitoring stations in the Panzano Bay.

At the time of measurements, a high continuity of meadows was observed in the monitoring stations and no particular signs of disturbance were recorded.

Other sites, coincident with the shallower areas are little or no colonized. These areas presented some retreat dynamics that need to be confirmed during the next investigations.

4.1.3. Percentage Cover and meadow continuity

In the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average cover of *Cymodocea nodosa* varied between 0% and 100%; in fact, in some areas (Station Z1-C) the seagrasses were absent (bare seabed). In the Zone 2 (stations Z2-A, Z2-B and Z2-C), as mentioned before, the *Cymodocea nodosa* meadows was mixed with *Zostera noltei* and (as the graphs shows) the average cover of *C. nodosa* was close to 100% and the *Z. noltei* cover was slightly below 80% (discontinuity of the meadow). In the Zone 3 (stations Z3-A, Z3-B and Z3-C), the cover of both the species (*C. nodosa* and *Zostera marina*) was close to 100%. Even considering the variability due to the presence of different species characterized by different seasonal cycles, the data analysis suggests the existence of limited differences along stations and Zones for percentage cover. The results are summarized in Figure 18.

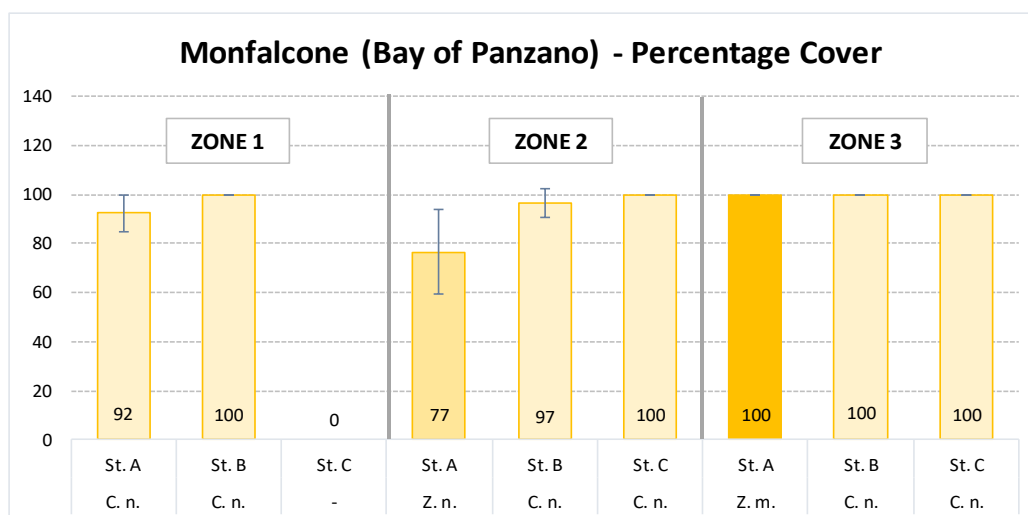


Figure 18. The average values of seagrasses percentage cover as measured in the sampling stations.

4.1.4. Shoot density

In the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average shoot density of *Cymodocea nodosa* varied between 437 and 548 shoots/m² (in the Z1-C station the seagrasses were absent). In the Zone 2 (stations Z2-A, Z2-B and Z2-C), the shoot density average value is between 719 and 798 shoots/m² for *Cymodocea nodosa* and equal to about 2110 shoots/m² for *Zostera noltei*. In the third Zone (stations Z3-A, Z3-B and Z3-C), the average shoot density of *Cymodocea nodosa* varied between 652 and 776 shoots/m² and it was about 320 shoots/m² for *Zostera marina*. As for the percentage cover, the data analysis suggests the existence of limited differences along stations and Zones for shoot density. The differences are related to the presence of species (*C. nodosa* e *Zostera* spp.) characterized by different seasonal cycles (growth rate and spread, reproductive season, etc.). The results are summarized in Figure 19.

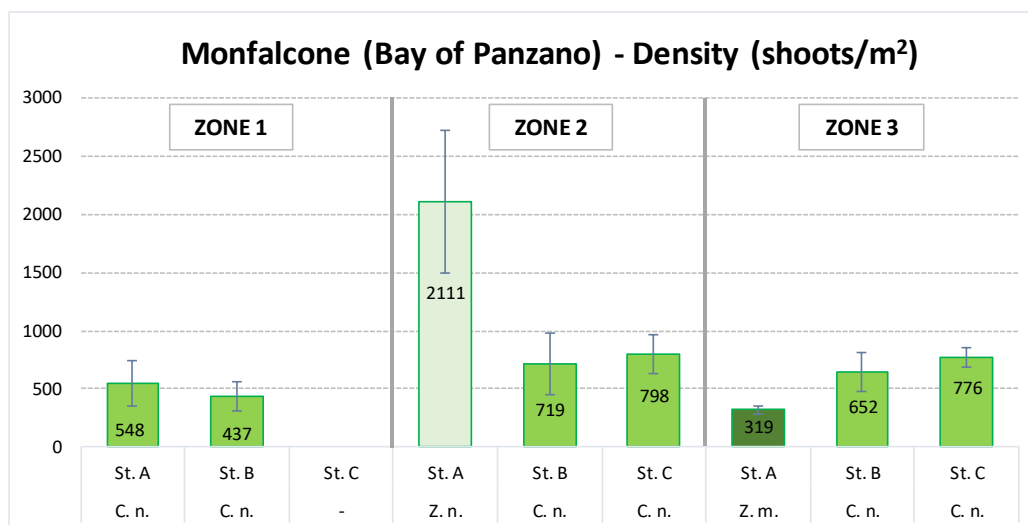


Figure 19. The average values of seagrasses shoot density as measured in the sampling stations.

4.1.5. Shoot morphometric measurement

In the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average shoot length of *Cymodocea nodosa* varied between 12,2 and 18,3 cm (in the Z1-C station the seagrasses were absent). In the Zone 2 (stations Z2-A, Z2-B and Z2-C), the shoot length average value is between 16,2 and 24,2 cm for *Cymodocea nodosa* and equal to 9,3 cm for *Zostera noltei*. In the Zone 3 (stations Z3-A, Z3-B and Z3-C), the average shoot length of *Cymodocea nodosa* varied between 24,0 and 29,2 cm and it is about 46,9 cm for *Zostera marina*. The data analysis suggests the existence of limited differences along stations and Zones, for *C. nodosa* shoot density, and they are mainly due to different water depth. Light attenuates with increasing depth and seagrasses prolong the leaves and thin the density of shoots to capture more light to be converted into photosynthetic production. Compared to *C. nodosa* average shoot length, the lower one of *Z. noltei* and the greater one of *Z. marina* are expected and due to different phenological cycles. The results are summarized in Figure 20.

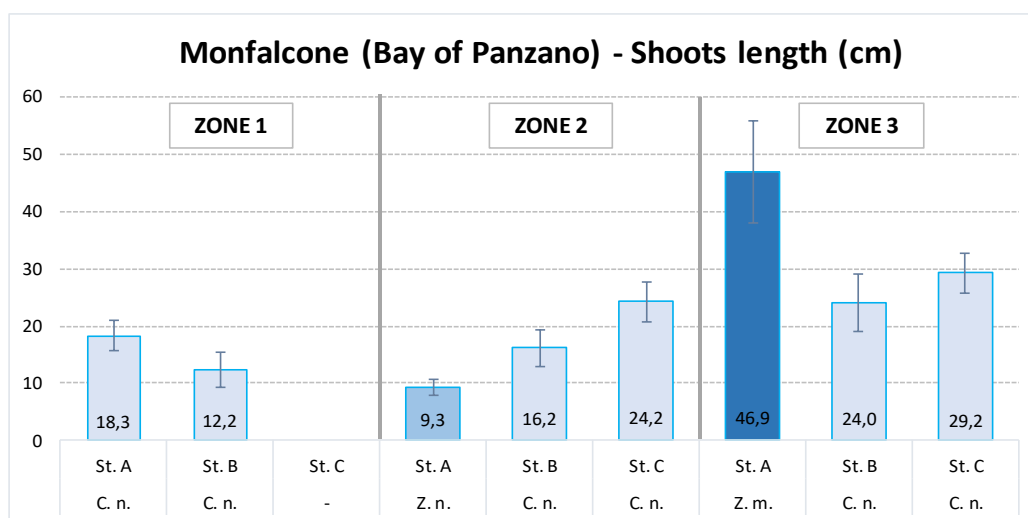


Figure 20. The average values of seagrasses shoot length as measured in the sampling stations.

The other parameters are summarized in the following table (average values and standard deviations):

Table 8. Shoot width (cm/shoot), n. of leaves/shoot and leaf necrosis (% leaves/shoot) (average values and standard deviations).

Zone 1	Z1-A (C.n.)	Z1-B (C.n.)	Z1-C
Shoot width (cm/shoot)	0,17±0,02	0,18±0,03	-
N. of leaves/shoot	3,1±0,5	3,0±0,7	-
Leaf necrosis (% leaves/shoot)	0,1±0,2	0,4±0,8	-
Zone 2	Z2-A (Z.n.)	Z2-B (C.n.)	Z2-C (C.n.)
Shoot width (cm/shoot)	0,10±0	0,18±0,02	0,28±0,02
N. of leaves/shoot	2,8±0,4	2,7±0,6	2,7±0,6
Leaf necrosis (% leaves/shoot)	0,2±0,2	0,3±0,5	1,4±0,9
Zone 3	Z3-A (Z.m.)	Z3-B (C.n.)	Z3-C (C.n.)
Shoot width (cm/shoot)	0,44±0,05	0,19±0,03	0,25±0,04
N. of leaves/shoot	4,8±0,7	2,8±0,5	2,8±0,5
Leaf necrosis (% leaves/shoot)	1,1±0,5	0,8±0,3	1,4±0,9

4.1.6. Leaf Area Index (LAI)

The index values are reported in the following table (average values):

Table 9. Leaf Area Index (LAI) averages values.

Zone 1	Z1-A (C.n.)	Z1-B (C.n.)	Z1-C
LAI (station average value)	0,28	0,14	-
LAI (Zone average value)	0,21		-
Zone 2	Z2-A (Z.n.)	Z2-B (C.n.)	Z2-C (C.n.)
LAI (station average value)	0,34	0,25	0,69
LAI (Zone average value)	-	0,47	
Zone 3	Z3-A (Z.m.)	Z3-B (C.n.)	Z3-C (C.n.)
LAI (station average value)	1,81	0,44	0,86
LAI (Zone average value)	-	0,65	

4.1.7. Algal blooms and filamentous algae

A general visual estimation from boat using aqua scope in the monitoring areas highlighted the absence of macroalgal blooms and filamentous algae. However, during the monitoring activities some samples have been collected to describe the algal community and the principal species found are listed below:

Chlorophyta

Blidingia ramifera (Bliding) Garbary & L.B.Barkhouse
Bryopsis plumosa (Hudson) C. Agardh
Chaetomorpha aerea (Dillwyn) Kützing
Cladophora lehmanniana (Lindenberg) Kützin
Ulothrix flacca (Dillwyn) Thuret
Ulothrix implexa (Kützing) Kützing
Ulva laetevirens Areschoug

Ochrophyta

Cystoseira compressa (Esper) Gerloff et Nizamuddin
Dictyota dichotoma (Hudson) J.V. Lamouroux
Ectocarpus fasciculatus Harvey
Scytosiphon lomentaria (Lyngbye) Link

Rhodophyta

Ceramium ciliatum (J.Ellis) Ducluzeau
Spyridia filamentosa (Wulfen) Harvey
Chondria capillaris (Hudson) M.J. Wynne
Gracilaria gracilis (Stackhouse) Steentoft, L.M. Irvine et Farnham
Hydrolithon boreale (Foslie) Y.M.Chamberlain
Hypnea spinella (C.Agardh) Kützing
Osmundea truncata (Kützing) K.W. Nam et Maggs
Pneophyllum fragile Kützing

4.1.8. Abundance of epiphytes

The average cover of the three categories has been calculated (i.e., the percentage of surface area occupied by the organisms on the leaf surface) and reported in the following table.

Table 10. Average cover of the three categories (Encrusting layer, Erect layer and Turf layer).

	Z1-A	Z1-B	Z1-C	Z2-A	Z2-B	Z2-C	Z3-A	Z3-B	Z3-C
Encrusting layer	10%	15%	/	10%	15%	15%	15%	15%	20%
Erect layer	<5%	<5%	/	<5%	<5%	<5%	<5%	<5%	<5%
Turf layer	<5%	<5%	/	<5%	<5%	<5%	<5%	<5%	<5%

The dominance of the *encrusting layer* (represented above all by the Corallinales) is reported in literature as a positive condition of the quality status of seagrass meadows; in fact, in disturbed environments (e.g., in the presence of nutrient increase or turbidity), there would be a reduction in encrusting layers abundance and a simultaneous increase in filamentous algae presence (Ballesteros, 1987; Martínez-Crego *et al.*, 2010).

4.1.9. Associated communities

Pinna nobilis was found only in Z1-B station for a total of 4 alive bivalves (3 adult individuals and 1 young individual).

A rapid assessment of the associated benthic communities detected the presence of the species reported in the following table:

Table 11. List of species of the macrobenthic communities associated to the seagrasses meadows.

Taxonomic group	Taxa	Zone 1	Zone 2	Zone 3
Anthozoa	<i>Anemonia viridis</i> (Forsskål, 1775)	x		
Crustacea Amphipoda	<i>Gammarus insensibilis</i> Stock, 1966			x
Crustacea Decapoda	<i>Carcinus aestuarii</i> Nardo, 1847	x		
	<i>Palaemon adspersus</i> Rathke, 1837			x
	<i>Upogebia pusilla</i> (Petagna, 1792)			x
Crustacea Isopoda	<i>Idotea</i> spp. Fabricius, 1798		x	
	<i>Synischia hectica</i> (Pallas, 1772)			x
Mollusca Bivalvia	<i>Fabulina fabula</i> (Gmelin, 1791)		x	x
	<i>Loripes orbiculatus</i> Poli, 1795		x	x
	<i>Lucinella divaricata</i> Linnaeus, 1758		x	
	<i>Modiolus barbatus</i> (Linnaeus, 1758)	x		
	<i>Mytilaster lineatus</i> (Gmelin, 1791)			x
	<i>Mytilus galloprovincialis</i> Lamarck, 1819	x		
Mollusca Gasteropoda	<i>Bittium reticulatum</i> (da Costa, 1778)	x	x	x
	<i>Gibbula</i> spp. Risso, 1826	x	x	x
	<i>Hexaplex trunculus</i> (Linnaeus, 1758)	x		
	<i>Nassarius nitidus</i> (Jeffreys, 1867)		x	x
	<i>Pusillina</i> spp. Monterosato, 1884		x	
	<i>Tricolia pullus</i> (Linnaeus, 1758)			x
	<i>Tritia neritea</i> (Linnaeus, 1758)			x
Polychaeta	Errantia indet.	x	x	x
	Spirorbidae Chamberlin, 1919	x	x	x
	Serpulidae Rafinesque, 1815	x	x	x

4.1.10. Type of substrate

Considering the close relationship between seagrasses and substrate, to identify the type of substrate, as well as through visual and tactile observation in field, sediment sample were collected for laboratory grain-size analyses and the results are reported below:

Table 12. Results of the grain-size analyses.

	coarse sand %	medium sand %	fine sand %	silt %	clay %	Grain size classification
	0,5< ϕ <2 mm	0,25< ϕ <0,5 mm	0,063< ϕ <0,25 mm	0,0039 mm< ϕ <0,063 mm	ϕ <0,0039 mm	
Z1	14,79	19,58	42,62	22,47	0,55	Fine silty sand
Z2	12,77	20,77	41,65	22,30	0,57	Fine silty sand
Z3	0,47	29,14	37,97	26,79	5,82	Fine medium sand with silt and weakly clayey

4.1.11. Alien species

In the study area, during the monitoring activities, no alien algal species were detected.

4.1.12. Presence/absence of habitat disturbance

Concerning human disturbance and the evidence of mechanical pressures, some gillnets were observed near the Zone 2 and Zone 3.

4.1.13. Localization of the concrete actions' sites

In the Monfalcone site (Figure 21), a potential area to perform pilot seagrass transplantation has been identified in the SPA SAC Foce dell'Isonzo – Isola della Cona (near Zone 2 and Zone 3). This area is characterized by the absence of seagrasses (bare seabed), shallow depth and the frequent presence of small, anchored boats. The areas for the laying of the anchoring system have been identified in the proximity of the SPA SAC Foce dell'Isonzo – Isola della Cona, and they are characterized by the frequent presence of anchored boats.



Figure 21. Panzano Bay: Seagrasses transplantation areas and laying buoys areas.

4.2. KORNATI NP

4.2.1. Monitoring area

In the Kornati NP site, the preliminary survey was carried out at the end of June. In this case, two typologies of sites, positioned on *P. oceanica* meadows, have been considered: the first one is the “Anchoring site” where anchoring pressures occur and the second one is the “Diving site” where diving boats frequently anchor for authorized diving activities.

In the “Anchoring site” (in Kravljačica Bay), two Zones have been selected (Zone 1 and Zone 2) on *P. oceanica* meadows, where three monitoring stations have been positioned at different depths (St. A, B and C) for a total of six stations. In addition, three marking points (balises) have been placed (see par. 4.2.10; Figure 22).



Figure 22. Sampling scheme applied to the Zone 1 and Zone 2 in the in the “Anchoring site” in Kravljačica Bay.

In the “Diving site”, located between Borovnik island and Balun Island, diving boats anchor for authorized diving activities one Zone (Zone 3), three monitoring stations (St. A, B and C) have been placed (Figure 23).

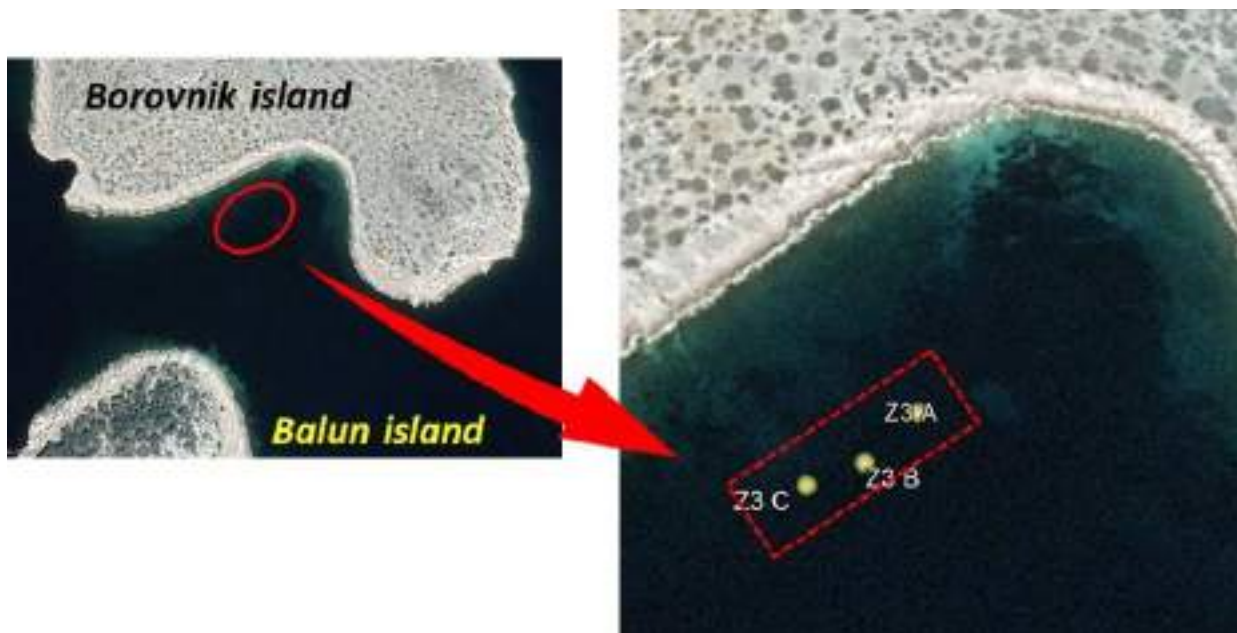


Figure 23. Sampling scheme applied to the Zone 3 in the in the “Diving site” positioned between Borovnik island and Balun Island.

4.2.2. Distribution of seagrass meadows

On an overall view, *P. oceanica* meadows are widespread in the park, down to depths of 25-30 meters and with an irregular distribution that mainly follows the bathymetric pattern of the archipelago (Figure 24). Existing distribution map was produced based on available orthophoto and bathymetric maps. This map represents potential distribution range. There is a need for more detailed seagrass distribution maps based on real data collected in the field. In the “Anchoring site” (Zone 1 and Zone 2) signs of disturbance on the meadows were reported and, in some areas, coverage is discontinuous and patchy and the damage to seagrasses seems caused by anchor dragging and scraping anchor chains along the seabed. The “Anchoring site”, due to its morphology, bathymetric trend, and exposure to the wind, behaves like a sedimentation basin. At present, it is reasonable to assume that even the numerous anchorages of pleasure boats, in the summer period, are responsible for an important phenomenon of sediment re-suspension.

In the “Diving site” (Zone 3) the meadow was continuous with no visible signs of disturbance and low sedimentation; only some points were devoid of meadows, but this is believed to be due to natural distribution dynamics and not to human activities impact.

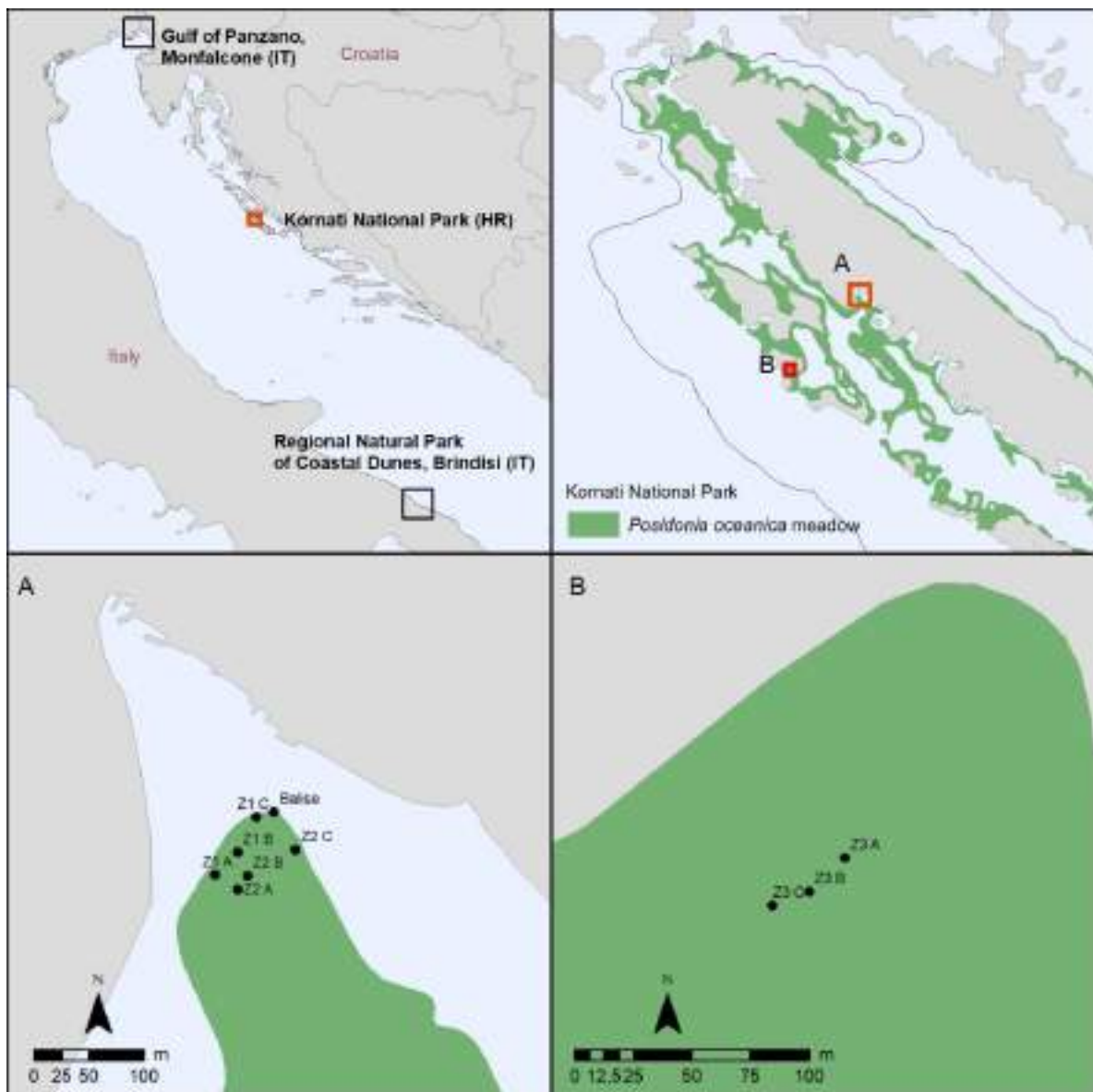


Figure 24. Seagrasses distribution and monitoring stations in the Kornati NP.

4.2.3. Percentage Cover and meadow continuity

In the “Anchoring site”, in the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average cover of *P. oceanica* varied between 28% and 34% and was discontinuous, mostly due to anchoring pressures; in the Zone 2

(stations Z2-A, Z2-B and Z2-C), the average cover of *P. oceanica* ranged between 28% and 78% (highlighting discontinuities of the meadow).

In the “Diving site”, in the Zone 3 (stations Z3-A, Z3-B and Z3-C), the cover of *P. oceanica* was equal or higher than 75% (between 75% and 85%); only some points were devoid of meadow, possibly due to the scraping of anchors and chains on the seabed.

The data analysis suggests the existence of differences in the percentage cover of *P. oceanica* along stations in the “Anchoring site” and in the “Diving site”. In particular, the stations placed in the “Diving site” were characterized by percentage cover values higher than the ones of the “Anchoring site”. This is an expected result because, as mentioned before, in the “Anchoring site” *P. oceanica* meadows suffer from mechanical damage caused by boats anchoring. The results are summarized in Figure 25.

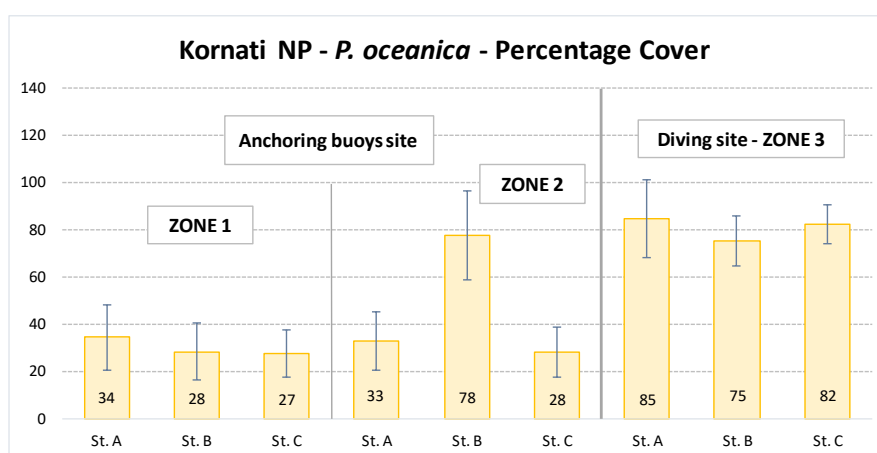


Figure 25. The average values of *P. oceanica* percentage cover as measured in the sampling stations.

4.2.4. Shoot density

In the “Anchoring site”, in the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average shoot density of *P. oceanica* ranged between 83 and 154 shoots/m², similar to the values reported in the Zone 2 (stations Z2-A, Z2-B and Z2-C), where the average values were between 119 and 149 shoots/m².

In the “Diving site”, in the Zone 3 (stations Z3-A, Z3-B and Z3-C), the average shoot density of *P. oceanica* ranged between 203 and 368 shoots/m². As for the percentage cover, the existence of differences along stations in the “Anchoring site” and in the “Diving site” for shoot density of *P. oceanica* are mainly related to the presence of anchoring pressure; in fact, damage to seagrasses seemed caused by dragging anchors and scraping anchor chains along the seabed. The results are summarized in Figure 26.

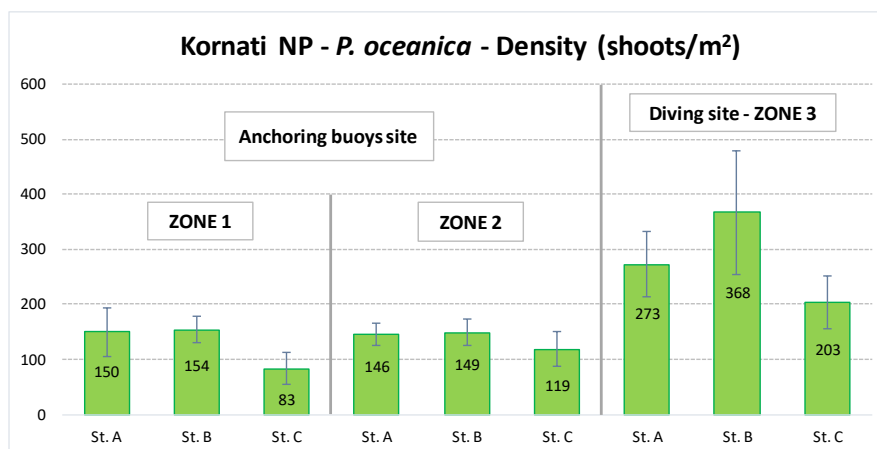


Figure 26. The average values of *P. oceanica* shoots density as measured in the sampling stations.

In the following table, shoot density and depth values are related to the five classes for the final ecological classification (*sensu* WFD) (UNEP/MAP-RAC/SPA, 2011) (see par. 3.6.3).

Table 13. Shoot density and depth values in relation to the five classes for the final ecological classification (*sensu* WFD) (UNEP/MAP-RAC/SPA, 2011).

Zones	Z1	Z2	Z3
Density (shoots/m²) (average value)	129	138	281
Depth (m) (average value)	12	14	10
Ecological classification (<i>sensu</i> WFD)	BAD	BAD	POOR

4.2.5. Shoot morphometric measurement

In the “Anchoring site”, in the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average shoot length of *P. oceanica* ranged between 36,9 and 46,7 cm, and, in the Zone 2 (stations Z2-A, Z2-B and Z2-C), between 48,2 and 52,4 cm. In the “Diving site”, in the Zone 3 (stations Z3-A, Z3-B and Z3-C), the average shoot length of *P. oceanica* was between 49,4 and 61,7 cm.

Unlike the previous parameters, as concern the shoot length the existence of differences along stations in the “Anchoring site” and in the “Diving site” were less evident; however, even in this case, they seemed related, at least in part, to the presence or the reduced presence of anchoring pressure. The results are summarized in Figure 27.

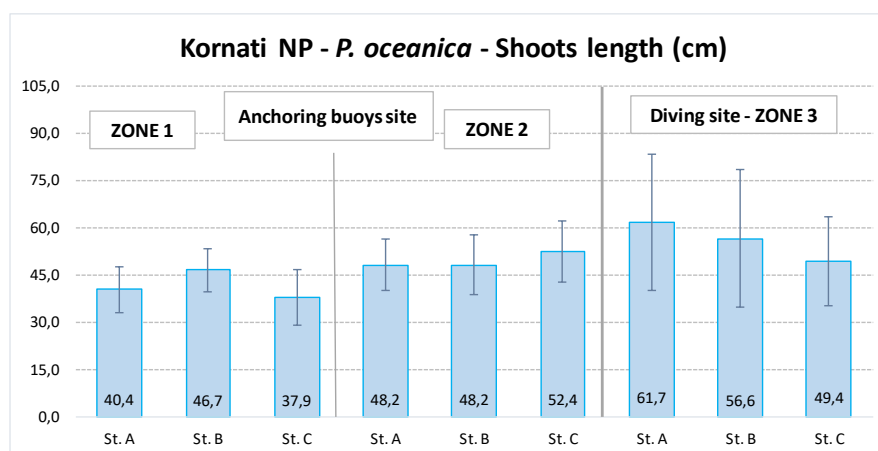


Figure 27. The average values of *P. oceanica* shoots length as measured in the sampling stations.

The other parameters are summarized in the following table (average values and standard deviations):

Table 14. Shoot width (cm/shoot), n. of leaves/shoot and leaf necrosis (% leaves/shoot) (average values and standard deviations).

Zone 1	Z1-A	Z1-B	Z1-C
Shoot width (cm/shoot)	1,06±0,51	0,84±0,03	0,79±0,01
N. of leaves/shoot	6,2±2,4	6,2±1,6	5,8±0,8
Leaf necrosis (% leaves/shoot)	15,9±7,7	12,4±6,6	3,2±2,6
Zone 2	Z2-A	Z2-B	Z2-C
Shoot width (cm/shoot)	0,79±0,05	0,81±0,03	0,89±0,01
N. of leaves/shoot	6,8±1,8	6,7±1,2	6,7±3,7
Leaf necrosis (% leaves/shoot)	17,7±9,9	9,1±5,4	9,3±3,7
Zone 3	Z3-A	Z3-B	Z3-C
Shoot width (cm/shoot)	0,69±0,03	0,70±0,03	0,70±0,03
N. of leaves/shoot	6,8±2,0	5,3±0,5	6,0±1,3
Leaf necrosis (% leaves/shoot)	22,2±10,0	30,7±6,4	36,3±10,6

4.2.6. Leaf Area Index (LAI) and Conservation Index (CI)

To assess the conservation status in the *P. oceanica* meadows, two indices have been applied: the Leaf Area Index (LAI) and the Conservation Index (CI).

Leaf Area Index (LAI)

The index values are reported in the following table (average values):

Table 15. Leaf Area Index (LAI) average .

Zone 1	Z1-A	Z1-B	Z1-C
LAI (station average value)	2,31	2,09	0,90
LAI (Zone average value)	1,77		

Zone 2	Z2-A	Z2-B	Z2-C
LAI (station average value)	1,92	2,07	2,23
LAI (Zone average value)	2,07		

Zone 3	Z3-A	Z3-B	Z3-C
LAI (station average value)	4,77	4,13	2,69
LAI (Zone average value)	3,87		

Conservation Index (CI)

The values of the CI range from 0 (maximum alteration or minimum conservation status, only presence of dead mat) to 1 (high conservation status).

Table 16. Conservation Index (CI) average values.

Zone 1	Z1-A	Z1-B	Z1-C
CI (station average value)	0,34	0,28	0,27
CI (Zone average value)	0,30 (poor conservation status)		

Zone 2	Z2-A	Z2-B	Z2-C
<i>CI (station average value)</i>	0,33	0,78	0,28
<i>CI (Zone average value)</i>	0,46 (poor conservation status)		

Zone 3	Z3-A	Z3-B	Z3-C
<i>CI (station average value)</i>	0,95	0,75	0,82
<i>CI (Zone average value)</i>	0,84 (good conservation status)		

4.2.7. Algal blooms and filamentous algae

A general visual estimation from boat using aqua scope in the monitoring areas highlighted the absence of macroalgal blooms and filamentous algae. However, during the monitoring activities some samples have been collected to describe the algal community and the principal species found are listed in the following table:

Chlorophyta

Acetabularia acetabulum (Linnaeus) P.C. Silva
Anadyomene stellata (Wulfen) C. Agardh
Chaetomorpha aerea (Dillwyn) Kützing
Cladophora laetevirens (Dillwyn) Kützing
Halimeda tuna (J. Ellis et Solander) J.V. Lamouroux

Ochrophyta

Dictyota dichotoma (Hudson) J.V. Lamourou
Halopteris filicina (Grateloup) Kützing
Padina pavonica (Linnaeus) Thivy

Rhodophyta

Halopteris scoparia (Linnaeus) Sauvageau
Hydrolithos spp. (Foslie) Foslie
Liagora viscida (Forsskål) C.Agardh
Peyssonnelia squamaria (S.G. Gmelin) Decaisne

4.2.8. Abundance of epiphytes

The average cover of the three categories has been calculated and reported in the following table:

Table 17. Average cover of the three categories (Encrusting layer, Erect layer and Turf layer).

	Z1-A	Z1-B	Z1-C	Z2-A	Z2-B	Z2-C	Z3-A	Z3-B	Z3-C
Encrusting layer	30%	35%	25%	30%	25%	35%	35%	35%	40%
Erect layer	5%	5%	5%	5%	5%	5%	5%	10%	5%
Turf layer	10%	5%	10%	10%	<5%	15%	10%	15%	10%

As for the other study sites, the dominance of the *encrusting layer* (represented above all by the Corallinales) can be considered a positive condition of the quality status of seagrass meadows.

4.2.9. Associated communities

Some alive individuals of *Pinna nobilis* were found only in the proximity of Zone 3 (outside the monitoring corridor, see par. 3.6.8). In the Zone 3 and Zone 1, no individuals were found and, in the Zone 2 (st. Z2-B), the presence of one dead bivalve was reported.

A rapid assessment of the associated benthic communities detected the presence of the species reported in the following table:

Table 18. List of species of the macrobenthic communities associated to the seagrasses meadows.

Taxonomic group	Taxa	Zone 1	Zone 2	Zone 3
Anthozoa	Actiniaria			x
Crustacea Decapoda	<i>Pagurus</i> spp. Fabricius, 1775		x	
Crustacea Tanaidacea	<i>Leptochelia</i> spp. Dana, 1849			x
Echinodermata	<i>Amphiura chiajei</i> Forbes, 1843	x	x	
Mollusca Bivalvia	<i>Gouldia minima</i> (Montagu, 1803)		x	
	<i>Loripinus fragilis</i> (Philippi, 1836)	x	x	
	<i>Lucinella divaricata</i> Linnaeus, 1758	x		
	<i>Papillicardium papillosum</i> (Poli, 1791)		x	x
Mollusca Gasteropoda	<i>Nucula nucleus</i> (Linnaeus, 1758)	x		
	<i>Alvania</i> spp. Risso, 1826	x		x
	<i>Aptyxis syracusana</i> (Linnaeus, 1758)		x	
	<i>Bittium latreillii</i> (Payraudeau, 1826)	x		x

Taxonomic group	Taxa	Zone 1	Zone 2	Zone 3
Mollusca Gasteropoda	<i>Cerithium vulgatum</i> Bruguière, 1792	x	x	
	<i>Rissoa</i> Desmarest, 1814			x
	<i>Smaragdia viridis</i> (Linnaeus, 1758)	x		x
Polychaeta	Ampharetidae Malmgren, 1866		x	
	<i>Aponuphis</i> Kucheruk, 1978		x	
	Capitellidae Grube, 1862		x	
	<i>Eunice</i> spp. Cuvier, 1817	x		
	<i>Glycera</i> spp. Lamarck, 1818	x	x	x
	<i>Lysidice</i> spp. Lamarck, 1818			x
	<i>Marphysa</i> spp. Quatrefages, 1866	x	x	
	<i>Nephtys</i> spp. Cuvier, 1817	x		
	<i>Notomastus</i> spp. M. Sars, 1851	x		
	Phyllodocidae Örsted, 1843	x		
	<i>Piromis</i> spp. Kinberg, 1867		x	
<i>Owenia</i> spp. Delle Chiaje, 1844		x		

4.2.10. Lower limit of meadows and balise placement

Three marking points (balises - dead bodies) have been placed in the “Anchoring site” on the seabed by the edge of the meadow (positioned at a depth of 14 meters), along sections of the lower limit characterized by degraded/risk conditions. In this case, only one section of the limit has been selected and divers took (central and lateral) photographs of the area where the balises were placed for future comparison to highlight possible retreat or increase of the limit.

The limit selected did not correspond to the proper lower limit of the meadow as only possible endangered contours by anchoring have been considered. The depth of the upper limit (13,2 m) was measured at station Z1-C.

4.2.11. Type of substrate

Laboratory grain-size analyses are reported below:

Table 19. Results of the grain-size analyses.

	coarse sand %	medium sand %	fine sand %	silt %	clay %	Grain size classification
	0,5< ϕ <2 mm	0,25< ϕ <0,5 mm	0,063< ϕ <0,25 mm	0,0039 mm< ϕ <0,063 mm	ϕ <0,0039 mm	
Z1	12,77	20,77	41,65	22,30	0,57	Fine silty sand
Z2	9,26	14,12	44,23	30,65	0,71	Fine sand with silt
Z3	11,78	14,95	42,74	28,22	0,68	Fine sand with silt

In the monitoring Zone 3, dead matte and sandy patches were present and in Zone 2 there were rocks.

4.2.12. Alien species

Even if the marine invasive algal species *Caulerpa cylindracea* has been observed in the last years, spreading in the entire Park, during the monitoring activities in the “Anchoring site” and in the “Diving site”, no alien algal species were detected.

4.2.13. Presence/absence of habitat disturbance

In the “Anchoring site” (Zone 1 and Zone 2) signs of disturbance and some rubbish on the seabed were reported. In the “Diving site” (Zone 3) the meadow was continuous with low sedimentation and no visible signs of disturbance; only some points were devoid of meadow, possibly due to anchoring (anchor and chains).

4.2.14. Localization of the concrete actions’ sites

In the Kornati NP site, two parcels to perform pilot seagrass transplantation have been identified in Anchoring site (near Zone 1 and Zone 2). These parcels are characterized by the absence of seagrasses or by low meadows coverage values and the clues of frequent presence of anchored boats. The meadows of the donor site have been selected in the diving site (Figure 28).

The area for the laying of the anchoring system, characterized by the frequent presence of anchored boats, has been identified in the proximity of the Anchoring site (Figure 28).

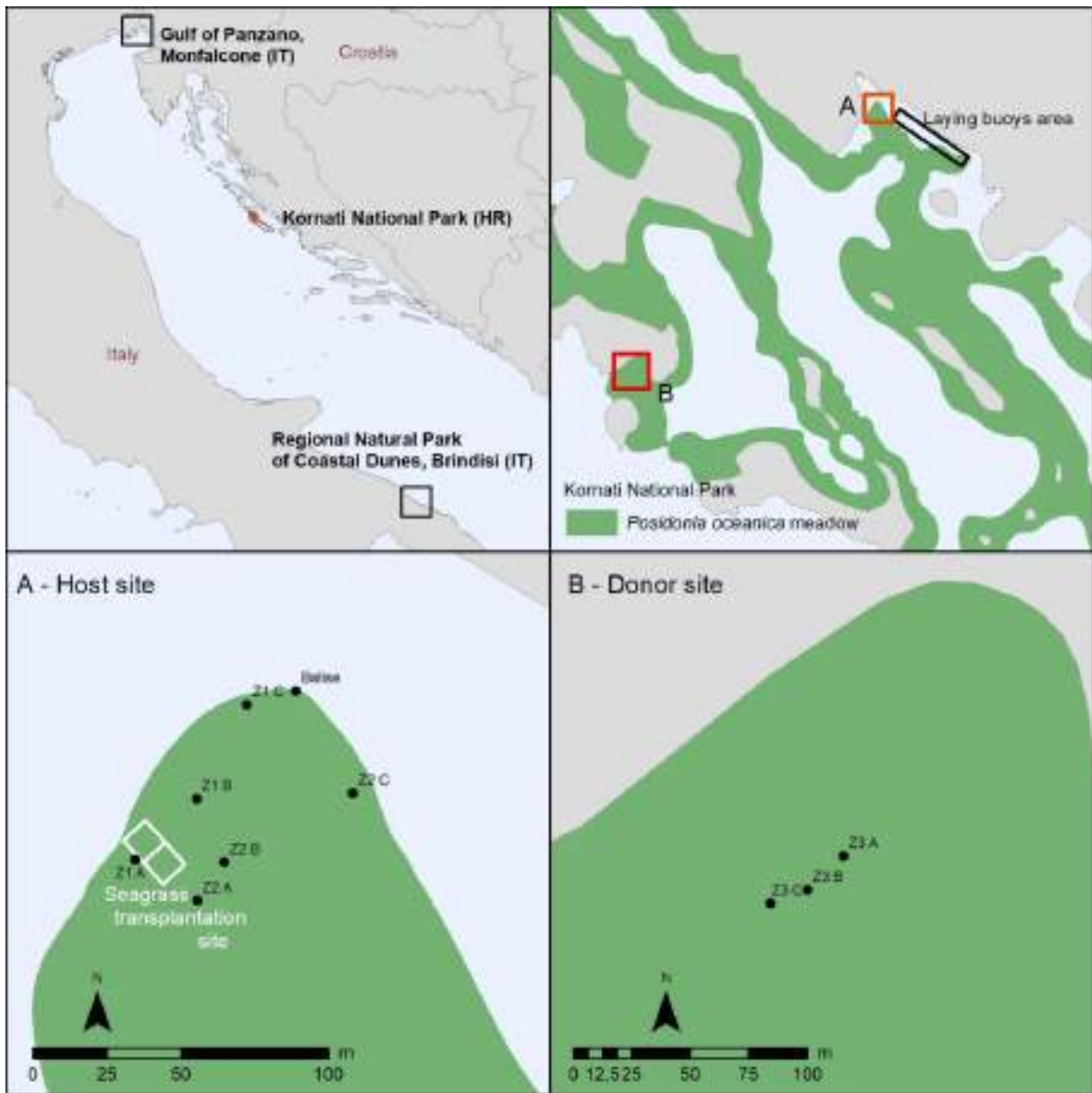


Figure 28. Anchoring site: Seagrass transplantation areas and Laying buoys area.

4.3. Regional Natural Park of Coastal Dunes from Torre Canne to Torre San Leonardo

4.3.1. Monitoring area

In the Regional Natural Park of Coastal Dunes site, the preliminary survey was carried out in mid-September in the Natura 2000 site “Litorale brindisino” (Figure 29).

The study area is placed about 500 meters from the coast and the zones are arranged almost parallel to the coastline. Z1 is the nearest Zone, Z3 the farthest one.

The three Zone were located on a *P. oceanica* meadow, where anchoring pressures occur, due to the presence of medium boats. Within each Zone, three monitoring stations have been positioned at different depths (Stations Z1-A, Z1-B and Z2-C; Z2-A, Z2-B and Z3-C; Z3-A, Z3-B and Z1-C).



Figure 29. Sampling scheme applied to the monitoring Zones (1-2-3) in the in the Regional Natural Park of Coastal Dunes.

4.3.2. Distribution of seagrass meadows

The presence of *P. oceanica*, along the coast of the park, has been detected at a few hundred meters offshore, at a depth of about 7 meters, where the upper limit showed an irregular course (Figure 30).

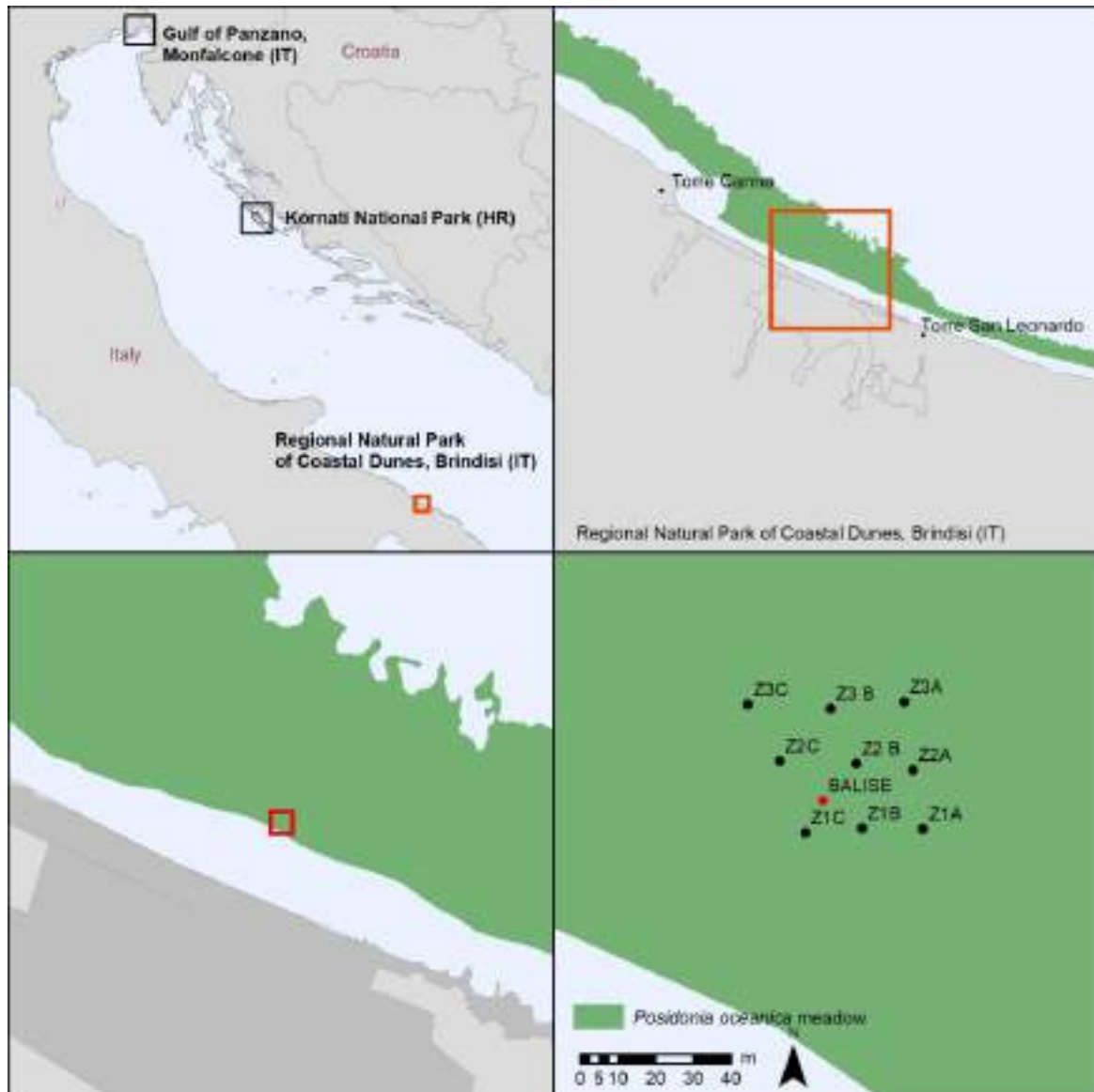


Figure 30. Seagrass distribution and monitoring stations in the RNP Dune Costiere.

The lower limit is considerably more offshore, at a depth that has not been investigated.

The site identified for the measurements and to carry out the pilot transplantations is located approximately in front of Rosa Marina. The meadow coverage was about 70-75%, on matte, with the presence of numerous areas of sandy deposition inter-matte.

Several surfaces of mattes have been observed where marine seagrass has certainly retreated, for reasons not directly connectable to anthropogenic pressure, presently.

4.3.3. Percentage Cover and meadow continuity

In the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average cover of *P. oceanica* ranged between 76% and 88% and was comparable with the one calculated for the Zone 2 (59% - 80%); in these Zones, the meadows were continuous. On the contrary, in the Zone 3 (stations Z3-A, Z3-B and Z3-C), the average cover of *P. oceanica* was lower than the ones recorded in Zone 1 and 2 (26% - 26% - discontinuity of the meadow).

The data analysis suggests the existence of differences along stations between Zones 1 and 2 and Zone 3. In particular, the stations placed in the Zone 1 and Zone 2 are characterized by percentage cover values that are higher than the ones of the Zone 3. The results are summarized in Figure 31.

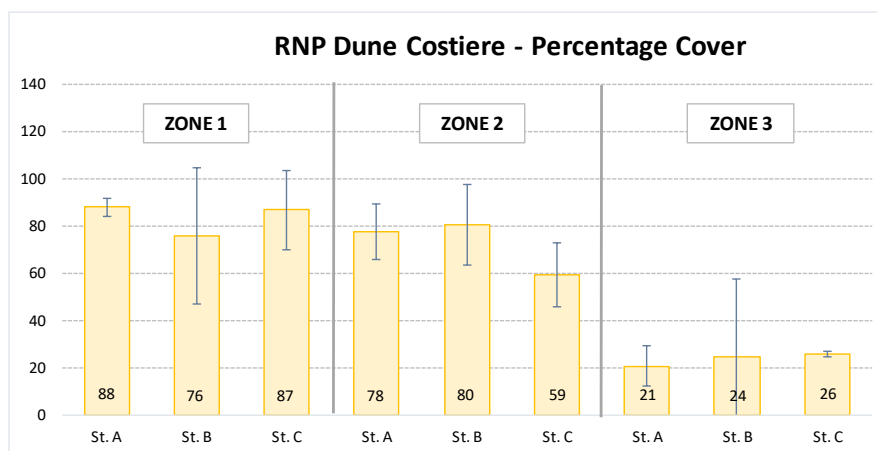


Figure 31. The average values of *P. oceanica* percentage cover as measured in the sampling stations.

4.3.4. Shoot density

In the Zone 1 (stations Z1-A, Z1-B and Z1-C), the average shoot density of *P. oceanica* ranged between 278 and 345 shoots/m², in the Zone 2 (stations Z2-A, Z2-B and Z2-C), the parameter value interval is 271-314 shoots/m² and equal to 331-380 shoots/m² in Zone 3. Unlike what was found for percentage cover, the data analysis suggests the existence of limited differences along stations and Zones for shoot density and,

in the Zone 3, the higher average values have been recorded contrary to what has been reported for coverage. The results are summarized in Figure 32.

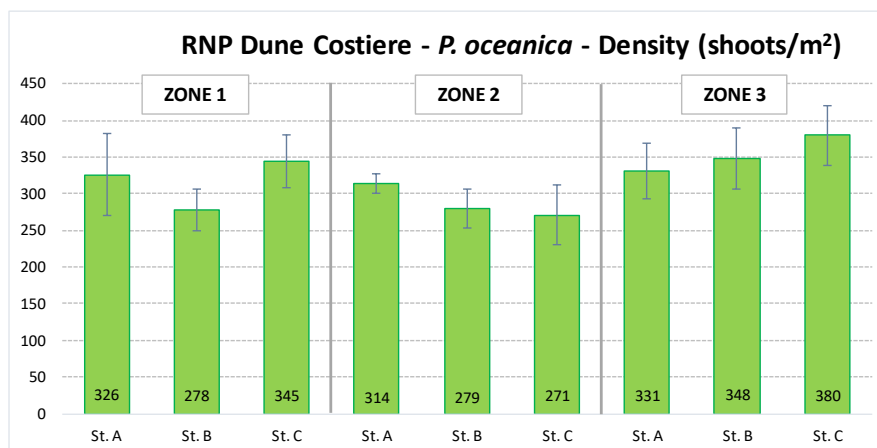


Figure 32. The average values of *P. oceanica* shoots density as measured in the sampling stations.

In the following table, shoot density and depth values are related to the five classes for the final ecological classification (*sensu* WFD) (UNEP/MAP-RAC/SPA, 2011) (see par. 3.6.3 and par. 4.2.4).

Table 20. Shoot density and depth values in relation to the five classes for the final ecological classification (*sensu* WFD) (UNEP/MAP-RAC/SPA, 2011).

Zones	Z1	Z2	Z3
Density (shoots/m²) (average value)	316	288	353
Depth (m) (average value)	7	7	8
Ecological classification (<i>sensu</i> WFD)	POOR	POOR	POOR

4.3.5. Shoot morphometric measurement

The average shoot length of *P. oceanica* ranged between 33,9 and 57,8 cm in the Zone 1 (stations Z1-A, Z1-B and Z1-C), 38,9 and 63,0 cm in the Zone 2 (stations Z2-A, Z2-B and Z2-C) and 59,6 and 64,1 cm in the Zone 3 (stations Z3-A, Z3-B and Z3-C). The data analysis suggested the existence of limited differences along stations and Zones (especially in Zone 3) for *P. oceanica* shoot length. The results are summarized in Figure 33.

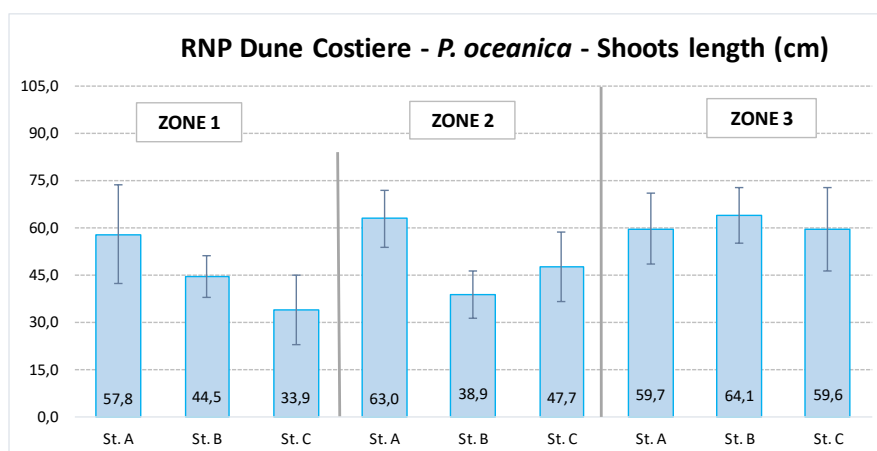


Figure 33. The average values of *P. oceanica* shoots length as measured in the sampling stations.

The other parameters that have been calculated are summarized in the following table (average values and standard deviations):

Table 21. Shoot width (cm/shoot), n. of leaves/shoot and leaf necrosis (% leaves/shoot) (average values and standard deviations).

Zone 1	Z1-A	Z1-B	Z1-C
Shoot width (cm/shoot)	0,81±0,03	0,84±0,02	0,81±0,03
N. of leaves/shoot	6,0±1,7	5,5±1,0	5,7±1,4
Leaf necrosis (% leaves/shoot)	4,1±3,9	9,8±4,9	8,5±4,0
Zone 2	Z2-A	Z2-B	Z2-C
Shoot width (cm/shoot)	0,80±0,03	0,83±0,04	0,84±0,04
N. of leaves/shoot	5,5±1,2	5,3±0,5	5,2±1,3
Leaf necrosis (% leaves/shoot)	5,9±5,1	7,7±4,3	11,2±6,6
Zone 3	Z3-A	Z3-B	Z3-C
Shoot width (cm/shoot)	0,81±0,03	0,84±0,02	0,85±0,01
N. of leaves/shoot	5,8±1,2	4,8±0,4	5,5±1,8
Leaf necrosis (% leaves/shoot)	7,8±7,2	7,1±4,9	18,4±6,9

4.3.6. Leaf Area Index (LAI) and Conservation Index (CI)

To assess the conservation status in the Posidonia meadows, two indices have been applied: the Leaf Area Index (LAI) and the Conservation Index (CI).

Leaf Area Index (LAI)

The index values are reported in the following table (average values and standard deviations):

Table 22. Leaf Area Index (LAI) average values.

Zone 1	Z1-A	Z1-B	Z1-C
LAI (station average value)	4,06	2,96	2,71
LAI (Zone average value)	3,24		

Zone 2	Z2-A	Z2-B	Z2-C
LAI (station average value)	3,81	2,72	2,71
LAI (Zone average value)	3,24		

Zone 3	Z3-A	Z3-B	Z3-C
LAI (station average value)	4,92	4,41	5,59
LAI (Zone average value)	4,98		

Conservation Index (CI)

The values of the Conservation Index (abbreviated CI) are reported in the Table 23 (average values and standard deviations):

Table 23. Conservation Index (CI) average values.

Zone 1	Z1-A	Z1-B	Z1-C
CI (station average value)	1	0,92	0,92
CI (Zone average value)	0,95 (high conservation status)		

Zone 2	Z2-A	Z2-B	Z2-C
<i>CI (station average value)</i>	0,80	0,89	0,71
<i>CI (Zone average value)</i>	0,80 (good conservation status)		

Zone 2	Z2-A	Z2-B	Z2-C
<i>CI (station average value)</i>	0,80	0,89	0,71
<i>CI (Zone average value)</i>	0,80 (good conservation status)		

4.3.7. Algal blooms and filamentous algae

A general visual estimation from boat using aqua scope in the monitoring areas highlighted the absence of macroalgal blooms and filamentous algae. However, during the monitoring activities some samples have been collected to describe the algal community and the principal species found are listed in the following table:

Chlorophyta

Caulerpa prolifera (Forsskål) J.V.Lamouroux

Codium bursa (Olivi) C.Agardh

Flabellia petiolata (Turra) Nizamuddin

Halimeda tuna (J. Ellis et Solander) J.V. Lamouroux

Ochrophyta

Padina pavonica (Linnaeus) Thivy

Rhodophyta

Hydrolithos spp. (Foslie) Foslie

Peyssonnelia spp. Decaisne

Pneophyllum spp. Kützing

4.3.8. Abundance of epiphytes

The average cover of the three categories has been calculated and reported in the following table:

Table 24. Average cover of the three categories (Encrusting layer, Erect layer and Turf layer).

	Z1-A	Z1-B	Z1-C	Z2-A	Z2-B	Z2-C	Z3-A	Z3-B	Z3-C
Encrusting layer	35%	40%	30%	35%	35%	30%	40%	35%	30%
Erect layer	5%	<5%	5%	<5%	5%	<5%	5%	<5%	5%
Turf layer	5%	5%	10%	10%	5%	5%	10%	10%	5%

As for the other study sites, the dominance of the *encrusting layer* (represented above all by the Corallinales) can be considered a positive condition of the quality status of seagrass meadows.

4.3.9. Associated communities

In the study area (within the corridors and in their proximity), no alive or dead individuals of *Pinna nobilis* were found.

A rapid assessment of the associated benthic communities detected the presence of the species reported in the following table:

Table 25. List of species of the macrobenthic communities associated to the seagrasses meadows.

Taxonomic group	Taxa	Zone 1	Zone 2	Zone 3
Anthozoa	Actiniaria	x	x	x
Cephalocordata	<i>Branchiostoma lanceolatum</i>	x		x
Crustacea Decapoda	<i>Alpheus</i> spp. Fabricius, 1798		x	
	<i>Pagurus</i> spp. Fabricius, 1775	x	x	x
	<i>Upogebia</i> spp. Leach, 1814	x	x	x
	<i>Xantho pilipes</i> A. Milne-Edwards, 1867	x	x	
Echinodermata	<i>Echinocardium</i> spp. Gray, 1825		x	
	<i>Holothuria</i> spp. Linnaeus, 1767		x	
Mollusca Bivalvia	<i>Abra alba</i> (W. Wood, 1802)	x		
	<i>Cardites antiquatus</i> (Linnaeus, 1758)		x	
	<i>Ctena decussata</i> (O. G. Costa, 1829)	x		x
	<i>Dosinia lupinus</i> (Linnaeus, 1758)		x	
	<i>Gari depressa</i> (Pennant, 1777)		x	
	<i>Glans trapezia</i> (Linnaeus, 1767)	x		x

Taxonomic group	Taxa	Zone 1	Zone 2	Zone 3
Mollusca Bivalvia	<i>Gouldia minima</i> (Montagu, 1803)		x	
	<i>Moerella donacina</i> (Linnaeus, 1758)		x	x
	<i>Striarca lacteal</i> (Linnaeus, 1758)	x		
	<i>Venus verrucosa</i> Linnaeus, 1758	x		
Mollusca Gasteropoda	<i>Alvania</i> spp. Risso, 1826	x	x	
	<i>Bittium latreillii</i> (Payraudeau, 1826)			x
	<i>Cerithium vulgatum</i> Bruguière, 1792		x	x
	<i>Conus ventricosus</i> Gmelin, 1791	x		
	<i>Raphitoma</i> spp. Bellardi, 1847		x	
	<i>Rissoa</i> Desmarest, 1814		x	
	<i>Rissoina</i> spp. d'Orbigny, 1841	x		
	<i>Smaragdia viridis</i> (Linnaeus, 1758)		x	
	<i>Tricolia pullus</i> (Linnaeus, 1758)	x		
	<i>Tritia incrassata</i> (Strøm, 1768)		x	
Moll. Polyplacophora	<i>Acanthochitona</i> spp. Gray, 1821		x	
Polychaeta	Aphroditidae Malmgren, 1867	x		
	<i>Glycera</i> spp. Lamarck, 1818	x		x
	<i>Lysidice unicornis</i> (Grube, 1840)	x		
	<i>Marphysa</i> spp. Quatrefages, 1866		x	x
	Nereididae Blainville, 1818	x	x	
	<i>Notomastus</i> spp. M. Sars, 1851	x		x
	Sipunculida	Sipunculidae Rafinesque, 1814		x

4.3.10. Lower limit of meadows and balise placement

Three marking points (balises - dead bodies) have been placed between Zone 1 and Zone 2 on the seabed by the edge of the meadow (positioned at a depth of 7,5 meters), along sections of the lower limit characterized by degraded/risk conditions (erosion and retreat of the meadow).

As in the Kornati NP site, only one section of the limit was selected where the balises were placed for future comparison to highlight possible retreat or increase of the limit that was characterized by erosion and retreat of the meadow and did not correspond to the proper lower limit of the meadow (as only possible endangered contours were considered).

4.3.11. Type of substrate

The results for grain-size analyses are reported below:

Table 26. Results of the grain-size analyses.

	coarse sand %	medium sand %	fine sand %	silt %	clay %	Grain size classification
	0,5< ϕ <2 mm	0,25< ϕ <0,5 mm	0,063< ϕ <0,25 mm	0,0039 mm< ϕ <0,063 mm	ϕ <0,0039 mm	
Z1	31,76	26,84	38,17	3,17	0,06	Sand
Z2	30,91	21,81	37,96	3,48	0,14	Sand
Z3	32,07	22,97	35,73	3,57	0,16	Sand

In the monitoring Zone 2, the presence of dead matte has been reported.

4.3.12. Alien species

In the study area, during the monitoring activities, no alien algal species were found. However, it is important to emphasize the abundant presence of *Caulerpa prolifera* (a “green alga”), an indigenous species related to the dangerous *Caulerpa taxifolia* and *Caulerpa racemosa* which are invading some areas of the Mediterranean. In fact, regressed meadows are prone to invasion by one or more of the potential substitutes for *P. oceanica* such as this algal species (in particular, *C. racemosa*) or the other common Mediterranean seagrass *Cymodocea nodosa*.

4.3.13. Presence/absence of habitat disturbance

Concerning human disturbance and the evidence of mechanical pressures, none of them were observed within or near the monitoring Zones.

4.3.14. Localization of the concrete actions’ sites

In the RNP Coastal Dunes site, the area to perform pilot seagrass transplantation has been identified near Zone 1. This area is characterized by the absence of marine seagrasses (bare seabed) or by low meadows coverage values and the frequent presence of anchored boats (Figure 34).

The area for the laying of the anchoring system, characterized by the frequent presence of anchored boats, has been identified near the three monitoring zones, in the proximity of the Natura 2000 site “Litorale brindisino” (Figure 34).

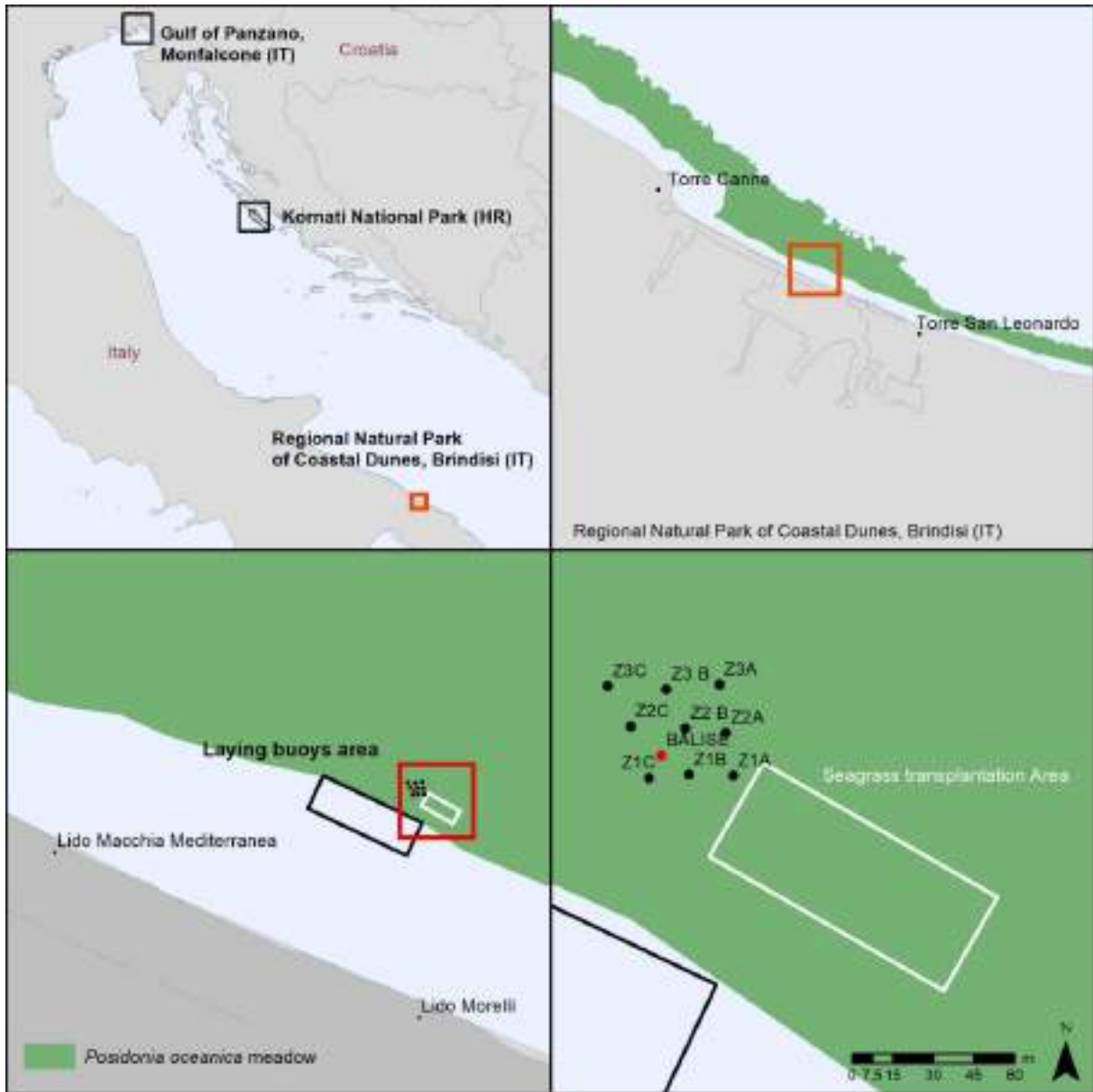


Figure 34. RNP Dune Costiere: Seagrasses transplantation area and laying buoys area.

5. Conclusions

In this Preliminary Survey Report, “*ante operam*” data have been collected to define the quality state of the marine seagrasses, together with their related habitats and species. This baseline is important because possible future changes could be recognized by assessing the monitored parameters over time (for example, dynamics - progress/regression - of the meadow through balise placement).

In the three sites (Monfalcone, Kornati NP and RNP Dune Costiere), no anomalies have been found considering the composition of benthic communities. As concern the marine seagrasses meadows, the main disturbances seem to be related to the presence of anchoring. However, the selection of sites potentially affected by this type of pressure was necessary to test the efficiency of safe anchorage systems and of the of the marine seagrass pilot transplantations.

For Kornati Park it has been possible to identify a site where *P.oceanica* meadows are more impacted by the anchoring pressures (Anchoring site) and one that is less affected by them (Diving site). In this case, as expected, the data analysis suggested the existence of differences along stations and Zones of the two sites for the main parameters analyzed (i.e., % cover or shoot density).

6. Acknowledgements

In the Monfalcone site, the survey was carried thanks to the concrete support of the Civil Protection and the Hannibal Marina of Monfalcone.

In the Regional Natural Park Coastal Dunes, the survey was carried out with the collaboration of the “Lega Navale”, section of Ostuni. Thanks for the cooperation received from the competent Offices of the Maritime Authority (Port Authority of Monfalcone and Delegation of “Spiaggia di Ostuni”).

In the Kornati NP, the survey was carried out by the competent partners, with the expert support of the Nadaja Diving of Murter.

In addition to the partners directly involved in the field activities, a special thanks go to the professors A. Sfriso and A. Falace, respectively of the UNIVE (PP7 CORILA) and UNITS (PP2 CONISMA) partners, for the comments and suggestions necessary for the completion of the document.

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8. ANNEXES

- Photos of field and laboratory activities.
- Field Data Sheets.
- Laboratory Data Sheets.

Photos of field and laboratory activities



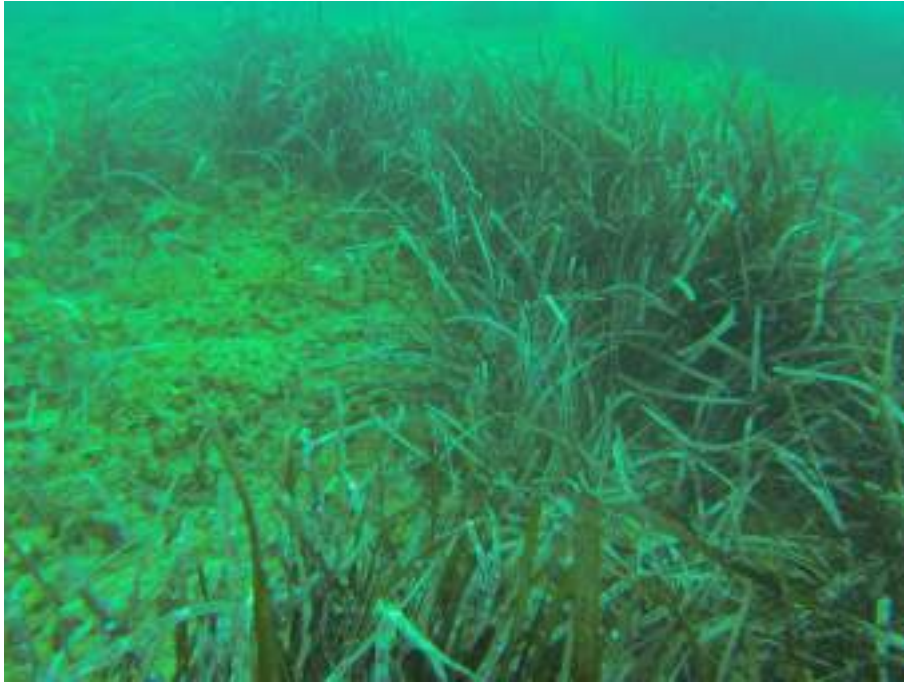
MONFALCONE (Bay of Panzano) – *Cymodocea nodosa* meadows.



KORNATI NP - Boat supporting monitoring activities and a monitoring zone delimited by inflatable signaling buoys.



RNP COASTAL DUNES – Monitoring zone delimited by inflatable signaling buoys and *Posidonia oceanica* meadows.



RNP COASTAL DUNES – *Posidonia oceanica* meadows.



KORNATI NP – *Posidonia oceanica* meadows.



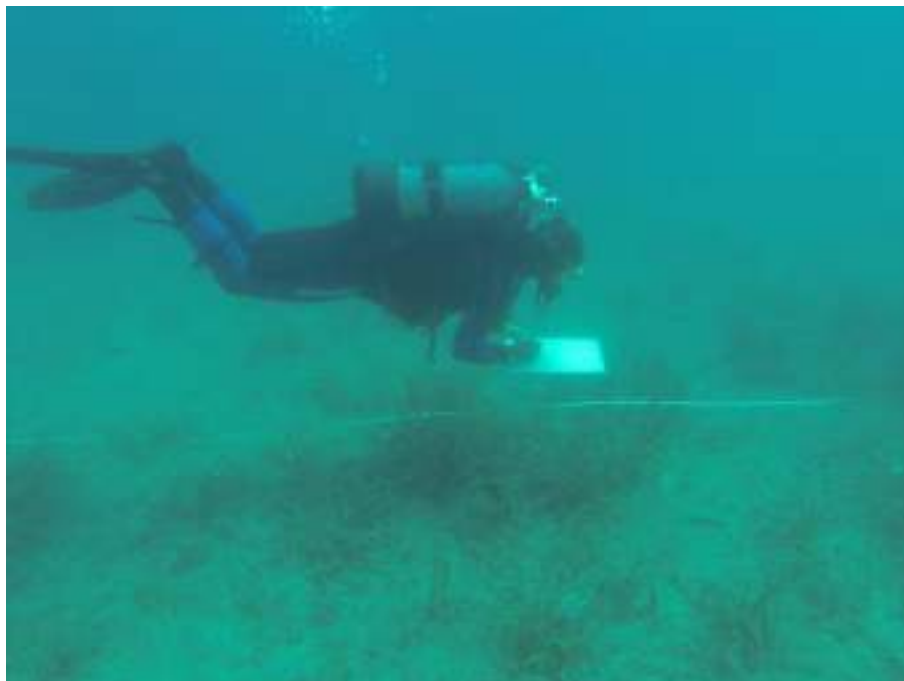
KORNATI NP – *Posidonia oceanica* meadows.



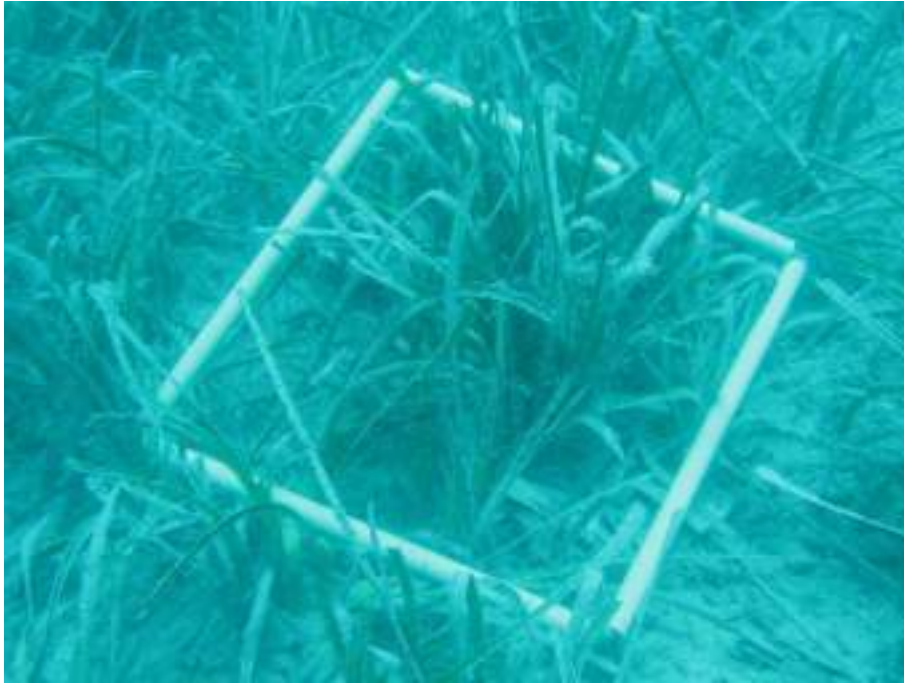
KORNATI NP – Divers taking photographs and making video in the monitoring area.



RNP COASTAL DUNES – Divers taking photographs and making video in the monitoring area.



KORNATI NP – Cover percentage and meadows continuity measurements.



KORNATI NP – Shoot density measurements and rapid assessment of benthic communities.



RNP COASTAL DUNES – Cover percentage and meadows continuity measurements and benthic community assessment.



RNP COASTAL DUNES – *Posidonia oceanica* morphometric measurements.



KORNATI NP – Marking points placement (Balise) to monitor the meadow's dynamics.



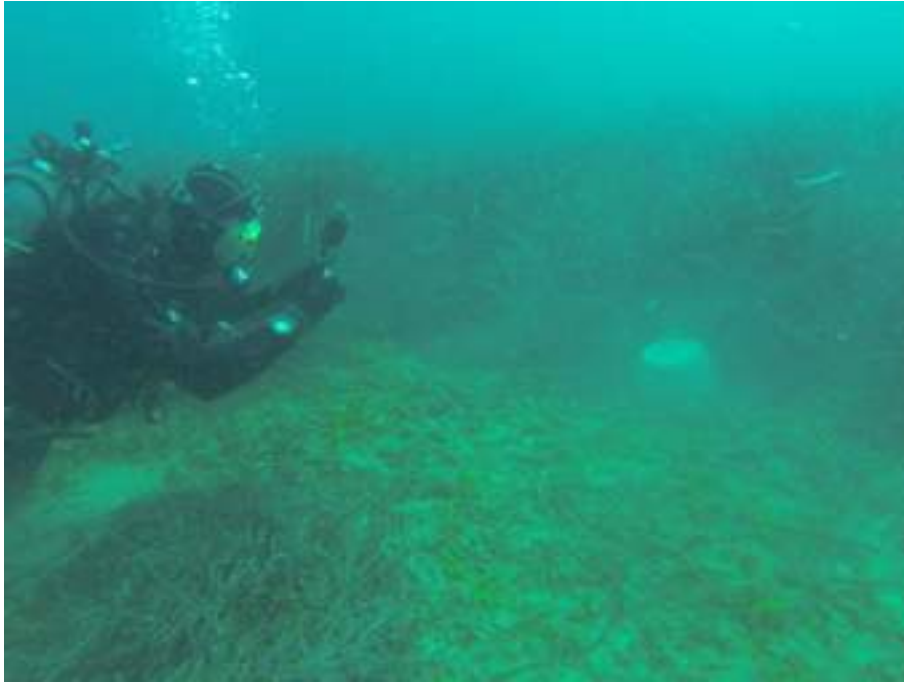
KORNATI NP – Marking points – Balise n°1



KORNATI NP – Marking points – Balise n°2



KORNATI NP – Marking points – Balise n°3



RNP COASTAL DUNES – Marking points placement (Balise) to monitor the meadow's dynamics.



RNP COASTAL DUNES – Marking points – Balise n°1



RNP COASTAL DUNES – Marking points – Balise n°2



RNP COASTAL DUNES – Marking points – Balise n°3



KORNATI NP - Anchoring site: presence of anchored sailboats.



KORNATI NP – Two algal species: *Anadyomene stellata* and *Acetabularia acetabulum*.



KORNATI NP - Divers taking photographs of the benthic species, such as the Sabellidae (feather duster worms) in the picture below.



KORNATI NP – Benthic communities associated to *Posidonia oceanica* meadows.



RNP COASTAL DUNES – The algal species *Caulerpa prolifera*.



RNP COASTAL DUNES – Benthic communities associated to *Posidonia oceanica* meadows.



Laboratory activities: morphometric measurements and examination to determine the organisms present.

Field Data Sheets

Monfalcone (Bay of Panzano)

WP 3.1 - Preliminary survey

Page: 1, 2

Date: 30-05-2019 Zone and sampling station: Z1-A (MONFALCONE)

Depth: 1,3 m

Coordinates: 45°46'45,81" - 13°32'12,51"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCHIU - A. BUONI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NODOSA

Other Seagrasses: _____

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: _____

Algal blooms and filamentous algae: _____

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30. x 30. cm

Replicate	No of shoots	Depth (m)	Notes
1	56	1,3	
2	44	1,3	
3	52	1,2	
4	64	1,3	
5	36	1,2	
6	44	1,3	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

WP 3.1 - Preliminary survey

Page: 1,2

Date: 30-05-2019 Zone and sampling station: Z1-B (MONFALCONE)

Depth: 1,7 m

Coordinates: 45°46'45,47" - 13°32'19,19"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCINI - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NOBILIS

Other Seagrasses: _____

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY/GRAVEL SHELL FRAGMENTS

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: _____

Algal blooms and filamentous algae: _____

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	32	1,7	
2	28	1,6	
3	28	1,7	
4	44	1,7	
5	48	1,7	
6	56	1,6	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

WP 3.1 - Preliminary survey

Page: 1/2

Date: 30-05-2019 Zone and sampling station: Z1-C (MONFALCONE)

Depth: 4,2 m

Coordinates: 45°46'37,97" - 13°32'27,58"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCON - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): /

Seagrass: /

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY / SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: x cm

Replicate	No of shoots	Depth (m)	Notes
1			
2			
3			
4			
5			
6			

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

WP 3.1 - Preliminary survey

Page: 1/2

Date: 30-05-2019 Zone and sampling station: Z2-A (MONFALCONE)

Depth: 0,9 m

Coordinates: 45°45'34,13" - 13°31'36,79"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - E. GRECCO - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): ZOSTERA NOLTET MEADOW

Seagrass: ZOSTERA NOLTET

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	244	0,9	
2	192	0,9	
3	148	0,9	
4	108	0,9	
5	196	0,9	
6	252	0,9	

Collection of shoots for laboratory analyses: ~~yes~~ / no

Collection of sediment for laboratory analyses: ~~yes~~ / no

Zone and sampling station: **ZZ-A (MONFALCONE)**

Page: **2/2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
ZN	400		ZN	600		ZN	400	
SA	450		SA	650		SA	800	
ZN	800		ZN	1000		ZN	1000	
SA	1000							

C = categories
 P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltei

D = Dead mat
 M = Mud
 S = Sand
 St = Stones/Pebbles
 R = Rock

O = other species
 I = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2 / ... / ...

Date: 30-05-2019 Zone and sampling station: ZZ-B (MONFALCONE)

Depth: 0,7 m

Coordinates: 45° 45' 28,69" - 13° 31' 54,76"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - E. CRECCIONI - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NODOSA

Other Seagrasses: ZOSTERA NOLTETI

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: yes

Algal blooms and filamentous algae: yes

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	32	0,7	
2	44	0,7	
3	64	0,7	
4	68	0,6	
5	96	0,7	
6	84	0,7	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station:

Z Z-B (MONFALCONE)

Page: 2/2

% Coverage

Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
CN	1000		CN	1000		CN	400	
						SA	450	
						CN	800	
						SA	850	
						CN	1000	

C = categories

- P = *P. oceanica*
- Cn = *C. nodosa*
- Zm = *Z. marina*
- Zn = *Z. noltii*
- D = Dead matter
- M = Mud
- Sa = Sand
- St = Stones/Pebbles
- R = Rock

O = other species

Notes: _____

i = intercept (cm)

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2

Date: 30-05-2019 Zone and sampling station: Z2-C (MONFALCONE)

Depth: 2,5

Coordinates: 45°45'23,05" - 13°32'32,63"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - E. CRECCHI'N - A. BUOSI'

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NODOSA

Other Seagrasses:

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species:

Algal blooms and filamentous algae:

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	63	2,5	
2	49	2,5	
3	72	2,6	
4	78	2,5	
5	95	2,6	
6	74	2,5	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **Z 2 - C (MONFALCONE)**

Page: **212**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
CN	1000		CN	1000		CN	1000	

C = categories
 P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltei

D = Dead matter
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species **i = intercept (cm)**
Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 30-05-2019 Zone and sampling station: Z3-A (MONFALCONE)

Depth: 1,2 m

Coordinates: 45°45'06,27" - 13°31'54,88"

Coordinator: A. RISMONDO -

Operators: A. RISMONDO - E. CHECCUZZI - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): ZOSTERA MARINA MEADOW

Seagrass: ZOSTERA MARINA

Other Seagrasses:

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species:

Algal blooms and filamentous algae:

Presence of *Pinna nobilis*: yes / ~~no~~

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	28	1,2	
2	32	1,2	
3	28	1,1	
4	32	1,2	
5	24	1,2	
6	28	1,1	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z3 - A (MONFALCONE)

Page: 2, 2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
Zm	1000		Zm	1000		Zm	1000	

C = categories

P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltii

D = Dead matter
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

Notes:

i = Intercept (cm)

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 30-05-2019 Zone and sampling station: Z3-B (MONFALCONE)

Depth: 1,4 m

Coordinates: 45°45'09,33" - 13°32'06,01"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - E. CRECCIONI - A. BUCCHETTI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NODOSA

Other Seagrasses: ZOSTERA NOLTII

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: ✓

Algal blooms and filamentous algae: ✓

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	36	1,4	
2	72	1,4	
3	64	1,3	
4	76	1,4	
5	48	1,4	
6	56	1,4	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z3-B (MONFALCONE) Page: 212
 % Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
CN	1000		CN	500		CN	600	
			CN	1000	ZN	CN	1000	ZN

C = categories

P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltii

D = Dead matter
 M = Mud
 S = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

I = Intercept (cm)

Notes:

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 30-05-2018 Zone and sampling station: Z3-C (MONFALCONE)
 Depth: 2,6 m
 Coordinates: 45°45'11,00" - 13°32'35,82"
 Coordinator: A. ROSMONDO
 Operators: A. ROSMONDO - E. CRECCIONI - A. BUOSI

Habitat characterization and disturbance (potential pressures in the area and signs of impact): CYMODOCEA MEADOW

Seagrass: CYMODOCEA NODOSA
 Other Seagrasses:
 Meadow continuity: yes / no
 Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species:
 Algal blooms and filamentous algae:

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 30 x 30 cm

Replicate	No of shoots	Depth (m)	Notes
1	58	2,6	
2	67	2,4	
3	72	2,6	
4	81	2,5	
5	70	2,4	
6	71	2,7	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z3-C (MONFALCONE)

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
CN	1000		CN	1000		CN	1000	

C = categories
P = P. oceanica
Cn = C. nodosa
Zm = Z. marina
Zn = Z. noltei

D = Dead matter
M = Mud
Sa = Sand
St = Stones/Pebbles
R = Rock

O = other species
l = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

Field Data Sheets

Kornati NP

WP 3.1 - Preliminary survey

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Date: 23-06-2019 Zone and sampling station: Z1-A (KORNATI-NP)
 Depth: 10,2 m
 Coordinates: 43°49'29,24" - 15°16'30,15"
 Coordinator: A. RISSMONDO
 Operators: V. MIHELČIĆ - Ž. JAKL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, WITH NO CONTINUITY, SIGNS OF DISTURBANCE, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA
 Other Seagrasses: ✓
 Meadow continuity: yes / no
 Type of substrate: SANDY / SILTY
 For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: ✓
 Algal blooms and filamentous algae: ✓
 Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	32	10,5	
2	30	10,3	
3	17	10,9	
4	26	10,8	
5	25	9,3	
6	14	9,6	

Collection of shoots for laboratory analyses: yes / no
 Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z1-A (KORNATI NP)

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
D	70		D	50		D	40	
P	150		P	80		P	60	
D	280		D	130		D	310	
P	360		P	150		P	330	
D	420		D	170		D	440	
P	460		P	210		P	510	
D	800		D	270		D	710	
P	820		P	320		P	810	
D	1000		D	360		D	890	
			P	400		P	1000	
			D	450				
			P	540				
			D	560				
			P	660				
			D	720				
			P	750				
			D	860				
			P	880				
			D	980				
			P	1000				

C = categories

P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltei*

D = Dead motte
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

Notes: _____

i = intercept (cm)

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2

Date: 23-06-2019 Zone and sampling station: Z1-B (KORNATI NP)
 Depth: 11,4 m
 Coordinates: 43°49'29,91" - 15°16'31,08"
 Coordinator: A. RISMONDO
 Operators: A. RISMONDO - D. CURIEL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, WITH NO CONTINUITY, SIGNS OF DISTURBANCE, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA
 Other Seagrasses: /
 Meadow continuity: yes / no
 Type of substrate: SANDY/SILTY
 For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /
 Algal blooms and filamentous algae: /
 Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	21	11,5	
2	22	11,2	
3	26	11,3	
4	32	11,6	
5	24	11,4	
6	23	11,2	

Collection of shoots for laboratory analyses: yes / no
 Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z1-B (KORNATI-NP)

Page: 2/2

% Coverage

Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
D	270		D	40		D	230	
P	320		P	80		P	240	
D	370		D	180		D	330	
P	400		P	200		P	440	
D	590		D	240		D	480	
P	610		P	270		P	610	
D	730		D	360		D	730	
P	740		P	390		P	890	
D	840		D	450		D	1000	
P	1000		P	460				
			D	690				
			P	750				
			D	800				
			P	870				
			D	990				
			P	1000				

C = categories

P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltei*

D = Dead mollie
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

I = Intercept (cm)

Notes:

Presence and density of *Pinna nobilis**

Replicate	No of alive individuals	No of dead individuals
1		
2		
3		

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 23-06-2019 Zone and sampling station: Z1-C (KORNATI NP)

Depth: 14, 1 m

Coordinates: 43°49'30,94" - 15°16'31,85"

Coordinator: A. ROSMONDO

Operators: T. ŠARČEVIĆ - F. ĐOKOZA

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM WITH NO CONTINUITY, WITH SEDIMENTATION, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth 13,2 / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	17	13,9	
2	12	14,2	
3	21	14,0	
4	10	14,3	
5	12	13,9	
6	8	14,2	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z1-C (KORNATI NP)

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% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	I	O	C	i	O
D	80		P	40		D	160	
P	140		D	90		P	280	
D	220		P	130		D	400	
P	230		D	210		P	420	
D	450		P	310		D	550	
P	480		D	340		P	600	
D	520		P	410		D	720	
P	530		D	440		P	730	
D	650		P	460		D	760	
P	660		D	570		P	770	
D	700		P	590		D	810	
P	720		D	660		P	860	
D	760		P	670		D	920	
P	770		D	830		P	1000	
D	850		P	950				
P	860		D	1000				
D	1000							

C = categories

P = P. oceanica
 Cr = C. nodosa
 Zm = Z. marina
 Zn = Z. noltel

D = Dead mottle
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

Notes:

I = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 23-06-2019 Zone and sampling station: E2-A (KORNATI NP)

Depth: 12,2 m

Coordinates: 43°49'28,80" - 15°16'31,08"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - D. CURIEL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, WITH NO CONTINUITY, SIGNS OF DISTURBANCE, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY/SILTY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	26	12,3	
2	22	12,5	
3	28	12,2	
4	19	12,1	
5	21	11,9	
6	24	12,3	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z2-A (KORNATI NP)

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
D	90		D	110		D	140	
P	110		P	140		P	170	
D	180		D	280		D	220	
P	190		P	390		P	240	
D	310		D	480		D	310	
P	320		P	490		P	320	
D	440		D	520		D	480	
P	450		P	540		P	620	
D	800		D	810		D	730	
P	1000		P	820		P	1000	
			D	920				
			P	1000				

C = categories

P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltai*

D = Dead mat
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

i = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2

Date: 23-06-2013 Zone and sampling station: Z2-B (KORNATI NP)

Depth: 14,3 m

Coordinates: 43°49'29,21" - 15°16'31,50"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - D. CURIEL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, WITH NO CONTINUITY, SIGNS OF DISTURBANCE, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / ~~no~~

Type of substrate: SANDY/SILTY/MUD

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / ~~no~~ 1 DEAD

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	21	14,2	
2	27	14,6	
3	29	14,3	
4	24	14,5	
5	23	14,4	
6	19	14,3	

Collection of shoots for laboratory analyses: yes / ~~no~~

Collection of sediment for laboratory analyses: yes / ~~no~~

Zone and sampling station: Z2-B (KORNATI NP)

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	410		P	400		P	400	
D	430		D	540		D	420	
P	660		P	560		P	600	
D	680		D	610		D	720	
P	740		P	640		P	1000	
D	750		D	660				
P	770		P	680				
D	810		D	720				
P	1000		P	740				
			D	810				
			P	820				
			D	900				
			P	950				
			D	990				
			P	1000				

C = categories

P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltel*

D = Dead matter
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

I = intercept (cm)

Notes:

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
T 1	✓	1
2	✓	✓
3	✓	✓

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1.1.2

Date: 23-06-2019 Zone and sampling station: Z2-C (KORNATI NP)

Depth: 150 m

Coordinates: 43° 49' 29,97" - 15° 16' 33,45"

Coordinator: A. RISMONDO

Operators: F. DOKOZA - Z. JAKL - T. ŠARČEVIĆ

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIUM, WITH NO CONTINUITY, SIGNS OF DISTURBANCE, SOME RUBBISH

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: MUD-SILT

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	28	15,7	
2	19	16,0	
3	21	16,2	
4	15	15,5	
5	17	15,9	
6	14	16,5	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: *ZZ-C (KORNATI NP)*

Page: *2/2*

% Coverage Size of sampling units: **transect 10 m**

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
D	120		D	170		D	110	
P	150		P	190		P	190	
D	260		D	340		D	340	
P	300		P	400		P	510	
D	390		D	460		D	820	
P	430		P	470		P	840	
D	490		D	520		D	870	
P	500		P	540		P	910	
D	580		D	810		D	930	
P	700		P	830		P	1000	
D	840		D	930				
P	890		P	970				
D	1000		D	1000				

C = categories
 P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltai
 D = Dead matter
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species **i = Intercept (cm)**
Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 24-06-2019 Zone and sampling station: Z3-A (KOLNATI NP)
 Depth: 9,5 m
 Coordinates: 43°48'32,63" - 15°15'18,93"
 Coordinator: A. ROSMONDO
 Operators: T. ŠARČEVIĆ - F. ĐOKOZA

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, SOME DEAD MATTE POSSIBLY OF ANCHORING CHAINS IN THE SHALLOWER PARTS, BUT MOST OF THE MEADOW WITH NO DAMAGES, HIGH HEALTHY GREEN CANOPY

Seagrass: POSIDONIA OCEANICA
 Other Seagrasses: _____
 Meadow continuity: yes / no
 Type of substrate: SAND / DEAD MATTE / ROCK

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: _____
 Algal blooms and filamentous algae: _____

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	46	9,7	
2	55	9,4	
3	45	9,0	
4	51	8,6	
5	32	10,1	
6	33	9,9	

Collection of shoots for laboratory analyses: yes / no
 Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z3-A (KORNATI NP)

Page: 2,2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
R	100		P	700		P	660	
P	590		D	710		D	690	
R	660		P	1000		P	800	
P	720					D	890	
R	770					P	1000	
P	810							
R	860							
P	880							
R	920							
P	950							
R	970							
P	1000							

- C = categories**
P = P. oceanica
Cn = C. nodosa
Zm = Z. marina
Zn = Z. noltzei
D = Dead matter
M = Mud
Sa = Sand
St = Stones/Pebbles
R = Rock

- O = other species** **i = intercept (cm)**
Notes: _____

Presence and density of *Pinna nobilis** → PINNA NOBILIS OBSERVED, BUT NOT ON THE TRANSECT LINE: 3 INDIVIDUALS (OF WHICH 1 DEAD AND 2 ALIVE)

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2 / 1, 2

Date: 24-06-2019 Zone and sampling station: Z3-B (KORNATI NP)
 Depth: 10,3 m
 Coordinates: 43° 48' 32,23" - 15° 15' 18,24"
 Coordinator: A. RISMONDO
 Operators: Z. JAKL - V. MIHELČIĆ

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA
 Other Seagrasses: _____
 Meadow continuity: yes / no
 Type of substrate: DEAD MATTE / ROCK / SAND
 For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: _____
 Algal blooms and filamentous algae: _____
 Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: x cm

Replicate	No of shoots	Depth (m)	Notes
1	59	10,2	
2	39	10,4	
3	38	10,2	
4	60	10,6	
5	75	10,5	
6	82	10,3	

Collection of shoots for laboratory analyses: yes / no
 Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **Z3-B (KORNATI NP)**

Page: **2/2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
P	100		P	100		P	320	
D	130		D	140		D	360	
P	160		P	220		P	600	
D	180		D	340		D	640	
P	340		P	660		P	680	
D	370		D	740		D	700	
P	430		P	810		P	900	
D	470		D	840		D	930	
P	560		P	910		P	980	
D	670		D	1000		D	1000	
P	1000							

C = categories
 P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltzei*

D = Dead matter
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock

O = other species
 Notes: _____

i = intercept (cm)

Presence and density of *Pinna nobilis** → PINNA NOBILIS SEEN BUT NOT ON THE TRANSECT LINE (DURING SHOOTING COUNTING) → 2 ALIVE

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1, 2 /

Date: 24-06-2019 Zone and sampling station: Z3-C (KORNATI NP)

Depth: 10,4 m

Coordinates: 43°48'32,03" - 15°15'17,54"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - D. CURIEL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIA MEADOW IN GOOD QUALITY, THICK AND HIGH CANOPY. NO VISIBLE SIGNS OF DISTURBANCE, LOW SEDIMENTATION SOME POINTS DEVOID OF MEADOW, POSSIBLY DUE TO ANCHORING (ANCHOR, CHAIN)

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SAND / DEAD MATTE

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	28	10,5	
2	31	10,3	
3	44	10,2	
4	32	10,4	
5	34	10,6	
6	36	10,3	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **Z3-C (KORNATI NP)**

Page: **2/2**

% Coverage Size of sampling units: **transect 10 m**

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	140		P	210		P	10	
D	230		D	240		D	50	
P	440		P	880		P	230	
D	450		D	950		D	260	
P	690		P	1000		P	480	
D	750					D	490	
P	920					P	620	
D	980					D	690	
P	1000					P	820	
						D	900	
						P	1000	

C = categories

P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltii*

D = Dead matter
 M = Mud
 Ss = Sand
 St = Stones/Pebbles
 R = Rock

O = other species

Notes: _____

I = intercept (cm)

Presence and density of *Pinna nobilis**

SOME INDIVIDUALS, DEAD AND ALIVE, AT THE UPPER LIMIT, CLOSE TO THE BOAT SITE.

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1./2

Date: 24-06-2019 Zone and sampling station: BAUSE (KORNATI-NP)

Depth: 14 m

Coordinates: 43° 49' 31,09" - 15° 16' 32,53"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - D. CURCEL

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM, LOW CANOPY, WITH SEDIMENTATION
DISTURBANCE FROM BOATS AND SEDIMENTATION

Seagrass: P. POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / ~~no~~

Type of substrate: SANDY / SILTY

For *Posidonia oceanica*: Upper limit depth 14 / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / ~~no~~

Shoot density

Size of sampling units: x cm

Replicate	No of shoots	Depth (m)	Notes
1			
2			
3			
4			
5			
6			

Collection of shoots for laboratory analyses: yes / ~~no~~

Collection of sediment for laboratory analyses: yes / ~~no~~

Zone and sampling station: BAUSE (KORNATI - NP)

Page: 2, 2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O

C = categories
P = P. oceanica D = Dead matter
Cr = C. nodosa M = Mud
Zm = Z. marina Sa = Sand
Zn = Z. noltei St = Stones/Pebbles
 R = Rock

O = other species i = intercept (cm)
Notes: _____

Presence and density of *Pinna nobilis**

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

Field Data Sheets

RNP Dune Costiere

WP 3.1 - Preliminary survey

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Date: 10-09-2019 Zone and sampling station: Z1-A (RNP DUNE COSTIERE)

Depth: 6,9 m

Coordinates: 40°48'59,81" - 17°31'25,11"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCINI - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	47	6,9	
2	49	6,9	
3	54	6,7	
4	62	6,8	
5	62	6,7	
6	39	6,6	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z1-A

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	70		P	100		P	80	
SA	90		SA	160		SA	110	
P	410		P	280		P	450	
SA	420		SA	340		SA	580	
P	750		P	480		P	1000	
SA	800		SA	510				
P	1000		P	1000				

C = categories
 P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltel
 D = Dead matte
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock
O = other species
I = intercept (cm)
Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	/	/
2	/	/
3	/	/

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1,2 / 1,2

Date: 10-09-2019 Zone and sampling station: Z1-B (RNP DUNE COMIERE)

Depth: 6,9 m

Coordinates: 40°48'59,83" - 17°31'24,42"

Coordinator: A. ROSMONDO

Operators: A. ROSMONDO - E. CHECCHIUW - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / ~~no~~

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	48	6,9	
2	39	6,7	
3	48	6,7	
4	39	6,6	
5	44	6,8	
6	49	6,7	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **ZI-B**

Page: **2/2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	20		P	410		P	60	
SA	30		SA	440		SA	420	CP
P	140		P	1000		P	740	
SA	170					D	820	
P	620					P	870	
SA	670					D	1000	
P	810							
SA	840							
P	1000							

C = categories
 P = P. oceanica
 Cn = C. nodosa
 Zm = Z. marina
 Zn = Z. noltei
 D = Dead mat
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock
O = other species
I = intercept (cm)
Notes: C.P. = CAULERPA PROLIFERA

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1,2 /

Date: 10-09-2019 Zone and sampling station: Z1-C (RNP DUNE COSTIERE)

Depth: 6,6 M

Coordinates: 40°48'59,81" - 17°31'23,78"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCUN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: ✓

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: ✓

Algal blooms and filamentous algae: ✓

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	58	6,6	
2	48	6,6	
3	59	6,5	
4	57	6,4	
5	61	6,6	
6	48	6,4	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **F1-C**

Page: **2,2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	610		P	1000		P	480	
SA	680					SA	580	
P	1000					P	680	
						D	730	
						P	890	
						D	1000	

C = categories
P = P. oceanica
Cn = C. nodosa
Zm = Z. marina
Zn = Z. noltii

D = Dead matie
M = Mud
Sa = Sand
St = Stones/Pebbles
R = Rock

O = other species

i = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1 / 2

Date: 10-09-2019 Zone and sampling station: Z2-A (RNP DUNE COSTIERE)

Depth: 7,0 m

Coordinates: 40°49'00,32" - 17°31'25,01"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCHIN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: _____

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species:

Algal blooms and filamentous algae:

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	52	7,0	
2	49	6,9	
3	53	6,8	
4	51	6,9	
5	48	6,7	
6	48	6,8	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: Z2-A

Page: 2,2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	190		P	280		P	330	
SA	240		D	550		SA	350	
P	350		P	1000		P	680	
D	610					D	750	
P	1000					P	1000	

C = categories
 P = P. oceanica D = Dead matte
 Cn = C. nodosa M = Mud
 Zm = Z. marina Sa = Sand
 Zn = Z. noltai St = Stones/Pebbles
 R = Rock
O = other species I = intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1,2 / ... / ...

Date: 10-09-2019 Zone and sampling station: Z2-B (RNP DUNE COSTIERE)

Depth: 8,2 m

Coordinates: 40°49'00,39" - 17°31'24,38"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCON - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: _____

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: yes

Algal blooms and filamentous algae: yes

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	38	8,2	
2	49	7,9	
3	42	8,0	
4	49	8,1	
5	44	8,0	
6	46	8,2	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: ZZ-B

Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
P	40		P	70		P	1000	
SA	330		D	90				
P	1000		P	720				
			D	1000	C.P.			

C = categories O = other species i = intercept (cm)
 P = P. oceanica D = Dead motte
 Cn = C. nodosa M = Mud
 Zm = Z. marina Sa = Sand
 Zn = Z. noltei St = Stones/Pebbles
 R = Rock

Notes: C.P. = CAULERPA PROLIFERA

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 10-09-2019 Zone and sampling station: ZZ-C RNP DUNE COSTIERE

Depth: 7,2 m

Coordinates: 40° 49' 00,43" - 17° 31' 23,51"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCHIN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: _____

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: yes

Algal blooms and filamentous algae: yes

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	33	7,2	
2	39	7,2	
3	42	7,0	
4	48	7,1	
5	48	7,0	
6	50	7,1	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **Z2-C**

Page: **2/2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
P	280		P	340		P	30	
SA	340		SA	520		SA	80	
P	580		P	630		P	520	
SA	640		D	940		D	790	
P	760		P	1000		SA	840	
D	830					P	980	
P	910					SA	1000	
D	940							
P	970							
D	1000							

C = categories

- P = P. oceanica
- Cn = C. nodosa
- Zm = Z. marina
- Zn = Z. noltel

- D = Dead matter
- M = Mud
- Sa = Sand
- St = Stones/Pebbles
- R = Rock

O = other species

i = Intercept (cm)

Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1,2 /

Date: 10-09-2019 Zone and sampling station: Z3-A (RNP DUNE COSTIERE)

Depth: 8,5 m

Coordinates: 40°49'00,91" - 17°31'24,93"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCHIN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	49	8,5	
2	59	8,4	
3	60	8,5	
4	44	8,3	
5	52	8,3	
6	54	8,5	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **73-A**

Page: **2,2** / .../...

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
SA	90		SA	80		SA	140	
P	140		P	110		P	200	
SA	320		SA	1000		SA	460	
P	410					P	580	
SA	1000					SA	1000	

C = categories O = other species I = intercept (cm)
 P = P. oceanica D = Dead matter Notes: _____
 Cn = C. nodosa M = Mud _____
 Zm = Z. marina Sa = Sand _____
 Zn = Z. noltel St = Stones/Pebbles _____
 R = Rock _____

Presence and density of Pinna nobilis*

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)



WP 3.1 - Preliminary survey

Page: 1,2
Page: .../...

Date: 10-09-2019 Zone and sampling station: Z3-B (RNP DUNE COSTIERE)

Depth: 8,2 m

Coordinates: 40°49'00,87" - 17°31'24,10"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCIN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	66	8,2	
2	61	8,1	
3	54	8,2	
4	50	8,0	
5	49	8,1	
6	54	8,1	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station:

Z3-B

Page: 2, 2

% Coverage

Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	i	O	C	i	O	C	i	O
SA	30		SA	1000		SA	890	
P	70					P	1000	
SA	130							
P	450							
SA	740							
P	1000							

C = categories

P = P. oceanica
Cn = C. nodosa
Zm = Z. marina
Zn = Z. noltel

D = Dead matter
M = Mud
Sa = Sand
St = Stones/Pebbles
R = Rock

O = other species

i = Intercept (cm)

Notes:

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1/2

Date: 10-09-2016 Zone and sampling station: Z3-C (RNP DUNE COSTIERE)

Depth: 8,1 m

Coordinates: 40°49'00,92" - 17°31'23,17"

Coordinator: A. RISMONDO

Operators: A. RISMONDO - E. CHECCHIN - M. CONSENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: 40 x 40 cm

Replicate	No of shoots	Depth (m)	Notes
1	67	8,1	
2	68	8,0	
3	68	8,1	
4	53	7,9	
5	54	7,8	
6	60	8,0	

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: **Z3-C**

Page: **2,2**

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O
P	20		P	40		P	80	
SA	420		SA	280		SA	380	
P	510		P	350		P	450	
SA	670		SA	590		SA	640	
P	810		P	650		P	710	
SA	1000		SA	750		SA	840	
			P	850		P	870	
			SA	1000		SA	1000	

C = categories
P = P. oceanica
Ch = C. nodosa
Zm = Z. marina
Zn = Z. noltel
D = Dead matie
M = Mud
Sa = Sand
St = Stones/Pebbles
R = Rock

O = other species
I = intercept (cm)
Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)

WP 3.1 - Preliminary survey

Page: 1,2

Date: 10-09-2019 Zone and sampling station: BALISE (RNP DUNE COSTIERE)

Depth: 7,5 m

Coordinates: 40°49'00,08" - 17°31'23,99"

Coordinator: A. RUSMONDO

Operators: A. RUSMONDO - E. CHECCINI - M. CONFENTINO

Habitat characterization and disturbance (potential pressures in the area and signs of impact): POSIDONIAETUM

Seagrass: POSIDONIA OCEANICA

Other Seagrasses: /

Meadow continuity: yes / no

Type of substrate: SANDY

For *Posidonia oceanica*: Upper limit depth / Lower limit depth:

Presence of alien species: /

Algal blooms and filamentous algae: /

Presence of *Pinna nobilis*: yes / no

Shoot density

Size of sampling units: x cm

Replicate	No of shoots	Depth (m)	Notes
1			
2			
3			
4			
5			
6			

Collection of shoots for laboratory analyses: yes / no

Collection of sediment for laboratory analyses: yes / no

Zone and sampling station: BAUSE (RNP DUNE COSTIERE) Page: 2/2

% Coverage Size of sampling units: transect 10 m

Replicate 1			Replicate 2			Replicate 3		
C	I	O	C	I	O	C	I	O

C = categories
 P = *P. oceanica*
 Cn = *C. nodosa*
 Zm = *Z. marina*
 Zn = *Z. noltei*
 D = Dead matfe
 M = Mud
 Sa = Sand
 St = Stones/Pebbles
 R = Rock
O = other species
I = Intercept (cm)
Notes: _____

Presence and density of *Pinna nobilis* *

Replicate	No of alive individuals	No of dead individuals
1	_____	_____
2	_____	_____
3	_____	_____

* density is measured counting all individuals encountered within a 1 m corridor for both sides of each of three transects 10 m long and evaluating their status (dead or alive)



Laboratory Data Sheets

Monfalcone (Bay of Panzano)

Zone and sampling station: Monfalcone - Z1A

Seagrass: *Cymdocea nodosa*

Page: 1/3

Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	5,5	11,5	0,20	0
1	5,5	10,6	0,20	0
1	5,5	7,3	0,15	1
1	5,5	4,9	0,20	0
2	5,0	11,7	0,20	0
2	5,0	8,4	0,20	0
2	5,0	5,0	0,20	0
3	5,0	10,4	0,20	0
3	5,0	9,2	0,15	0
3	5,0	7,1	0,15	0
4	5,5	11,4	0,20	0
4	5,5	9,9	0,20	0
4	5,5	5,9	0,20	0
4	5,5	0,9	0,15	0
5	6,3	14,0	0,15	1
5	6,3	5,9	0,15	0
6	8,0	12,4	0,20	0
6	8,0	12,2	0,20	0
6	8,0	7,3	0,20	0
7	4,5	12,1	0,15	0
7	4,5	11,7	0,15	0
7	4,5	3,7	0,15	0
8	6,5	14,0	0,20	0
8	6,5	10,2	0,15	0

Zone and sampling station: Monfalcone - Z1A

Seagrass: *Cymdocea nodosa*

Page: 2/3

Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
8	6,5	2,6	0,15	0
9	6,3	14,2	0,20	0
9	6,3	13,9	0,15	0
9	6,3	8,8	0,15	0
10	7,0	13,1	0,20	0
10	7,0	10,8	0,20	0
10	7,0	10,2	0,20	0
11	4,5	10,4	0,15	0
11	4,5	5,4	0,15	0
11	4,5	4,7	0,15	0
12	7,0	17,7	0,20	0
12	7,0	12,4	0,20	0
12	7,0	11,0	0,15	0
13	6,5	13,6	0,15	0
13	6,5	11,4	0,15	0
13	6,5	6,9	0,15	0
14	5,5	11,9	0,15	0
14	5,5	9,3	0,20	0
14	5,5	4,0	0,15	0
15	6,0	11,5	0,15	1
15	6,0	11,3	0,15	1
16	4,5	15,8	0,20	0
16	4,5	15,4	0,20	0
16	4,5	11,9	0,20	0

Zone and sampling station: Monfalcone - Z1A

Seagrass: *Cymdocea nodosa*

Page: 3/3

Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
17	4,0	12,7	0,20	0
17	4,0	9,4	0,20	0
17	4,0	1,3	0,20	0
18	3,0	10,2	0,15	1
18	3,0	4,9	0,15	0
18	3,0	3,6	0,15	0
18	3,0	1,2	0,15	0
19	6,0	12,4	0,15	0
19	6,0	10,3	0,15	0
19	6,0	8,3	0,15	0
20	5,0	12,7	0,20	0
20	5,0	10,3	0,20	0
20	5,0	2,5	0,20	0

Note: _____

Zone and sampling station: Monfalcone - Z1B

Seagrass: *Cymdocea nodosa*

Page: 1/3

Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	5,0	13,1	0,15	1
1	5,0	8,7	0,15	0
1	5,0	2,4	0,15	0
1	5,0	0,7	0,15	0
2	2,5	7,3	0,25	0
2	2,5	6,0	0,25	0
2	2,5	3,1	0,20	0
2	2,5	1,0	0,20	0
3	4,0	8,7	0,20	0
3	4,0	7,3	0,20	1
3	4,0	3,2	0,20	0
4	2,0	6,5	0,20	0
4	2,0	5,7	0,25	0
4	2,0	2,0	0,20	0
5	2,5	5,2	0,15	1
5	2,5	3,1	0,20	0
6	5,0	6,2	0,15	1
6	5,0	5,0	0,15	0
7	6,0	13,5	0,20	0
7	6,0	5,4	0,15	1
7	6,0	5,1	0,15	0
8	4,0	9,6	0,15	0
8	4,0	7,4	0,15	1
8	4,0	6,0	0,15	0

Zone and sampling station: Monfalcone - Z1B

Seagrass: *Cymdocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
9	3,0	7,8	0,20	0
9	3,0	4,3	0,25	0
9	3,0	0,5	0,20	0
10	5,0	8,6	0,20	0
10	5,0	7,3	0,20	0
10	5,0	5,8	0,20	0
10	5,0	3,3	0,20	0
11	2,5	6,5	0,15	0
11	2,5	5,8	0,15	0
11	2,5	3,4	0,15	0
12	6,0	10,2	0,20	0
12	6,0	8,8	0,20	5
12	6,0	4,9	0,20	0
13	3,0	7,3	0,15	0
13	3,0	5,2	0,15	0
14	3,0	7,0	0,15	0
14	3,0	4,9	0,15	0
14	3,0	1,8	0,15	0
15	3,5	8,9	0,15	0
15	3,5	4,2	0,15	0
15	3,5	1,7	0,15	0
16	3,0	7,3	0,15	0
16	3,0	6,8	0,15	0
16	3,0	4,0	0,15	0

Zone and sampling station: Monfalcone - Z1B

Seagrass: *Cymdocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
17	5,0	8,8	0,20	5
17	5,0	5,4	0,20	5
17	5,0	2,3	0,20	0
18	3,0	8,0	0,20	1
18	3,0	5,9	0,20	1
18	3,0	5,5	0,20	0
18	3,0	0,6	0,20	0
19	4,0	8,3	0,15	0
19	4,0	6,8	0,15	0
20	4,5	9,3	0,20	1
20	4,5	7,0	0,15	1

Note: _____

Zone and sampling station: Monfalcone - Z1C

Seagrass: *no seagrasses*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)

Note: _____

Zone and sampling station: Monfalcone - Z2A

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	2,0	7,8	0,1	0
1	2,0	5,0	0,1	0
1	2,0	4,7	0,1	1
2	1,7	9,9	0,1	0
2	1,7	8,4	0,1	0
2	1,7	8,2	0,1	0
3	1,7	7,1	0,1	0
3	1,7	6,3	0,1	0
3	1,7	4,9	0,1	0
4	2,0	9,8	0,1	0
4	2,0	7,4	0,1	0
4	2,0	4,2	0,1	0
5	1,5	6,9	0,1	0
5	1,5	5,9	0,1	0
5	1,5	2,5	0,1	0
6	1,8	6,4	0,1	0
6	1,8	5,5	0,1	0
6	1,8	4,2	0,1	0
7	1,6	6,7	0,1	1
7	1,6	5,2	0,1	0
7	1,6	4,7	0,1	0
8	1,8	5,3	0,1	0
8	1,8	4,7	0,1	0
8	1,8	3,5	0,1	0

Zone and sampling station: Monfalcone - Z2A

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
9	1,5	7,3	0,1	0
9	1,5	5,4	0,1	0
9	1,5	3,8	0,1	0
10	2,0	7,0	0,1	1
10	2,0	5,8	0,1	0
11	1,8	8	0,1	1
11	1,8	3,3	0,1	0
12	1,8	10,1	0,1	0
12	1,8	6,2	0,1	0
12	1,8	1,2	0,1	0
13	1,6	8	0,1	0
13	1,6	5,5	0,1	0
13	1,6	3,2	0,1	0
14	1,6	8,4	0,1	1
14	1,6	5	0,1	1
14	1,6	1,6	0,1	0
15	1,8	7,9	0,1	0
15	1,8	6,2	0,1	0
15	1,8	3	0,1	0
16	1,9	7,5	0,1	0
16	1,9	5	0,1	0
17	1,5	7,2	0,1	1
17	1,5	6,1	0,1	0
18	2	5,2	0,1	0

Zone and sampling station: Monfalcone - Z2A

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
18	2	4,1	0,1	0
18	2	2	0,1	0
19	1,5	8,1	0,1	1
19	1,5	6,2	0,1	0
19	1,5	3,1	0,1	0
20	1,5	7,0	0,1	1
20	1,5	6,2	0,1	0
20	1,5	1,8	0,1	0

Note: _____

Zone and sampling station: Monfalcone - Z2B

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	6,0	11,6	0,20	0
1	6,0	7,0	0,20	0
1	6,0	1,5	0,20	0
2	9	5,5	0,20	0
2	9	1,9	0,20	0
3	7,5	8,8	0,20	0
3	7,5	5,8	0,20	5
3	7,5	5,0	0,15	0
4	7,0	9,3	0,20	0
4	7,0	5,8	0,20	0
4	7,0	5,6	0,20	1
5	6,5	14,5	0,15	0
5	6,5	8,9	0,15	0
6	5,0	9,9	0,20	1
6	5,0	6,3	0,15	1
6	5,0	5,2	0,15	0
7	4,5	16,2	0,15	0
7	4,5	5,2	0,15	0
8	5,5	11,6	0,20	1
8	5,5	4,3	0,20	0
9	6,0	5,5	0,15	0
9	6,0	3,2	0,15	0
10	5,0	10,5	0,20	1
10	5,0	7,8	0,20	1

Zone and sampling station: Monfalcone - Z2B

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
11	7,0	10,8	0,20	0
11	7,0	6,8	0,20	0
11	7,0	4,6	0,20	0
12	5,5	7,4	0,15	0
12	5,5	3,9	0,20	0
13	4,5	15,3	0,20	0
13	4,5	10,7	0,20	0
13	4,5	4,6	0,20	0
14	6,0	8,3	0,20	0
14	6,0	5,4	0,20	0
14	6,0	1,6	0,20	0
15	7,5	14,1	0,20	1
15	7,5	10,7	0,20	1
15	7,5	7,2	0,20	1
16	7,0	8,4	0,20	0
16	7,0	4,6	0,15	0
16	7,0	4,0	0,15	1
17	2,5	6,0	0,20	0
17	2,5	5,8	0,20	0
17	2,5	4,9	0,20	0
17	2,5	1,8	0,20	0
18	7,0	10,8	0,15	0
18	7,0	3,8	0,15	0
18	7,0	0,4	0,15	0

Zone and sampling station: Monfalcone - Z2B

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
19	5,0	10,7	0,15	0
19	5,0	4,0	0,15	0
20	5,0	9,7	0,20	0
20	5,0	6,0	0,20	0
20	5,0	5,0	0,20	0

Note: _____

Zone and sampling station: Monfalcone - Z2C

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	6,0	16,6	0,30	1
1	6,0	10,2	0,30	1
1	6,0	1	0,30	1
2	7,5	20,6	0,30	5
2	7,5	11,2	0,30	2
2	7,5	3,5	0,30	0
3	8,5	18,5	0,30	5
3	8,5	9,2	0,30	1
3	8,5	3,4	0,30	1
4	6,5	14,9	0,25	1
4	6,5	9	0,25	1
5	9,0	20,6	0,3	5
5	9,0	14	0,3	5
5	9,0	1,2	0,3	1
6	6,5	24,6	0,30	5
6	6,5	10,1	0,3	1
6	6,5	5,9	0,3	0
7	6,0	17,2	0,25	0
7	6,0	8	0,25	0
8	8,0	16,5	0,25	1
8	8,0	10	0,25	1
8	8,0	1,8	0,25	0
9	7,0	12,5	0,25	2
9	7,0	7	0,25	0

Zone and sampling station: Monfalcone - Z2C

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
10	9,0	18,9	0,30	5
10	9,0	11,3	0,30	1
10	9,0	5,5	0,30	0
11	5,5	14,5	0,25	1
11	5,5	5,4	0,25	0
12	6	15,2	0,25	0
12	6	8	0,25	0
13	7,5	21,2	0,30	5
13	7,5	18	0,30	2
13	7,5	14,2	0,30	1
13	7,5	1,1	0,30	0
14	8,0	15,4	0,25	2
14	8,0	11	0,25	2
14	8,0	9	0,25	0
15	6,5	19	0,30	5
15	6,5	10,3	0,30	0
15	6,5	7,3	0,30	0
16	7,0	15,5	0,30	5
16	7,0	11,2	0,3	2
16	7,0	0,5	0,3	0
17	5	15,5	0,30	5
17	5	11,2	0,30	2
17	5	3	0,30	0
18	7,5	12,3	0,25	1

Zone and sampling station: Monfalcone - Z2C

Seagrass: *Zostera noltei*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
18	7,5	4	0,25	0
19	6,0	15,6	0,25	1
19	6,0	9,0	0,25	0
20	8,0	18,5	0,30	2
20	8,0	12,3	0,30	2
20	8,0	7,0	0,30	0

Note: _____

Zone and sampling station: Monfalcone - Z3A

Seagrass: *Zostera marina*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	12,9	44,2	0,45	5
1	12,9	32,2	0,45	2
1	12,9	30,1	0,45	0
1	12,9	29,8	0,45	0
2	12,6	43,5	0,5	1
2	12,6	38,8	0,5	1
2	12,6	37,6	0,5	2
2	12,6	23,3	0,5	3
2	12,6	15,1	0,5	0
3	9,4	37,5	0,4	1
3	9,4	34,2	0,4	0
3	9,4	29,2	0,4	1
3	9,4	17,2	0,4	0
4	9,6	37,7	0,45	1
4	9,6	36,9	0,45	0
4	9,6	31,3	0,45	5
4	9,6	30	0,4	0
4	9,6	4,9	0,4	0
5	10	37,3	0,4	0
5	10	35,6	0,4	3
5	10	32,3	0,4	0
5	10	16,6	0,4	5
5	10	6,2	0,4	0
6	8,8	37,6	0,4	0

Zone and sampling station: Monfalcone - Z3A

Seagrass: *Zostera marina*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
6	8,8	33,7	0,4	2
6	8,8	24,9	0,35	5
6	8,8	19,5	0,4	0
7	8,2	32,2	0,35	1
7	8,2	27,7	0,35	0
7	8,2	17,2	0,35	0
8	9,7	34,8	0,45	0
8	9,7	29,6	0,45	0
8	9,7	27,6	0,45	0
8	9,7	18,9	0,45	5
8	9,7	8,2	0,4	0
9	8,7	26,6	0,4	0
9	8,7	21,6	0,4	2
9	8,7	19,1	0,4	0
9	8,7	14,4	0,4	1
10	9,2	38,3	0,5	1
10	9,2	36,8	0,5	1
10	9,2	28,7	0,5	2
10	9,2	17,3	0,5	0
11	13,2	48,4	0,5	0
11	13,2	44,5	0,5	1
11	13,2	44,3	0,5	3
11	13,2	40	0,5	7
11	13,2	26,8	0,5	0

Zone and sampling station: Monfalcone - Z3A

Seagrass: *Zostera marina*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
11	13,2	3,3	0,45	0
12	13,9	44,4	0,5	0
12	13,9	38,8	0,5	1
12	13,9	36,7	0,5	0
12	13,9	34,5	0,5	3
12	13,9	14,7	0,5	0
13	9,2	22,9	0,4	0
13	9,2	21	0,4	0
13	9,2	17,1	0,4	0
13	9,2	8,6	0,4	1
13	9,2	7,3	0,4	0
14	12	43,2	0,5	2
14	12	41,9	0,5	0
14	12	33,5	0,5	1
14	12	20,8	0,5	3
14	12	18	0,5	0
15	10,2	31,2	0,4	1
15	10,2	28,5	0,4	0
15	10,2	19,2	0,4	1
15	10,2	17,8	0,4	0
15	10,2	12,3	0,4	5
16	12,9	43	0,5	1
16	12,9	39,5	0,5	0
16	12,9	35,1	0,5	3

Zone and sampling station: Monfalcone - Z3A

Seagrass: *Zostera marina*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
16	12,9	30,4	0,5	0
16	12,9	21	0,5	5
16	12,9	2,9	0,3	0
17	9,9	34,6	0,4	0
17	9,9	21,8	0,4	2
17	9,9	15,9	0,4	2
17	9,9	10,6	0,4	2
17	9,9	10,4	0,4	0
18	7,6	21	0,4	0
18	7,6	18,1	0,4	0
18	7,6	16,1	0,4	0
18	7,6	13,2	0,4	0
18	7,6	1,2	0,35	0
19	9,6	30,3	0,4	1
19	9,6	28,8	0,4	1
19	9,6	22,7	0,4	1
19	9,6	15,6	0,4	3
19	9,6	11,9	0,4	0
20	11,5	39,3	0,5	1
20	11,5	36,9	0,5	2
20	11,5	35,9	0,5	1
20	11,5	30,1	0,5	5
20	11,5	18,1	0,5	0

Note: _____

Zone and sampling station: Monfalcone - Z3B

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	7,3	20,4	0,3	1
1	7,3	20,3	0,3	0
1	7,3	11,6	0,25	2
2	7,6	18,6	0,25	1
2	7,6	7,3	0,2	1
2	7,6	2	0,2	0
3	7,2	13,2	0,25	2
3	7,2	5	0,2	0
4	7,4	14,4	0,2	1
4	7,4	12,2	0,15	1
4	7,4	7,5	0,2	1
5	5,3	13,3	0,2	1
5	5,3	12,2	0,2	0
5	5,3	1,6	0,2	0
6	5,6	10,7	0,15	1
6	5,6	5,8	0,2	0
6	5,6	4,6	0,15	1
7	6	11	0,2	0
7	6	9,4	0,2	1
8	4,8	15	0,15	1
8	4,8	13	0,2	1
8	4,8	6,3	0,15	1
8	4,8	2,5	0,15	0
9	7,2	22,1	0,2	1

Zone and sampling station: Monfalcone - Z3B

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
9	7,2	14,3	0,2	1
9	7,2	4,5	0,2	0
10	9	23,1	0,2	3
10	9	19,6	0,2	1
10	9	3,6	0,2	0
11	8,7	19,8	0,2	2
11	8,7	13,3	0,2	1
11	8,7	1,4	0,15	0
12	7,8	17,1	0,15	1
12	7,8	13,8	0,15	1
12	7,8	4,9	0,15	0
13	5,2	21,3	0,2	1
13	5,2	17,4	0,2	1
14	10,5	20,5	0,2	0
14	10,5	19,4	0,2	1
14	10,5	16,1	0,2	1
15	7,6	19,2	0,2	1
15	7,6	18	0,2	1
15	7,6	2,6	0,15	0
16	5,1	19,2	0,2	3
16	5,1	15,1	0,2	1
16	5,1	1,8	0,15	0
17	3,3	24,6	0,2	0
17	3,3	11,8	0,2	0

Zone and sampling station: Monfalcone - Z3B

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
18	3,6	12,6	0,2	1
18	3,6	7,8	0,15	0
18	3,6	7,5	0,15	1
19	8,9	16,9	0,15	1
19	8,9	15,6	0,2	1
19	8,9	2,8	0,15	0
20	7,3	11,6	0,15	1
20	7,3	9,4	0,15	0

Note: _____

Zone and sampling station: Monfalcone - Z3C

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
1	10,5	27,1	0,3	5
1	10,5	24,1	0,3	2
1	10,5	15,1	0,3	0
2	8	24	0,3	2
2	8	13,8	0,3	2
2	8	6,6	0,3	0
3	8,5	22	0,25	5
3	8,5	18,1	0,25	2
3	8,5	3,6	0,25	0
4	9	23,7	0,3	2
4	9	17,5	0,3	0
5	7,5	21,4	0,25	1
5	7,5	22,1	0,25	0
5	7,5	14,5	0,25	0
6	7	20	0,25	5
6	7	14,8	0,25	2
6	7	6,5	0,25	0
7	8	21,5	0,25	1
7	8	5	0,25	0
8	7,5	21	0,15	1
8	7,5	13,7	0,15	1
8	7,5	6	0,15	0
9	8	23,6	0,3	5
9	8	16,8	0,3	5

Zone and sampling station: Monfalcone - Z3C

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
9	8	11,5	0,3	2
9	8	8,1	0,3	0
10	9	21	0,25	2
10	9	12,9	0,25	2
10	9	7	0,25	1
11	10	22,1	0,25	5
11	10	17,7	0,25	1
11	10	10,5	0,25	0
12	9	18	0,25	5
12	9	13,7	0,25	1
12	9	10,4	0,25	0
13	8	21,1	0,25	2
13	8	12,9	0,25	0
14	9	23	0,25	2
14	9	17	0,25	1
14	9	10,9	0,25	0
15	6,5	21,5	0,15	2
15	6,5	13,8	0,15	0
16	7,5	21,6	0,3	5
16	7,5	17,8	0,3	5
16	7,5	6,6	0,3	0
17	6,5	20	0,25	2
17	6,5	13,5	0,25	0
17	6,5	8	0,25	0

Zone and sampling station: Monfalcone - Z3C

Seagrass: *Cymodocea nodosa*

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Leaves				
Shoot n.	Leaf sheath (cm)	Length (cm)	Width (cm)	Necrosis (%)
18	6	16,5	0,25	1
18	6	13,7	0,25	0
18	6	10,5	0,25	1
19	8,5	19,8	0,2	1
19	8,5	13,2	0,2	1
19	8,5	11,2	0,2	0
20	6	16	0,2	2
20	6	12,2	0,2	0

Note: _____



Laboratory Data Sheets

Kornati NP

Zone and sampling station: Kornati NP - Z1A

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	4,8	0,8	2,4	0					+
1	29,1	0,8	2,8	0					+
1	38,2	0,8	1,9	0					+
1					2,2	33,2	0,9	5	+
1					2,5	24,2	0,9	10	-
1					2,8	26,8	0,9	60	-
2	2,1	0,6	2,1	0					+
2	6,5	0,7	3,2	0					+
2	23,8	0,8	2,7	0					+
2	9,2	0,8	2,1	0					+
2	10,2	0,8	2,2	0					+
2	31,7	0,9	2	0					+
2	21,8	0,9	1,2	0					+
2					3,1	21,8	0,9	30	-
2					3,4	11,8	0,9	20	-
2					3,1	19,7	0,9	30	-
2					2,9	29,7	0,9	10	+
3	37,7	0,8	1,1	0					+
3	24,2	0,8	2	10					+
3	30,7	0,9	3,7	20					+
3					2,8	28,1	0,9	40	-
3					2,9	11,5	0,9	40	-
4	3	0,7	3	0					+
4	50,3	0,8	2,3	50					+

Zone and sampling station: Kornati NP - Z1A

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4	43,1	0,9	2	5					+
4					2,5	36,1	0,9	20	+
4					3,2	17,7	0,9	50	-
5	42,7	0,9	2	20					+
5	15,5	0,9	2,1	0					+
5	48,7	0,9	1,8	0					+
5					3,1	18,3	0,9	10	+
5					3,2	6,8	0,9	5	-
6	8,8	0,9	1,5	0					+
6	34,7	0,9	1,6	20					+
6	27,8	6,9	1,5	0					+
6					2,3	25,2	0,9	25	-
6					2,4	16,1	0,9	60	-

(* non-photosynthetic tissue)

Note: _____

Zone and sampling station: Kornati NP - Z1B

Page: 1/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	1,8	0,8	1,8	0					+
1	2,8	0,9	2,5	0					+
1	23,8	0,9	2,4	0					+
1					1,5	44,3	0,8	0	+
1					3	36,1	0,9	0	+
1					3	12,3	0,9	5	-
1					3,8	20,3	0,9	0	+
1					3,9	18,2	0,9	10	-
2	1	0,6	1	0					+
2	6,2	0,8	3,1	0					+
2	31,2	0,8	2,4	0					+
2	48,3	0,8	2,5	0					+
2					2,5	50,2	0,9	10	+
2					3,2	41,3	0,9	10	-
2					3,4	26,3	0,9	20	-
2					3,2	22,4	0,9	30	+
3	0,8	0,6	0,8	0					+
3	15,2	0,8	2,8	0					+
3	37,8	0,9	3	0					+
3					3,1	35,4	0,8	20	+
3					2,8	22,3	0,8	20	-
3					2,5	12,4	0,9	40	-
4	3	0,6	3	0					+
4	23,1	0,9	3,2	0					+

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4	48,1	0,9	2,8	5					-
4					3,2	45,2	0,9	25	+
4					3,4	35,8	0,9	30	+
5	39,2	0,8	2	0					+
5	30,7	0,8	2	0					+
5					2,8	29,8	0,9	30	+
5					3	17,8	0,9	50	-
6	2,6	0,6	2,6	0					+
6	37,7	0,8	2,4	0					+
6	52,8	0,9	2,3	10					+
6					3	52,3	0,9	25	+
6					3,2	37,4	0,9	25	-
6					3,8	16,4	0,9	50	-

(* non-photosynthetic tissue)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	1,2	0,6	1,2	0					+
1	29,5	0,8	4	0					+
1	43,4	0,8	4	0					+
1					2,9	43,2	0,9	0	+
1					3,4	18,3	0,8	15	-
1					3,8	28,2	0,8	0	+
2	4,2	0,7	3	0					+
2	22,3	0,8	3,4	0					+
2	31,2	0,8	3,2	0					+
2					1,2	29,3	0,8	0	+
2					2,4	21,8	0,8	0	+
2					2,3	14,2	0,9	50	-
3	1,1	0,6	1,1	0					+
3	9,2	0,8	3,2	0					+
3	22,4	0,8	2,8	0					+
3	24,6	0,8	2,6	0					+
3					2,3	29,2	0,8	5	-
3					2,8	24,3	0,9	10	-
3					2,9	18,3	0,9	0	+
4	1,2	0,6	1,2	0					+
4	20,9	0,8	2,2	0					+
4	28,4	0,9	2,4	0					+
4					2,3	31,8	0,8	0	+
4					2,4	22,4	0,8	10	-

Zone and sampling station: Kornati NP - Z1C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
5	1,1	0,6	1,1	0					+
5	43,2	0,8	2,8	0					+
5	24,4	0,8	3	0					+
5					2,1	49,8	0,8	5	-
5					3,2	28,7	0,8	5	-
5					3,4	22,1	0,8	10	-
6	3,1	0,8	2,5	0					+
6	24,4	0,8	2,5	0					+
6	32,5	0,8	2,1	0					+
6					2,2	26	0,8	0	+
6					3	19,3	0,8	5	-

(* non-photosynthetic tissue)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	4	0,7	3,5	0					+
1	9,8	0,8	3,2	0					+
1	30,1	0,8	3,2	0					+
1	30,3	0,8	3,3	0					+
1	41,3	0,8	3,2	20					-
1					3,2	15,1	0,9	40	-
1					3,9	23,2	0,9	20	-
1					2,9	35,1	0,9	10	+
1					2,4	36,1	0,9	10	+
2	23,1	0,8	2,8	0					-
2	36,3	0,8	2,9	0					-
2					2,8	3	0,9	0	+
2					3	16,8	0,9	0	+
2					2,1	46	0,9	10	-
3	2,5	0,6	2,5	0					+
3	23,2	0,7	2,2	0					+
3	39,1	0,7	2,1	10					-
3					3,5	15,8	0,8	60	-
3					3,5	32,1	0,8	80	-
3					2,5	38,1	0,8	10	+
4	4,2	0,6	3,8	0					+
4	6,8	0,7	6,4	0					+
4	10,8	0,7	3,1	0					+
4	22,1	0,8	2,5	0					+

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4	40,2	0,8	3,3	0					+
4					3,2	20,1	0,9	70	-
4					3	29,2	0,9	20	-
4					3,1	41,3	0,9	40	-
4					2,1	44,1	0,9	10	+
5	1,8	0,6	1,8	0					-
5	25,1	0,7	1,8	0					-
5	40	0,7	1,5	0					-
5					3,2	11,3	0,7	100	-
5					3,5	12,3	0,9	60	-
5					3,5	34,1	0,9	10	+
5					2,8	47,3	0,9	10	+
6	2,2	0,6	2,2	0					+
6	3,2	0,7	2,3	0					+
6	63,1	0,7	2,4	5					+
6					4,2	13,7	0,9	80	-
6					2,8	41,3	0,9	40	-

(* non-photosynthetic tissue)

Note: _____

Zone and sampling station: Kornati NP - Z2B

Page: 1/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	4,8	0,7	2	0					+
1	42,5	0,7	1,9	0					+
1	55,6	0,8	1,8	0					+
1					3	27,3	0,8	20	-
1					3,2	49,2	0,8	25	-
1					3,5	15,4	0,8	25	-
2	1	0,6	1	0					+
2	41,3	0,8	2,6	0					+
2	58,2	0,8	2,6	0					+
2					41,2	2,9	0,9	10	-
2					53,8	3,2	0,9	10	-
3	19,7	0,8	2,2	0					+
3	32,1	0,9	2	0					+
3	39,4	0,8	2,2	0					+
3					3,1	17,2	0,9	10	+
3					2,8	18,7	0,9	50	-
3					3,2	32,1	0,9	50	-
4	0,8	0,6	0,8	0					-
4	8,7	0,7	1,2	0					-
4	32,1	0,8	2	0					-
4	45,8	0,8	2	0					-
4					3,8	16,2	0,9	20	-
4					3,9	20,7	0,9	10	+
4					4	31,5	0,8	5	+

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4					3,1	4,7	0,9	5	+
5	1,8	0,6	1,8	0					+
5	9,2	0,7	5,1	0					+
5	27,7	0,8	2	0					+
5	48,2	0,8	2,5	0					+
5					4,1	30,4	0,9	20	-
5					4,2	20,2	0,9	20	-
5					3,8	44,1	0,9	30	-
5					2,1	53	0,9	10	+
6	9,7	0,7	1,5	0					+
6	25,4	0,8	1,6	0					+
6	35,1	0,8	1	0					+
6					2,5	23,1	0,8	0	+
6					3,1	23,1	0,8	0	+
6					3,2	24,2	0,8	10	-
6					3,1	18,8	0,9	30	-

(* non-photosynthetic tissue)

Note: _____

Zone and sampling station: Kornati NP - Z2C

Page: 1/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	11,3	0,9	2,3	0					+
1	33	0,9	2,3	0					+
1	44,7	0,9	1,9	0					+
1					4	21,2	0,9	20	+
1					3,2	36,8	0,9	10	+
1					3,1	21,8	0,9	60	-
2	27,2	0,9	2,7	0					+
2	41,7	0,9	2,3	0					+
2					2,8	37,5	0,9	0	+
2					2,9	21,4	0,9	10	+
2					3,1	17,3	0,9	50	-
3	2	0,6	2	0					+
3	4,5	0,7	2,8	0					+
3	5,3	0,7	4,1	0					+
3	6,4	0,7	5,2	0					+
3	10,7	0,8	1,5	0					+
3	21,7	0,9	1,3	0					+
3	46,8	1	1,8	0					+
3	32,1	1	1,5	0					+
3	24,8	1	1,2	0					+
3					3,1	44,8	1	10	+
3					3,9	36,7	1	20	-
3					3,5	24,7	1	20	+
3					3,6	22,8	1	30	-

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
3					3,8	22,7	1	10	+
4	31,4	0,8	3,8	0					+
4	48,2	0,9	4,1	0					+
4					2,9	49,6	0,9	0	+
4					4	18,2	0,9	40	-
4					4	32,8	0,9	10	+
4					4,2	21,4	0,9	10	+
5	54,4	0,9	4,5	0					+
5	67,1	0,9	3,8	10					+
5					5,2	24,8	0,9	5	+
5					4,8	50,9	0,9	10	+
6	60,3	0,9	2,8	5					+
6	41,3	0,9	2,8	5					+
6	59,2	0,9	3	5					+
6					4,2	29,1	0,9	5	+
6					4	22,3	0,9	10	+

(* non-photosynthetic tissue)

Note: _____

Zone and sampling station: Kornati NP - Z3A

Page: 1/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	8,8	0,6	1,8	0					+
1	9,2	0,6	1,8	0					+
1	42,8	0,7	2,8	0					+
1	63,8	0,7	3,8	0					+
1	70,2	0,7	3	10					+
1					4	29,1	0,8	10	+
1					4,2	19,8	0,8	80	-
1					4,2	22,1	0,8	20	-
1					4,2	72,3	0,8	20	-
2	3,8	0,6	3	0					+
2	37,8	0,7	2,2	0					+
2	49,1	0,7	2	0					+
2					3,1	20,1	0,7	50	-
3	1,1	0,5	1,1	0					+
3	7,8	0,6	2	0					+
3	8,3	0,6	2,2	0					+
3	58,1	0,8	4,8	0					+
3	78,8	0,8	5	0					+
3					3	81,2	0,8	10	+
3					4,1	50,3	0,8	30	+
3					4,7	82,8	0,8	30	+
3					4,8	39,8	0,8	60	-
4	9,1	0,6	2	0					+
4	53,2	0,6	2,2	0					+

Zone and sampling station: Kornati NP - Z3A

Page: 2/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4	78,8	0,6	3	0					+
4					4,2	25,4	0,8	80	-
4					4,3	34,1	0,8	50	-
4					3,8	74,3	0,8	30	-
4					3,7	50,1	0,8	10	+
5	4,9	0,5	2,7	0					+
5	23,8	0,6	2	0					+
5	33,4	0,6	2,1	0					+
5	40,3	0,7	2,2	0					+
5					2,2	12,8	0,7	100	-
5					2	21,3	0,7	80	-
5					4	16,8	0,7	90	-
6	5,2	0,5	1	0					+
6	27,8	0,6	1,1	0					+
6	38,2	0,7	2	30					+
6					2	34,5	0,8	50	-
6					2,2	28,1	0,8	60	-

(* non-photosynthetic tissue)

Note: _____

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	3,1	0,7	2,5	0					+
1	20	0,7	2	0					+
1	46,2	0,7	2	30					+
1	50,7	0,7	2,1	40					-
1					32	39,8	0,7	40	-
1					2,2	17,7	0,7	90	-
2	10,8	0,6	0,8	0					+
2	26,9	0,6	1	0					+
2	31	0,7	2,1	10					+
2					2,2	19,4	0,7	80	-
2					1,8	30,7	0,7	90	-
3	3,1	0,5	2,4	0					+
3	40,3	0,7	2,3	0					+
3	21,2	0,7	2	0	2,2	28,7	0,7	30	+
3					2,8	50	0,7	40	-
3					2,9	32,1	0,7	60	-
4	20,7	0,7	2	0					+
4	35,7	0,7	1,8	20					+
4	38,2	0,7	1	40					+
4					3	21,3	0,8	80	-
4					2,8	23,8	0,8	50	-
5	2,5	0,6	2	0					+
5	11,8	0,6	1,5	0					+
5	44,8	0,7	1,5	0					+

Zone and sampling station: Kornati NP - Z3B

Page: 2/2

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
5					2,3	41,2	0,7	40	+
5					3,1	50,3	0,8	40	-
5					3,3	16,5	0,8	100	-
6	3,5	0,7	2,3	5					+
6	91	0,7	2	0					+
6	41,3	0,7	2,1	20					+
6					3,2	20,7	0,8	50	-
6					3	40,8	0,8	50	-

(* non-photosynthetic tissue)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
1	26,7	0,6	2,5	0					+
1	51,1	0,7	2,3	20					-
1					3,2	14,2	0,7	90	-
1					3,1	20,4	0,7	80	-
1					2,3	47,3	0,8	70	-
2	3,7	0,6	3,7	0					+
2	35,7	0,6	2,1	0					+
2	49,3	0,7	2,2	0					+
2					2,8	37,3	0,7	60	-
2					2,5	47,7	0,7	60	-
2					3,1	20,8	0,8	80	-
3	3,8	0,8	3,8	0					+
3	3,8	0,8	3,3	0					+
3	74,5	0,8	4,2	0					+
3	59,1	0,8	3,8	0					+
3					3,8	71,2	0,7	30	-
3					4,2	58,2	0,7	40	-
3					4,1	26,7	0,7	80	-
3					4,3	34,1	0,7	60	-
4	1,8	0,7	1,8	0					+
4	12,8	0,7	2,2	0					+
4	22,8	0,7	2	20					+
4	40,1	0,7	2,3	40					+
4					2,1	23,8	0,7	80	-

Zone and sampling station: Kornati NP - Z3C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Grazing
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	si - / no +
4					2,8	38,1	0,7	50	-
4					2,2	35,3	0,7	50	-
5	12,2	0,6	2,4	0					+
5	41,3	0,7	2,1	10					+
5					1,9	43,3	0,7	40	-
5					2,4	16,1	0,7	100	-
5					2,5	26,7	0,7	80	-
6	6,2	0,6	4,2	0					+
6	18,6	0,6	2,8	0					+
6	32,8	0,6	3	20					+
6					2,8	20,8	0,7	70	-
6					2	31,8	0,8	40	-

(* non-photosynthetic tissue)

Note: _____

Laboratory Data Sheets

RNP Dune Costiere

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	4	0,8	4	0					+
1	8,2	0,8	5	0					+
1	15,5	0,8	6	0					+
1					3,2	12,3	0,7	0	+
1					3,5	14,8	0,8	0	+
1					3,7	47,8	0,8	0	+
1					4	61,8	0,9	0	+
1					4	40,1	0,9	0	+
2	6,1	0,8	4,8	0					+
2					1	37,1	0,8	0	+
2					3	58	0,8	10	+
2					3	38,9	0,9	20	+
3	2,2	0,7	2,2	0					+
3	7,8	0,8	3	0					+
3					3,1	40	0,8	0	+
3					3,8	45	0,9	10	+
3					4	65	0,9	10	+
4	1	0,7	1	0					+
4	8	0,8	3	0					+
4					2,8	10	0,8	0	+
4					3	32	0,8	0	+
4					3,8	44	0,8	10	+
5	1,5	0,7	1,5	0					+
5	5,8	0,7	2	0					+

Zone and sampling station: RNO Dune Costiere - Z1A

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5	5,5	0,7	2	0					+
5	14,5	0,8	1,5	0					+
5					1,8	10	0,8	0	+
5					1,9	25	0,8	0	+
5					2	27,8	0,8	0	+
5					2,2	28,7	0,8	10	-
6	1,8	0,7	1,8	0					+
6	4,2	0,8	3	0					+
6	9,8	0,8	4	0					+
6					3	38,5	0,9	10	-
6					3	45,5	0,9	20	-
6					3	69,5	0,9	30	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	7,2	0,8	2	0					+
1	22,8	0,8	1,5	0					+
1									+
1					3	43,5	0,9	10	-
1					3	50	0,9	10	-
2	2	0,8	2	0					+
2	5	0,8	3	0					+
2	40	0,8	3	0					+
2					3,2	44	0,9	10	-
2					3,1	28	0,9	20	-
2					4	39	0,9	30	-
3	3	0,8	3	0					+
3	4,5	0,8	3	0					+
3	5,8	0,8	3,5	0					+
3	15	0,8	4	0					+
3					3	29	0,9	10	-
3					3	25	0,9	10	-
3					3	30	0,9	10	-
4	4,5	0,8	4	0					+
4	8	0,8	4	0					+
4					2,8	28	0,9	10	-
4					3	35	0,9	10	-
4					3	43	0,9	40	-
5	1,8	0,7	1,8	0					+

Zone and sampling station: RNO Dune Costiere - Z1B

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5	5	0,8	3	0					+
5	38	0,8	4	0					+
5					2	15	0,8	0	+
5					2,4	35	0,8	20	-
5					2,5	40	0,9	40	-
6	1,2	0,7	1,2	0					+
6	6,8	0,8	2	0					+
6					3,2	37	0,9	30	-
6					3	42	0,9	40	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Zone and sampling station: RNO Dune Costiere - Z1C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	2,5	0,7	2,5	0					+
1	3	0,7	3	0					+
1	6	0,8	4	0					+
1	10	0,8	3	0					+
1					3,5	12	0,8	10	-
1					3	23	0,8	10	-
1					3	28	0,9	20	-
1					3,5	45	0,9	20	-
2	1,5	0,7	1,5	0					+
2	5	0,8	3	0					+
2	13	0,8	3	0					+
2					2,5	22	0,9	10	-
2					3	28	0,9	10	-
2					2,8	18	0,9	20	-
3	2,5	0,7	2,5	0					+
3	11	0,7	3	0					+
3					2	25	0,9	0	+
3					2,5	30	0,9	10	-
3					3	15	0,9	20	-
4	4	0,7	3	0					+
4	20	0,8	4	0					+
4					2	44	0,8	20	-
4					2	40	0,8	20	-
5	7,2	0,8	3	0					+

Zone and sampling station: RNO Dune Costiere - Z1C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5	18	0,8	3	0					+
5	22	0,8	3	0					+
5					2	10	0,8	10	-
5					2	15,7	0,8	10	-
5					2	18,6	0,9	10	-
6	2,5	0,8	2,5	0					+
6	5,5	0,8	3	0					+
6					2,5	21	0,9	10	-
6					3	17	0,9	20	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	2	0,8	2	0					+
1	14	0,8	2,6	0					+
1	18	0,8	2	0					+
1					3	18,8	0,8	0	+
1					4	12	0,8	0	+
1					4	61	0,9	0	+
2	1	0,7	1	0					+
2	17,7	0,8	2	0					+
2					3	28	0,8	20	+
2					3	63	0,9	30	-
3	4,8	0,7	2	0					+
3	8	0,8	2	0					+
3					4	22	0,9	20	+
3					4	41	0,9	20	+
4	1,5	0,7	1,5	0					+
4	3	0,8	3	0					+
4					2,7	28	0,8	0	+
4					3	31	0,8	0	+
4					3	51	0,8	0	+
4					4	66	0,8	10	+
5	2	0,7	1,5	0					+
5	12	0,7	1,5	0					+
5	5	0,7	1,5	0					+
5					2,5	11	0,8	0	+

Zone and sampling station: RNO Dune Costiere - Z2A

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5					2,5	56	0,8	0	+
5					2,9	43	0,8	10	-
5					3,1	61	0,8	10	-
6	2	0,7	1,8	0					+
6	19	0,8	3	0					+
6	22	0,8	3	0					
6	8,1	0,8	4	0					+
6					4	31	0,9	10	-
6					4	47	0,9	10	-
6					4	64	0,9	40	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	2,5	0,7	1,2	0					+
1	5,8	0,7	3	0					+
1	8,8	0,8	4	0					+
1					3,2	20	0,8	0	-
1					3,5	22	0,8	0	-
2	5,2	0,8	2	0					+
2	10,4	0,8	2	0					+
2					3,3	36	0,9	10	-
2					4	40	0,9	10	-
2					4	42	0,9	10	-
3	3	0,7	2,2	0					+
3	7	0,8	3	0					+
3	11	0,8	3,5	0					+
3					3,2	22	0,9	20	-
3					4	34	0,9	10	-
3					3,5	37	0,9	20	-
4	3,2	0,7	2,2	0					+
4	8	0,8	2	0					+
4					1,2	37	0,9	10	-
4					3,3	28	0,9	10	+
4					3,5	39	0,9	20	+
4					4	34	0,9	20	-
5	2,5	0,8	2,5	0					+
5	4,5	0,8	2,5	0					+

Zone and sampling station: RNO Dune Costiere - Z2B

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5					2,5	31	0,8	10	-
5					2,6	32	0,8	30	-
5					2,6	28	0,9	20	-
6	3	0,8	2,8	0					+
6	7,8	0,8	3	0					+
6	13	0,8	3						
6					3,5	25	0,9	20	-
6					3,8	30	0,9	20	-
6					4	40	0,9	10	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	1,8	0,8	1,8	0					+
1	8,2	0,8	2	0					+
1					3,2	36,2	0,8	30	-
1					3,1	54	0,9	0	-
1					3,3	57	0,9	20	-
2	5,1	0,8	1,5	0					+
2	14,3	0,8	1,5	0					+
2					3,1	33	0,9	10	-
2					3,5	48	0,9	10	-
2					3,5	52	0,9	10	-
3	6,8	0,8	3	0					+
3					3,2	16,9	0,9	10	-
3					3,8	39	0,9	0	-
4	5,2	0,8	1,8	0					+
4	13	0,8	2,7	0					+
4					4,2	47	0,9	10	-
4					4,2	52	0,9	10	-
4					4	30	0,9	50	-
4					4,5	50	0,9	30	-
4					4	44	0,9	40	-
5	2,5	0,7	2,4	0					+
5	6,8	0,8	2,5	0					+
5	15	0,8	2	0					+
5					2,5	16	0,8	20	-

Zone and sampling station: RNO Dune Costiere - Z2C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5					2,6	27	0,8	20	-
5					3	33	0,9	20	-
6	2,2	0,7	2,2	0					+
6	6	0,8	3	0					+
6					2,2	33	0,8	40	-
6					2,5	32	0,8	20	-
6					2	28	0,8	30	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	6	0,8	2	0					+
1	8,7	0,8	2,6	0					+
1					2,5	48	0,8	0	+
1					2,2	27	0,8	0	-
1					2,5	39	0,8	0	-
1					2,5	44	0,8	0	-
1					2,5	45	0,9	0	-
2	3	0,8	2	0					+
2	3,1	0,8	2,5	0					+
2					2	40	0,8	50	-
2					2	29	0,8	20	-
3	2,1	0,8	2	0					+
3	17	0,8	2	0					+
3	9,8	0,8	2	0					+
3					4	43	0,9	30	+
3					4	58	0,9	20	+
3					4	62	0,9	40	-
3					4	67	0,9	20	-
4	1,3	0,8	1,2	0					+
4	4,8	0,8	2	0					+
4	6,6	0,8	2	0					+
4					3,2	52	0,8	10	+
4					4	54	0,8	20	-
4					3,8	63	0,8	10	-

Zone and sampling station: RNO Dune Costiere - Z3A

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5	5,2	0,7	2	0					+
5	5	0,7	3	0					+
5					4,2	13	0,8	0	+
5					3,7	57	0,8	0	+
5					4	41	0,8	10	-
6	2,5	0,7	2,5	0					+
6	8,7	0,8	4	0					+
6	18,5	0,8	4	0					+
6					3,5	55	0,9	10	+
6					3,5	58	0,9	0	-
6					4	63	0,9	20	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	2,5	0,8	2,5	0					+
1	7,2	0,8	3	0					+
1					3,5	50	0,8	0	+
1					3,6	55	0,8	0	+
1					4	65	0,8	0	-
2	4,2	0,8	3,5	0					+
2	11	0,8	4	0					+
2					4,5	19	0,9	10	-
2					4	38	0,9	10	-
2					4	64	0,9	10	-
3	3,5	0,8	3	0					+
3	5,7	0,8	3	0					+
3	19	0,8	2,5	0					+
3					3,5	70	0,9	10	-
3					4,5	56	0,9	10	-
4	2,8	0,8	2,2	0					+
4	5,8	0,8	2	0					+
4	6	0,8	3	0					+
4					2,1	10	0,9	10	+
4					2	18	0,9	10	+
4					2	20	0,9	10	-
4					3	37	0,9	20	-
4					4	44	0,9	20	-
5	1,2	0,8	1,2	0					+

Zone and sampling station: RNO Dune Costiere - Z3B

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5					4	60	0,8	10	-
5					4	61	0,8	20	-
5					4	28	0,9	10	-
6	3,2	0,8	3,2	0					+
6	4,2	0,8	3	0					+
6					3,5	34	0,9	20	-
6					3,1	40	0,9	20	-
6					3,2	58	0,9	30	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
1	4,4	0,8	3,5	0					+
1	5,1	0,8	3,5	0					+
1					3	62	0,8	30	-
1					3	45	0,9	50	-
2	4,5	0,8	3,4	0					+
2	9	0,8	4	0					+
2					3,4	55	0,9	40	-
2					3,4	61	0,9	30	-
2					3,5	65	0,9	20	-
3	1,3	0,8	1,3	0					+
3	9,8	0,8	2,5	0					+
3					3,4	55	0,9	40	-
3					3,7	62	0,9	30	-
3					3,8	63	0,9	20	-
4	1,5	0,8	1,5	0					+
4	4,5	0,8	2	0					+
4	6,4	0,8	3	0					+
4	11	0,8	4	0					+
4					3,2	50	0,9	30	-
4					3	54	0,9	0	-
4					3	35	0,9	0	-
4					3,4	45	0,9	10	-
4					3	40	0,9	20	-
5	1	0,8	1	0					+

Zone and sampling station: RNO Dune Costiere - Z3C

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Seagrass: *Posidonia oceanica*

Shoot n.	Juvenile and intermediate leaves				Adult leaves				Apex
	Length (cm)	Width (cm)	non-ph. (cm) *	Necrosis (%)	Leaf base (cm)	Length (cm)	Width (cm)	Necrosis (%)	+ / - **
5	6,2	0,8	3	0					+
5					3	52	0,8	30	-
5					3,3	40	0,9	40	-
5					2,3	64	0,9	30	-
6	1,4	0,8	1,2	0					+
6	12	0,8	2	0					+
6					2	30	0,9	40	-
6					3	15	0,9	50	-
6					3	31	0,9	50	-

(* non-photosynthetic tissue)

(** + = intact apex / - = eroded apex)

Note: _____